

The relationship between food deserts, farmers' markets, Nutrition Benefits, and health in Delaware census tracts; 2017

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Abstract

Food desert residents struggle to maintain a well-balanced, nutritious diet, increasing their risk of obesity and diabetes. Farmers' markets are a community-level intervention, bringing healthy food to food deserts. This study explores the relationship between food deserts, farmers' market location, the prevalence of obesity and diabetes, and the availability of Nutrition Benefit Programs (NBPs) in Delaware. Data are from the 2017 USDA Food Access Research Atlas and the Farmers' Market Directory. Descriptive statistics and spatial visualization were used to explore census tract-level relationships. Twenty percent of Delaware census tracts are food deserts. Of these, 7.2% have a farmers' market within their boundary, compared to 5.7% of non-food desert tracts. Of these markets, 3.2% accept Farmers' Market Nutrition Program coupons, 9.6% accept WIC Fruit and Vegetable Checks, and 21.6% accept Supplemental Nutrition Assistance Program. Sussex County has the highest obesity and diabetes rates, and the least number of markets that accept NBPs. Fresh food remains inaccessible to low-income residents, which is associated with diet-related chronic diseases. To reduce food insecurity, farmers' markets could expand acceptance of NBPs. Additional farmers' markets could be established in food deserts to increase the availability of healthy food, reducing the risk of developing obesity and diabetes.

Introduction

Limited access to healthy foods makes it difficult for people who live in low-income communities to maintain a balanced and nutritious diet. These communities are frequently referred to as food deserts. The United States Department of Agriculture (USDA) defines food deserts as urban or rural locations lacking in ready access to fresh produce and other healthy foods due to an absence of stores that sell these foods.¹ Additionally, food desert residents may have limited resources, such as income, a vehicle, or access to public transportation to access healthy foods elsewhere.¹ The combination of lack of access to healthy food near their home and limited resources makes it difficult for food desert residents to obtain and consume healthy food.

The USDA's Economic Research Service established that 64.1 million U.S. residents live in food deserts, of which 5.1 million reside in rural food deserts.² Of this population, almost 29% (20.2 million) are low-income individuals. Within the state of Delaware, 228,000 residents, including 55,000 children, live in food deserts.²

The food environment impacts the health of residents who live in the region.^{3–6} Food desert residents tend to purchase food from nearby, convenient locations, such as fast food restaurants, convenience stores, and gas stations. Food purchased from these places are often processed,

packaged, and high in calories, fat, sugar, sodium, and preservatives. Additionally, price impacts the relationship between diet quality and the health status of low-income neighborhoods.⁷ In food deserts, nutritious food often costs more due to the lack of local competition, leading to more reliance on less expensive, processed food.^{8,9}

There is an association between access to food, food prices, and health outcomes.¹⁰ Limited availability of nutritious foods contributes to unhealthy diets, which are associated with obesity, diabetes, and other diet-related diseases.^{5,6,11–13}

According to the Centers for Disease Control and Prevention (CDC), obesity refers to a weight range that is greater than what is considered healthy for the height of the individual.¹⁴ Obesity identifies ranges of weight that are shown to increase the likelihood of disease and other health problems. Obesity is a problem both nationally and in the state of Delaware. In Delaware, the prevalence of self-reported obesity in 2017 was 31.8% among adults,¹⁵ which was lower than the percentage of U.S. adults who were obese (39.8%).¹⁴ Though lower than the national average, the obesity rate in Delaware has increased in recent years. In 2012, 26.9% of Delaware adults were obese, which is an increase of 4.9% over 5 years.¹⁴

Obesity and becoming overweight can be prevented.¹¹ Physical activity and eating fruits and vegetables can protect against overweight and obesity, as well as various other chronic diseases. Consuming more fruits and vegetables also reduces the risk of cardiovascular disease and some cancers. Body weight and fat mass have been seen to decrease with increased consumption of fruits and vegetables.¹⁶

Food insecurity has been implicated in the development of a number of chronic diseases that include obesity and type-2 diabetes.¹⁷ Food insecurity and decreased intake of fruits and vegetables often leads to higher obesity rates in low-income communities.⁷ The presence of supermarkets within two miles of one's neighborhood is associated with a lower prevalence of obesity.^{6,9} Proximity to a grocery store is also associated with higher fruit and vegetable intake and a better diet.¹⁸ The relationship between BMI, neighborhood disadvantage, and distance to grocery stores has been previously examined.¹⁹ Individuals who shopped in lower income neighborhoods had a higher BMI, suggesting a relationship between neighborhood socioeconomic status of grocery stores and BMI.⁶

