



Mapping Heart Disease, Stroke and Other Chronic Diseases: A Program to Enhance GIS Capacity within State Health Departments

Map Highlights from Florida, Ohio, Oklahoma, Pennsylvania, and South Carolina

Submitted to the US Centers for Disease Control and Prevention, Division for Heart Disease and Stroke Prevention, and the National Association of Chronic Disease Directors

Prepared by the Children's Environmental Health Initiative at the School of Natural Resources and Environment, University of Michigan

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CHRONIC DISEASE GIS EXCHANGE

To see additional maps that address heart disease, stroke and other chronic diseases, visit the Chronic Disease GIS Exchange at www.cdc.gov/dhdsp/maps/gisx. The site includes a map gallery, GIS training modules, and a wide range of GIS resources. Visitors to the site are also invited to submit their own map to the map gallery.

INTRODUCTION

Geographic Information Systems (GIS) are powerful tools for enhancing the ability of health departments to address the public health burden of heart disease, stroke, and other chronic diseases. In order to build the capacity of health departments to utilize GIS for the surveillance and prevention of chronic diseases, the Division for Heart Disease and Stroke Prevention at the national Centers for Disease Control and Prevention (CDC) funds a collaborative training project with the National Association of Chronic Disease Directors and the University of Michigan. The central objective of this GIS Surveillance Training Project is to enhance the ability of health departments to integrate the use of GIS into daily operations that support existing priorities for surveillance and prevention of heart disease, stroke, and other chronic diseases. Staff members from health departments receive training regarding the use of GIS surveillance and mapping to address four major purposes:

- documenting geographic disparities
- informing policy and program decisions
- enhancing partnerships with external agencies
- facilitating collaboration within agencies

In 2013, the following state health departments were competitively selected to participate in this GIS Surveillance Training Project: Florida, Ohio, Oklahoma, Pennsylvania, and South Carolina. The project is intentionally designed to develop a GIS infrastructure that can serve a vast array of chronic disease areas, yet with a focus on heart disease and stroke.

The maps displayed in this document highlight examples of how each participating health department produced maps to support their chronic disease priorities by documenting the burden, informing program and policy development, and enhancing partnerships. The extent of collaboration among chronic disease units within each health department is evident in the diversity of the teams that participated in the training and have continued to work to strengthen GIS infrastructure within their respective health departments.

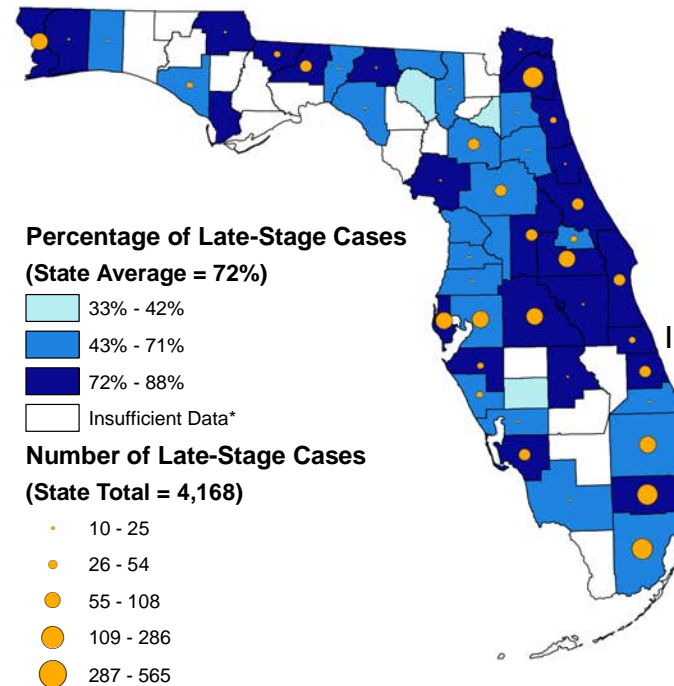
Florida: Using GIS to Address Chronic Disease Prevention and Health Promotion

Late-stage lung cancer is defined as lung cancer that has spread to other parts of the body, when it becomes more difficult to treat. The Florida statewide average percentage of lung cancer cases diagnosed at late stage among non-Hispanic whites is 65% and among non-Hispanic blacks is 72%. These maps illustrate the county-level patterns of late-stage lung cancer diagnosis by race. The shades of blue represent the percentage of individuals diagnosed with late-stage lung cancer out of all lung cancer cases diagnosed in each county from 2006 to 2010. The proportional symbols (illustrated by the gold dots) represent the total number of late-stage lung cancer cases diagnosed in each county from 2006 to 2010.

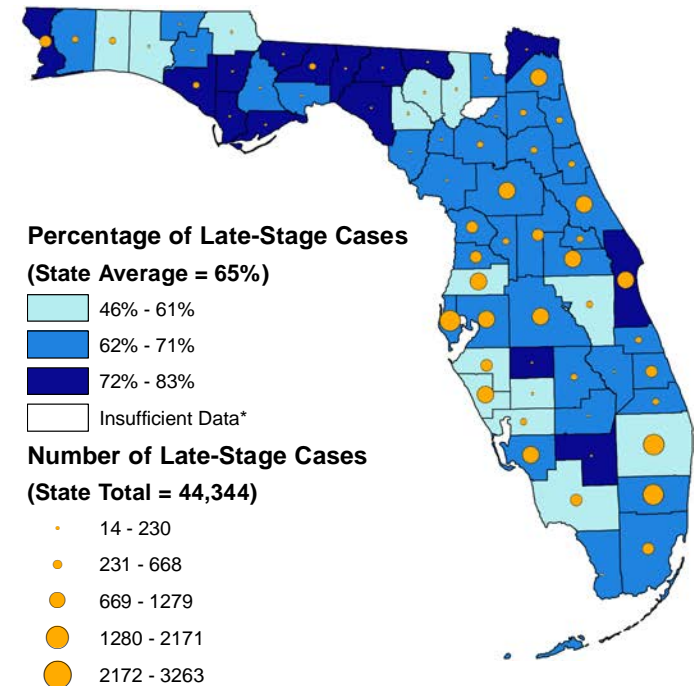
This set of maps depicts geographic disparities in late-stage lung cancer burden (both absolute and percentage) at the county level for both Non-Hispanic Blacks, and Non-Hispanic Whites. Side-by-side comparisons of the maps indicate that counties in the east had higher percentages of late-stage lung cancers in non-Hispanic blacks. The Florida Department of Health will use this map to inform recommendations for future prevention and early detection programming.

