MOUNTAIN-PLAINS CONSORTIUM

MPC 23-508 | J. Hough, J. Mattson, H. Al Qublan and B. Rahman

THE ASSOCIATION
BETWEEN TRIBAL TRANSIT
AND FOOD INSECURITY
STATUS AMONG NATIVE
AMERICANS IN NORTH
DAKOTA

**MOUNTAIN-PLAINS
CONSORTIUM** REGION 8

Technical Report Documentation Page

1. Report No. MPC-684	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle The Association Between Tribal Transit and Food Insecurity Status Among Native Americans in North Dakota		5. Report Date December 2023	
		6. Performing Organization Code	
7. Author(s) Jill Hough Jeremy Mattson Hamad Al Qublan Baishali Rahman		8. Performing Organization Report No. MPC 23-508	
9. Performing Organization Name and Address North Dakota State University NDSU Dept 2880, PO Box 6050 Fargo, ND 58108-6050		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No.	
12. Sponsoring Agency Name and Address Mountain-Plains Consortium North Dakota State University PO Box 6050, Fargo, ND 58108		13. Type of Report and Period Covered Final Report	
		14. Sponsoring Agency Code	
15. Supplementary Notes Supported by a grant from the US DOT, University Transportation Centers Program			

16. Abstract

Food insecurity is a persistent problem in the U.S. that is disproportionately distributed across racial groups. Native American tribes, many located in rural areas, have high rates of food insecurity. Transportation plays a role in the limited access to food. This study focused on transportation used by Native Americans in North Dakota to access healthy foods. A survey was administered in September and October 2022. Responses from 246 Native Americans revealed that nearly 50% of the respondents have very low food security, 27% have low food security, and 25% have high or marginal food security. An ordered logit model revealed that income, food assistance programs, education, and the ability to drive to the grocery store significantly influence food security. The study found that 20% of respondents do not drive or have access to a vehicle for transportation. Native Americans in North Dakota are significantly less likely to own or have access to a vehicle. Most respondents (71%) drive to get groceries, while 27% get a ride from someone, and 21% walk. Age, income, living within walking distance of a grocery store, availability of fresh food, and living on the reservation were found to be positively associated with the likelihood of an individual eating healthy food every day.

17. Key Word accessibility, COVID-19, food, Indian reservations, Native Americans, public transit		18. Distribution Statement Public distribution	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 70	22. Price n/a

Form DOT F 1700.7 (8-72)   Reproduction of completed page authorized

The Association Between Tribal Transit and Food Insecurity Status Among Native Americans in North Dakota

Prepared by:

Jill Hough, Ph.D.
Jeremy Mattson, Ph.D.
Hamad Al Qublan, Ph.D.
Baishali Rahman

Small Urban and Rural Center on Mobility
Upper Great Plains Transportation Institute
North Dakota State University
Fargo, North Dakota

December 2023

Acknowledgments

Disclaimer

ABSTRACT

Food insecurity is a persistent problem in the United States that is disproportionately distributed across racial groups. Native American tribes, many located in rural areas, have high rates of food insecurity. Transportation plays a role in the limited access to food. This study focused on transportation used by Native Americans in North Dakota to access healthy foods. A survey was conducted in September and October 2022. Responses from 246 Native Americans revealed that nearly 50% of the respondents have very low food security, 27% have low food security, and 25% have high or marginal food security. An ordered logit model revealed that income, food assistance programs, education, and the ability to drive to the grocery store significantly influence food security. The study found that 20% of respondents do not drive or have access to a vehicle for transportation. Native Americans in North Dakota are significantly less likely to own or have access to a vehicle. Most respondents (71%) drive to get groceries, while 27% get a ride from someone, and 21% walk. Age, income, living within walking distance of a grocery store, availability of fresh food, and living on the reservation were found to be positively associated with the likelihood of an individual eating healthy food every day.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

EXECUTIVE SUMMARY

This study focuses on food insecurity among Native American households in North Dakota, a state with a significant Native American population residing in rural areas and reservations. The research highlights the disproportionate impact of food insecurity on Native Americans, particularly due to limited access to healthy food, high poverty rates, and unemployment. Nutrition-related diseases are prevalent among Native households, emphasizing the urgency to address these disparities.

Background

There are five federally recognized tribes in North Dakota. In 2020, North Dakota had approximately 38,914 Native Americans, equating to approximately 5% of the state's population. However, concerns about undercounting persist, especially among those living on reservations.

North Dakota has three tribal transit systems, operated by Turtle Mountain, Spirit Lake, and Standing Rock reservations. These systems serve various essential areas, including housing, healthcare, and shopping. Ridership trends for these programs from 2013 to 2022 indicate a significant drop in 2020 due to the COVID-19 pandemic, followed by a rebound in 2022.

The Food Access Research Atlas identifies areas with poor access to food based on income, distance to the nearest supermarket, and vehicle access. About 8.4% of North Dakota's population, including many Native Americans, lives in low-income low-access (LILA) areas, facing challenges in accessing healthy and affordable food.

Food insecurity is linked to preventable diseases such as hypertension, diabetes, cancer, and obesity among Native Americans. Undernutrition historically leads to an obesity epidemic. Several studies connect food insecurity to obesity and other health issues in Native American populations, emphasizing the importance of food quality. Traditional food systems, education, and prevention programs are suggested as means to address these health challenges.

Methodology

The study employed a six-item survey module developed by the National Center for Health Statistics, incorporating a six-item food security scale. This scale classifies individuals into categories of high/marginal food security, low food security, or very low food security. The survey, available in Appendix A, also included 37 additional questions devised by the research team, addressing transportation systems, financial information, hunger-coping strategies, health, nutrition, and demographics.

The survey was launched on September 1, 2022, and closed on October 31, 2022. The survey was distributed in hard copy and electronically through tablets at events like the Turtle Mountain Chippewa Pembina Labor Day Pow Wow. It was also disseminated through emails, social media, and direct contacts to Native American organizations and entities across North Dakota.

The survey received 292 responses, with 246 respondents answering most questions. Responses were obtained from various North Dakota tribes, with the Turtle Mountain Band of Chippewa having the highest representation (29%), followed by Spirit Lake Nation (21%), and Standing Rock Sioux Tribe (17%).

Results

The survey gathered demographic information to gain insights into the respondents' characteristics. Most respondents were younger adults, with 30% aged 35-44 years and 29% aged 25-34 years. No respondents were in the 75 years and older category, possibly due to limited participation from that age group. The gender breakdown included 159 women, 85 men, and two who preferred not to identify their gender.

Regarding employment, 39% of respondents reported working full-time, 29% were students, and about 12% were employed part-time. Almost 10% were unemployed and seeking work. Among those not living on reservations, 42% were students compared with 13% on reservations. Respondents living on reservations had a higher percentage of full-time employment (52%).

As for education, 34% of respondents were current students, 22% had an associate degree, and 14% had a bachelor's degree or higher. Income distribution revealed that nearly 43% earned less than $20,000 annually, 25% earned between $20,000 and $34,999, and 3.6% earned over $100,000. Two-thirds of respondents reported household income below $35,000, indicating high poverty levels. About 12.8% reported receiving disability income in the last year.

Regarding marital status, approximately half of the respondents were single and never married. About a third reported having no children under 18 at home, while about 43% had two or more children. The demographic characteristics underscored the prevalence of younger individuals, high poverty levels, and diverse employment and education statuses among the surveyed Native Americans in North Dakota.

The survey employed the U.S. Household Food Security Survey Module to assess the food security status using six questions related to food availability, affordability, and meal skipping over the past 12 months. Results indicated a high level of food insecurity, with 28% reporting often insufficient food that did not last, and nearly half reporting sometimes facing this issue. Additionally, one-third reported often being unable to afford balanced meals, and 43% reported this sometimes.

Responses were categorized into raw scores, revealing that almost half of the respondents experienced very low food security, 27% had low food security, and 25% had high or marginal food security. No significant difference in food security levels was observed between tribal members living on or off reservations.

An ordered logit model was employed to analyze factors influencing food security. Significant variables included income, education, use of assistance programs, and the ability to drive to the grocery store. Higher income and education were associated with lower food insecurity, while assistance programs mitigated the negative effects of low income. Driving oneself to the grocery store significantly lowered food insecurity levels by 63%, emphasizing the role of transportation in improving food security.

Variables such as age, gender, disability, number of children, residence on or off the reservation, and the proximity of a grocery store within walking distance were statistically insignificant in their association with food security. The model's inability to detect associations does not necessarily negate their importance, potentially indicating the need for further exploration or a larger sample size.

The survey investigated the causes of food insecurity and proposed strategies to alleviate it among Native Americans in North Dakota. Respondents provided insights through open-ended questions, and a qualitative data analysis approach was employed to identify key themes and categorize responses.

Causes of Food Insecurity and Strategies to Reduce Food Insecurity

The top causes of food insecurity identified by respondents included financial hardship, inflation/high costs, lack of transportation, and unavailability of food. Respondents proposed various strategies to address food insecurity, with the most common suggestions being: increasing the number of food pantries, farmers markets, and accessible groceries; greater job creation and security; reducing drug abuse; better transportation and communication; and expanded food assistance programs, among other ideas. The findings underscore the multifaceted nature of food insecurity, suggesting a need for comprehensive strategies addressing economic, social, and environmental factors.

Native Americans in North Dakota have substantially less access to vehicles compared to national and state averages. As suggested by the statistical analysis, this is one of the contributors to food insecurity.

Food Shopping Patterns

The results showed that 72% of respondents commonly shopped at grocery stores, 58% shopped at supermarkets like Walmart, 37% shopped at discount stores like Dollar General, and 30% shopped at convenience stores or gas stations.

Health and Nutrition

In 2019, 33% of respondents reported excellent or very good health, which decreased to 25% during the COVID-19 pandemic in 2020 and 2021, slightly improving to 27% in 2022. The percentage of respondents reporting fair or poor health increased from 30% in 2019 to 39% in 2022. Almost 37% of respondents reported being diagnosed with a food-related disease.

The health and wellness programs targeted at food-related illnesses, such as the Diabetes Treatment Prevention Program, saw varying levels of participation. Of the respondents, 56% had not participated in any of the five identified health and wellness programs. The Diabetes Treatment Prevention Program had the highest participation at 22%. Of those participating in health programs, 51% drove themselves, 28% walked, and 26% used taxi services. Transportation was reported as an obstacle by 23% of respondents.

Factors positively associated with daily healthy eating habits included age, income, walking distance to a grocery store, availability of fresh food, and living on the reservation. These conclusions were based on results from a binary logit regression model. Older adults were shown to be more likely to eat healthy foods. Living within walking distance of a grocery store has a positive effect, which indicates that proximity to a grocery store promotes healthy eating habits. Those who reported that the stores in their area provide all the fresh food they need to make their daily meals were more likely to report eating healthy food every day. This shows the importance of having fresh food available locally.

The findings highlight fluctuations in self-reported health during the pandemic, the prevalence of food-related diseases, and challenges in participation in health programs, particularly due to transportation barriers. Positive associations with daily healthy eating habits underscore the importance of local food accessibility and living conditions.

The study's limitations include possible sampling bias and over-representation of certain groups, like college students. Future research is recommended using stratified random sampling. Despite challenges, results align with previous research, emphasizing higher food insecurity rates and reduced car ownership among Native Americans. Transportation is identified as a key factor, suggesting the need for more focused research on mobility options to improve food access in tribal areas, including emerging options and their cost-benefit analysis.

1. INTRODUCTION

Food insecurity is a persistent problem in the United States, and it is disproportionately distributed across racial and ethnic groups (Myers and Painter 2017). The percentages of food insecurity increase among minority groups. Black, Asian, and Hispanic households usually experience higher levels of food insecurity. Native Americans are most affected by food insecurity. In 2021, the rate of food insecurity was 23.5% among Native Americans; 19.3% among Black, non-Hispanic individuals; and 15.8% for Latino individuals (Feeding America 2021). The COVID-19 pandemic may have exacerbated issues of food insecurity. Fitzpatrick et al. (2021) found that during COVID-19, the number of Native Americans suffering from food insecurity was nearly twice the number of white Americans. Many Native American tribes in the United States live in rural areas and reservations that have been classified as having low food access and high rates of food insecurity. Indigenous people in other countries have also been shown to have high rates of food insecurity (Ahiman, Estrada, and Colmenero 2017; Skinner, Pratley, and Burnett 2016; Tam, Findlay, and Kohen 2014; Temple and Russell 2018).

The Economic Research Service (ERS) of the U.S. Department of Agriculture (USDA) found that 59% of all U.S residents live within one mile of a supermarket or grocery store, but only 26% of Native Americans live within this distance. In addition to greater travel distances to food, tribal communities also suffer from high poverty and unemployment rates. As a result, some households do not own a vehicle, despite the long distances (Kaufman, Dicken and Williams 2014). Poverty, level of income, and unemployment are considered main factors for food insecurity. According to American Community Survey data, about 23% of Native Americans live below the poverty level, compared with 10% for the white population and 13% for the total population.

Native Americans may have difficulties maintaining a healthy diet because of limited food choices and poor access to healthy food (Archer et al. 2002). Poor access to healthy food and high rates of food insecurity have numerous implications for the health and welfare of Native American families (Jernigan et al. 2012). The rate of nutrition-related diseases, such as cardiovascular disease, diabetes, and obesity, is doubled among Native households (Kaufman, Dicken, and Williams 2014; Jernigan et al. 2013; Jernigan et al. 2017).

According to Brown, Noonan, and Nord (2007), 44% of 187 households studied of Northern Plains Indians were found to be food insecure. They noticed that the food insecurity rate and level decreased with increasing household income. As the authors claimed, this region is in urgent need of "programs that decrease the prevalence of food insecurity and health disparities in this population" (Brown, Noonan, and Nord 2007).

Therefore, this study focuses on Native American households in North Dakota. North Dakota has the sixth largest Native American population in the United States. This population is divided into five federally recognized tribes and one Indian community. These include the Mandan, Hidatsa, & Arikara Nation (Three Affiliated Tribes); the Spirit Lake Nation; the Standing Rock Sioux Tribe; the Turtle Mountain Band of Chippewa Indians; the Sisseton-Wahpeton Oyate Nation; and the Trenton Indian Service Area. These tribal communities are located in very rural areas.

Transportation is an important component of food security. While Native Americans travel longer distances, on average, to access healthy food, costs of vehicle ownership and operation are a burden for many low-income tribal households. Therefore, public transportation can play an important role in improving access to food and reducing food insecurity in these communities.

This study examines food insecurity among Native Americans in North Dakota and the role public transit plays in improving access. Specific objectives are as follows:

- Report the association between tribal transit and food insecurity among Native Americans in North Dakota.
- Evaluate public transportation services and food access in Native American reservations in North Dakota.
- Measure the effect of public transportation service on food insecurity.
- Examine the food security status of Native Americans in North Dakota.
- Assess food access, the food environment, and the local food system available in and off Native American reservations in the state.
- Document issues that prevent Native Americans from living on reservations.

The remainder of the paper is organized as follows: Section 2 provides background information about Native American populations in North Dakota, public transportation services available in tribal areas, the identification of areas characterized by having low income and low access to food, and the effects of food insecurity on health for Native American populations. Section 3 describes the methods used in the study, which include a series of surveys conducted of Native Americans across the state. Results are presented in Section 4 and conclusions in Section 5.

2. BACKGROUND

2.1 North Dakota Native American Tribes

2.1.1 North Dakota Reservations and Native American Population

There are five federally recognized tribes in North Dakota: the Mandan, Hidatsa, and Arikara Nation (Three Affiliated Tribes); the Spirit Lake Nation; the Standing Rock Sioux Tribe; the Turtle Mountain Band of Chippewa Indians; and the Sisseton-Wahpeton Oyate Nation. As of 2011 data, there were 77,710 members enrolled in these tribes (ND.Gov 2011). However, not all members live in North Dakota. Two of the reservations extend into South Dakota, and some members may also live in other states, as not all members live on the reservation.

Corresponding with these five tribes are five Native American reservations located at least partially in North Dakota, as shown in Figure 2.1. These are the Fort Berthold Reservation, home of the Mandan, Hidatsa, and Arikara Nation; Spirit Lake Reservation; Standing Rock Sioux Reservation; Turtle Mountain Reservation; and the Sisseton-Wahpeton Oyate Nation. Most of Sisseton-Wahpeton Oyate, including tribal headquarters, is in South Dakota, and the Standing Rock Reservation also extends into South Dakota with the headquarters in North Dakota.
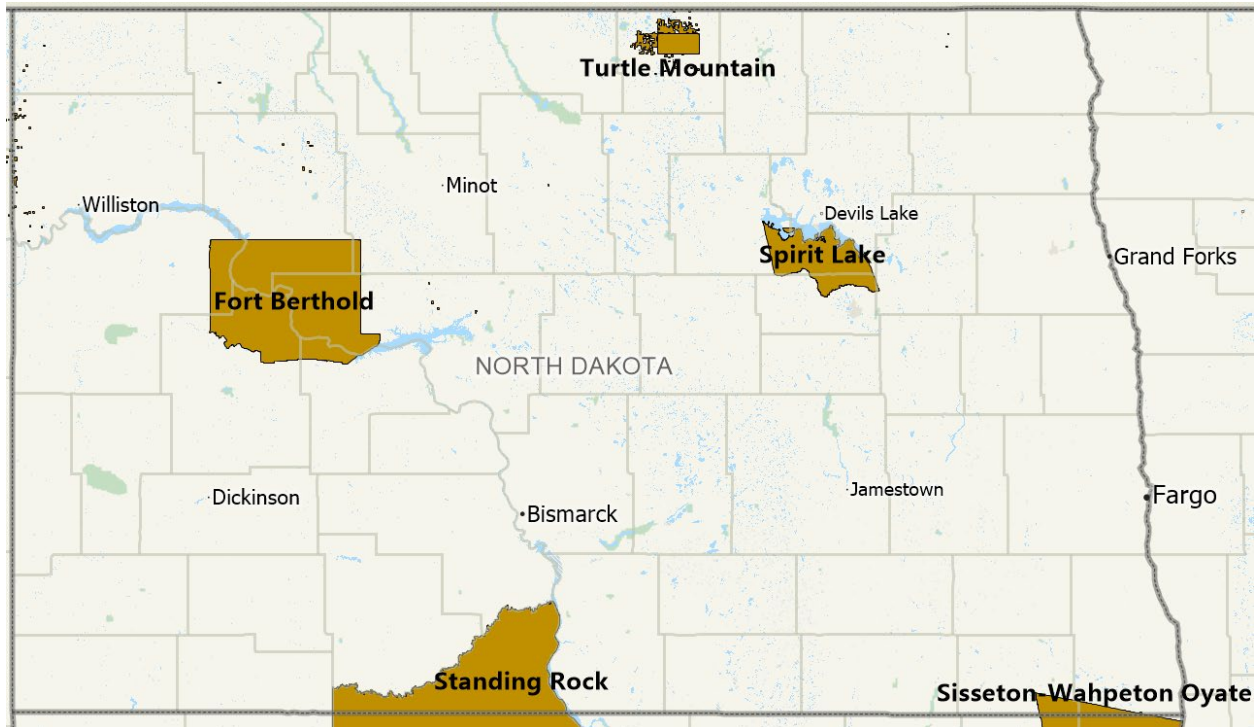
Figure 2.1 Native American Reservations in North Dakota

According to 2020 U.S. Census data, there are 38,914 Native Americans living in North Dakota, about 5% of the state total population. However, this includes only those who identify as one race, and many identify as more than one race. There are 55,777 people in North Dakota, or about 7.2% of the state's population, that identify either entirely or partially as Native American, according to the 2020 U.S. Census. This could still undercount the Native American population because there have been concerns about the Native American population, particularly those living on the reservation, being undercounted in the census (O'Hare 2019).