Obesity is a risk factor for diabetes and heart disease and is more prevalent in food insecure individuals. Diabetes is a chronic disease that affects how the body converts food into energy.²⁰ Diabetes can be caused either by the bodies' inability to create sufficient insulin (Type-1 diabetes) or ineffective use of the insulin (Type-2 diabetes). This insulin disorder can lead to too much sugar being in the bloodstream. Type-2 diabetes is more common, and is a result of lifestyle factors, including diet.²⁰ Type-2 diabetes mellitus is a quickly growing chronic disease that affects approximately 22 million people in the United States.²¹ According to the National Diabetes Statistics Report, 30.3 million (9.4%) of Americans have diabetes.²⁰ In 2014, 9.1% of the population in Delaware was diagnosed with diabetes, which has almost doubled since 1996 when 5.2% of Delawareans were diagnosed with diabetes.²²

Individuals who are food insecure tend to be obese due to a high prevalence of low-cost energy-dense "convenience" foods available in impoverished areas. A study done involving 450 patients at a community center in Chelsea, MA found that patients who self-reported food insecurity had an average BMI increase of 0.15 per year. Cheap and easily accessible high calorie foods promote overconsumption, which over time leads to weight gain.¹⁷ Such excess weight gain

leads to a high risk of developing medical problems. Individuals with severe food insecurity are also more likely to have type 2 diabetes than those who are food secure.²³ This relationship remains even after adjusting for sociodemographic factors and physical activity level.

Farmers' markets may play an important role in bringing fresh foods to food deserts. One of the major problems of the lack of transportation to distance grocery stores and the cost of produce can be resolved by farmers markets ability to bring locally sourced, healthy, seasonal and fresh produce to community members. Over the past twenty years, farmers' markets increased with an annual growth rate of about 8.4% from 1994 to 2014.²⁴ This growth is due to an increased interest in fresh, local foods.²⁵ Farmers' markets can provide fresh fruits and vegetables to communities where they were previously lacking. Farmers' markets can enable low-income residents to purchase healthy foods in their local community.¹³

The USDA recommends farmers' markets as a community level intervention to address food accessibility in food deserts.²⁴ These markets can serve as a feasible intervention since they are less costly, require less space, and can be quicker to implement than building a new grocery store.¹ Farmers' markets can make healthy food available to food desert residents.^{24,26} In rural and urban areas, they help to lower the cost of food. Farmers sell directly to their customers and provide low-income residents with greater access to affordable fresh fruits and vegetables.²⁶

The Farmers' Market Promotion Program is a United States Department of Agriculture (USDA) program that supports the development, improvement, and expansion of farmers' markets.²⁷ Low-income communities are considered a priority area for improvement. To target low-income families who are nutritionally at risk, the USDA has designed federal Nutrition Benefit Programs (NBPs) for eligible recipients to buy healthy foods. NBPs include the Supplemental Nutrition Assistance Program (SNAP); the Farmers' Market Nutrition Program (FMNP), which is associated with the Supplemental Nutrition Program for Women, Infants, and Children (WIC); and the Senior Farmers' Market Nutrition Program (SFMNP). In some instances, recipients may qualify for more than one Nutrition Benefit Program.²⁷

SNAP is a federal nutrition program that offers assistance to eligible, low-income individuals and families. SNAP benefits can be used to buy healthy food at grocery stores, convenience stores, and some farmers' markets and co-op food programs. Eligibility to receive SNAP benefits depends on household size, monthly income, and basic household expenses.²⁸

WIC provides supplemental foods, health care referrals, and nutrition education for low-income women who are pregnant, breastfeeding, or up to six months postpartum; for infants; and for children up to age five who are at nutritional risk.²⁷ WIC benefits are offered in the form of WIC Fruit and Vegetable Checks, which can be spent on fruits and vegetables at farmers' markets. Eligibility is based on household size and gross monthly income.