Late Stage Lung Cancer in Florida, by Race, 2006-2010

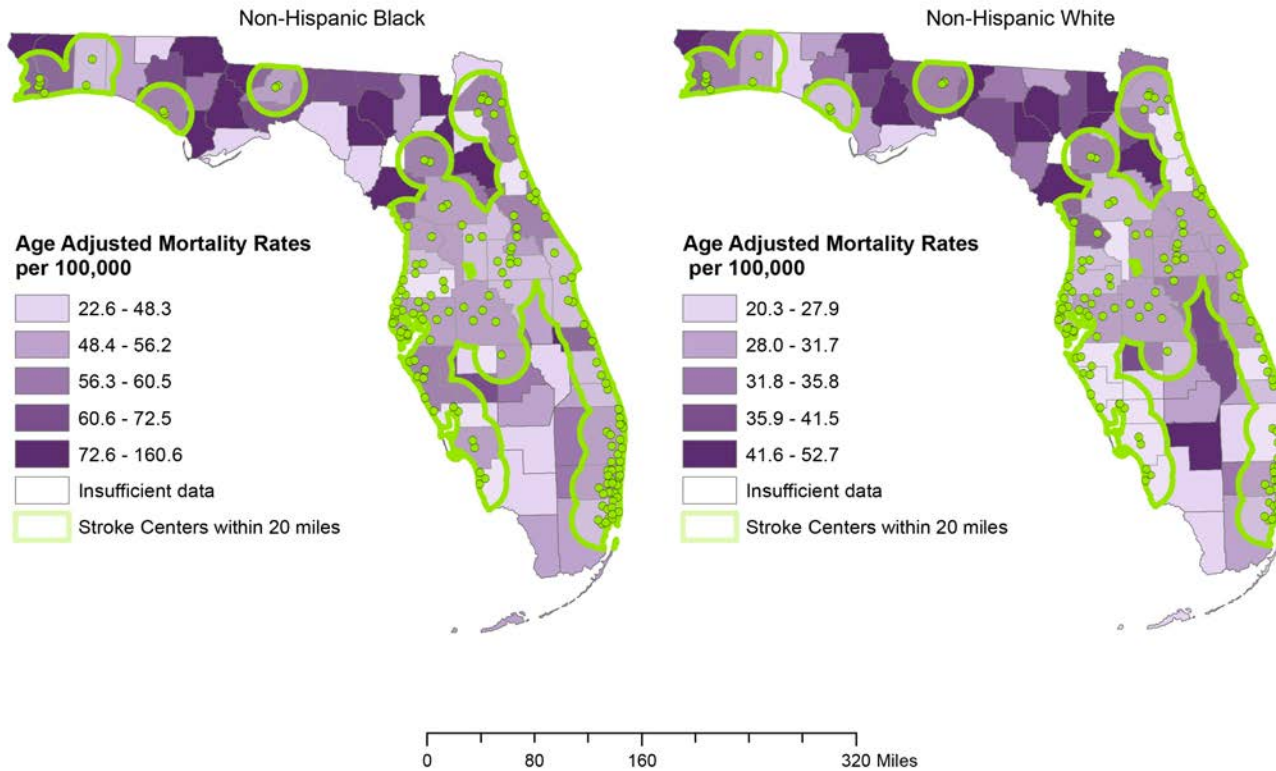
Non-Hispanic Black



Non-Hispanic White



Stroke Mortality by County and Access to Stroke Centers in Florida, 2006-2010



Source: Florida Department of Health, Bureau of Vital Statistics, Florida Agency for Health Care Administrations (AHCA).

Data Notes: ICD-10 Code(s): I60-I69

Florida Agency for Health Care Administration (AHCA)

**In an effort to protect indirect identification of a patient, data were excluded for counties with less than 10 cases. In addition, Union County data were excluded because of the large percentage of incarcerated individuals.

*Age-Adjusted per 100,000



This map highlights the areas in Florida that are within 20 miles of designated primary and comprehensive stroke centers - hospitals certified by The Joint Commission to meet standards to support better treatment and outcomes for stroke.

This map also documents the county-level patterns of age-adjusted stroke death rates (2006-2010) among Non-Hispanic Blacks and Non-Hispanic Whites. The darker regions represent areas of higher stroke mortality and are located primarily in the northern region. Stroke mortality is highest in counties that lack timely access to stroke centers. Approximately 32% of counties in Florida are outside of a 20 mile radius to a primary or comprehensive stroke center.

For both Non-Hispanic Blacks and Non-Hispanic Whites there are northern counties with high stroke mortality rates that are outside of the 20 mile boundaries to a primary or comprehensive stroke center. These maps can be used to inform recommendations for expanding the network of primary and comprehensive stroke centers. Findings can also be used to inform programmatic decisions for prevention efforts.

Ohio: Using GIS to Address Chronic Disease Prevention and Health Promotion

According to the Ohio Behavioral Risk Factor Surveillance System, over 60 percent of adults in Ohio have at least one chronic condition and one-third have two or more¹. Chronic diseases accounted for nearly two-thirds of all deaths in Ohio in 2011².

This map shows the concentration of the burden of chronic disease deaths in the Appalachian region of the state, primarily in the southern end of the Appalachian region. Age-adjusted death rates per 100,000 people are represented in shades of blue with the darkest shades showing the highest rates of deaths due to heart disease, cancer, stroke, chronic lower respiratory disease, diabetes, and kidney disease.

In addition, the number of Federally Qualified Health Centers (FQHC) in each county is shown by a yellow dot. The larger the dot appears, the greater the number of FQHCs located within that county. Many of the counties with the highest death rates have very few or no FQHCs. Four counties with multiple FQHCs are highlighted on the right to display the distribution of FQHCs within more populous counties.