Figure 2.2 and Figure 2.3 show the concentration of Native American populations across the state, using 2020 Census data. Figure 2.2 shows the total Native American population in each county, and Figure 2.3 shows the percentage of population in each that is Native American. These data include only those who identify as one race alone. Higher concentrations of Native American populations correspond to the locations of reservations shown in Figure 2.1. About 85% of the population in Sioux County, part of the Standing Rock Reservation, is Native American; 76% is Native American in Rolette County, home of the Turtle Mountain Reservation; and 54% in Benson County, which contains Spirit Lake Reservation. Mattson et al. (2020) showed that these counties have the highest rates of poverty in North Dakota. About a third of the residents in these three counties were found to be living below the poverty level, which is an indicator of transportation disadvantage and food insecurity.
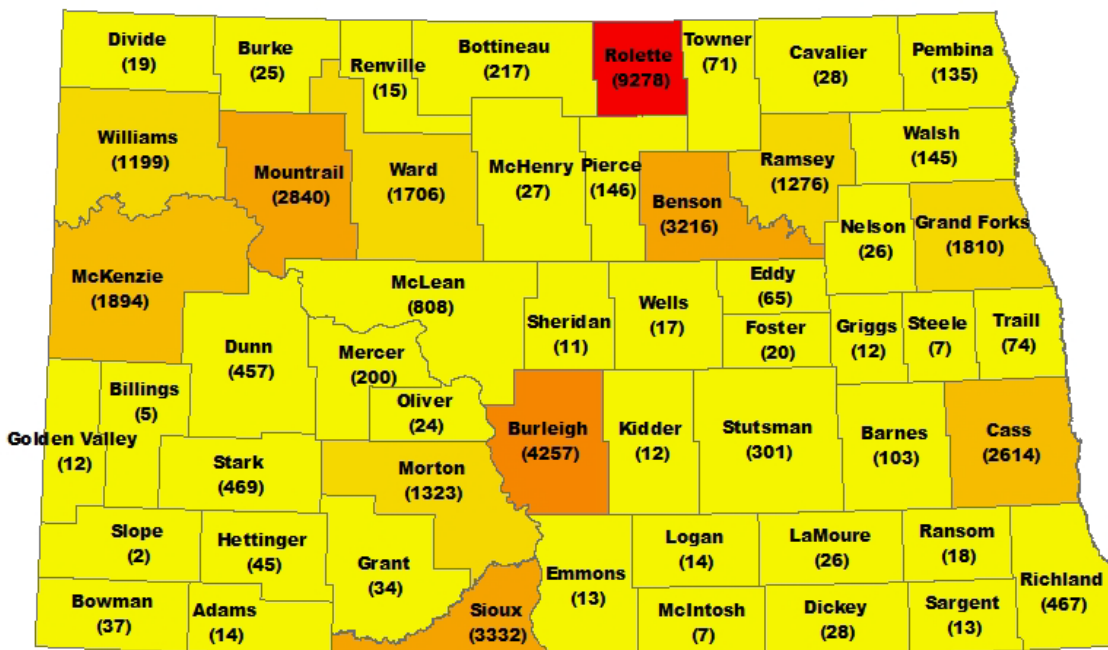
Figure 2.2 Total Native American Population (One Race Alone) by County in North Dakota, 2020 Census
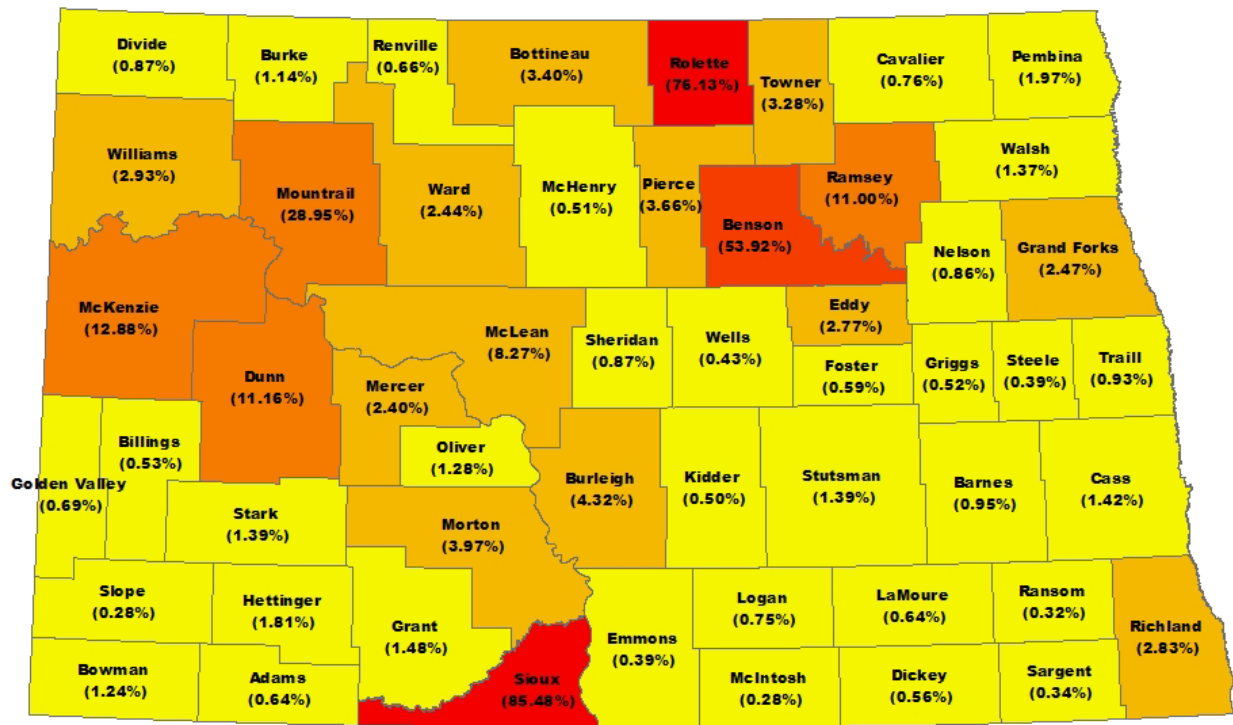
Figure 2.3 Percentage of Population in Each North Dakota County that is Native American (One Race Alone), 2020 Census

2.1.2   Transit Systems Serving North Dakota Tribal Areas

North Dakota has three tribal transit systems funded by the Federal Transit Administration through Section 5311c. This section of the rural transit program was created specifically for funding tribal transit programs. See Ndembe et al. (2021) for more details about tribal transit funding and trends in tribal transit operations across the country. The three tribal transit programs in North Dakota are operated by the Turtle Mountain, Spirit Lake, and Standing Rock reservations.

Turtle Mountain Transit operates two deviated fixed routes that serve housing areas, the casino, the tribal complex, a shopping area, retirement facilities, the tribal college, a hospital, and the post office. The service can deviate up to a mile from the fixed route if a reservation is made 24 hours in advance. Spirit Lake Public Transportation serves the Spirit Lake Reservation and surrounding areas, including the city of Devils Lake, providing transportation services for shopping, employment, medical care, education, and social trips on and near the reservation. They provide a demand-response service seven days a week. Standing Rock Public Transportation provides intercity services for 12 communities and two casinos in south central North Dakota and north central South Dakota and dial-a-ride services in Fort Yates, North Dakota. The intercity services provide connections to Bismarck, including to the airport and other transportation services, and trips are provided twice per month to the Veterans Administration medical centers in Fargo, North Dakota, and Fort Mead, South Dakota. Standing Rock also provides Medicaid transit services.

Figure 2.4 shows trends in ridership for these programs for the 2013-2022 period. Similar to transit agencies across the country, ridership dropped considerably in 2020 because of the COVID-19 pandemic, but ridership rebounded in 2022, returning close to previous levels.
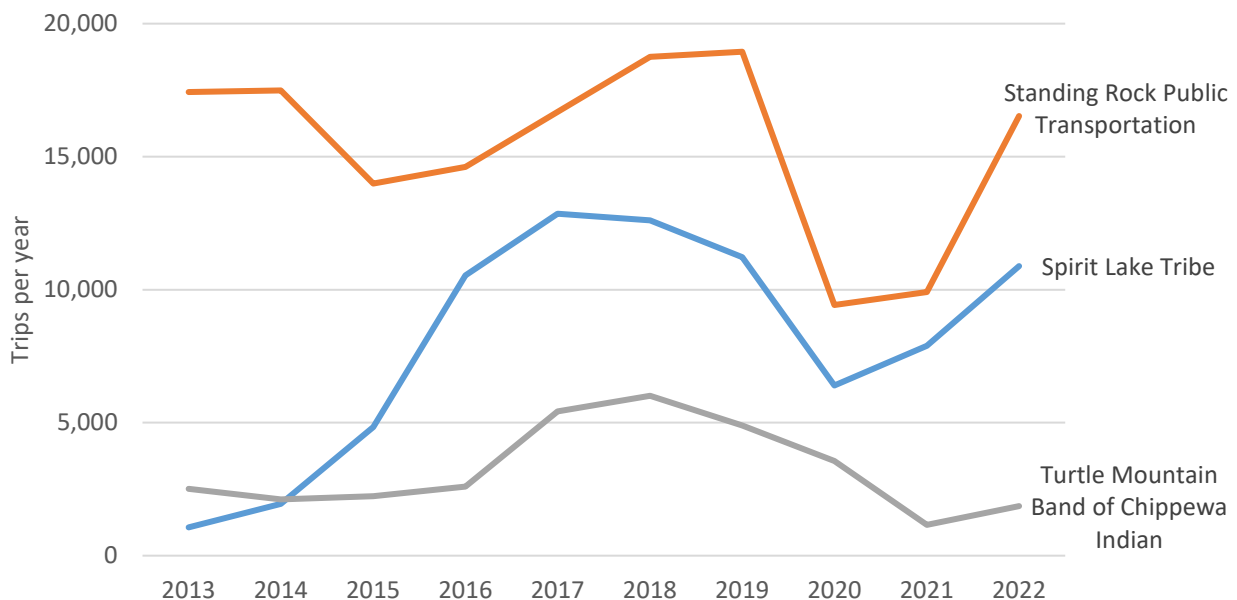
Figure 2.4 North Dakota Tribal Transit Ridership, 2013-2022

In addition to these tribal transit systems, other rural transit agencies provide services in areas where reservations and high concentrations of Native American populations are located, as shown in Table 2.1. Mattson et al. (2020) and Mattson et al. (2023) provide more detail about the level of rural transit service provided across North Dakota.

Table 2.1 Transit Agencies in Counties with Reservations or High Concentrations of Native American Populations

County	Transit Agency
Benson	Benson County Transportation, Spirit Lake Public Transportation
Dunn	West River Transit
McKenzie	Northwest Dakota Public Transit
Mountrail	Souris Basin Transportation, Wildrose Public Transportation
Ramsey	Devils Lake Transit
Rolette	Nutrition United/Rolette County Transportation, Turtle Mountain Transit
Sioux	Standing Rock Public Transportation

2.2   Food Access

2.2.1   Low-Income Low-Access Areas

The U.S. Department of Agriculture's (USDA) Economic Research Service (ERS) says the following about access to healthy food and food security:

> "Consumer choices about food spending and diet are likely to be influenced by the accessibility and affordability of food retailers, travel time to shopping, availability of healthy foods, and food prices. Some people and places, especially those with low income, may face greater barriers in accessing healthy and affordable food retailers, which may negatively affect diet and food security." (U.S. Department of Agriculture, Economic Research Service 2022)

Hence, the geographical location and where a person lives within that area will determine the availability, affordability, and quality of food for that person. The distance to the nearest grocery store will determine if they live in a food desert.

ERS has created the Food Access Research Atlas to identify areas with poor access to food, based on income, distance to the nearest supermarket, and number of households without access to a vehicle. ERS defines a low-income census tract as one with a poverty rate of 20% or more or median family income at or below 80% of the median income for the state or metropolitan area in which it is located. They define a low-access census tract as one where at least 500 people or 33% of the population lives more than one mile from the nearest food store if in an urban area or more than 10 miles in a rural area. Census tracts that are both low income and low access (LILA) are identified as areas where accessing affordable and nutritious food is a challenge. ERS estimated that in 2015, 39.4 million people, or 12.8% of the U.S. population, lived in LILA census tracts (U.S. Department of Agriculture, Economic Research Service 2019).

In North Dakota, 56,724 people, or 8.4% of the state's population, was identified as living in a LILA census tract in 2015. A large share of this population in North Dakota lives in tribal areas. Figure 2.5 shows a screenshot of the Food Access Research Atlas for North Dakota, based on 2019 data. In green are the census tracts identified as low income and low access, based on the definitions previously discussed. In yellow are additional areas identified as low income and low access based on the number of households without a vehicle or a large share of rural residents more than 20 miles from a food store. The map shows that the four main reservations in North Dakota are either completely or partially identified as being low income and low access. This suggests that many Native Americans in the state may face challenges in accessing healthy, affordable food.
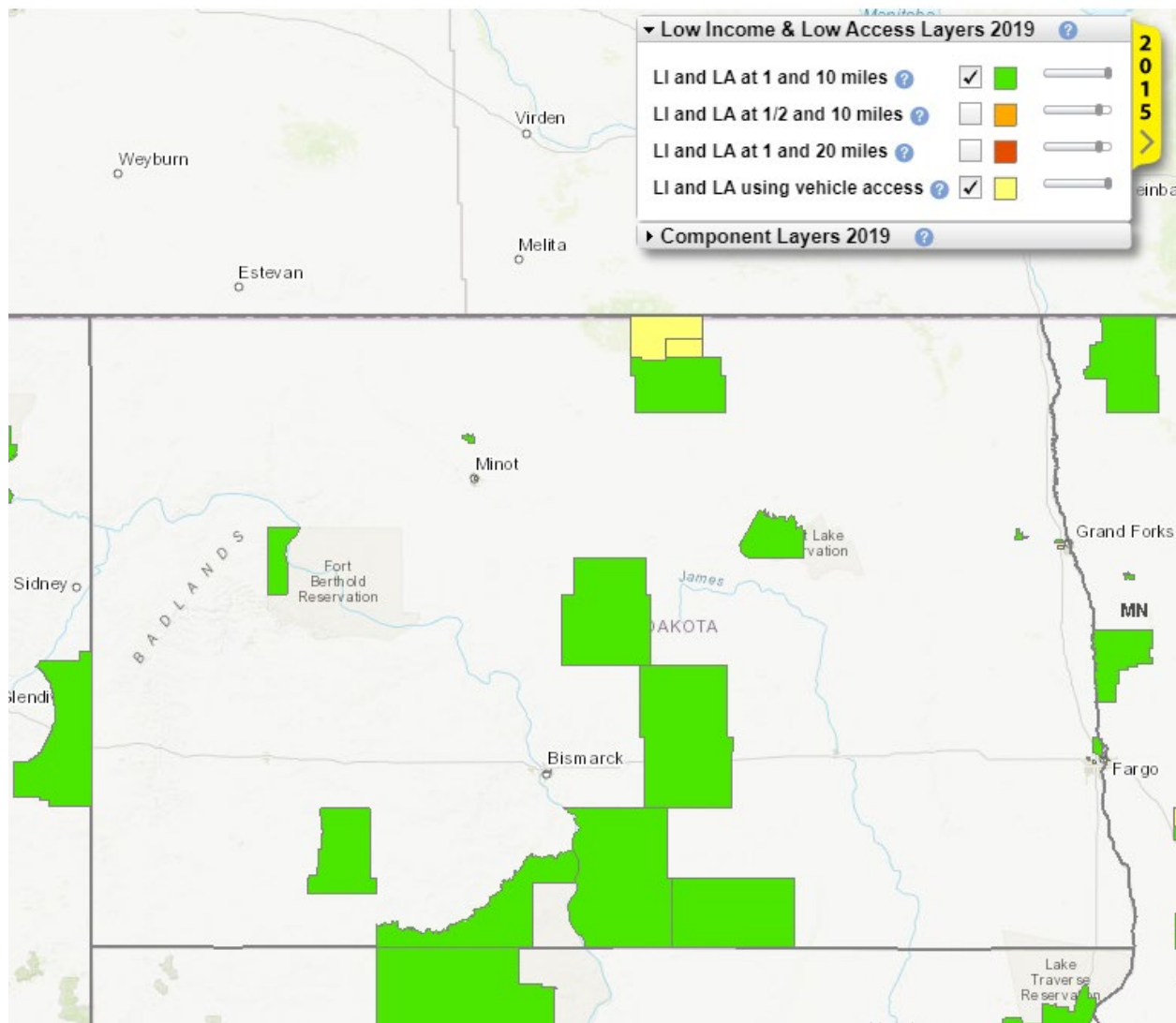
Figure 2.5 Low Income and Low Access Census Tracts in North Dakota, 2019
Source: Food Access Research Atlas, U.S. Department of Agriculture, Economic Research Service

Other research shows the inequalities for Native Americans in accessing healthy, affordable food. Saksena and Kaufman (2015) showed the median distance to the closest large grocery store was four times greater for individuals living in tribal areas. Jernigan et al. (2013) argued that health policies should be concerned more with providing healthy food access to Native Americans.

2.2.2 Food Assistance Programs

There are various federal food assistance programs that help people facing food insecurity and hunger in the United States. For example, low-income Americans can receive monthly funds through a benefits card, similar to a debit card, to buy groceries at local stores or farmers' markets. This food assistance program, known as the Supplemental Nutrition Assistance Program (SNAP), is available to almost everyone. However, some food assistance programs are available for specific people or periods, such as the special supplemental nutrition program for women, infants, and children (WIC) or the emergency food assistance program (TEFAP). Feeding America provides a chart, shown in Table 2.2, that can help low-income people differentiate and learn how the food assistance programs differ and who is eligible for them (Feeding America , Federal Food Assistance Programs n.a). Moreover, people facing hunger and needing immediate response can call the National Hunger Hotline provided by the USDA (USA.gov 2022).