The FMNP is a federally funded program for WIC recipients and seniors (SFMNP) over the age of 65 who meet income eligibility guidelines. WIC and SFMNP participants receive checks, which can be redeemed at farmers' markets that have been approved by a state agency. The farmers or farmers' market managers then submit the checks to a bank or state agency to be reimbursed.²⁷

Acceptance of payment from Nutrition Benefit Programs increases attendance at farmers' markets, sales, and vegetable intake. New York City's Health Bucks Program, established in 2005, uses coupons to encourage more EBT spending. Evaluation of this program shows that

markets accepting EBT had a higher demand for vendor participation.²⁹ In another study, the authors attached a coupon to WIC benefits to be redeemed at farmers' markets. They found that 43% of the customers had never been to a farmers' market and that 73% planned to return, even without a coupon.³⁰ Participants who continued to return to the farmers' markets showed a long-term, 5% increase in vegetable consumption.³⁰

This report explores the relationship between locations farmers' markets, participation in Nutrition Benefit Programs, and food desert status by census tracts in Delaware. The following were research questions assessed:

- 1) What is the relationship between location of farmers' markets and food desert census tracts within Delaware?
- 2) What proportion of farmers' markets in Delaware participate in Nutrition Benefit Programs?
- 3) What is the relationship between the first two questions and the prevalence of obesity and diabetes in Delaware.

By answering these questions, we add to the literature on food deserts and provide a more thorough understanding of the availability and effectiveness of Nutrition Benefit Programs in reducing food insecurity through farmers' markets.

Methods

This report analyzes the relationship between USDA-designated food deserts, locations of farmers' markets, access to Nutrition Benefit Programs at farmers' markets, and obesity and diabetes prevalence in the state of Delaware. Data sources include the 2017 USDA Food Access Research Atlas and the 2017 USDA Farmers' Market Directory.^{31,32} The USDA Food Access Research compiles the following data:

- Census tract food desert designation across the US,
- Population data from the 2010 Census,
- Income data from the 2010 American Community Survey, and
- Food access data drawn from two 2010 lists of food stores selling all major categories of food.^{32,33}

The linked datasets provide information to identify US residents who have low access to healthy food, live more than one mile from a grocery store in urban settings, live more than ten miles from a grocery store in rural settings, and are designated as low-income by the US Census Bureau.

The USDA food desert locator is an online mapping tool that determines the location of food deserts around the U.S. This tool provides data on population characteristics of census tracts where residents have limited access to affordable and nutritious foods.³⁴ It was created by the USDA's Economic Research Service (ERS).

The United States Census Bureau (USCB) defines a census tract as a small, statistical subdivision of a county or equivalent entity that is updated by local participants prior to each decennial census.³⁵ Census tracts serve the purpose of providing a stable set of geographic units for presenting statistical data. The tracts generally have a population size between 1,200 and

8,000 people; the ideal size being about 4000. The spatial size of census varies depending on the density of the land. The census tracts are intended to be maintained over a long time so that statistical comparisons can be made from census to census.³⁵

The USDA defines a food desert as a “low income” census tract where a significant number of residents have little access to a supermarket or large grocery store. “Low income” tracts are defined as those where at least 20 percent of residents earn income at or below the federal poverty levels for family size, or where median family income for the tract is at or below 80% of the adjacent area's median family income.³⁶ To qualify as a food desert, at least 500 people or 33% of a population must live more than one mile from a supermarket or large grocery store. According to these income and food access criteria, approximately 10% of the 65,000 census tracts in the United States meet the definition of a food desert.³⁶

The USDA Farmers’ Market Directory is a self-report registry of markets that provide agricultural products for sale in physical locations at registered times.³¹ For each registered market, the USDA Farmers’ Market Directory provides the address, days and hours of operation, products, and participation in Nutrition Benefit Programs for each registered farmers’ market. Addresses of farmers’ markets were geocoded in ArcGIS 10.3. Quantitative data were analyzed using descriptive statistics in IBM SPSS Statistics version 21.0. Access to food programs, including the Farmers’ Market Nutrition Program (FMNP), WIC Fruit and Vegetable Checks (FVC), and Supplemental Nutrition Assistance Program (SNAP) were linked to farmers’ markets. These point data were analyzed with the USDA Food Access Research Atlas tract data. Diabetes and obesity data were linked by FIPS codes and added as a map layer. Descriptive statistics and spatial visualization were used to analyze the relationship between locations of farmers’ markets, participation in Nutrition Benefit Programs, and food desert status by census tract in Delaware.