This map and others like it are being used to drive data-informed decision-making processes and support efforts that address the prevention and treatment of chronic diseases. Through collaboration among the Ohio Department of Health (ODH) and several statewide organizations, these efforts are being implemented at FQHCs across the state.

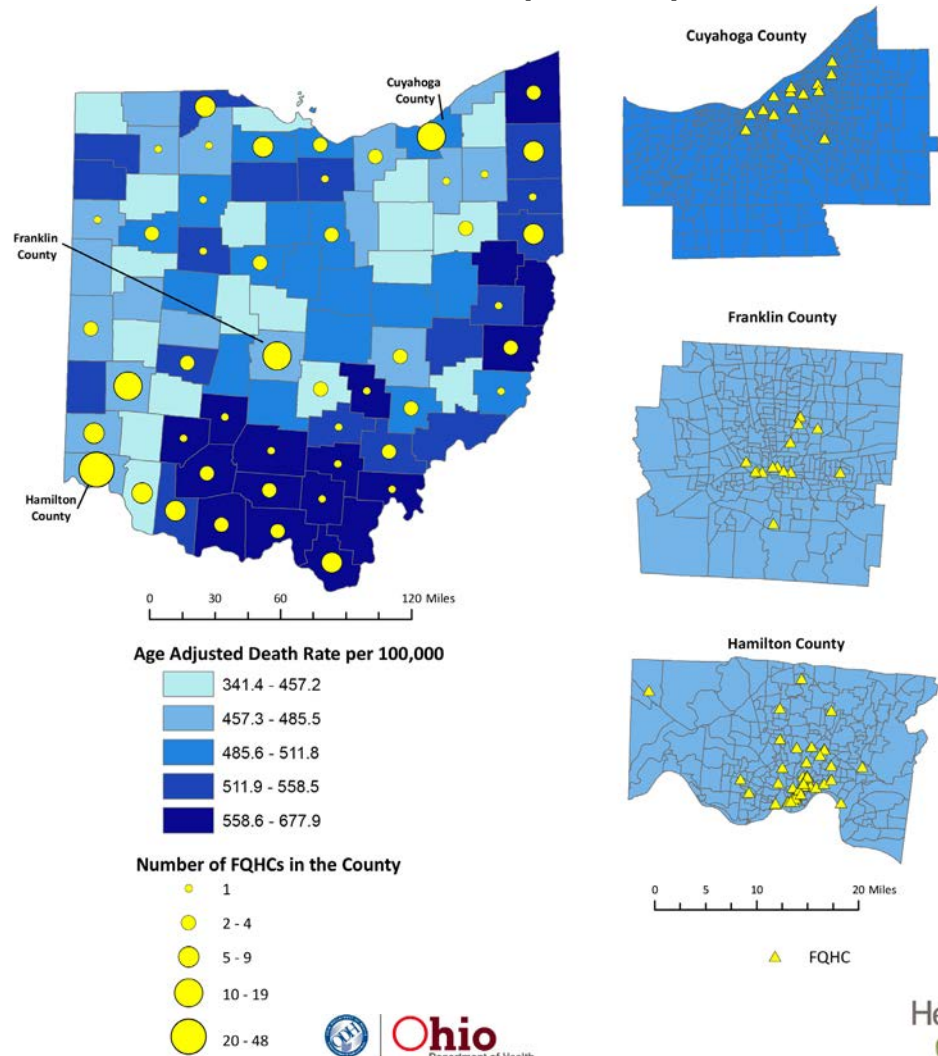
¹Ohio Behavioral Risk Factor Surveillance System, 2011 and 2012, Ohio Department of Health

²Ohio Vital Statistics, Ohio Department of Health

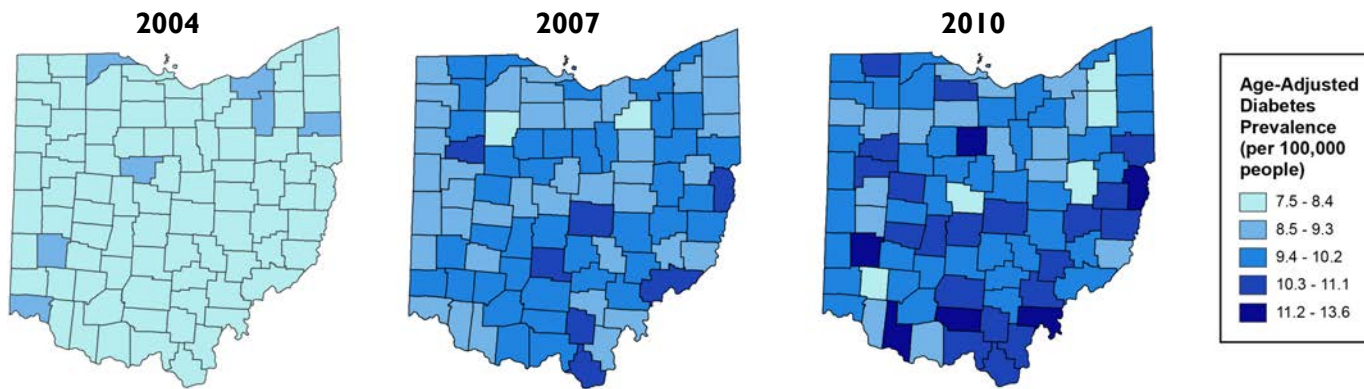
Notes: "Chronic Diseases" include heart disease, stroke, diabetes, cancer, kidney disease and chronic lower respiratory disease. Cuyahoga, Franklin and Hamilton counties are highlighted to show the distribution of FQHCs in the 3 largest metropolitan counties.

Sources: Ohio Department of Health, Vital Statistics; Health Resources and Services Administration; U.S. Census Bureau.