Table 2.2 Federal Food Assistance Programs

Acronym	Full Name	Brief Description	Parents and Kids	Fostering Nutrition	Senior Hunger	Supplying Food Banks
SNAP	Supplemental Nutrition Assistance Program	Provides timely, targeted, and temporary benefits to low-income Americans to buy groceries.	✓	✓	✓	
TEFAP	The Emergency Food Assistance Program	Provides USDA commodities to families in need of short-term hunger relief through emergency food providers like food banks.	✓	✓	✓	✓
CSFP	The Commodity Supplemental Food Program	Provides food assistance for low-income seniors with a monthly package of healthy USDA commodities.		✓	✓	✓
CACFP	The Child and Adult Care Food Program	Provides nutritious meals and snacks to children and adults in designated child and adult care centers.	✓	✓	✓	
NSLP	The National School Lunch Program	Provides nutritionally balanced lunch to qualified children each school day.	✓	✓		
SBP	The School Breakfast Program	Provides nutritionally balanced breakfast to qualified children each school day.	✓	✓		
SFSP	The Summer Food Service Program	Provides free meals and snacks to low-income children during the summer months.	✓	✓		
WIC	Women, Infants, and Children	Provides nutritious foods and nutrition education for low-income, at-risk women, infants.	✓			

Source: Feeding America

2.2.3 Health Issues and Diseases in Native Americans

According to the U.S. Commission on Civil Rights, "The health status of Native Americans continues to lag behind that of all other Americans. Native Americans die at an earlier age than other ethnic groups, and their quality of life is diminished as a result of the prevalence of disease" (US Commission on Civil Rights 2004, p.148). Food insecurity is associated with many of the costliest and most deadly preventable diseases in the United States, such as hypertension, diabetes, cancer, stroke, coronary heart disease (CHD), chronic obstructive pulmonary disease (COPD), and kidney disease (Gregory and Coleman-Jensen 2017). Relying on nutritionally poor foods (refined carbohydrates and foods with added sugars, fats, and sodium) to maintain their daily caloric intake is one of the coping strategies that low-income households usually adopt to compensate for the inadequacy of the food budget. However, while these coping strategies allow low-income households to meet their budget, they do not support good health (Seligman and Berkowitz 2019). Figure 2.6 was developed by Seligman and Berkowitz to show how food insecurity can lead to chronic diseases.
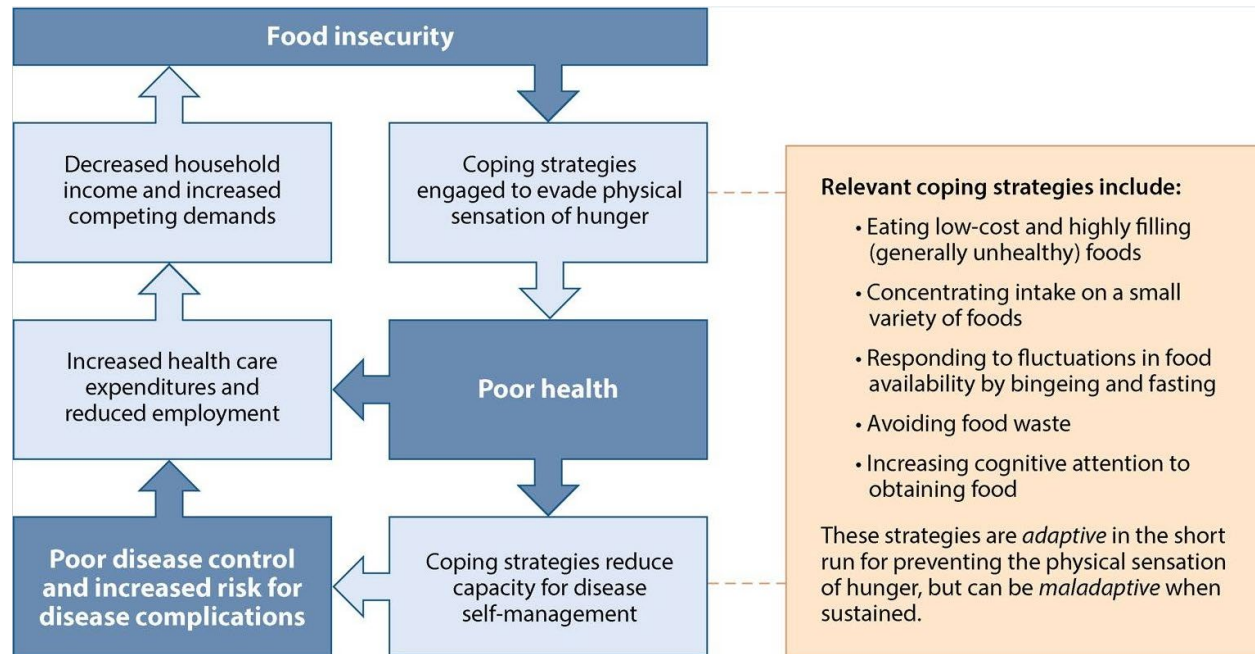
Figure 2.6 Interwoven Pathways Connecting Food Insecurity and Poor Health
Source: Seligman and Berkowitz (2019)

Story et al. (1998) studied the nutritional health of Native American children and diseases related to malnutrition and undernutrition in Native American children for 30 years. According to Story et al. (1998), the adjustment made by the National Institutes of Health in 1969 treated malnutrition, increased food availability, provided food assistance programs, and improved transportation, but it created an obesity epidemic among children and adults in Native Americans due to undernutrition. Undernutrition has been linked with many chronic diseases that Native Americans suffer from today. Childhood and adult obesity are the tip of the iceberg. Undernutrition is putting many Native Americans at the most significant risk for diabetes due to the severe nutritional stress (Benyshek, Martin and Johnston 2001).

Several studies have examined food insecurity, obesity, and other health outcomes. Jimenez-Cruz, Bacardi-Gascon, and Spindler (2003) confirmed that obesity among Native American children was an effect of the undernutrition associated with hunger. In addition, Casey et al. (2006) associated childhood obesity with household food insecurity. Metallinos-Katsaras, Sherry, and Kallio (2009) verified that household food insecurity with hunger was positively associated with being overweight. Furthermore, the association between food insecurity and obesity in women was documented by Townsend et al. (2001), Adams, Grummer-Strawn, and Chavez (2003), Dinour, Bergen, and Yeh (2007), and Martin and Ferris (2007). Jernigan et al. (2017) examined food insecurity and health outcomes of American Indians in rural Oklahoma and found the prevalence of diabetes, obesity, and hypertension was higher among those with inadequate food quantity or inadequate food quality. After accounting for other factors, such as age, gender, study site, education, and income, the relationship between these health outcomes and inadequate food quantity became statistically insignificant, but those who reported inadequate food quality were still shown to have higher rates of diabetes, obesity, and hypertension. These findings show the importance of food quality.

Parker et al. (2007) studied food choices and coping strategies during food shortages among low-income women who were Native American, Hispanic, African American, and White. The authors reported that the stronger proximal familial ties among Native American and African American respondents made the perceived food shortage less common, compared with White or Hispanic women. Three coping strategies were adopted by Native Americans during the food shortage: relying on family members, usually the mother, and going to churches, and utilizing food pantries. Commodity foods are beneficial for Native Americans during a food shortage. Native Americans were eating less frequently at fast-food restaurants. The majority of food was purchased at larger chain grocery stores, and convenience stores were often used by Native Americans for some food choices. Also, Native Americans buy local food, which is influenced by three factors: travel distance, cost, and advertising. Leung and Tester (2019) documented a lower diet quality among Native Americans due to food insecurity.

As a result of food insecurity, many Native Americans suffer from obesity, diabetes, and metabolic syndrome (MetS) (Wiedman 2012). For example, 48% of Native Americans aged 18 or older were obese in 2018, compared with 30% of non-hispanic whites (OMH 2020). According to the Indian Health Service Division of Diabetes Treatment and Prevention, diabetes has existed in Native Americans for many generations. By the mid-1990s, the number of Native Americans diagnosed with diabetes was high enough to make Congress establish the Special Diabetes Program for Indians (SDPI) in the Balanced Budget Act of 1997 (U.S. Department of Health and Human Services 2016).

Traditionally, Native Americans organized entire societies and assembled political structures around the management of food resources; their societal fabric consisted of intricate storytelling that focused on ancient food systems (Romero-Briones 2019). Conti (2006) related diabetes and obesity present on U.S. indigenous reservations to the disruption of the traditional food systems of Native Americans. Others have argued that unfair treatment, racial inequalities, and the forced movement of Native Americans to designated reservations contributed to food insecurity and disease (Farmer 1999, Elsheikh and Barhoum 2013). A case study of Native Americans in Oregon and California showed that most participants "lacked access to desired native foods, due to reduced availability from restrictive laws and habitat degradation under settler colonialism," which they found to be strongly related to food insecurity (Sowerwine, et al. 2019, 1). Wiedman (2012) argued that standards used for food technologies and nutrition created an unhealthy modern diet that continues among Native Americans today.

Education, prevention programs, and the development of local food systems could help reduce food insecurity and disease among Native Americans. Native American tribes are engaged in disease prevention, health promotion efforts, and restoring Native America traditional food system components (Conti 2006). For example, the Three Affiliated Tribes of North Dakota and Native Americans in California developed nutrition models for their tribes. "Each nutrition model tells the story of food system change and its health consequences through narrative and cultural imagery. Ultimately the models suggest ways to eat that reflect the traditional food pattern by using contemporary and traditional foods available today" (Conti 2006, 1), as Figure 2.7 shows. Archer et al. (2004) studied food habits among Native Americans in Minnesota and Wisconsin and found that nutrition education helped Native Americans who had been diagnosed with diabetes to follow healthier eating patterns than those without diabetes.

Jernigan et al. (2012) studied the application of a local food system model to eliminate the numerous effects of food insecurity on Native American families' health and welfare. The Community Supported Agriculture (CSA) project may change the reservation food environment by creating jobs and local ownership and increasing access to fresh vegetables and fruits.
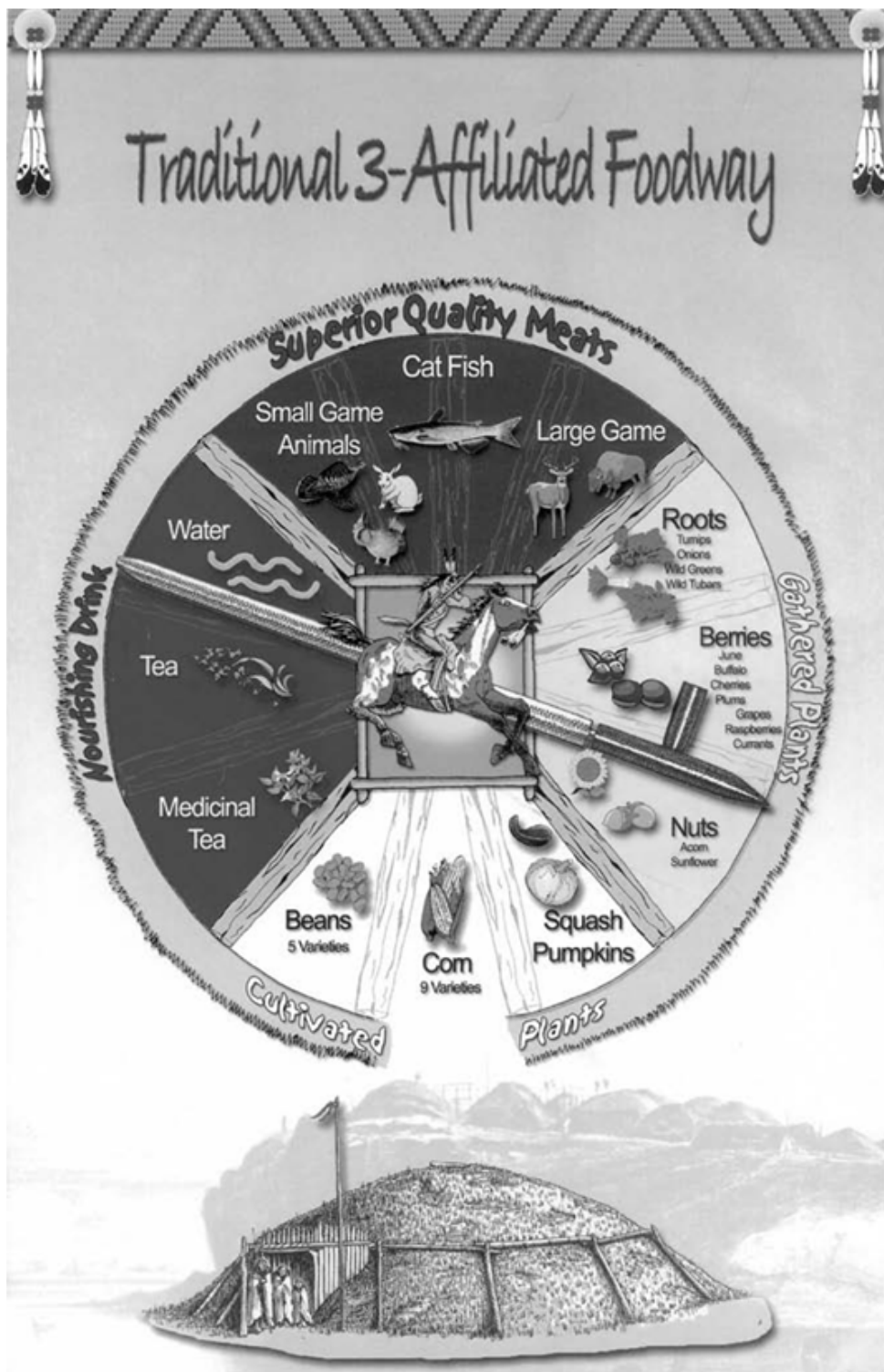
Figure 2.7 Traditional Food Pattern of the Mandan, Arikara, and Hidatsa Tribes
Source: (Conti 2006)

3. METHODOLOGY

To measure the food security status of an individual, researchers at the National Center for Health Statistics developed a six-item survey module and an associated six-item food security scale (U.S. Department of Agriculture, Economic Research Service 2012). Blumberg et al. (1999) found that this module was highly accurate in identifying food insecurity, correctly classifying 97.7% of households. The six-item food security scale assigns the food security status as follows:

- High or marginal food security
- Low food security
- Very low food security

This study adopted the six-item food security survey module to measure the food security status of Native Americans in North Dakota. Surveys were conducted of Native Americans across the state. In addition to the six-item food security survey module, the survey included 37 additional questions designed by the research team and tested and evaluated by professional experts in transportation systems. Two open-ended questions were added to the six-item survey module to collect in-depth information about factors that lead to food insecurity/hunger and ideas that may reduce them. The survey includes five sections, starting with the USDA food security module and followed by sections on transportation and food access, financial information and hunger-coping strategies, health and nutrition, and demographics. The survey is included in Appendix A.

The survey was reviewed and approved by the Institutional Review Boards (IRB) from United Tribes Technical College (UTTC), Sitting Bull College, Turtle Mountain, Community College, and North Dakota State University. In addition to those IRBs, the survey obtained a resolution from Spirit Lake Nation. The survey was launched on September 1, 2022, and closed on October 31, 2022, and was made available in both hard copy format and electronic format using Qualtrics survey software.

The survey was distributed in person and through emails to organizations and entities in North Dakota. The research team set up a booth at the Turtle Mountain Chippewa Pembina Labor Day Pow Wow September 2-4 to administer the survey. The survey was distributed as hard copies and electronically through four tablets.

The electronic version of the survey was online and available for distribution from September 1, 2022, to October 31, 2022. A voluntary sampling technique was used to distribute the survey and to ensure it reached most Native American organizations and entities across the state. The link for the survey was distributed by emails that included the survey flyer and via social media such as Native American Tribes' Facebook pages. Phone calls were made and emails sent to many locations/organizations to recruit participants. The following is a list of organizations that received follow-up messages to attract participants:

- Spirit Lake Nation / Senior Meals & Service
- United Tribes Technical College
- Nueta Hidatsa Sahnish College
- Cankdeska Cikana Community College Fort Totten
- Turtle Mountain Community College, Belcourt
- Sitting Bull College, Fort Yates
- University of North Dakota

- Tribal Historical Preservation Office at Spirit Lake
- Sisseton Wahpeton Oyate, (expense to administer the survey so did not include this group)
- Mandan, Hidatsa, Arikara (MHA) Nation (the Three Affiliated Tribes) (did not participate)
- NDSU Multi-Cultural Office
- NDSU American Indian Public Health Resource Center (they did not respond)
- North Dakota Human Rights Coalition / Indigenous Population
- Community Action Partnership of North Dakota
- Great Plains Food Bank
- Red River Valley Community Action Agency

Many of the organizations were welcoming while some of the others did not return calls or did not participate. However, good connections were made with North Dakota tribes and organizations that serve the tribes.

4.   RESULTS AND DISCUSSION

In this section we describe the survey responses and present the results to gain an understanding of food security and transportation's role in addressing food insecurity among Native Americans in North Dakota. First, we describe the demographics of the respondents followed by identifying the food security among the tribes. We then present the respondents' thoughts on the causes and strategies to address food insecurity. The section also covers transportation's role in food access for the tribes. The final portion of this section describes the health and nutrition of the respondents during the COVID-19 timeframe, according to their assessment.