Results

Figure 1 shows locations of farmers’ markets in relation to food desert census tracts within Delaware. In 2017, there were 39 registered farmers’ markets in Delaware. Of the Delaware census tracts, 20% were classified as food deserts. Of these tracts, only 7.2% had a farmers’ market within their boundary, compared to 5.7% of non-food desert tracts.

Farmers’ markets are distributed throughout Delaware, but a cluster is found in the Wilmington metropolitan area in the northern part of the state. In southern Delaware, one or two farmers’ markets are typically found in county seats. Few appear in Kent County as compared to New Castle or Sussex Counties.

The farmers’ markets were coded based on the availability of Nutrition Benefit Programs at each market. Within Delaware, 24 markets (61.5%) did not participate in any NBP, zero markets (0%) accepted FMNP, two (5.1%) accepted FVC, 15 (38.4%) accepted SNAP benefits, and two (5.1%) accepted more than one type of NBP. There was no clear apparent spatial pattern of markets by their Nutrition Benefit Program status.

Figure 1. Nutrition Benefit Programs/Food Assistance Program Availability at Delaware Farmers’ Market

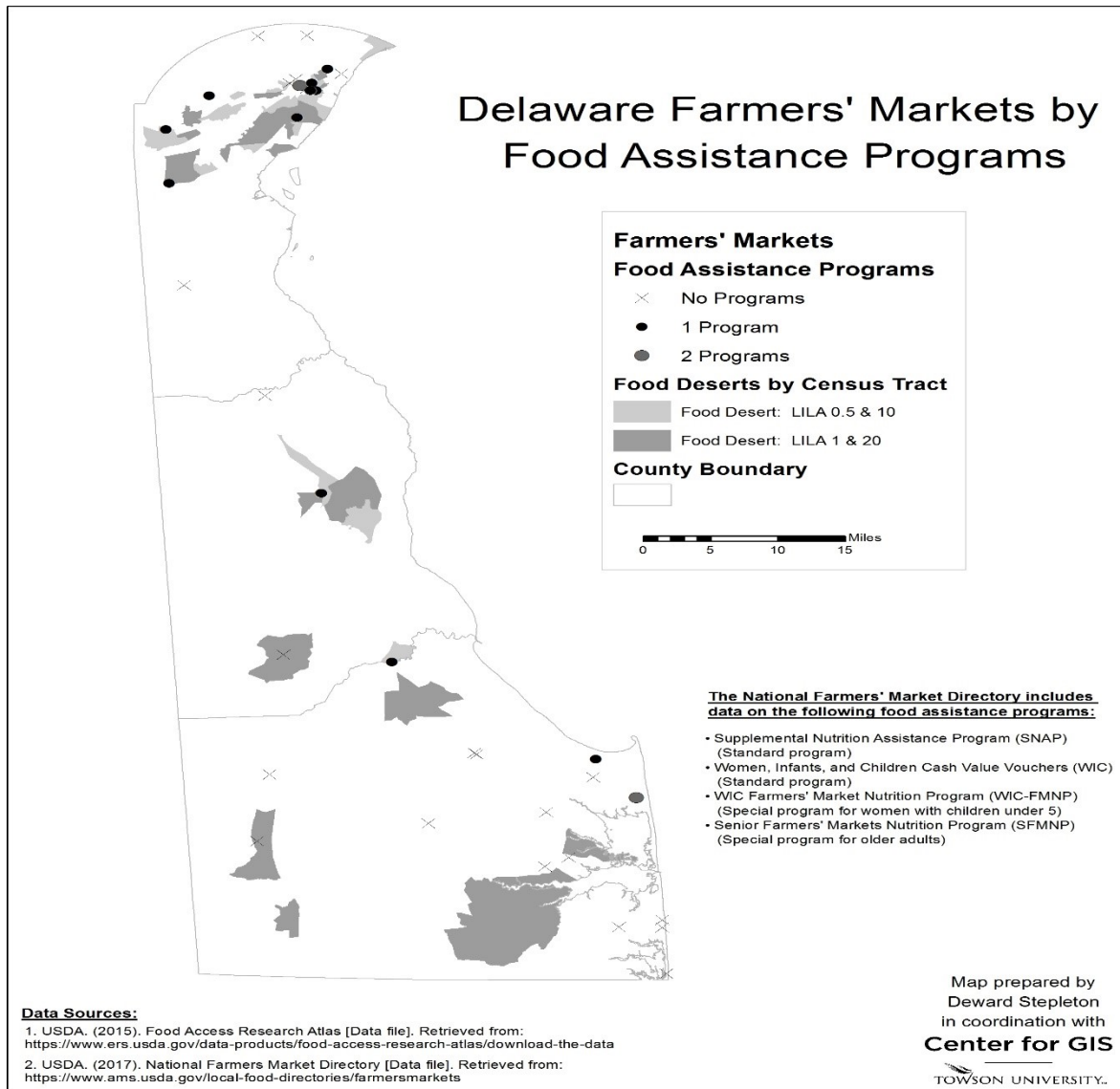


Figure 2 displays Delaware diabetes rates by county with Nutrition Benefit Programs/Food Assistance Program Availability at Delaware Farmers' Markets. New Castle County has a diabetes rate of 9%. Kent County has a diabetes rate of 12.8%. Sussex County has a diabetes rate of 13.2%. Of the three counties, Sussex County has the highest number of farmers' markets that do not accept at least one FAP, along with the highest diabetes rate. Kent County has the second highest diabetes rate at 12.8%, as well as the least number of farmers' markets in Delaware. New Castle County has the lowest diabetes rate as well as the most farmers' markets. New Castle County also has the most farmers' markets that accept Nutrition Benefit Programs.

Figure 2: Nutrition Benefit Programs/Food Assistance Program Availability at Delaware Farmers' Market and Delaware diabetes rate by county.