Chronic Disease Death Rates and Federally Qualified Health Centers (FQHC) in Ohio, 2011



Geographic and Temporal Trends in the Prevalence of Diabetes, 2004-2010, Ohio

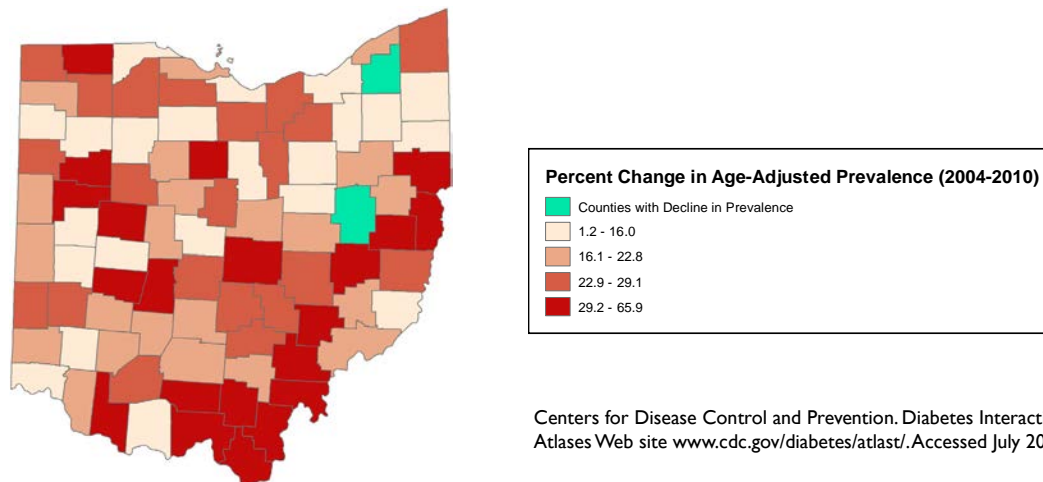


In 2010, Ohio was tied for the twelfth highest estimated prevalence of diabetes in the nation as well as ranked fifth in estimated prevalence for prediabetes¹. These facts raise concern among health officials seeking to combat the effects of diabetes on the population and reduce the costs of treating its complications.

These maps show how rapidly the estimated prevalence of diabetes increased from 2004 to 2010. The maps present the annual county estimates for prevalence of diabetes in 2004, 2007 and 2010 along with the percent increase in estimated prevalence during the study period. A decline in the estimated prevalence of diabetes was observed in only two counties between 2004 and 2010. All other counties (n=86) experienced increases in the estimated prevalence of diabetes.

This series of maps can serve as an aid for identifying areas with the greatest need for change, which will in turn help state agencies efficiently utilize resources to provide training and interventions to reduce the estimated prevalence of diabetes in the state of Ohio.

Percent Change in the Prevalence of Diabetes, 2004-2010, Ohio



Centers for Disease Control and Prevention. Diabetes Interactive Atlases Web site www.cdc.gov/diabetes/atlas/. Accessed July 2013.



¹Centers for Disease Control and Prevention (CDC). Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2010

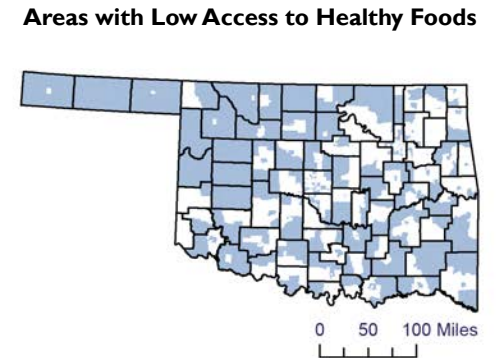
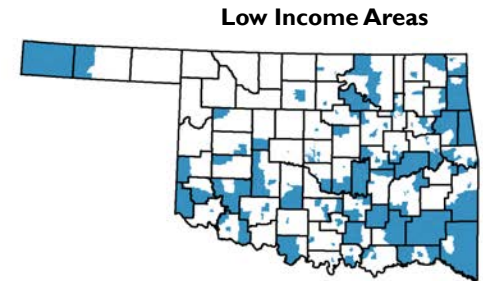
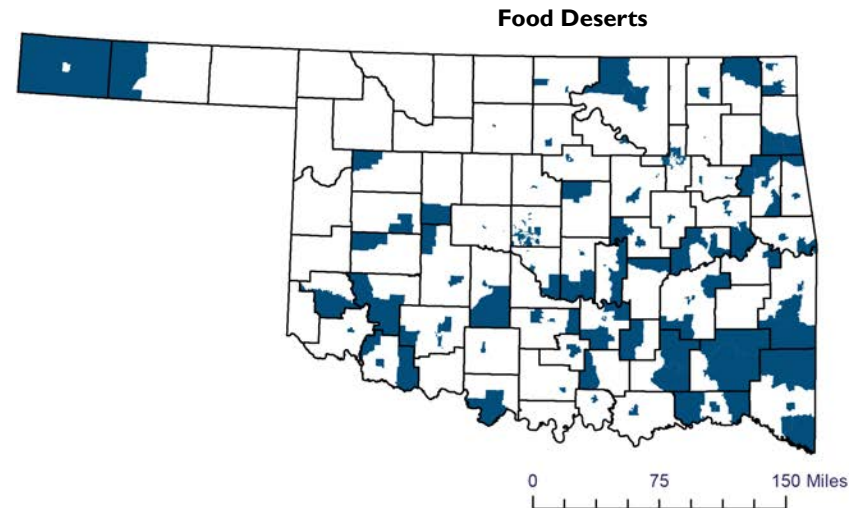
Oklahoma: Using GIS to Address Chronic Disease Prevention and Health Promotion

Mapping Food Deserts and Contributing Factors Oklahoma, 2010

Obesity is a risk factor associated with many chronic diseases. Increasing access to healthy affordable food is one strategy to curb the obesity epidemic. Access to healthy food is limited in many Oklahoma counties due to their rural nature. These maps of Oklahoma show locations of census tracts classified as low access to healthy food, low income, and food deserts.

For this map, a food desert census tract is classified as both low income and low access. Low income is defined by the Department of Treasury's New Markets Tax Credit program. Low access to healthy food is defined as urban areas being more than 1 mile and rural areas being more than 10 miles from a supermarket, supercenter, or large grocery store.

These maps were used in a presentation to private family foundations and corporate giving programs interested in funding projects within their community. In the future, these maps will be used in working with state and community advocates to create access to healthy food and eliminate food deserts. As policies, programs, and environmental changes are implemented these maps could also be utilized over the next few years to depict reductions in the proportion of census tracts within the state that are classified as food deserts.