4.1   Survey Response

There were 292 survey responses after removing duplicates and responses containing an answer to only the first question. Among these, 246 respondents answered most of the questions. Responses were received from each of the North Dakota tribes (Figure 4.1). Turtle Mountain Band of Chippewa had the highest number of responses, accounting for 29% of total responses, followed by Spirit Lake Nation (21%) and Standing Rock Sioux Tribe (17%). Also, 16% did not belong to any North Dakota tribe, including several that belong to one of the South Dakota tribes. The higher number of responses from the Turtle Mountain Band of Chippewa was likely due to the outreach the research team did by attending the Labor Day Weekend Powwow to administer surveys. In addition to collecting surveys at the event, the exposure to the research may have prompted more participation through electronic completion. The following sections describe the geographic locations and demographic characteristics of the respondents.
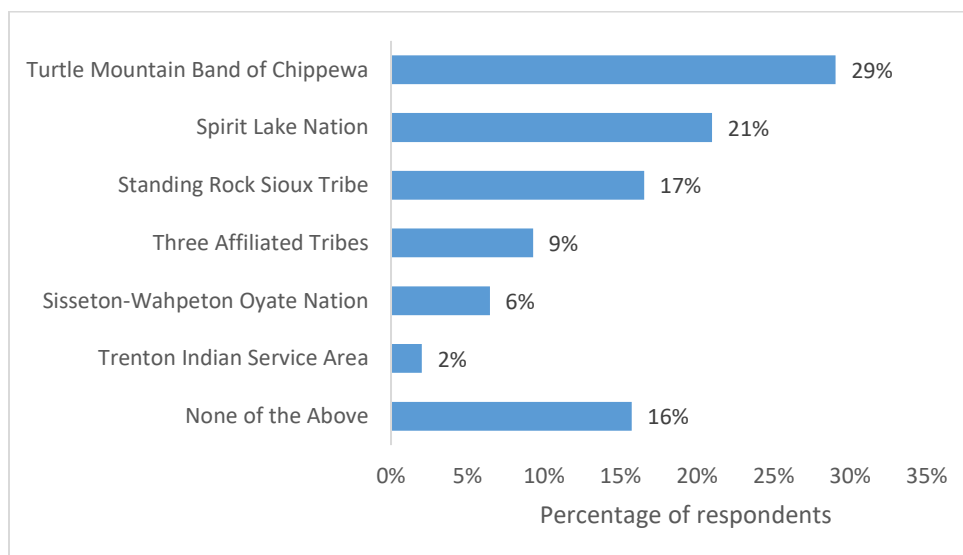
Figure 4.1 Survey Responses by Tribe, n=248

4.1.1   Geographic Locations of Respondents

The intent was to distribute the survey to Native Americans in North Dakota, though some responses were received from individuals living in other states, as shown in Figure 4.2. This is not surprising because many tribal members do not live on the reservation and may live in another state. Also, the Standing Rock and Lake Traverse reservations extend into South Dakota, and the powwow where the survey was distributed could have attracted individuals from other states. The most responses were from

the Turtle Mountain Reservation and surrounding area, the Bismarck area, the Spirit Lake Reservation and surrounding area, and Standing Rock Reservation. Responses were received from other areas across North Dakota, including Fargo, Grand Forks, and the Fort Berthold Reservation. Responses were also received from people from South Dakota, Montana, and Minnesota, many of them living in tribal areas. Not shown in Figure 4.2 is a small number of responses received from individuals who do not live in North Dakota or any neighboring state but are a member of a North Dakota tribe.
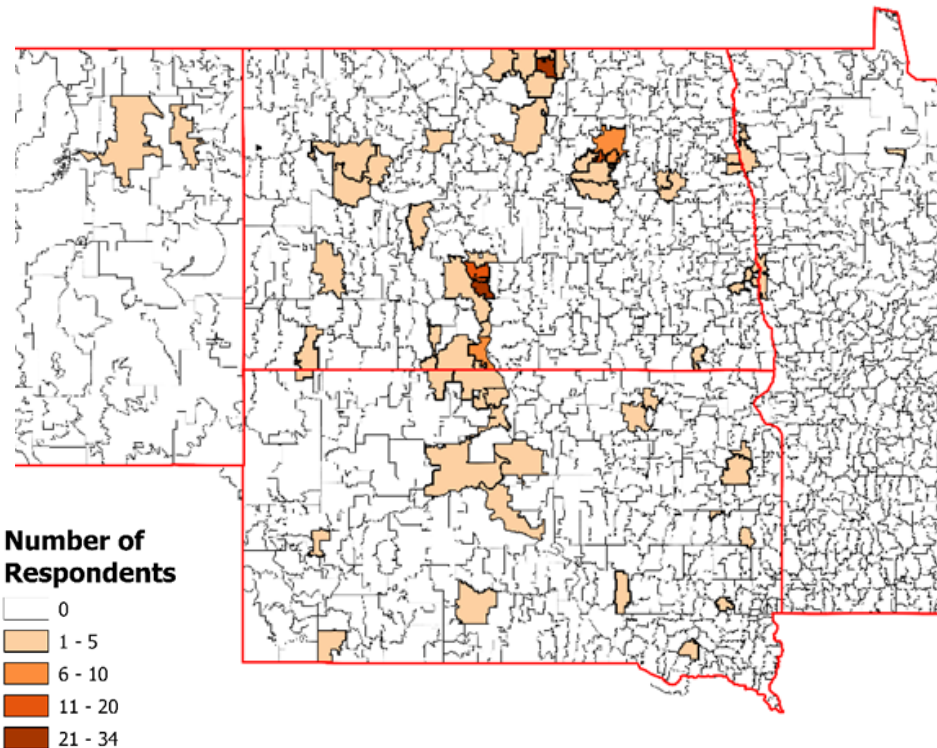
Figure 4.2 Location of Survey Respondents

More than half of the respondents (56%) reported that they do not live on a reservation. They were asked to identify why they do not live on the reservation, with several answer options to choose from. The top reasons provided for not living on a reservation included lack of available jobs (reported by 62% of respondents), lack of affordable housing (46% of respondents), lack of shopping and entertainment (40%), and lack of access to healthy, affordable food (40%) (Figure 4.3).

In a previous study, Ndembe et al. (2021) surveyed members of Standing Rock Tribe, as well as Makah Tribe in Oregon, and asked a similar question about reasons for not living on the reservation. Results from those surveys were similar, as lack of available jobs, lack of affordable housing, and lack of shopping and entertainment were the most reported reasons for not living on the reservation. Crime was also a common reason cited by Standing Rock members in that study.
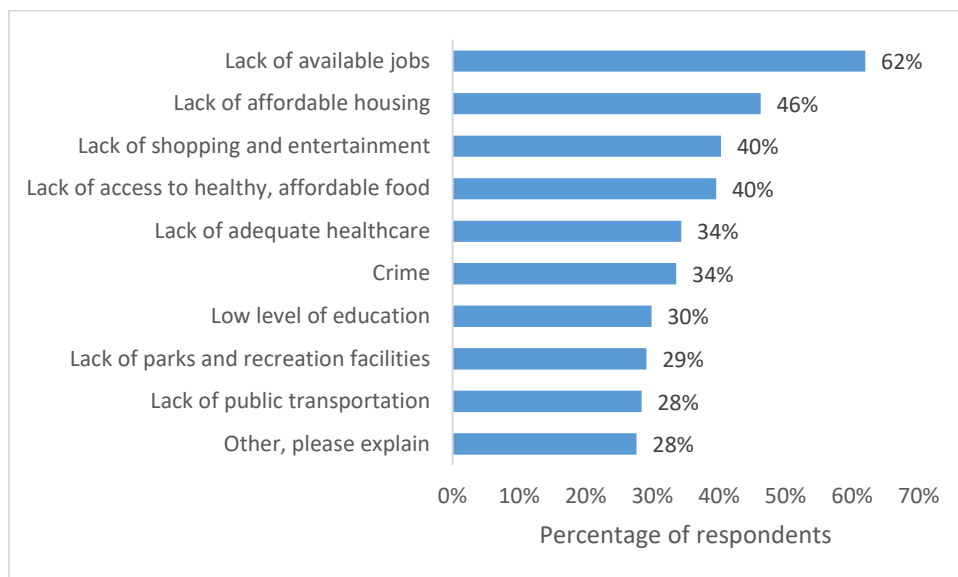
Figure 4.3 Reasons Given by Respondents for Not Living on a Reservation, n=134

4.1.2 Demographics of Respondents

The survey collected basic demographic information to better understand the respondents, including age, employment, education, income, marital status, and number of children under 18 living in the household (Figure 4.4). Of the 246 respondents that answered most of the questions, the gender breakdown included 159 females, 85 males, and two who preferred not to identify their gender. Most respondents were younger adults, including 30% aged 35-44 years and 29% aged 25-34 years. There were no respondents in the category of 75 years and older. Although we reached out to the Senior Meals & Service, those in the highest age category either did not receive the survey or decided not to participate.

Age (n=246)

Age	Percentage
18-24	19%
25-34	29%
35-44	30%
45-54	10%
55-64	7%
65-74	4%
75 +	0%

Percentage of respondents

Household Income (n=249)

Income	Percentage
Over $100,000	4%
$75,000 to $99,999	4%
$50,000 to $74,999	10%
$35,000 to $49,999	15%
$20,000 to $34,999	25%
Less than $20,000	43%

Percentage of respondents

Employment Status (n=247)

Status	Percentage
Employed full time	39%
Student	29%
Employed part-time	12%
Unemployed, looking for work	10%
Unemployed, not looking for work	2%
Unable to work	2%
Self-employed	2%
Retired	2%
Homemaker	2%

Percentage of respondents

Highest Education Level Attained (n=247)

Education	Percentage
Doctorate or professional degree	2%
Master's degree	2%
Bachelor's degree	9%
Associate degree	22%
Some college, no degree	34%
High school degree or equivalent	17%
Less than a high school diploma	13%

Percentage of respondents

Marital Status (n=245)

Status	Percentage
Separated	3%
Divorced	9%
Widowed	3%
Married or domestic partnership	36%
Single, never married	49%

Percentage of respondents

Children under 18 Years Living at Home (n=246)

Children	Percentage
More than 4	4%
2-4	39%
1	24%
None	33%

Percentage of respondents

Figure 4.4 Demographic Characteristics of Respondents

19

Respondents were asked to describe their employment status, selecting from among the nine options shown in Figure 4.4. Although having employment does not guarantee food security, employment does provide finances to pay expenses for necessities including food, shelter, etc. Among respondents, 39% reported working full-time, while 29% reported being a student, and about 12% reported being employed part-time. Nearly 10% of respondents reported being unemployed and looking for work.

As shown in the figure, many of the respondents were students. This is especially true of those who do not live on the reservation. Among the respondents not living on the reservation, 42% reported being a student, compared with 13% of those living on the reservation. A higher percentage of respondents living on the reservation were employed full-time (52%), compared with those living off the reservation (28%), but that was largely due to the high percentage of students from off the reservation. The unemployment rate was approximately the same for respondents living on and off the reservation.

Because many respondents were current students, a large share (34%) have some college education with no degree, followed by 22% who have an associate degree. Overall, 36% reported having some type of college degree, including 14% who have a bachelor's degree or higher. Compared with national averages from the American Community Survey (ACS) 2021 one-year estimates for adults 18 and older, the percentage of respondents with a high school degree or higher is similar to national averages. However, the percentage of respondents with a bachelor's degree or higher is below the national average of 32%.

Income certainly plays a role in the ability to purchase food. Almost 43% of the survey respondents earn less than $20,000 per household annually, while 25% earn between $20,000 and $34,999. There were 3.6%, or nine respondents, that reported earning over $100,000 annually. Results show high levels of poverty and low income among respondents. Two-thirds of respondents reported household income below $35,000. Nationally, according to ACS 2021 data, 25% of households earn income below $35,000. Respondents were then asked if they received any disability income in the last year. Among participants, 32 (12.8%) reported they had received disability income within the last year.

About half of respondents were single and never married. Again, this was likely influenced by the larger percentage of younger respondents. About a third of respondents reported having no children under age 18 living at home, while about 43% had two or more children.

4.2 Food Security

4.2.1 U.S. Household Food Security Survey Module: Six-Item Short Form

To measure the food security status of survey respondents, the survey contained six questions designed to determine if there was enough food in the household, if respondents could afford balanced meals, if they skipped meals because there was not enough food or money, the frequency this happened, and if they ever ate less than they wanted because there was not enough money for food. These questions are from the six-item U.S. Household Food Security Module used by the Economic Research Service of the USDA and originally developed by the National Center for Health Statistics. The six-item short form helps to identify food-insecure households and households with very low food security with minimal bias. However, it does not directly account for children's food security, nor does it measure the most severe range of food insecurity.

The six questions are as follows:
1. The food that I/we bought just didn't last, and I/we didn't have money to get more. Was that often, sometimes, or never true for you/your household in the last 12 months?
2. I/we couldn't afford to eat balanced meals. Was that often, sometimes, or never true for you/your household in the last 12 months?
3. In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
4. How often did this happen?
5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
6. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?

Responses to the six questions are shown in Figure 4.5. The questions all pertain to the 12 months prior to when the survey was administered. Results suggest a high level of food insecurity. Among respondents, 28% said it was often true that the food they bought did not last, and they did not have money to get more. Nearly half said it was sometimes true. One-third of respondents reported it was often true that they could not afford to eat balanced meals, and another 43% said this was sometimes true. About half answered that they, or another adult in their household, sometimes cut the size of their meal or skipped meals because there was not enough money for food. Among those who reported cutting the size of meals or skipping meals, 38% said it happened almost every month. More than half of all respondents (59%) said they sometimes ate less than they felt they should because there was not enough money for food, and slightly less than half (46%) reported that they were ever hungry but did not eat because there was not enough money for food.

1. The food that I/we bought just didn't last, and I/we didn't have money to get more. (n=291)

- Often true — 27%
- Sometimes true — 48%
- Never true — 25%

Percentage of respondents

2. I/we couldn't afford to eat balanced meals. (n=290)

- Often true — 33%
- Sometimes true — 43%
- Never true — 23%
- Refuse to answer — 1%

Percentage of respondents

3. In the last 12 months, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food? (n=290)

- Yes — 52%
- No — 45%
- Refuse to answer — 3%

Percentage of respondents

4. How often did this happen? (n=144)

- Almost every month — 38%
- Some months but not every month — 47%
- Only 1 or 2 months — 15%
- Refuse to answer — 1%

Percentage of respondents

5. In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food? (n=261)

- Yes — 59%
- No — 38%
- Refuse to answer — 3%

Percentage of respondents

6. In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food? (n=259)

- Yes — 46%
- No — 50%
- Refuse to answer — 4%

Percentage of respondents

Figure 4.5 Responses to Six-Item Food Security Short Form

22

The food security status for each respondent was calculated by combining their responses to each of the six questions. Following the procedure described by the Economic Research Service (U.S. Department of Agriculture, Economic Research Service 2012), responses of "often" and "sometimes" to the first two questions, "yes" to questions three, five, and six, and "almost every month" and "some months but not every month" to question four were coded as affirmative (yes). The affirmative responses to the six questions for each respondent were totaled to come up with the household's raw score.

The food security status assigned is as follows:

- Raw score 0-1: High or marginal food security
- Raw score 2-4: Low food security
- Raw score 5-6: Very low security

The raw food security scores are shown in Figure 4.6. This shows that nearly one-third of respondents answered affirmative to all six questions. After combining the scores into the three categories of food security, we find that almost half of respondents have very low food security, while 27% have low food security, and 25% have high or marginal food security (Figure 4.7). These results show high levels of food insecurity among North Dakota tribal members.
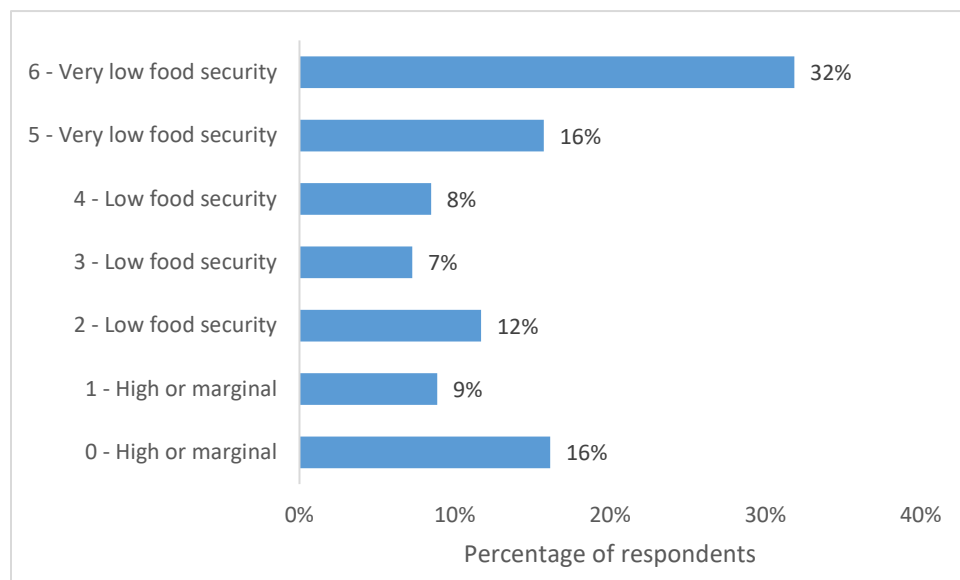
Figure 4.6 Raw Food Security Scores, n=248
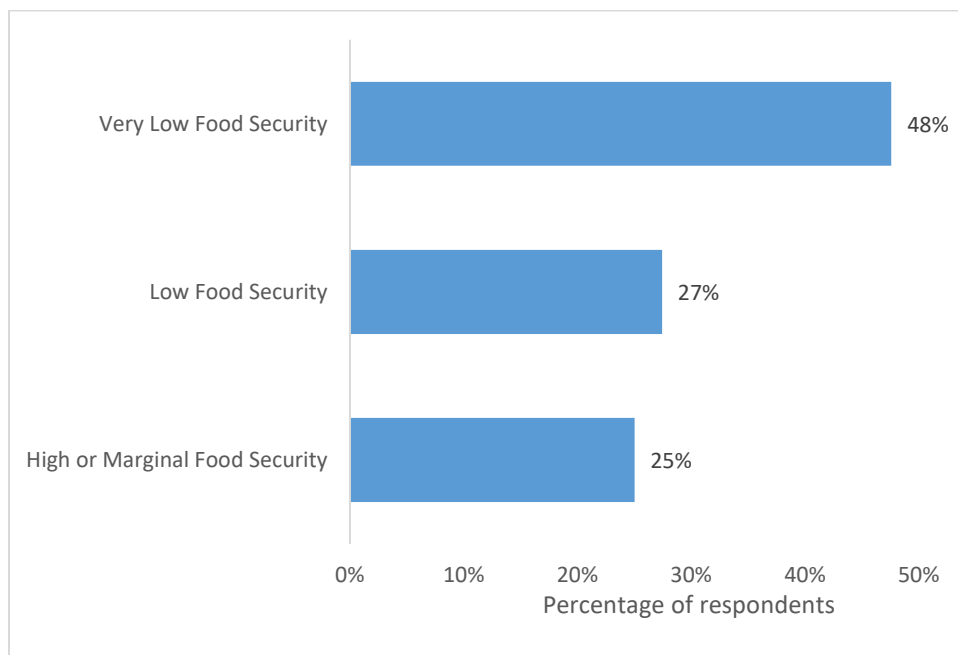
Figure 4.7 Level of Food Security Among Survey Respondents, n=248

There does not appear to be a significant difference in levels of food security between tribal members that live on or off the reservation. About 45% of respondents that live on the reservation have very low food security, compared with 50% that live off the reservation.

Further analysis was conducted to understand the characteristics of those with lower levels of food security. Factors such as income, education, use of assistance programs, access to transportation, and others could be associated with food security. An ordered logit model was developed to estimate the relationships between each of these factors and food security. The model also examined if food security levels were different between the tribes or between those living on or off the reservation.

The dependent variable in the model is the food security level, where 3=very low food security, 2=low food security, and 1=high or marginal food security. Potential explanatory variables include income, use of assistance programs, education, age, gender, disability, number of children in the household, mode used to travel to the grocery store, having a grocery store within walking distance, and whether they live on or off the reservation.

The model was first developed using all of these explanatory variables. However, many were found to be statistically insignificant. The statistically insignificant variables were dropped, and the model was re-run. Results are shown in Table 4.1.

Table 4.1 Results for Ordered Logit Model of Food Security

Variable	Estimate	p-value	Odds Ratio Point Estimate	95% Confidence Interval
Income	-0.592	<.0001***	0.55	0.43 – 0.71
Assistance*Income	0.367	0.0011***	1.44	1.16 – 1.80
Education	-0.219	0.0705*	0.80	0.63 – 1.02
Drive	-1.007	0.0023***	0.37	0.19 – 0.70

*p<0.10, **p<0.05, ***p<0.01

Income, assistance programs, education, and being able to drive to the grocery store are significantly related to food security. Because the dependent variable is measured on a 1-3 scale, with 3 being very low food security, a negative estimate, or an odds ratio below 1.0, indicates that an increase in the explanatory variable is associated with a decrease in food insecurity, or an increase in food security, and vice versa. Therefore, an increase in income or education is associated with a decrease in food insecurity. Income was measured on a scale of 1-6 and education on a scale of 1-7, following the categories shown in Figure 4.4. The magnitude of the effects can be interpreted from the odds ratios. If income increases by one level (along the 1-6 scale), the odds of a higher level of food insecurity decrease by 45%. The odds decrease by 20% as education increases by one level.