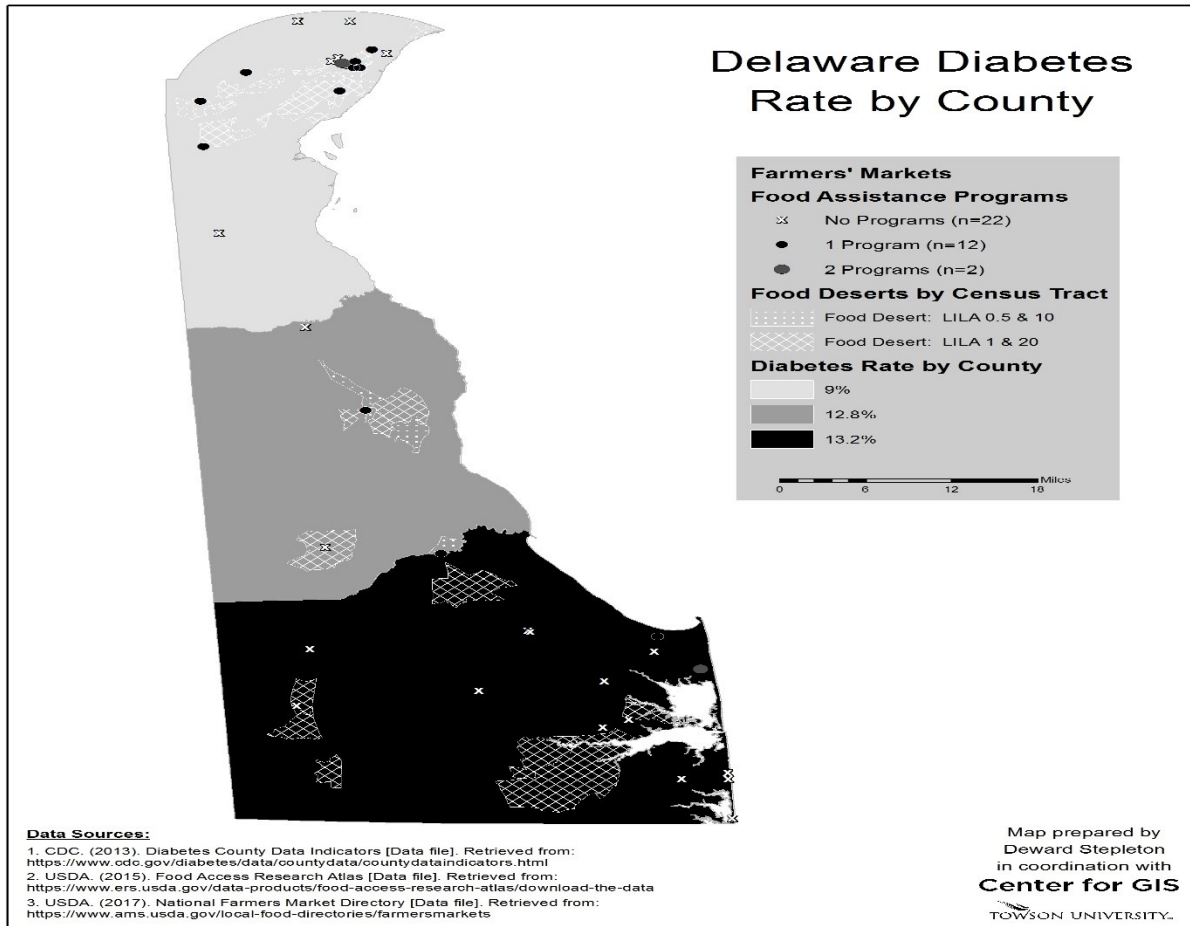