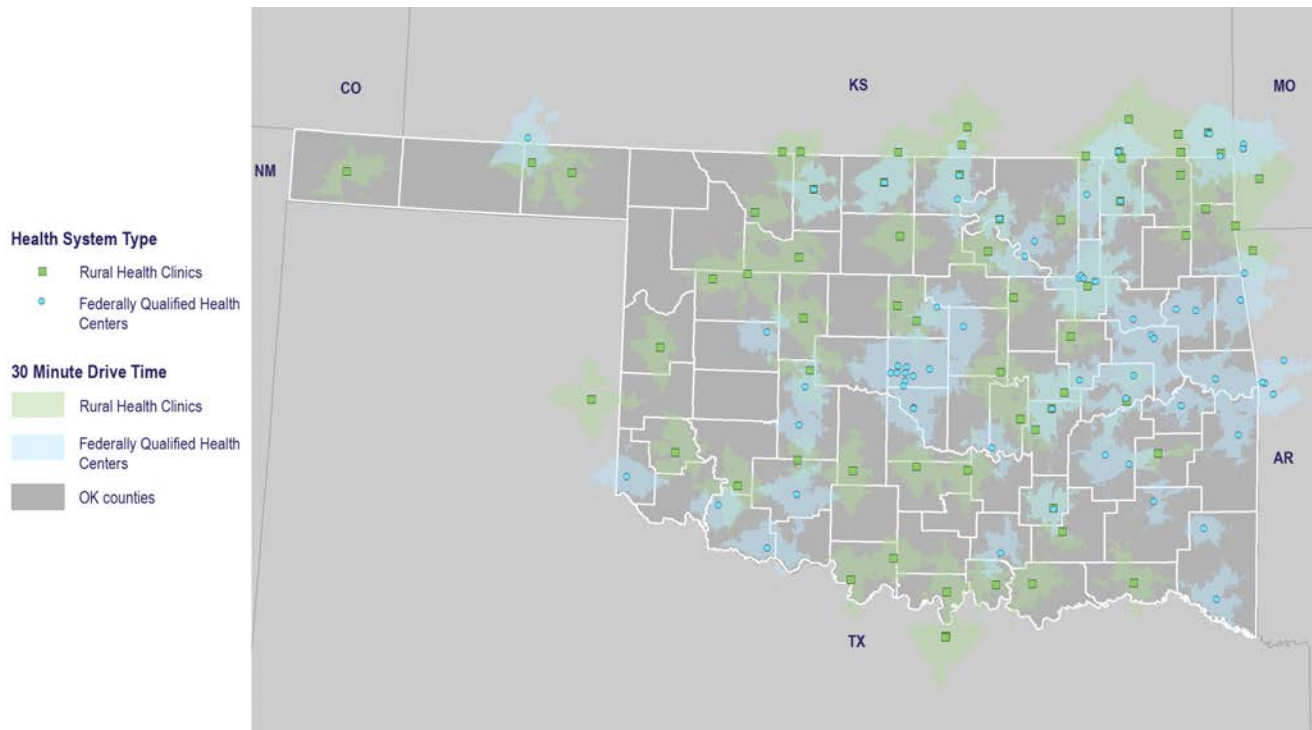
Data Source: Economic Research Service (ERS), U.S. Department of Agriculture (USDA). Food Access Research Atlas, www.ers.gov/data-products/food-access-research-atlas.aspx.

Notes: A Food Desert is defined by the USDA and classified as both low income and low access. Low income is defined by the Department of Treasury's New Markets Tax Credit program. Low access to healthy food is defined as urban areas being more than 1 mile and rural areas being more than 10 miles from a supermarket, supercenter, or large grocery store.



Center for the Advancement of Wellness
Oklahoma State Department of Health

Geographic Accessibility of Primary Care Services for Oklahomans



Data Source: Health Care Information (November 2013 Oklahoma FQHCs and 2013 Rural Health Clinics), Centers for Disease Control and Prevention (2012 FQHCs in bordering states), OSDH Geodatabase, ArcGIS online, and the ESRI 9.1 Network Dataset.



Chronic Disease Service
Prevention and Preparedness Services
Oklahoma State Department of Health

This map addresses the agency's priority of implementing interventions related to heart disease, stroke, and other chronic diseases in a coordinated manner. Many evidence-based strategies for addressing chronic diseases are in the health care setting. Therefore, maps such as this one are useful tools for program planning.

This map illustrates that the majority of the state's population is within a 30 minute drive of a Rural Health Clinic (RHC) or Federally Qualified Health Center (FQHC). However there are populations that are not within a 30 minute drive – particularly in the west and northwestern part of the state. GIS analysis using Census 2010 data revealed that approximately 70% and 42% of the state's population are within a 30 minute drive of an FQHC and RHC, respectively. Further GIS analysis will be conducted in order to determine the percent of various populations at high risk for heart disease, stroke, and other chronic diseases that are within a 30 minute drive time to RHCs and FQHCs.

This map will be used in conjunction with disease burden maps in order to determine which health centers would be ideal settings for interventions. It may be used in discussions of what proportion of the population is likely to go out of state for health care. This map will also be made available on the Oklahoma State Department of Health's website for providers, community-based coalitions, and community-based organizations to access for planning purposes.