The effect of assistance programs was measured by using an interaction variable with income. First, a dummy variable was created equal to 1 if the respondent reported anyone in their household using any food assistance program, or 0 if not.[1] This dummy variable was then multiplied by the income level and included as a variable in the model. The result shows how the effect of income on food security changes if the individual receives food assistance. To interpret the results, the estimate for this variable (0.367) is added to the estimate for income (-0.592) to estimate the effect of income for someone receiving food assistance (-0.225). The result is an estimate for income that is still negative but smaller in magnitude. Therefore, assistance programs are found to reduce the negative effects of low income on food security.

Lastly, if someone reported that they drove themselves to the grocery store, they had significantly lower levels of food insecurity. The odds decrease by 63% if the individual can drive to the grocery store. This result demonstrates the importance of transportation for improving food security. While the results show that not being able to drive is associated with higher levels of food insecurity, the use of public transportation to grocery stores was not found to have a statistically significant relationship with food security. Results may suggest that those who cannot drive need improved options for accessing food, which could include improved public transit services if existing services are not meeting their needs, other transportation options, or food delivery.

Other variables studied, including age, gender, disability, number of children, whether they live on or off the reservation, and whether they have a grocery store within walking distance, were statistically insignificant. The model was not able to detect any association between these variables and food security.

---

[1] Food assistance programs could include WIC, SNAP, the Commodity Supplemental Food Program, the Senior Farmers' Market Nutrition Program, Meals on Wheels, a local food bank, food assistance available from a church or another organization, the Food Distribution Program on Indian Reservations, the National School Lunch Program, summer feeding programs, the school breakfast program, the Child and Adult Care Food Program, or the USDA Fresh Fruit and Vegetable Program.

However, that does not necessarily mean they do not play any role. It could mean that too few survey responses were received to measure the importance of those variables.

4.2.2 Food Insecurity Causes and Strategies

The survey asked two open-ended questions to gather more information about the causes of food insecurity and strategies for reducing food insecurity. The two questions were:
- In general, what do you think are the top three factors that lead to food insecurity and hunger among North Dakota Native Americans?
- Would you please identify three ideas that you think would help reduce food insecurity and hunger among Native Americans in North Dakota and all U.S. states?

Responses to these questions were analyzed using a qualitative data analysis technique. First, key themes were identified, and responses were categorized under these themes. After identifying key themes, responses were coded using keywords. Responses that did not fit in any of the categories were categorized as "others." The number of responses categorized under each theme was then calculated to find how often those themes show up in the responses.

Table 4.2 shows the list of themes found in response to the first question, which asked respondents to identify factors leading to food insecurity and hunger. Figure 4.8 shows how often each of those themes were found in the survey responses.

Respondents most frequently identified financial hardships as a contributor to food insecurity. This includes low income, unemployment, lack of jobs, and job instability. The next most common response was inflation and the high cost of food, housing, fuel, and other necessities. Several respondents also mentioned lack of transportation as a contributor to food insecurity, confirming the important role transportation plays in providing access to food. Other common responses included the unavailability of food, a lack of education about food and budgeting, drug and alcohol abuse, and insufficient government benefits.

Table 4.2 Factors Identified that Lead to Food Insecurity and Hunger Among Native Americans in North Dakota

| Theme	Description
Financial hardship	Any responses related to financial hardship, including unemployment, job instability or insecurity, and low income.
Unavailability of food	Lack of availability of food or inaccessibility of food sources.
Location/distance from food	Location of the food store, grocery store, food pantry, and distance of the community from food sources. Communities are in such places where people cannot get enough food facilities. There is also a lack of groceries and food pantries in such localities.
Drugs/alcohol abuse	When respondents mention that drug/alcohol/substance abuse is the reason for their hunger.
Lack of education about food and budgeting	Lack of education or knowledge about the benefits of eating healthy food, food preparation, and budgeting limited income to spend on food.
Lack of transportation	**When respondents cannot get enough food because they do not have access to a vehicle or transit.**
Lack of government provided benefits	When there is not enough EBT/SNAP and other government provided benefits, when the available EBT/SNAP benefits are not enough to manage food for all the members of the family, single parents not qualifying for SNAPs.
Misuse of government provided benefits	Misuse of SNAP/EBT benefits, such as selling them.
Lack of support from family/community	Not enough support from family and community. Too many children at home and not getting any support from family/community to take care of them.
Inflation/high costs	Inflation-related factors, high price of food, high fuel cost, high cost of living. Increased price of necessary things other than food, leaving less money available for food.
Eating disorders/eating junk foods	People are more interested to eat junk food rather than healthy food.
Homelessness/lack of housing	Lack of proper housing, people living in housing shelters.
Weather/environmental conditions	Because of adverse weather/bad weather conditions, respondents cannot travel to food pantries/groceries
Health conditions/ dietary restrictions	Some people cannot eat the food available in food pantries/grocery stores because they have special physical issues and dietary restrictions.
Discrimination	Racial discrimination, racism, ethnic discrimination, not getting equal treatment in workplace.
Covid-19 pandemic	Impact of Covid-19 pandemic.
Violence/conflict	Regional conflicts, exposure to violence, war, violence against women and children.
Food production and distribution	Transporting and distributing food in the community, the gap between the rich and poor, irregular and inadequate food supply in the community, food loss and waste, lack of a unified management system for food production, gap in demand and supply of food grain.
Economic factors	Lack of economic development in the community, economic crisis.
Demographic issues	Too many children in family, population density, less population, big family, small population base, excessive population growth, multiple families living in one house.
Other inconveniences	Factors that could not be categorized under any of the above categories, such as food spoiling, pride (not asking for help), lack of proper mental counseling, laziness, stress, timing, lack of internet resources, extreme events, gambling, personal choice, inability to hunt, etc.
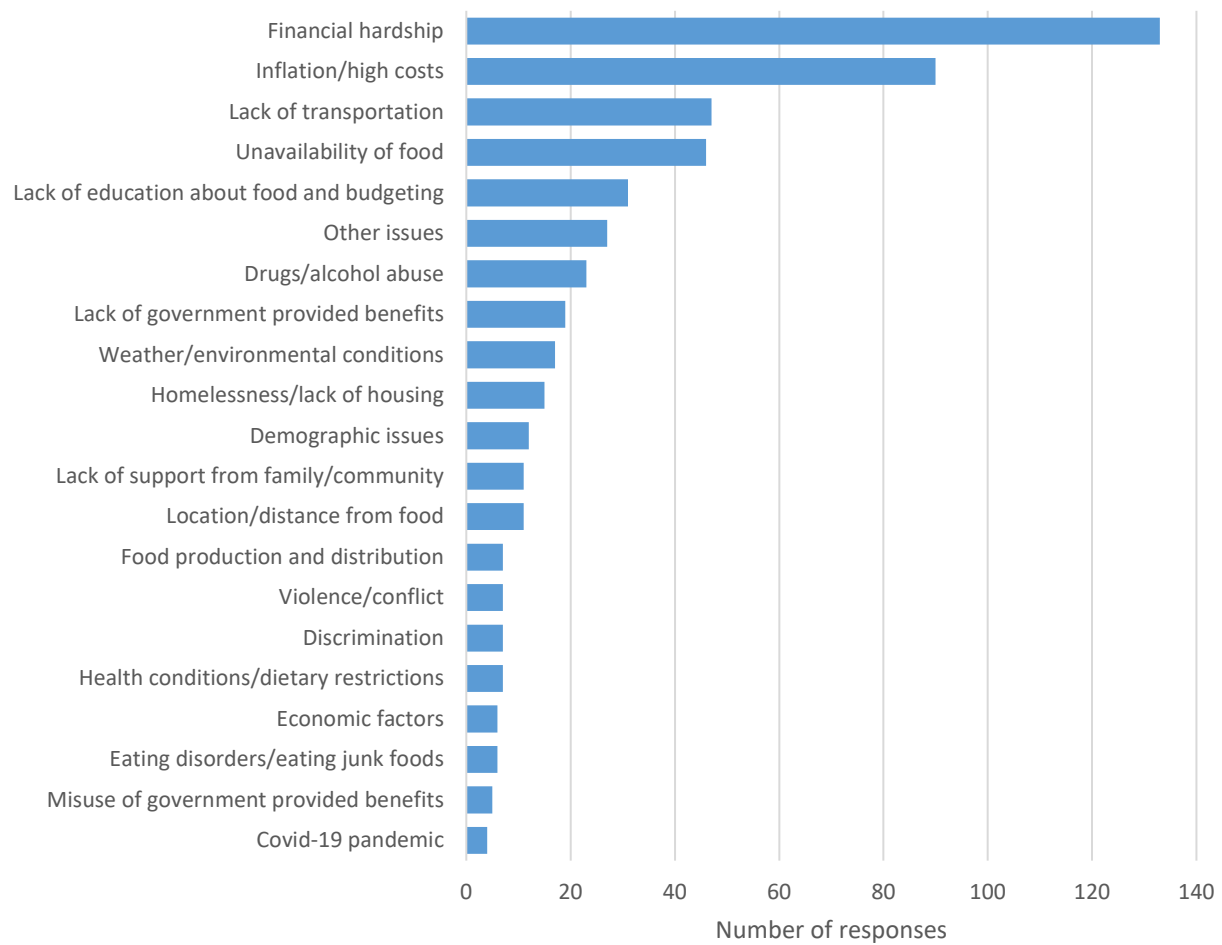
Figure 4.8 Frequency of Factors Identified as Leading to Food Insecurity

Respondents were next asked to identify ideas for reducing food insecurity and hunger. Table 4.3 shows the list of themes found in response to this question, and Figure 4.9 shows the frequency of these themes in the survey responses.

Table 4.3 Strategies Identified to Reduce Food Insecurity Among Native Americans

Theme	Description
More food options	More food pantries, farmers markets, and groceries inside and near the community; increase the supply and accessibility of food; increase resources.
Job creation and security	Create more jobs in the community, improve the job environment, and increase job security.
Reduce drug abuse	Reduce the amount of drugs/alcohol, prevent drugged parents from selling EBT, create more organizations to stop substance abuse, bring more police and laws to stop drug abuse.
Transportation and communication	Transportation to grocery stores, transit access, more and better transportation options, honest communication, having the right people in the county offices to communicate with people, providing a ride share program.
Expand food assistance programs	More food pantries, EBT, SNAP, and other government benefits; national and tribal policies to expand food aid.
Education	Cooking classes to teach the community how to cook healthy food, provide education, teach community members how to budget their income efficiently.
Enhance community capacity	Build and increase community capacity; prevent people from other communities from taking food from the local food pantry; build partnerships among community members; invest in community gardens; improve community services.
Food production and distribution	Farmers markets, food giveaways, achieving food sovereignty, better distribution of food in reservations, gardening, hunting, providing fruit and veggies common to indigenous life.
Price reduction	Reducing the price of food, fuel, other essential products, house rents, and living cost.
Housing assistance	More housing, more access to housing shelters, offer safe and secure places to live, homeless shelters in reservations.
Health related factors	Providing healthy foods, vitamin packs, addressing mental issues of native people.
Higher wages/income	Provide better jobs with higher wages, increase personal income and revenue.
More food programs for children	Free school lunches for children, food bags for children each week, more programs for single parents to provide for children.
Economic initiatives	Economic development, no taxes on fresher food, increase resources, reduce export restrictions, increase trade flows, more imports, increase savings.
Grocery related factors	Provide in-store sales on groceries, no tax on groceries, more reliable stores gift cards or grocery vouchers, work with groceries so they donate salvageable items.
Availability of information	Openness, provide information to people about available resources, more advertisement of the free meals, access to Wifi, more advertisement on programs and their services for bus passes
Reduce conflict and crisis	Address climate crisis, reduce regional conflicts, reduce pesticide residue and water pollution.
Volunteering	More volunteers in local soup kitchens and feeding programs.
Industrial/agricultural development	Establish greenhouses, use new products and technologies, strengthen agricultural infrastructure, grow drought tolerant grains, develop industry, agricultural sustainability.
Reduce food wastage	Donation from stores that waste a lot of food, stop wastage.
Other	Factors not categorized elsewhere, such as public security, tribal oversight, equal treatment, childcare assistance, leadership, having the right people in county offices, people needing to accept food that is distributed to them, more secure ways of using government assistance, better decision-making, more mentoring of young people, respect, permanent residency, organizational skills, simpler meal plans, better quality food, etc.

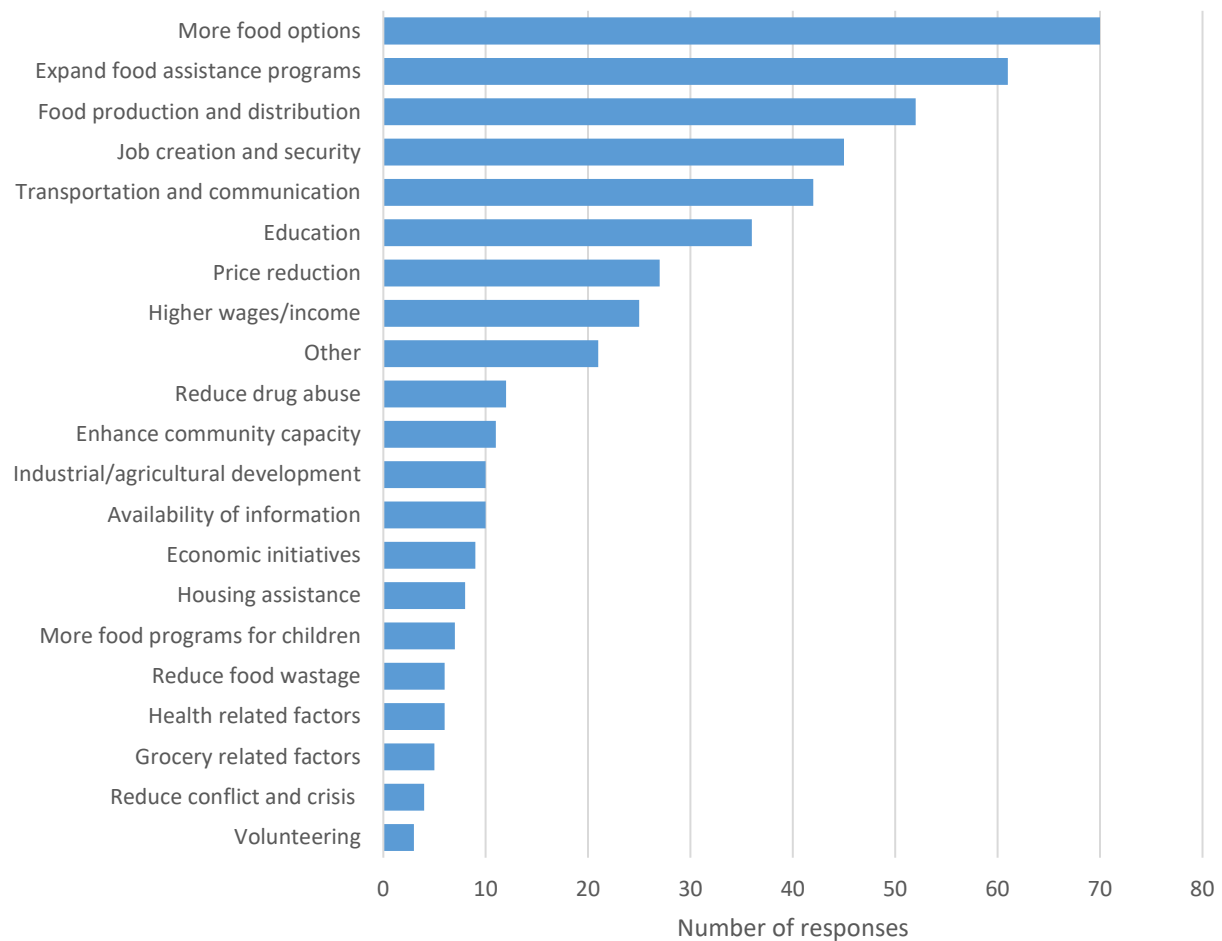**Figure 4.9** Frequency of Strategies Identified for Reducing Food Insecurity

The most common suggestions for reducing food insecurity involved providing more food options, expanding food assistance programs, improving food production and distribution on the reservation, increasing jobs and job security, improving transportation and communication, and providing education on food and budgeting.

4.3   Transportation and Food Access

The survey contained 15 questions to help provide an accurate picture of the transportation related issues that may hinder Native Americans in North Dakota from accessing food. The questions addressed the respondent's ability to drive, access to a car, access to public transportation, deterrents of making a trip, and the distance to travel to access food.