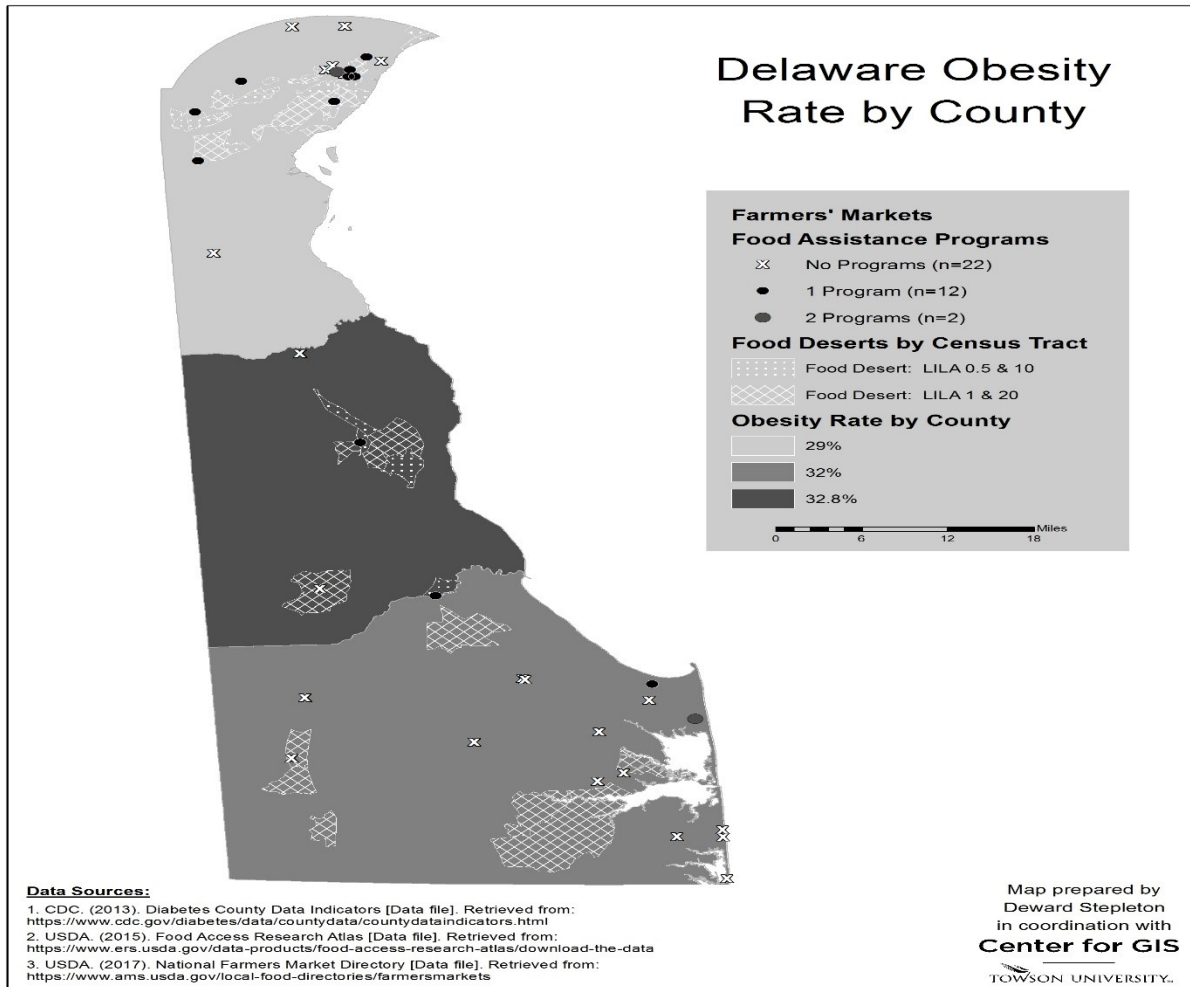