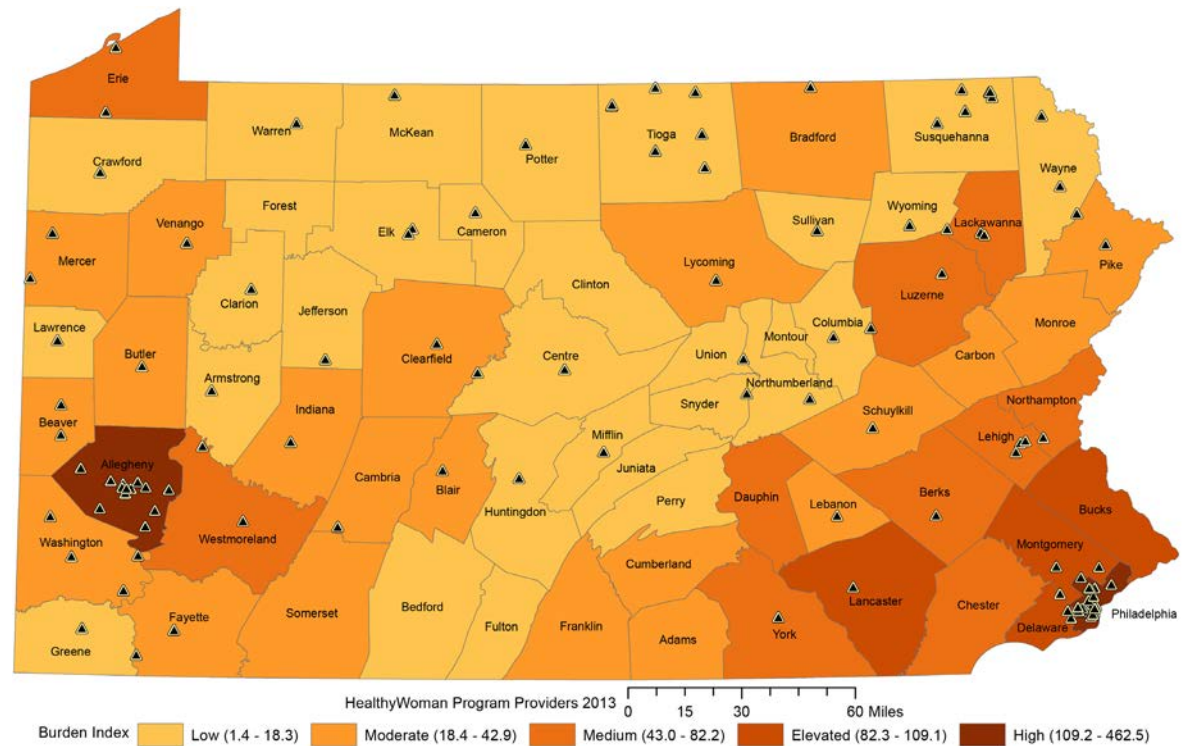
Pennsylvania: Using GIS to Address Chronic Disease Prevention and Health Promotion

Breast and Cervical Cancer Burden Index and Healthy-Woman Program (HWP) Provider Locations, 2013

The HealthyWoman program (HWP) provides breast and cervical cancer screening to underserved women in Pennsylvania between the ages of 40 and 64.

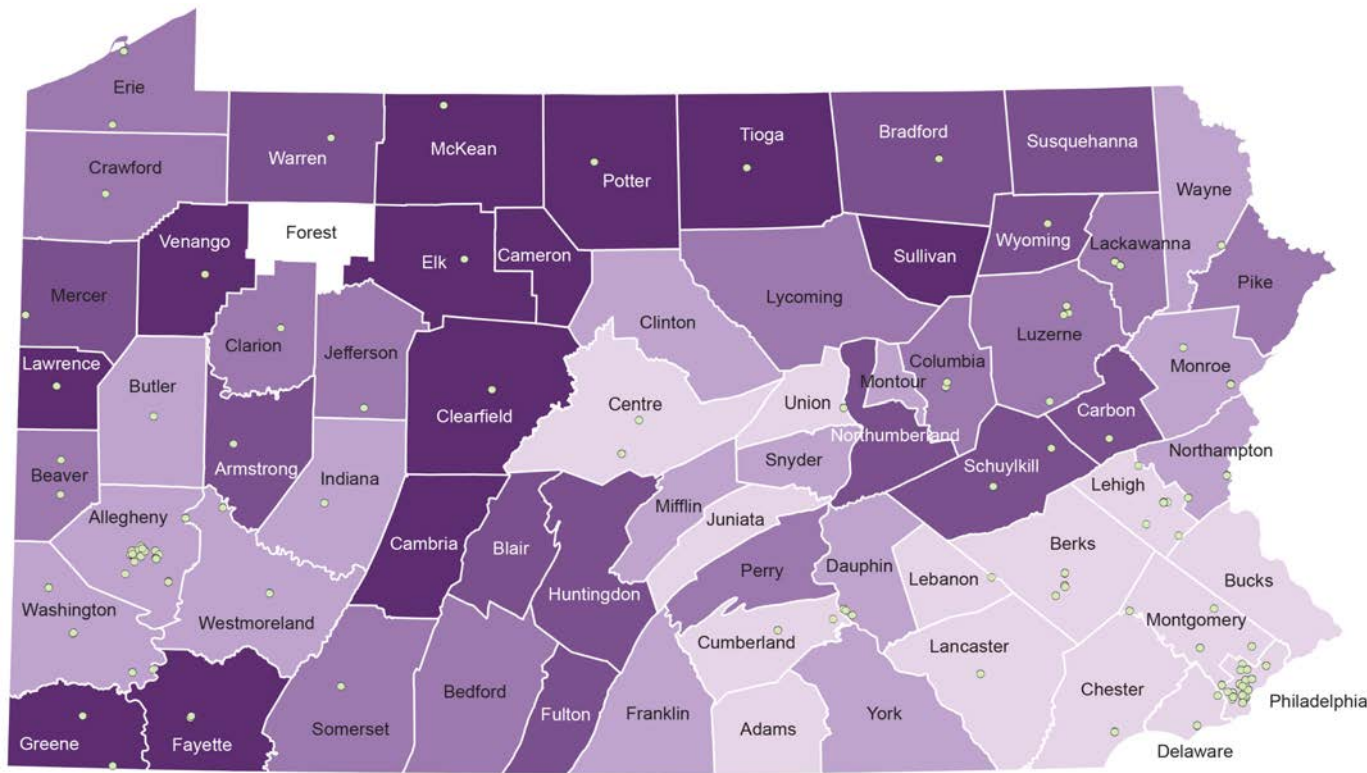
The Bureau of Health Statistics at the Pennsylvania Department of Health developed a breast and cervical cancer burden index in 2009 to fulfill this need. The burden index comprises several data sources from 2008 to 2010 including: the Pennsylvania Cancer Registry, Death Certificates, U.S. Census Bureau, SAHIE, and BRFSS. These normalized, weighted data sources are combined with crude count incidence/mortality data and population data to produce a burden index value for each county.