The majority of respondents, 88%, reported not having a disability that prevents them from driving while 10% do have a disability that prevents them from driving a vehicle (Figure 4.10). We also asked the respondents if they owned a car or had access to a car. Again, the majority, 81%, of respondents reported that they do own or have access to a car while 19% do not (Figure 4.11). The U.S. Census Bureau 5-year American Community Survey (ACS) (2015-2021) reports that 8.3% of households nationally do not have a vehicle, and just 3.7% of rural households across the country and 5.0% of North Dakota households (3.0% of rural North Dakota households) do not have a vehicle. The data also show that 8.2% of households on reservations across the country do not have a vehicle. In North Dakota, according to the ACS data, the counties with the highest percentages of households without a vehicle are those with the highest Native American population (11.7% of households in Sioux County without a vehicle, 9.1% in Benson County, and 8.7% in Rolette County). It is clear that Native Americans in North Dakota have substantially less access to vehicles than the national average for rural areas or the state average, which makes it more difficult to access food.
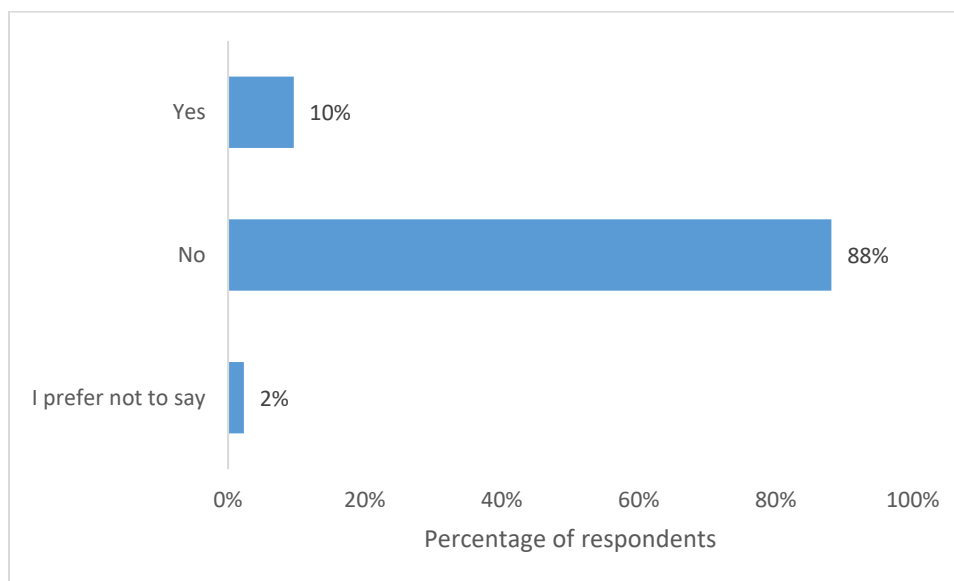
Figure 4.10 Do You Have a Disability that Prevents You from Driving? n=261
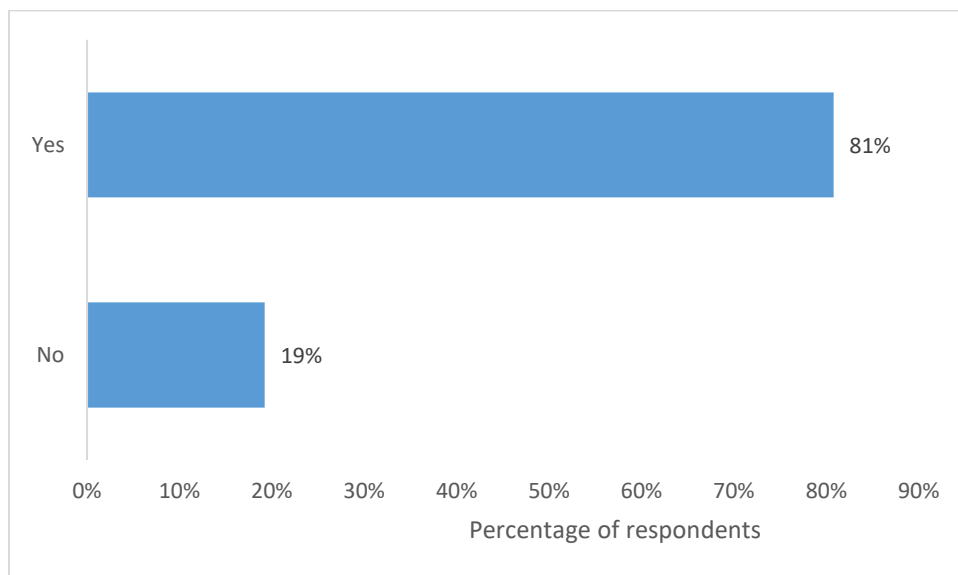
Figure 4.11 Do You Own a Car or Have Access to a Car? n=260

We also wanted to know if the tribal members had access to public transportation. We found that 73% reported having access to public transportation, 15% do not have access, and 12% do not know if they have access to public transportation.
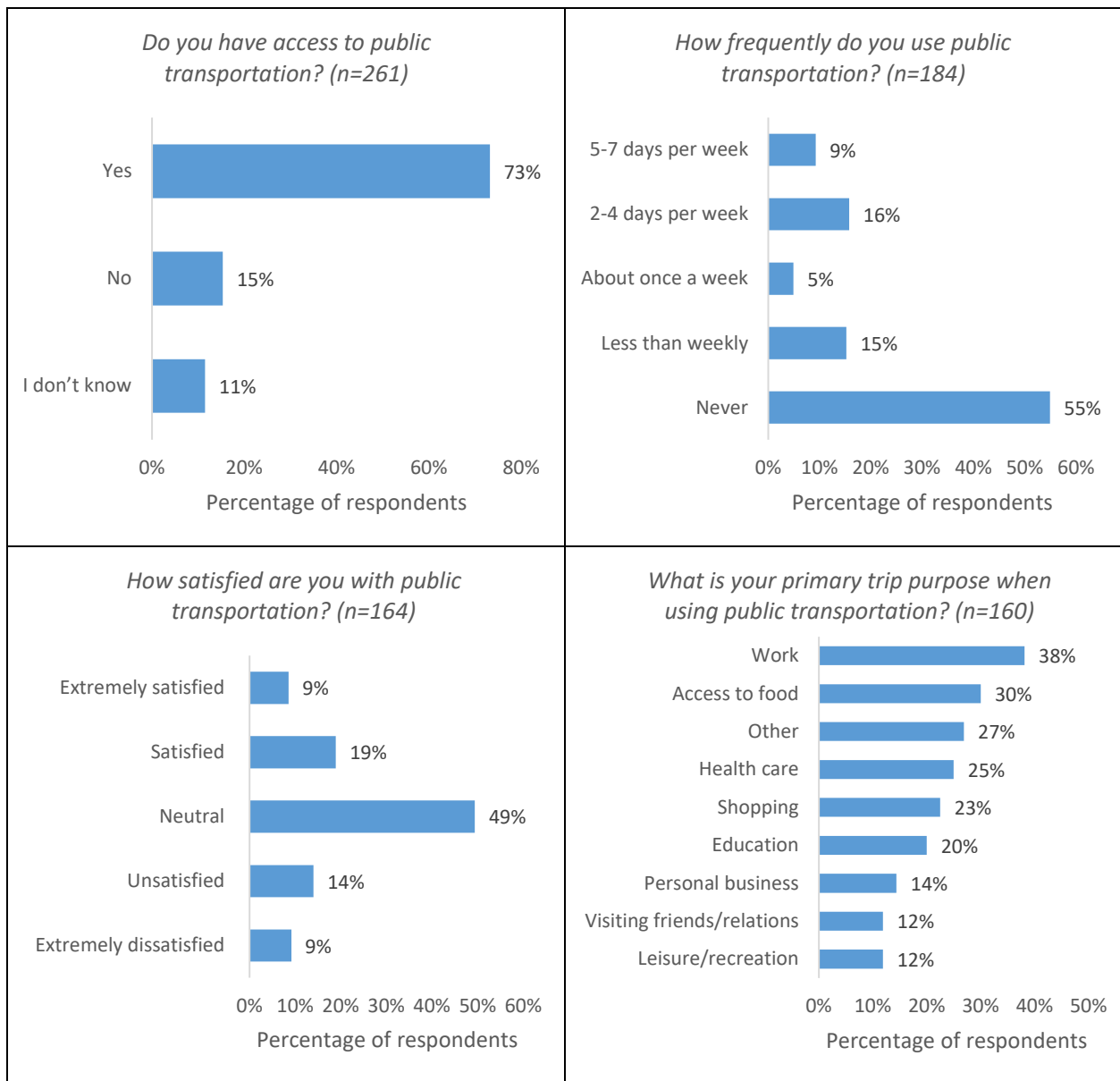
Figure 4.12 Access to and Use of Public Transportation

For the respondents that have access to public transportation, we asked how frequently they used the service. While 55% reported that they never use public transportation, 9% reported using transit almost every day, 16% reported 2-4 days per week, and 15% reported less than weekly (Figure 4.12).

We also asked about the satisfaction the respondents have with the public transportation service they use or have access to ride. Of the 164 respondents answering the question, 49% were neutral regarding the service while 19% were satisfied. Among respondents, 23% reported they were either unsatisfied (14%) or extremely dissatisfied (9%).

The respondents who reported using public transit were asked to identify their primary trip purposes when using transit. Of the 160 respondents who answered this question, 38% identified work, followed by 30% who reported they use public transportation to access food, as shown in Figure 4.12.

Respondents were asked how they get to the grocery store. They were asked to select all of the options they use, and they were provided with seven modal options as well as space to write in any option they may use that was not listed. Not surprising, 71% reported that they drive themselves. There were 27% of respondents that reported they get a ride from a family member, friend, or volunteer, while 21% walk, and 20% utilize public transportation (Figure 4.13).

How do you go to the grocery store/supermarket? (n=254)

- Drive myself: 71%
- Get a ride: 27%
- Walk: 21%
- Public transportation: 20%
- Bicycle: 10%
- Motorcycle/moped/...: 7%
- Taxi, Uber, Lyft, or similar...: 6%
- Other: 2%

Percentage of respondents

Do you usually have to pay for your ride to the grocery store? (n=253)

- Always: 22%
- Most of the time: 6%
- Sometimes: 22%
- Never: 34%
- Not applicable: 16%

Percentage of respondents

Which of the following has the potential to deter you from making the trip? (n=238)

- Price of gasoline and cost of owning a car: 63%
- Travel distance or time: 39%
- Bus or taxi fare: 20%
- Lack of public transportation: 17%
- Inability to drive: 15%
- Other: 13%
- Lack of sidewalks or safe pedestrian infrastructure: 12%

Percentage of respondents

Where do you most commonly shop for food? (n=253)

- Grocery store: 72%
- Supermarkets (such as Walmart): 58%
- Discount stores (such as Dollar General/Family Dollar): 37%
- Convenience store/gas station: 30%
- Farmer's markets, roadside stands, and other local food...: 23%
- Eat at restaurants: 15%
- Other: 2%

Percentage of respondents

Are the stores in your area providing all the fresh food you need to make your daily meals? (n=250)

- Yes: 76%
- No: 24%

Percentage of respondents

Figure 4.13 Traveling for Food and Groceries

35

Respondents were asked to identify the factors that have the potential to deter them from making a trip to the grocery store. The price of gasoline and the cost of owning a car was identified as the greatest deterrent by 63% of the respondents. The next most reported deterrents include travel distance or time (39%), bus or taxi fare (20%), and lack of public transportation (17%) (Figure 4.13).

Accessing food can be challenging in rural areas as grocery stores and other food purchasing options are spread out given the low population densities. Of the respondents, 72% reported they most commonly shop for their food at the grocery store, followed by 58% who shop at supermarkets such as Walmart, and 37% shop at discount stores such as Dollar General (Figure 4.13). Also, 30% reported they most commonly shop for food at convenience stores or gas stations, which tend to have higher prices and more processed, less nutritious foods available. About three-quarters of respondents reported the stores in their area provide all of the fresh food needed for daily meals.

Respondents were asked to describe the food access in their area each year from 2019 to 2022 on a 7-point Likert scale, ranging from totally unacceptable to perfectly acceptable. Results are shown in Table 4.4. For each year, a majority of respondents answered that food access is at least slightly acceptable, and 35% to 43% responded that it is either acceptable or perfectly acceptable. To illustrate trends over the four years, Figure 4.14 shows the percentage of respondents that answered either acceptable or perfectly acceptable and the percentage that answered either unacceptable or totally unacceptable each year. Results show a decrease in acceptability in 2020 during the Covid-19 pandemic and an increase in 2022 to previous levels.

Table 4.4 Acceptability of Food Access by Year, 2019-2022, n=248

				Response			
Year	Totally unacceptable	Unacceptable	Slightly unacceptable	Neutral	Slightly acceptable	Acceptable	Perfectly acceptable
	----------------------------------Percentage of respondents----------------------------------						
2019	1	7	14	16	19	28	15
2020	3	8	15	21	17	27	8
2021	3	6	16	22	17	27	9
2022	4	4	11	23	15	31	12
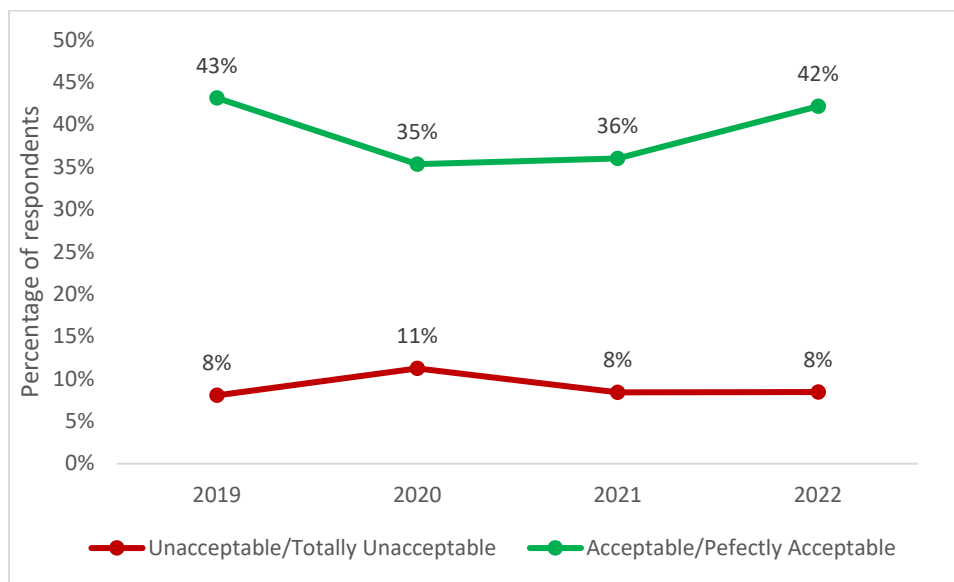
Figure 4.14 Trends in Acceptability of Food Access, 2019-2022

Respondents were also asked to identify how important select strategies would be for improving access to food in their area using a 5-point Likert scale, with 1 being not important and 5 being very important. Among respondents, 41% thought it to be extremely important to increase indigenous food, and two-thirds thought it to be either extremely important or important. Similarly, 67% of respondents thought it to be either extremely important or important to increase the variety of food, followed by 64% who said the same for providing or improving the transportation to food access, and 63% who identified modifications to current policy or regulations at the local, state, or federal levels to be either extremely important or important (Figure 4.15).

Figure 4.15 Importance of Food Strategies for Improving Food Access in Tribal Areas

4.4   Health and Nutrition

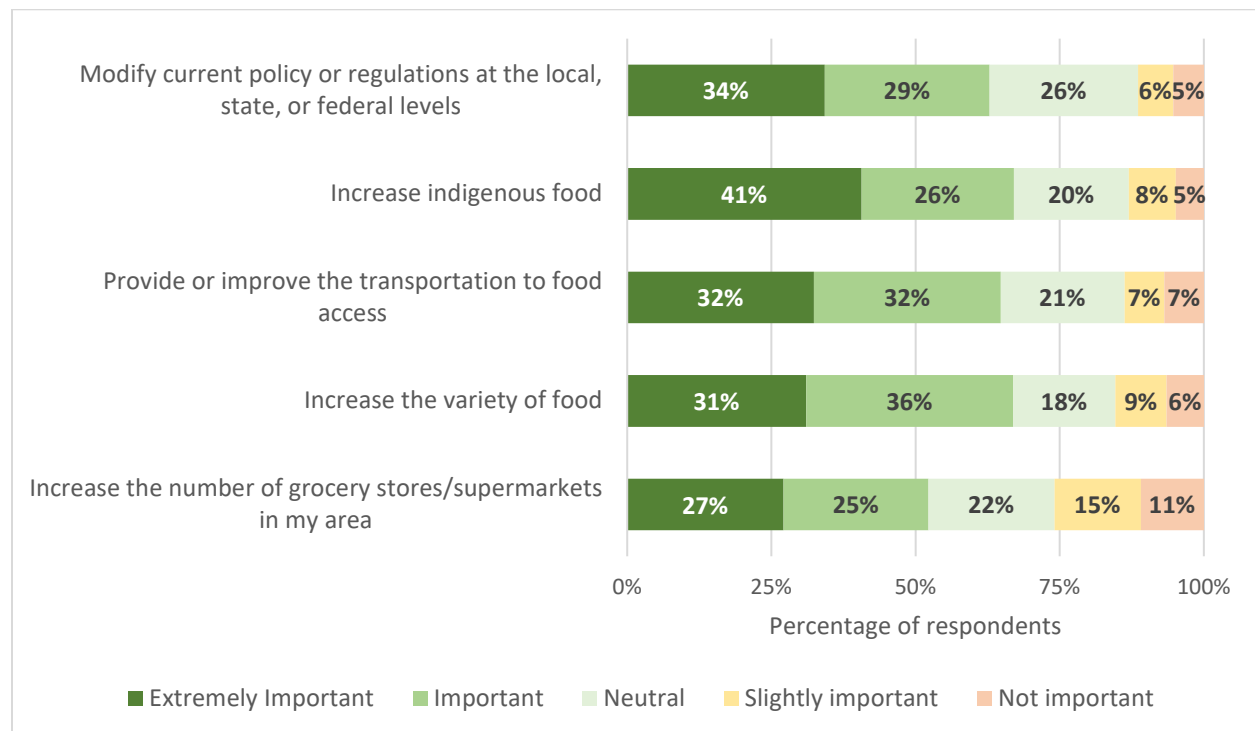The health and nutrition portion of the survey contained six questions to better understand the health status of respondents between 2019 and 2022. We asked the respondents to describe their health over the past three years ranging from excellent to poor. In 2019, prior to Covid-19, 33% of respondents reported to be in excellent or very good health (Table 4.5), 37% reporting good, and 30% reporting fair or poor health (Figure 4.16). The pattern of excellent and very good health declined to 25% during Covid-19 in 2020 and 2021 but improved slightly to 27% in 2022 as the pandemic lingered. There was an increase in the respondents who felt their health was fair or poor, as it increased to 35% in 2020 and continued increasing to 39% in 2022 (Figure 4.16). It is alarming that respondents felt their health declined during the pandemic. It would be interesting to see how the respondents would rate their health after 2022, since the pandemic has largely subsided.

Table 4.5 Respondents' Description of their Health, n=247

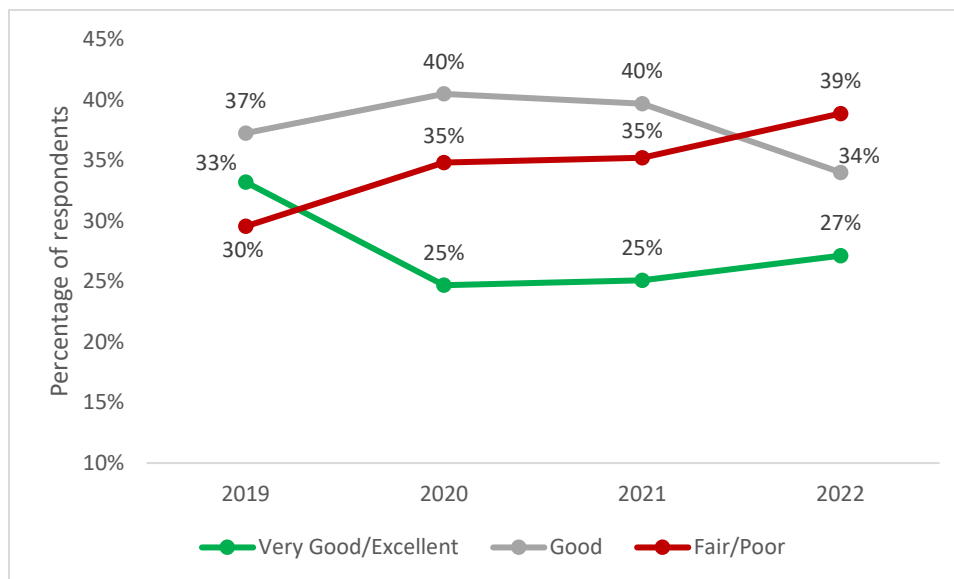|			Health Condition		
Year	Excellent	Very Good	Good	Fair	Poor
	-----------Percentage of respondents-----------				
2019	14	19	37	22	8
2020	9	15	40	24	11
2021	10	15	40	23	12
2022	10	17	34	29	10

Figure 4.16 Respondents' Description of Their Health, n=247

To further understand the respondents' health, they were asked if they have ever been diagnosed with a food-related disease. Nearly 37% reported they had been diagnosed with a food-related disease while 63% had not been diagnosed with one.