Figure 3 shows the Delaware obesity rate by county. New Castle County has an obesity rate of 29%. Kent County has an obesity rate of 32%. Sussex County has an obesity rate of 32.8%. The obesity rate variation is similar to that of diabetes prevalence for the three counties, with New Castle County having the lowest rate and Kent County and Sussex County being nearly interchangeable. Within each county, New Castle County has the most number of farmers' markets that accept NBPs, and Sussex County has the fewest number of farmers' markets that accept NBPs.

Figure 3. Delaware Obesity rate by county.



Discussion

Few farmers' markets in Delaware are located in food deserts or accept Nutrition Benefit Programs (NBPs). Fresh food remains inaccessible to many low-income residents in these areas. Lack of fresh, healthy food increases the resident's risk of developing overweight and obesity, as well as other diet-related chronic conditions.^{5,6} Even among the markets located within food deserts, the likelihood of acceptance of NBPs was low, with less than 30% of farmers' markets participating in NBPs. The lack of participation in NBPs acts as a barrier to low-income residents accessing the healthy, fresh foods being sold at the markets. Additionally, the counties with the highest obesity rate and diabetes rate had the lowest number of markets that participate nutrition benefits programs. Delaware residents who live in food deserts, who live in areas with higher prevalence of obesity and diabetes, and depend on NBPs have little access to produce being sold at farmers' markets due to the markets' lack of participation in NBPs.

This study has several strengths, including: 1) examination of a potentially essential community resource (farmers' markets) that could mitigate obesity and improve access to healthy food in Delaware; 2) the use of spatial methods to analyze the relationship of food deserts and farmers' markets, health and Nutrition Benefit Programs; and 3) the use of multiple datasets in a spatial framework to examine issues related to food access.

This study has limitations. The USDA Farmers' Market data were self-reported and cross-sectional. Since the data include only markets registered with the USDA, it may not be exhaustive. Since the data were cross-sectional and include only one year of data for one state, causation cannot be established. Future studies should extend over multiple years and several states to establish trends and to illustrate a more comprehensive picture of issues related food access.

Future research could include collecting information regarding the establishment of farmers' markets in food deserts. Interviewing farmers and community leaders to determine barriers to establishing of farmers' markets in food deserts would provide information for communities looking to alleviate issues related to access to healthy food. Additionally, understanding the barriers faced when establishing Nutrition Benefit Programs at farmers' markets located in food deserts could enable community leaders to develop policies to reduce such barriers. Awareness of access, socioeconomic status, and cultural factors, including race and ethnicity, also affect how people utilize transportation to obtain food.^{9,37} Likewise, a lack of information regarding where to find affordable healthy foods can lead individuals in food deserts to continue purchasing processed foods from convenient locations.³⁸

To reduce food insecurity in food deserts, more farmers' markets could accept SNAP, FMNP, and FVC. Promotion of available technologies such as EBT and support for their implementation would aid this process. Also, additional farmers' markets could be established in food deserts to increase availability of food. This can be accomplished through various avenues, including: 1) public investment in health promotion and prevention, as a means to lower long-term health costs by reducing rates of obesity and diabetes through promotion of healthier diets; 2) public-private partnerships between local government and community agencies to promote an increase in community gardening as a means to develop supplies for local farmers' markets; and 3) private entrepreneurial activity, potentially stimulated through tax incentives and farm subsidies, and also tapping into the desire of many entrepreneurs today to engage in activities that are both profitable and socially responsible. Development of additional farmers' markets in these areas would increase access to healthy food in food deserts, reducing the ecological risk of developing obesity and diet-related chronic diseases.

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