This map displays HWP provider locations in 2013. The two counties with the highest burden index scores have the largest number of providers, but throughout the rest of the state, several counties with medium and elevated burden index scores do not have the number of providers proportional to their burden index. This coverage gap reflects areas where the program has had difficulty finding providers in the past, but presents an opportunity for expansion in the future to the extent that funding allows. This map will be used by the program to aid policy decisions related to locating new providers and contract guidelines, as well as for general informational purposes.



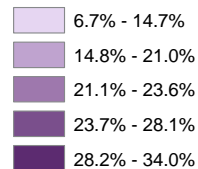
Source: Pennsylvania Bureau of Health:
Healthy Woman Program; Bureau of Health Statistics
*Burden Index created by the Bureau of Health Statistics, using data from the Pennsylvania Cancer Registry, Pennsylvania Death Certificates, Behavioral Risk Factor Surveillance Survey, and Small Area Health Insurance Estimates.

Prevalence of births to mothers who smoked and locations of 'Fax-to-Quit' Health Care Providers



● Location of trained Fax-to-Quit providers

Percent of births to mothers who smoked, 2011



Source: Pennsylvania Department of Health, 2011 birth certificates
2013 WISEWOMAN program data



The Pennsylvania WISEWOMAN program provides prevention and screening services for cardiovascular disease to uninsured and underinsured women ages 40 to 64. Twenty-eight percent of WISEWOMAN clients are smokers, compared to an adult smoking rate of 21 percent for the state. The WISEWOMAN program goal for 2013 was to increase service-provider knowledge and capacity to assist low-income women in smoking cessation. To achieve this goal, the WISEWOMAN program asked participating organizations to train staff to use the Pennsylvania Fax-to-Quit Program.

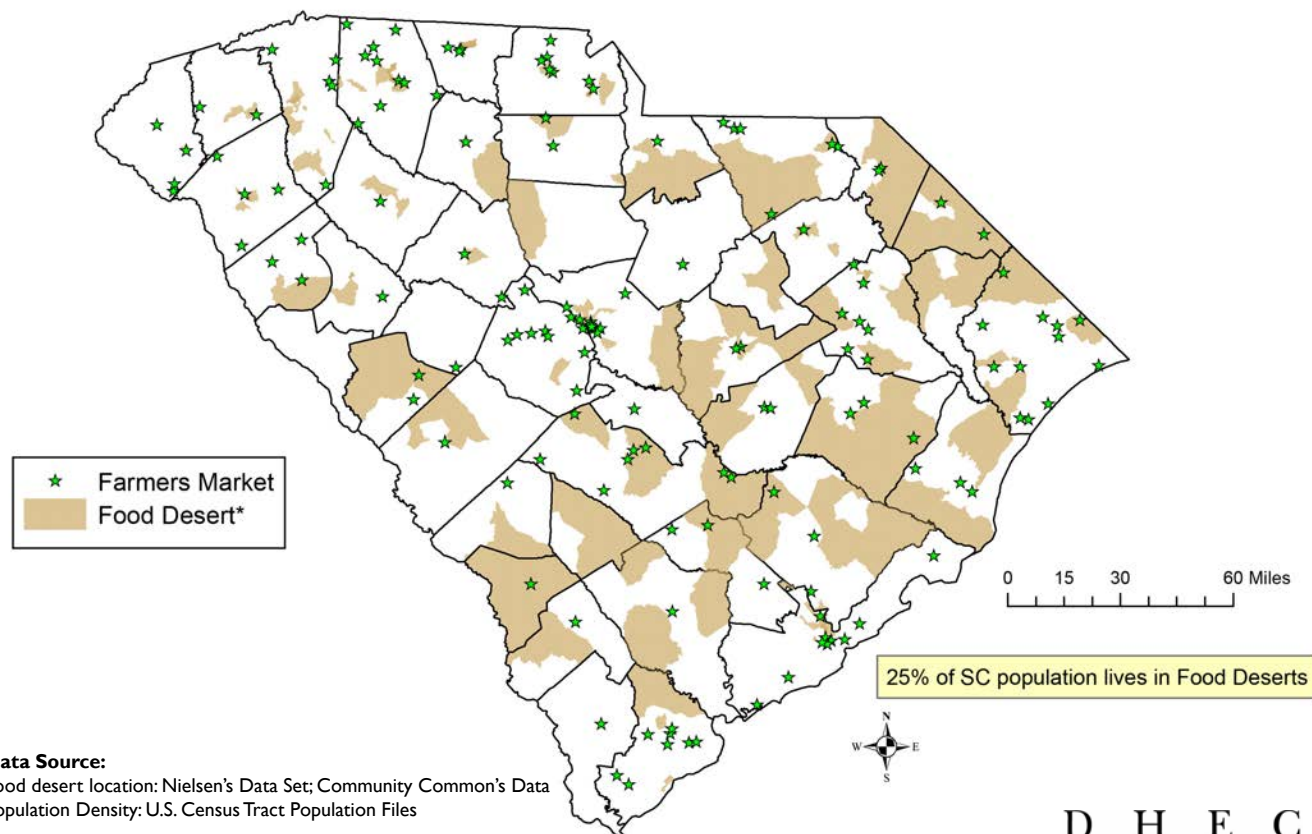
Using data from birth certificates in Pennsylvania, we calculated and mapped the percentage of births among mothers who reported that they smoked during pregnancy [and used this as a proxy for smoking prevalence among women] for 2011. In addition, we included the location of providers that were trained during the WISEWOMAN program Fax-to-Quit recruitment and training process. The map is being used to show the impact of the WISEWOMAN project on the number of providers trained in the smoking cessation program. It also illustrates the regions of the state where additional recruitment and training of tobacco cessation providers may be needed and will inform the direction of future WISEWOMAN program planning. The WISEWOMAN program will work to ensure that more service providers are knowledgeable about smoking cessation.