Health and wellness programs are made available to help individuals with food-related illnesses. For example, as stated earlier in this report (Section 2.2.3), during the mid-1990s Congress established the Special Diabetes Program for Indians (SDPI) (U.S. Department of Health and Human Services 2016). Respondents were asked if they had participated in any of the five identified health and wellness programs:

- Diabetes treatment and prevention
- Epidemiology and disease prevention
- Healthy weight for life
- Health promotion disease prevention
- Breastfeeding promotion and support

More than half (56%) of respondents reported they had not participated in any of the five identified programs. The highest participation rate was found for the Diabetes Treatment Prevention Program (22% of respondents), followed by the Health Promotion Disease Prevention Program, with 14% participating (Figure 4.17). Other programs mentioned included health and wellness at work, weight loss programs, and use of a fitness center at school.
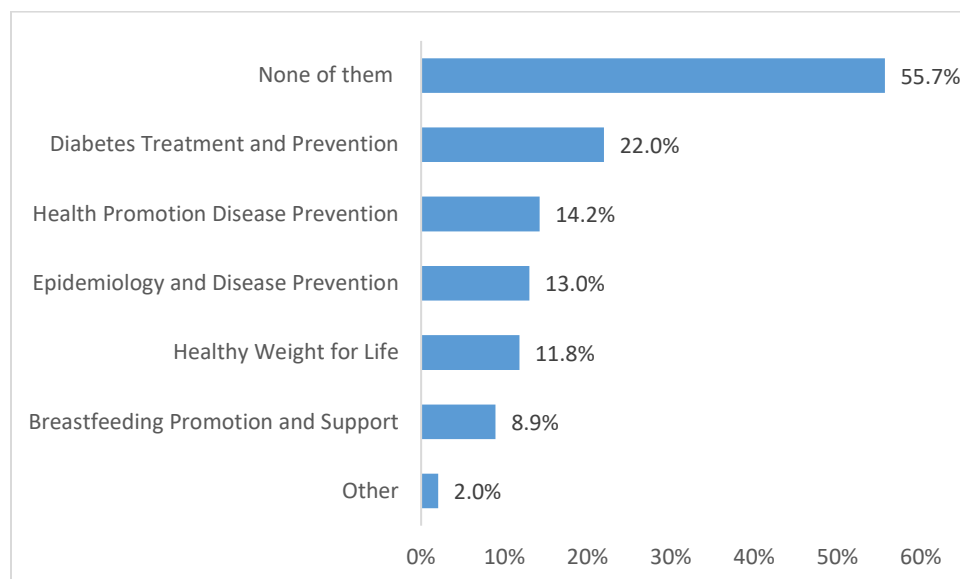

Figure 4.17 Health and Wellness Programs, n=246

Respondents were asked how they traveled to the health and wellness programs in which they participated. They were asked to select all they use out of eight modal options. Of the 108 respondents who participate in health and wellness programs, 51% drive themselves followed by 28% who walk, and 26% who use taxi, Uber, Lyft, or a similar service (Figure 4.18). Interestingly, 5% of respondents participate in programs online while 4% found another way, including phone, someone coming to the school, or a community health representative providing a ride. However, transportation appears to be a significant barrier to participation in these programs. Respondents were asked if transportation was an obstacle for participating in one of the health and wellness programs, and 23% reported that transportation was an obstacle.
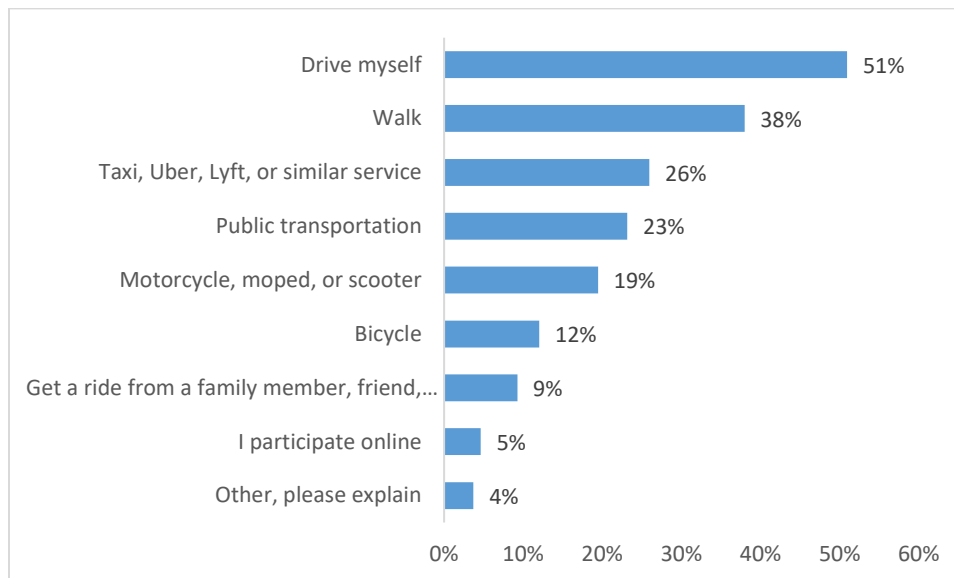

Figure 4.18 Transportation to Health and Wellness Programs, n=108

In addition to participation in health and wellness programs, respondents were asked if they usually eat healthy food every day. A note was provided to participants to explain that the study defined a healthy diet as one that emphasizes fruits, vegetables, and whole grains and a variety of protein foods, while avoiding foods that contain added sugars, sodium, saturated fats, and trans fats. Of the 248 respondents, 58% said they do not eat healthy food every day while 42% reported they do eat healthy foods each day.

A binary logit regression model was developed to identify the characteristics of those who eat healthy foods every day. The dependent variable in the model is a binary variable equal to 1 if the respondent reported eating healthy food every day and 0 if not. Explanatory variables include individual characteristics, access to transportation, and access to food. Individual characteristics include income, age, and education. It is expected that those with higher income and education have better access to and knowledge of healthy food. Age may also be positively related to healthy eating habits as older adults may be more concerned with their health. As in the previous model, an interaction variable is included with income and assistance to test if assistance programs have any influence on healthy eating habits. Transportation variables include whether the individual drives to the grocery store and whether they use public transportation. The ability to drive and the use of transit improve access to food and may influence eating habits. Food access variables include a dummy variable for whether the individual lives within walking distance of a grocery store. This variable does not necessarily indicate that they walk to the grocery store, but it is an indicator of proximity to the grocery store, which may influence eating habits. Also included is a variable indicating whether the respondent reported if the stores in their area provide

41

all the fresh food they need to make their daily meals. It is expected that proximity to grocery stores and the availability of fresh food would have a positive effect on healthy eating habits. Lastly, a variable was included to indicate if the respondent lives on the reservation.

Results are shown in Table 4.6. Age, income, walking distance to a grocery store, availability of fresh food, and living on the reservation are all positively associated with the likelihood of an individual eating healthy food every day. Age is an important predictor of healthy eating habits, as older adults are shown to be more likely to eat healthy foods. Income has a positive effect, as expected, though the result is marginally significant. Living within walking distance of a grocery store has a positive effect, which indicates that proximity to a grocery store promotes healthy eating habits. Those who reported that the stores in their area provide all the fresh food they need to make their daily meals were more likely to report eating healthy food every day. This shows the importance of having fresh food available locally. Those living on a reservation were also more likely to report eating healthy food. Assistance programs were not found to have a significant effect, nor were the transportation variables or education significant, though education has a correlation with income.

Table 4.6 Results of Binary Logit Model for Likelihood of Eating Healthy Every Day

Variable	Estimate	p-value	Odds Ratio	
			Point Estimate	95% Confidence Interval
Income	0.215	0.093*	1.24	0.97 – 1.59
Assistance*Income	-0.081	0.503	0.92	0.73 – 1.17
Age	0.297	0.012**	1.35	1.07 – 1.70
Education	0.139	0.312	1.15	0.88 – 1.51
Drive	0.516	0.176	1.68	0.79 – 3.54
Transit	-0.116	0.784	0.89	0.39 – 2.04
Walking distance	0.689	0.024**	1.99	1.10 – 3.62
Fresh food available	0.683	0.060*	1.98	0.97 – 4.03
On reservation	0.810	0.007***	2.25	1.25 – 4.05

*p<0.10, **p<0.05, ***p<0.01

5. CONCLUSIONS

The national average of food insecurity in the United States during 2021 was nearly 13%. However, food insecurity in the United States is a problem that disproportionately impacts racial and ethnic minority groups. Nearly a quarter of Native Americans faced food insecurity in 2021, while 19% of Black, non-Hispanic individuals and 16% of Latino individuals lacked enough food to live active productive lives. Furthermore, the USDA found that 59% of U.S. residents live within one mile of a supermarket or grocery store while only 26% of Native Americans live within this distance. Not only do Native Americans have longer travel distances to access healthy foods, but they also experience higher rates of poverty and unemployment, and a higher percentage do not own a vehicle.

This study examined food access for Native Americans living in North Dakota and the role that transportation plays in accessing healthy food. The analysis was based primarily on data collected using a survey instrument administered online and at the 2022 Labor Day Turtle Mountain Chippewa Powwow.

Using the U.S. Household Food Security Survey Module: Six-Item Short Form on the survey to measure food security among the Native Americans in North Dakota, we found that almost 50% of the respondents have very low food security, 27% have low food security, and 25% have high or marginal food security. These results reveal that Native Americans in North Dakota have higher food insecurity than the nearly 25% of Native Americans as reported by Feeding America in 2021. However, results could potentially be biased because of the high percentage of college students and young adults who participated in the survey.

An ordered logit model was developed in the study to investigate the relationship between factors such as income, education, use of assistance programs, access to transportation, and other factors that could be associated with food security. The results revealed that income, food assistance programs, education, and the ability to drive to the grocery store are significantly related to food security. Not surprising, results showed an increase in income or education is associated with better food security. For example, if income increases just one level (among the 1-6 scale used in the survey), the odds of a higher level of food insecurity decreases by 45%. The odds decrease by 20% as education increases by a level and by 63% if the individual drives to the grocery store. These results demonstrate the importance of being able to drive a car to reduce food insecurity. While non-drivers were found to have lower food security, the study did not find that use of public transportation significantly improved levels of food security. This finding could be due to a limitation of the data. A larger dataset with more survey responses may be needed to show the effects of transit on food access. The findings could also suggest that current transit services are ineffective at improving food security and services. Enhanced public transit services or other options are needed to improve food access for non-drivers to reduce food insecurity Food assistance programs were also found to improve food security by reducing the negative effects of low income. The other variables included in the model—age, gender, disability, number of children, and whether there is a grocery store within walking distance—were statistically insignificant.

The survey revealed that participants thought that financial hardship, inflation, lack of transportation, and unavailability of food were the greatest factors leading to food insecurity. They also thought the best strategies to reduce food insecurity were: provide additional food options through more food pantries, farmers markets, and groceries near the community; expand food assistance programs; improve food production and distribution; create jobs and improve job security; and increase transportation and communication.

Nearly 20% of respondents do not drive or have access to a vehicle for transportation. Results from the survey and ACS data suggest that Native Americans in North Dakota are significantly less likely to own or have access to a vehicle, which creates challenges for accessing healthy food, especially in rural areas with long travel distances. Among respondents, 73% do have access to public transportation. Three of the five reservations in North Dakota have a tribal transit program: Turtle Mountain, Spirit Lake, and Standing Rock.

The majority (71%) of respondents drive themselves to get their groceries, whereas 27% get a ride and 21% walk. Slightly over half (51%) live within walking distance to access food, and 72% reported they most commonly shop at grocery stores and 58% at supermarkets for food. More than 75% of respondents thought their area provided the fresh food needed to make their daily meals. However, only 42% reported eating healthy meals every day. There does appear to be a need to provide better access to healthy foods and to provide education regarding the need to eat healthy meals to reduce food-related diseases such as diabetes. Education and access to healthy foods is important as nearly 37% of respondents reported being diagnosed with a food-related disease.

Respondents did report declines in their health between 2019-2022, during the Covid-19 pandemic. The timing to provide better access to healthy foods and to education is ideal as effects of the pandemic are still fresh in most people's minds.

5.1   Need for Further Study

The survey provides interesting information about food security, access to food, transportation access, and the health of Native American survey respondents. Caution should be used, however, in making inferences from this study about the Native American population in North Dakota because of possible sampling bias. Because of challenges in obtaining responses from the target population, the study relied on a non-random sample of convenience based on the availability and willingness of respondents to participate. Some populations were very difficult to reach. This may have resulted in some groups being over- or under-represented. For example, the results included a large number of college students or younger adults. Future research could attempt to use a stratified random sampling technique to ensure that different subgroups are proportionally represented and to reduce sampling bias.

Despite the challenges in collecting survey responses, the results are largely consistent with previous research that shows higher rates of food insecurity among Native Americans and lower levels of vehicle access. Responses to the open-ended questions identified strategies addressing food insecurity. Lack of transportation was often mentioned as one of the factors contributing to food insecurity, and improving transportation and communication was often mentioned as a strategy for overcoming this problem. Future research could focus more specifically on transportation and different mobility options to improve access to food. Such research could explore emerging mobility options and the topics of mobility management and coordination, as well as other options such as food delivery, in the context of tribal areas to identify preferred strategies. Research could also estimate the benefits these services provide by improving access to food, in relation to their costs, to demonstrate the value of improved mobility options.

REFERENCES

Adams, Elizabeth J, Laurence Grummer-Strawn, and Gilberto Chavez. 2003. "Food insecurity is associated with increased risk of obesity in California women." *The Journal of Nutrition 133, no. 4* 1070-1074.

Ahiman, Otilia Vanessa Cordero, Eduardo Santellano Estrada, and Alberto Garrido Colmenero. 2017. "Explaining food insecurity among indigenous households of the Sierra Tarahumara in the Mexican state of Chihuahua." *Spanish Journal Of Agricultural Research 15, no. 1* 6.

Archer, S. L., K. J. Greenlund, R. Valdez, M. L. Casper, S. Rith-Najarian, and J. B. Croft. 2004. "Differences in food habits and cardiovascular disease risk factors among Native Americans with and without diabetes: the Inter-Tribal Heart Project." *Public Health Nutrition 7, no. 8 (* 1025-1032.

Archer, Sujata L., Kurt J. Greenlund, Michele L. Casper, Stephen Rith-Najarian, and Janet B. Croft. 2002. "Associations of community-based health education programs with food habits and cardiovascular disease risk factors among Native Americans with diabetes: the Inter-Tribal Heart Project, 1992 to 1994" (Research and Professional Briefs). *Journal of the American Dietetic Association 102, no. 8* 1132-1136.

Benyshek, Daniel C., John F. Martin, and Carol S. Johnston. 2001. "A reconsideration of the origins of the type 2 diabetes epidemic among Native Americans and the implications for intervention policy." *Medical Anthropology 20, no. 1* 25-64.

Blumberg, S. J., K. Bialostosky, W. L. Hamilton, and R. R. Briefel. 1999. "The effectiveness of a short form of the Household Food Security Scale." *American Journal of Public Health* 89 (8): 1231-1234.

Brown, Blakely, Curtis Noonan, and Mark Nord. 2007. "Prevalence of food insecurity and health-associated outcomes and food characteristics of Northern Plains Indian households." *Journal of Hunger & Environmental Nutrition 1, no. 4* 37-53.

Casey, Patrick H., Pippa M. Simpson, Jeffrey M. Gossett, Margaret L. Bogle, Catherine M. Champagne, Carol Connell, and David Harsha. 2006. "The association of child and household food insecurity with childhood overweight status." *Pediatrics 118, no. 5* e1406-e1413.

Conti, Kibbe M. 2006. "Diabetes prevention in Indian country: developing nutrition models to tell the story of food-system change." *Journal of Transcultural Nursing 17, no. 3* 234-245.

Dinour, Lauren M., Dara Bergen, and Ming-Chin Yeh. 2007. "The food insecurity–obesity paradox: a review of the literature and the role food stamps may play." *Journal of the American Dietetic Association 107, no. 11 (2007): 1952-1961* 1952-1961.

Elsheikh, Elsadig, and Nadia Barhoum. 2013. *Structural racialization and food insecurity in the United States.* A Report to the UN Human Rights Committee on the International Covenant on Civil and Political Rights 20 (2013) 20-26, University Of California, Berkeley.

Farmer, Paul. 1999. *Infections and Inequalities: The Modern Plagues.* University of California Press.

Feeding America. n.a. *Federal Food Assistance Programs.* Accessed August 10, 2022.
    https://www.feedingamerica.org/take-action/advocate/federal-hunger-relief-programs.

Feeding America. 2021. *The Impact of the Coronavirus on Food Insecurity in 2020 & 2021.* March.
    Accessed March 15, 2022. https://www.feedingamerica.org/sites/default/files/2021-
    03/National%20Projections%20Brief_3.9.2021_0.pdf.

Fitzpatrick, Kevin M., Casey Harris, Grant Drawve, and Don E. Willis. 2021. "Assessing food insecurity
    among US adults during the COVID-19 pandemic." *Journal of Hunger & Environmental
    Nutrition 16, no. 1* 1-18.

Gregory, Christian A., and Alisha Coleman-Jensen. 2017. *Food insecurity, chronic disease, and health
    among working-age adults.* USDA-ERS No. 1477-2017-3689.

Jernigan, Valarie Blue Bird, Alicia L. Salvatore, Dennis M. Styne, and Marilyn Winkleby. 2012.
    "Addressing food insecurity in a Native American reservation using community-based
    participatory research."*Health Education Research 27, no. 4* 645-655.

Jernigan, Valarie Blue Bird, Eva Garroutte, Elizabeth M. Krantz, and Dedra Buchwald. 2013. "Food
    insecurity and obesity among American Indians and Alaska Natives and Whites in California."
    Journal of Hunger & Environmental Nutrition 8, no. 4 458-471.

Jernigan, Valarie Blue Bird, Kimberly R. Huyser, Jimmy Valdes, and Vanessa Watts Simonds. 2017.
    "Food insecurity among American Indians and Alaska Natives: A national profile using the
    current population survey–food security supplement." *Journal of Hunger & Environmental
    Nutrition 12, no. 1* 1-10.

Jernigan, Valarie Blue Bird, Marianna S. Wetherill, Jordan Hearod, Tvli Jacob, Alicia L. Salvatore,
    Tamela Cannady, Mandy Grammar, et al. 2017. "Food Insecurity and Chronic Diseases Among
    American Indians in Rural Oklahoma: The THRIVE Study." *American Journal of Public Health*
    107: 441-446.

Jimenez-Cruz, A., M. Bacardi-Gascon, and A. A. Spindler. 2003. "Obesity and hunger among Mexican-
    Indian migrant children on the US–Mexico border." *International Journal of Obesity 27, no. 6*
    740-747.