South Carolina: Using GIS to Address Chronic Disease Prevention and Health Promotion

The USDA defines a food desert as a low-income census tract where a substantial share of residents has limited access to a supermarket or large grocery store. A low-income census tract is defined as an area with a poverty rate of at least 20% and median family income at or below 80% of the area's median family income. The South Carolina Department of Health and Environmental Control is actively seeking to improve access to healthy foods by identifying census tracts classified as USDA food deserts, as well as the locations of farmers' markets throughout the state. Farmers' markets provide another access point to purchase fruits and vegetables beyond traditional supermarkets and grocery stores.

This map displays census tracts designated as food deserts, population density, and the location of farmers' markets throughout the state. It illustrates that food deserts not only exist in less densely populated counties, but also in some of the more populated counties. Analysis reveals approximately 25% of South Carolina's population lives within a food desert. This map will be shared with local and state level decision-makers and community leaders to determine where efforts to improve access to healthy foods can be targeted.

South Carolina Farmer's Markets and Food Deserts*



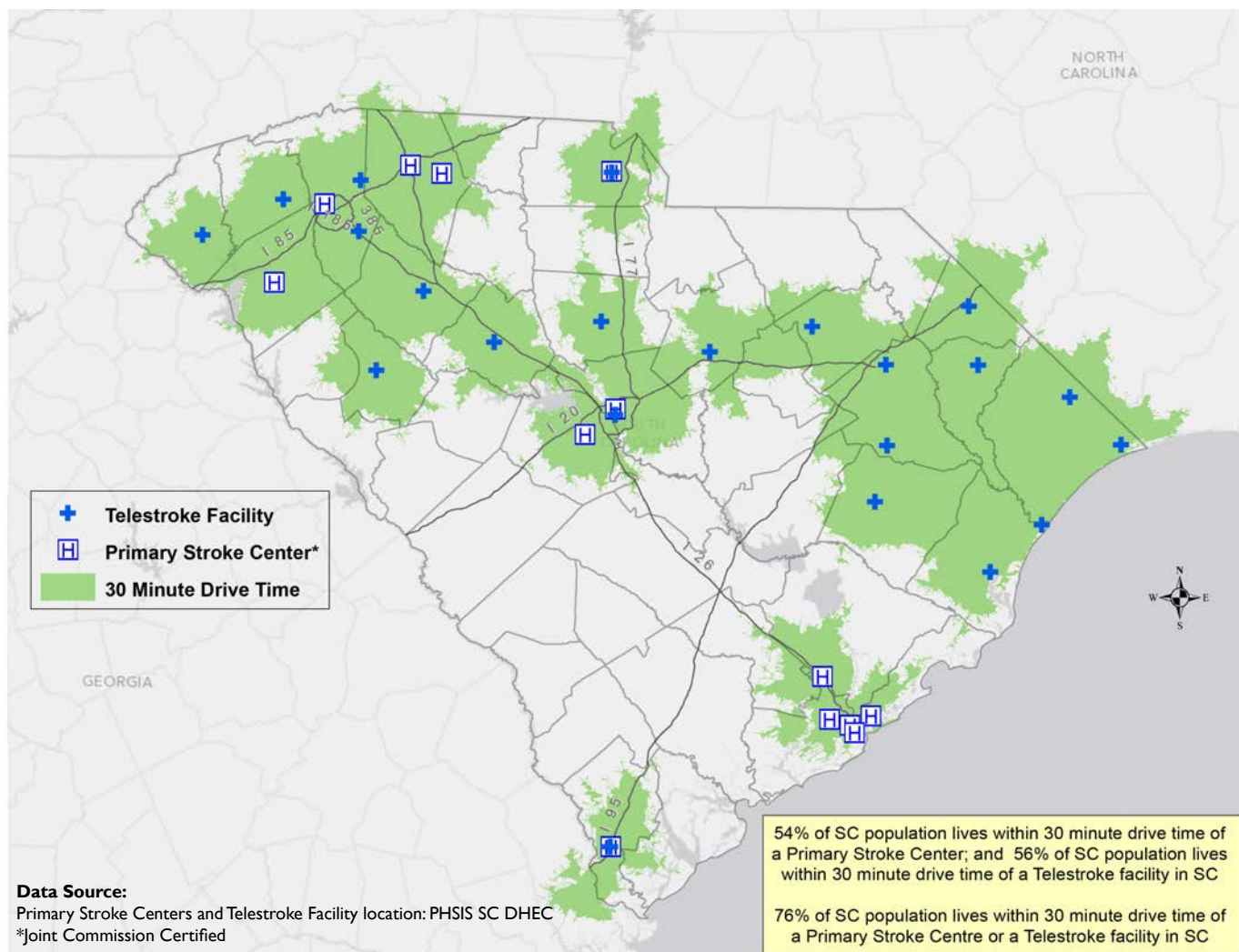
Data Source:

Food desert location: Nielsen's Data Set; Community Common's Data
Population Density: U.S. Census Tract Population Files

***Food Desert:** USDA defines a food desert as a low-income census tract where a substantial number or share of residents has low access to a supermarket or a large grocery store.



South Carolina Primary Stroke Centers,*Telestroke Facilities and Population Coverage within 30 Minute Drive Time



South Carolina (SC) is located in the southeastern part of the U.S., an area also known as the stroke belt. In 2011, SC had the 6th highest mortality rate for stroke in the U.S. SC currently has 13 Primary Stroke Centers (PSC) and 22 telestroke facilities. This map highlights the areas within a 30 minute drive time to either a PSC or telestroke facility in SC.

The map illustrates the geographic distribution of stroke resources within the state. Analysis reveals that 76% of the SC population lives within a 30 minute drive time to a PSC or telestroke facility within South Carolina.

This map will be shared with partners in the stroke network (hospital hubs) to help guide future planning and expansion of stroke facilities in SC.

Facilitating Collaboration

The GIS State Surveillance Training Program was intentionally designed to develop a GIS infrastructure that would facilitate collaboration among an array of chronic disease units within each state health department, yet with a focus on heart disease and stroke. To that end, the staff members from each state health department that participated in the training represented different chronic disease units. Each state health department was led by a member of the heart disease and stroke unit (**bold**). The following lists the chronic disease units that were represented in each of the participating health departments:

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