Kaufman, Phillip, Chris Dicken, and Ryan Williams. 2014. "Measuring access to healthful, affordable
    food in American Indian and Alaska Native tribal areas." *USDA-ERS No. 1476-2017-3886.*
    https://www.ers.usda.gov/webdocs/publications/43905/49690_eib131_errata.pdf.

Leung, Cindy W., and June M. Tester. 2019. "The association between food insecurity and diet quality
    varies by race/ethnicity: an analysis of national health and nutrition examination survey 2011-
    2014 results." *Journal of the Academy of Nutrition and Dietetics 119, no. 10* 1676-1686.

Martin, Katie S., and Ann M. Ferris. 2007. "Food insecurity and gender are risk factors for obesity."
    Journal of Nutrition Education and Behavior 39, no. 1 31-36.

Mattson, Jeremy, Bright Quayson, and Zhila Dehdari Ebrahimi. 2023. *Comparing Public Transportation Services for Rural States in the Upper Midwest and Great Plains Region.* DP-320, North Dakota State University, Fargo: Upper Great Plains Transportation Institute.

Mattson, Jeremy, Dilip Mistry, and Jill Hough. 2020. *Assessment of North Dakota Mobility Options, Transit Needs, and Characteristics of Users.* DP-307, Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

Metallinos-Katsaras, Elizabeth, Bettylou Sherry, and Jan Kallio. 2009. "Food insecurity is associated with overweight in children younger than 5 years of age." *Journal of the American Dietetic Association 109, no. 10* 1790-1794.

Myers, Ana McCormick, and Matthew A. Painter. 2017. "Food insecurity in the United States of America: An examination of race/ethnicity and nativity." *Food Security* 9, no. 6 1419-1432.

ND.Gov. 2011. *North Dakota Indian Affairs Commission.* March. Accessed September 20, 2022. https://www.indianaffairs.nd.gov/tribal-nations/statistics.

Ndembe, Elvis, Ranjit Godavarthy, Jeremy Mattson, and Jill Hough. 2021. *Tribal Transit Study: Demographic Needs Indicators, Funding Needs and Livability.* SURTCOM 21-05, Fargo: North Dakota State University, Upper Great Plains Transportation Institute.

O'Hare, William P. 2019. "Census Coverage of American Indians and Alaskan Natives." In *Differential Undercounts in the U.S. Census. SpringerBriefs in Population Studies.* Springer.

OMH. 2020. *Obesity and American Indians/Alaska Natives.* March 26. Accessed October 24, 2022. https://minorityhealth.hhs.gov/omh/browse.aspx?lvl=4&lvlid=40.

Parker, Stephany, Vlasta Pinto, Tay Kennedy, Joshua A Phelps, and Janice R Hermann. 2007. "Food choices and coping strategies during periods of perceived food shortage: Perspectives from four racial/ethnic groups." *Journal of Extension 45, no. 5.* https://archives.joe.org/joe/2007october/a6.php.

Romero-Briones, A-dae. 2019. "Fighting for the taste buds of our children." *Journal of Agriculture, Food Systems, and Community Development 9, no. B* 35-43.

Saksena, Michelle, and Phillip Kaufman. 2015. "Native Americans Living in Tribal Areas Face Longer Trips to the Grocery Store." *Amber Waves* 28.

Seligman, Hilary K., and Seth A. Berkowitz. 2019. "Aligning programs and policies to support food security and public health goals in the United States." *Annual Review of Public Health 40* 319.

Skinner, Kelly, Erin Pratley, and Kristin Burnett. 2016. "Eating in the City: A Review of the Literature on Food Insecurity and Indigenous People Living in Urban Spaces." *Societies 6, no. 2* 7.

Sowerwine, Jennifer, Megan Mucioki, Daniel Sarna-Wojcicki, and Lisa Hillman. 2019. "Reframing food security by and for Native American communities: A case study among tribes in the Klamath River basin of Oregon and California." *Food Security 11, no. 3* 579-607.

Story, Mary, Karen F. Strauss, Elenora Zephier, and Brenda A. Broussard. 1998. "Nutritional concerns in American Indian and Alaska Native children: transitions and future directions." *Journal of the American Dietetic Association 98, no. 2* 170-176.

Tam, Benita Y., Leanne Findlay, and Dafna Kohen. 2014. "Social networks as a coping strategy for food insecurity and hunger for young Aboriginal and Canadian children." *Societies 4, no. 3* 463-476.

Temple, Jeromey B., and Joanna Russell. 2018. "Food insecurity among older Aboriginal and Torres Strait islanders." *International Journal of Environmental Research and Public Health 15, no. 8* 1766.

Townsend, Marilyn S., Janet Peerson, Bradley Love, Cheryl Achterberg, and Suzanne P. Murphy. 2001. "Food insecurity is positively related to overweight in women." *The Journal of Nutrition 131, no. 6* 1738-1745.

U.S. Department of Agriculture, Economic Research Service. 2022. *Food Access Research Atlas: Documentation Definitions.* October 20. Accessed October 20, 2022. https://www.ers.usda.gov/data-products/food-access-research-atlas/documentation/#:~:text=Food%20access,-Limited%20access%20to&text=Accessibility%20to%20sources%20of%20healthy,income%20or%20vehicle%20availability%3B%20and.

—. 2019. *Food Access Research Atlas: State-Level Estimates of Low Income and Low Access Populations.* September 30. Accessed March 7, 2023. https://www.ers.usda.gov/data-products/food-access-research-atlas/state-level-estimates-of-low-income-and-low-access-populations/.

—. 2012. "Food Security in the U.S.Survey Tools." *USDA.* September. Accessed January 15, 2022. https://www.ers.usda.gov/media/8282/short2012.pdf.

U.S. Department of Health and Human Services. 2016. *Indian Health Service Division of Diabetes Treatment and Prevention.* October. Accessed March 10, 2022. https://www.ihs.gov/newsroom/factsheets/diabetes/.

U.S. Commission on Civil Rights. 2004. *Broken Promises: Evaluating the Native American Health Care System.* Office of the General Counsel.

USA.gov. 2022. *Food Assistance.* June 16. Accessed August 10, 2022. https://www.usa.gov/food-help.

Wiedman, Dennis. 2012. "Native American embodiment of the chronicities of modernity: reservation food, diabetes, and the metabolic syndrome among the Kiowa, Comanche, and Apache." *Medical Anthropology Quarterly 26, no. 4* 595-612.

APPENDIX A. SURVEY OF NORTH DAKOTA NATIVE AMERICANS

NDSU UPPER GREAT PLAINS TRANSPORTATION INSTITUTE

THE ASSOCIATION BETWEEN TRIBAL AND FOOD INSECURITY AMONG NATIVE AMERICANS IN NORTH DAKOTA

Dear Native Americans in North Dakota:

American Indians and Alaska Natives have been associated with food insecurity and hunger. The Small Urban and Rural Center on Mobility (SURCOM) at North Dakota State University seeks to understand the association between tribal transit service and food insecurity and hunger among Native Americans in North Dakota. Limitations to food access and food insecurity have numerous implications for the health and welfare of Native American families. Results from this research will help us understand and evaluate food access, the food environment, and the traditional Indigenous food system available in and off Native American reservations in North Dakota. Also, it will help us to measure the effect of public transportation services on food insecurity among Native Americans and whether improved services are needed.

You are invited to participate in this research project. If you are a North Dakota Native American and your age is 18 or older, please take approximately 10 to 15 minutes of your time to share your opinion by completing the following survey. Your participation is strictly voluntary, and completing the survey means you will be provided an opportunity to enter a drawing to win one of four $50 visa gift cards.

This project has been accepted by the Institutional Review Board (IRB) from United Tribes Technical College (UTTC), Sitting Bull College, Turtle Mountain, NDSU IRB # 0004264; and Spirit Lake tribe Resolution A05-22-426. Should you have any concerns regarding the conduct of this research project, you are welcome to contact the researcher or the NDSU Human Research Protection Program at 701.231.8995, toll-free at 1-855-800-6717, by email at ndsu.irb@ndsu.edu, or by mail at NDSU HRPP Office, NDSU Dept. 4000, P.O. Box 6050, Fargo, ND 58108-6050

The information provided will be used solely for this research project, and only non-identifiable, aggregated results will be reported.

If you have any questions about this project, please contact:

Dr. Hamad Al Qublan at hamad.alqublan@ndsu.edu Phone: (214) 603-0237 or

Dr. Jill Hough at jill.hough@ndsu.edu Phone: (701) 793-1364.

Thank you for your taking part in this research!

Is your age 18 or older?

    A. Yes

    B. No **(if you answer No, do not continue completing the survey. Thank you for your interest)**

Section 1: Food Security

The following questions are about the food eaten in your household in the last 12 months, since September of 2021, and whether you were able to afford the food you need.

The following statements were made by people about their food situation. For these statements, please tell us whether the statement was <u>often</u> true, <u>sometimes</u> true, or <u>never</u> true for (you/your household) in the last 12 months. That is, since last September.

1- The food that I/we bought just didn't last, and I/we didn't have money to get more. Was that often, sometimes, or never true for you/your household in the last 12 months?
   A. Often true
   B. Sometimes true
   C. Never true
   D. I refuse to answer

2- I/we couldn't afford to eat balanced meals. Was that often, sometimes, or never true for you/your household in the last 12 months?
   A. Often true
   B. Sometimes true
   C. Never true
   D. I refuse to answer

3- In the last 12 months, since last September, did you or other adults in your household ever cut the size of your meals or skip meals because there wasn't enough money for food?
   A. Yes **(if you answer A, please GO to question 4)**
   B. No **(if you answer B, please GO to question 5)**
   C. I refuse to answer

4- How often did this happen?
   A. Almost every month
   B. Some months but not every month
   C. Only 1 or 2 months
   D. I refuse to answer

5- In the last 12 months, did you ever eat less than you felt you should because there wasn't enough money for food?
   A. Yes
   B. No
   C. I refuse to answer

6- In the last 12 months, were you ever hungry but didn't eat because there wasn't enough money for food?
   A. Yes
   B. No
   C. I refuse to answer

7- In general, what do you think are the top three factors that lead to food insecurity and hunger among North Dakota Native Americans?

_____

_____

_____

8- Would you please identify three ideas that you think would help reduce food insecurity and hunger among Native Americans in North Dakota and all U.S. states?

_____

_____

_____

Section 2: Transportation and Food Access

1- Do you have a disability that prevents you from driving?
   - A. Yes
   - B. No
   - C. I prefer not to say
2- Do you own a car or have access to a car?
   - A. Yes
   - B. No
3- Do you have access to public transportation?
   - A. Yes **(if you answer A, please GO to questions 4,5 and 6)**
   - B. No **(if you answer B or C, please GO to question 7)**
   - C. I don't know
4- On a scale of 1 to 5, with 1 being extremely dissatisfied and 5 being extremely satisfied, how would you rate your satisfaction with the tribal transit service in your area?

Extremely dissatisfied 1	Unsatisfied 2	Neutral 3	Satisfied 4	Extremely satisfied 5

5- How frequently do you use public transportation?
   - A. 5-7 days per week
   - B. 2-4 days per week
   - C. About once a week
   - D. Less than weekly
   - E. Never
6- What is your primary trip purpose when using public transportation? Please select all answers that apply.
   - A. Work
   - B. Health care
   - C. Education
   - D. Shopping
   - E. Access to food
   - F. Leisure/recreation
   - G. Visiting friends/relations
   - H. Personal business
   - I. Other, please explain _____
7- How do you go to the grocery store/supermarket? Please select all answers that apply.
   - A. Drive myself
   - B. Get a ride from a family member, friend, or volunteer
   - C. Public transportation
   - D. Taxi, Uber, Lyft, or similar service
   - E. Motorcycle, moped, or scooter
   - F. Bicycle
   - G. Walk
   - H. Other, please explain _____

8- Do you usually have to pay for your ride to the grocery store?
   A. Never
   B. Sometimes
   C. Most of the time
   D. Always
   E. Not applicable
9- Which of the following has the potential to deter you from making the trip? Please select all answers that apply.
   A. Bus or taxi fare
   B. Price of gasoline and cost of owning a car
   C. Travel distance or time
   D. Inability to drive
   E. Lack of sidewalks or safe pedestrian infrastructure
   F. Lack of public transportation
   G. Other, please explain _____
10- Where do you most commonly shop for food items? Please select all answers that apply.
   A. Convenience store/gas station
   B. Discount stores (such as Dollar General/Family Dollar)
   C. Grocery store
   D. Farmer's markets, roadside stands, and other local food places
   E. Eat at restaurants
   F. Supermarkets (such as Walmart)
   G. Other, please explain _____
11- Do you have food access (discount stores, grocery stores, or supermarkets) within walking distance of your home?
   A. Yes, **(if you answer A, please GO to question 12)**
   B. No **(if you answer B, please GO to question 13)**
12- What is the walking distance from your home to the grocery store/supermarket in miles?

   _____ miles

13- Are the grocery stores/supermarkets in your area providing all the fresh food you need to make your daily meals?
   A. Yes
   B. No

14- How do you describe the food access in your area in the past three years and this year? Check the box for each year with what corresponds to your description for food access in that year.

	2019	2020	2021	2022
A. Perfectly acceptable				
B. Acceptable				
C. Slightly acceptable				
D. Neutral				
E. Slightly unacceptable				
F. Unacceptable				
G. Totally unacceptable				

15- On a scale of 1 to 5, with 1 being not important and 5 being very important, how important are the following strategies for improving food access in your area? The first column has 5 plans; check the box for each one with what corresponds to its importance.

	Not at all important 1	Slightly important 2	Neutral 3	Important 4	Extremely important 5
Increase the number of grocery stores/supermarkets in my area					
Increase the variety of food					
Provide or improve the transportation to food access					
Increase indigenous food					
Modify current policy or regulations at the local, state, or federal levels					

Section 3: Financial Information and Hunger-Coping Strategies

1- What is your total annual household income?
   A. Less than $20,000
   B. $20,000 to $34,999
   C. $35,000 to $49,999
   D. $50,000 to $74,999
   E. $75,000 to $99,999
   F. Over $100,000

2- Did you receive a disability income in the last year?
   A. Yes
   B. No
   C. I prefer not to say

3- Do you depend on natural resources, for example, fishing, hunting, and natural harvest, to feed yourself, your family, or others?
   A. Yes
   B. No

4- Do you, or anyone in your household, currently use any of the following food assistance programs, social services, or charitable organizations to help with hunger or food insecurity? Select all that apply
   A. WIC
   B. Food Stamps (SNAP)
   C. Commodity Supplemental Food Program
   D. Senior Farmers' Market Nutrition Program
   E. Meals on Wheels
   F. A food bank in your community
   G. Food assistance available from a church in your community
   H. Food assistance from another organization in your community
   I. Food Distribution Program on Indian Reservations
   J. National School Lunch Program
   K. Summer Feeding Programs
   L. School Breakfast Program
   M. Child and Adult Care Food Program
   N. USDA Fresh Fruit and Vegetable Program
   O. National Hunger Hotline/Why Hunger
   P. Other _____
   Q. None of the above

Section 4: Health and Nutrition

1- In general, would you say your health has been in the past three years and this year? Check the box below each year with what corresponds to your health condition in that year.

Your health condition/Year	2019	2020	2021	2022
A. Excellent				
B. Very good				
C. Good				
D. Fair				
E. Poor				

2- Have you ever been diagnosed with food-related diseases (e.g., obesity, diabetes, or heart disease)?
    A. Yes
    B. No

3- Have you participated in any Health and Wellness Program services provided? Please select all that apply.
    A. Diabetes Treatment and Prevention
    B. Epidemiology and Disease Prevention
    C. Healthy Weight for Life
    D. Health Promotion Disease Prevention
    E. Breastfeeding Promotion and Support
    F. None of them **(if you answer F, please GO to question 5)**
    G. Other, please explain _____

4- How do you travel to the Health and Wellness Programs? Please select all that apply
    A. Drive myself
    B. Get a ride from a family member, friend, or volunteer
    C. Public transportation
    D. Taxi, Uber, Lyft, or similar service
    E. Motorcycle, moped, or scooter
    F. Bicycle
    G. Walk
    H. I participate online
    I. Other, please explain _____

5- Is transportation an **obstacle** for not being in one of the Health and Wellness Programs?
    A. Yes
    B. No

6- Do you usually eat healthy food every day? **Note**: A person who eats a healthy diet emphasizes fruits, vegetables, and whole grains. Also, they eat a variety of protein foods and avoid food that contains added sugars, sodium, saturated fats, trans fats, and cholesterol. They may or may not rely on fat-free or low-fat milk and dairy products.
    A. Yes
    B. No

Section 5: Demographics Information

1- What tribe do you belong to?
   A. The Mandan (Three Affiliated Tribes)
   B. The Hidatsa (Three Affiliated Tribes)
   C. The Arikara Nation (Three Affiliated Tribes)
   D. The Spirit Lake Nation, Dakota
   E. The Standing Rock Sioux Tribe, Lakota
   F. The Turtle Mountain Band of Chippewa Indians, Anishinabe/Ojibwe
   G. The Sisseton-Wahpeton Oyate Nation – Dakota
   H. The Trenton Indian Service Area, Anishinabe/Ojibwe (Part of Ft Peck Reservation in Montana)
   I. None of the above_____

2- Do you live on a reservation?
   A. Yes **(if you answer A, skip question 4)**
   B. No **(if you answer B, please DO NOT skip question 4)**

3- What is your home zip code?
   _____

4- Which of the following issues are your reasons for not living on a reservation? Please select all answers that apply.
   A. Lack of access to healthy, affordable food
   B. Lack of public transportation
   C. Lack of adequate healthcare
   D. Lack of available jobs
   E. Lack of affordable housing
   F. Lack of parks and recreation facilities
   G. Lack of shopping and entertainment
   H. Crime
   I. Low level of education
   J. Other, please explain _____

5- What is your gender?
   A. Male
   B. Female
   C. I prefer not to say

6- What is your age?
   A. 18-24
   B. 25-34
   C. 35-44
   D. 45-54
   E. 55-64
   F. 65-74
   G. 75 years or older

7- What is your marital status?
   A. Single, never married
   B. Married or domestic partnership
   C. Widowed
   D. Divorced
   E. Separated

8- How many children under 18 years of age are living in your household?
   A. None
   B. 1
   C. 2 - 4
   D. More than 4

9- What is your employment status?
   A. Employed full-time (40 or more hours per week)
   B. Employed part-time (up to 39 hours per week)
   C. Unemployed and currently looking for work
   D. Unemployed, not currently looking for work
   E. Student
   F. Retired
   G. Homemaker
   H. Self-employed
   I. Unable to work

10- What is the highest level of education you have achieved?
   A. Less than a high school diploma
   B. High school degree or equivalent (e.g., GED)
   C. Some college, no degree
   D. Associate degree (e.g., AA, AS)
   E. Bachelor's degree (e.g., BA, BS)
   F. Master's degree (e.g., MA, MS, MEd)
   G. Doctorate or professional degree (e.g., MD, DDS, Ph.D.)

End of the survey