

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

Map Highlights from State Health Departments: Georgia, Kentucky, Nevada, Virginia, and Washington;
and Local Health Departments: California Counties- Napa, San Joaquin, and Solano; North Carolina
Counties- Alamance, Caswell, Chatham, Durham, Guilford, and Orange.

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, Rice University, September 2016

ACKNOWLEDGEMENTS

The following staff from each of the participating agencies provided valuable contributions to the success of this project's ability to enhance the use of GIS within health departments for the prevention and treatment of heart disease, stroke, and other chronic diseases.

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INTRODUCTION

Geographic Information Systems (GIS) offer 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 (NACDD), and The Children's Environmental Health Initiative (CEHI). 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:

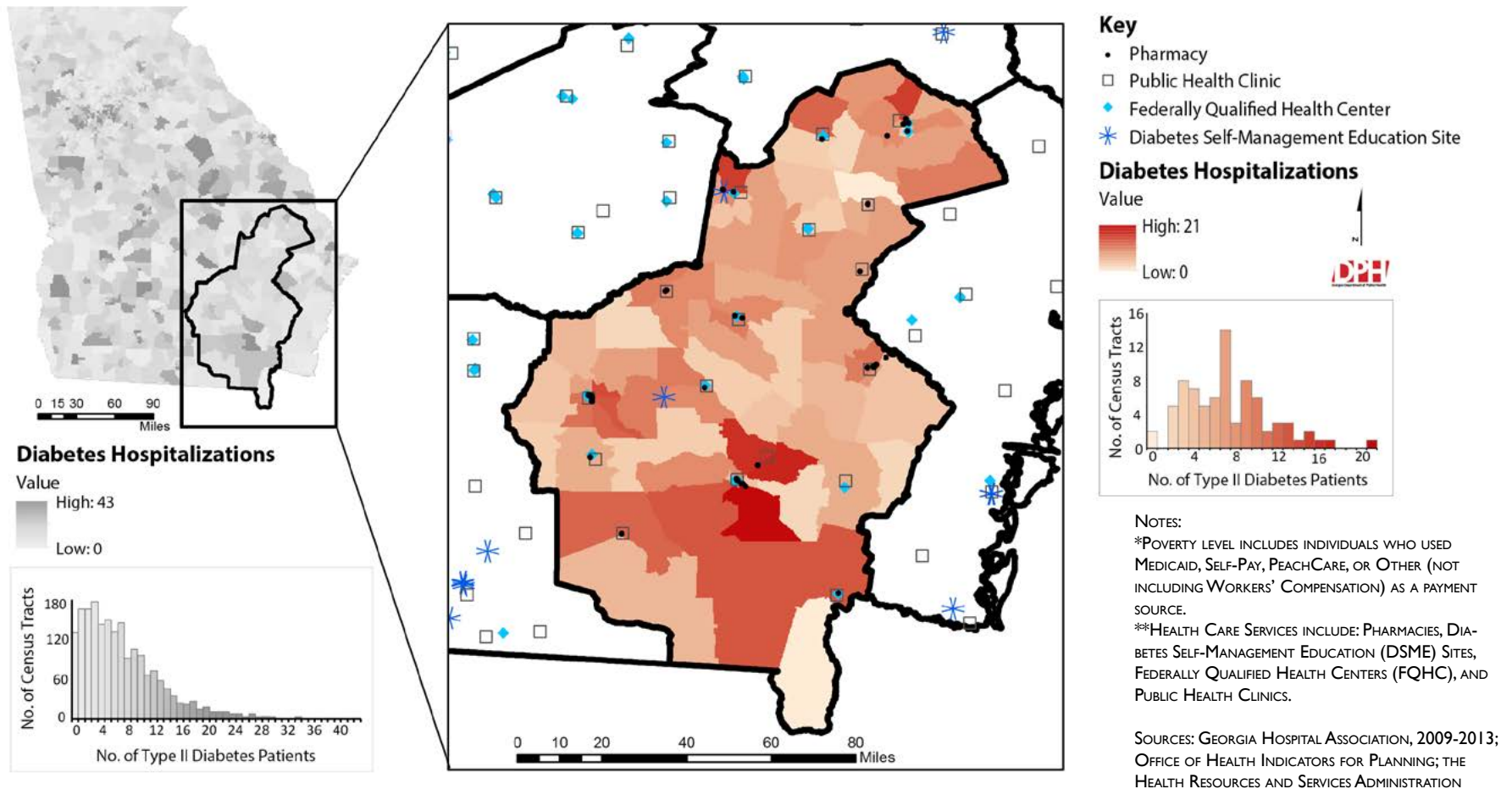
- Documenting geographic disparities
- Informing policy and program decisions
- Enhancing partnerships with external agencies
- Facilitating collaboration within agencies

In 2015, the following state health departments were competitively selected to participate in this GIS Surveillance Training Project: State Health Departments: Georgia, Kentucky, Nevada, Virginia, and Washington; and Local Health Departments: California Counties - Napa, San Joaquin, and Solano; North Carolina Counties - Alamance, Caswell, Chatham, Durham, Guilford, and Orange.

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.

GEORGIA

Hospitalizations for Type II Diabetes among People at or below the Poverty Level* by Census Tract (2009-2013), and Location of Health Care Services**

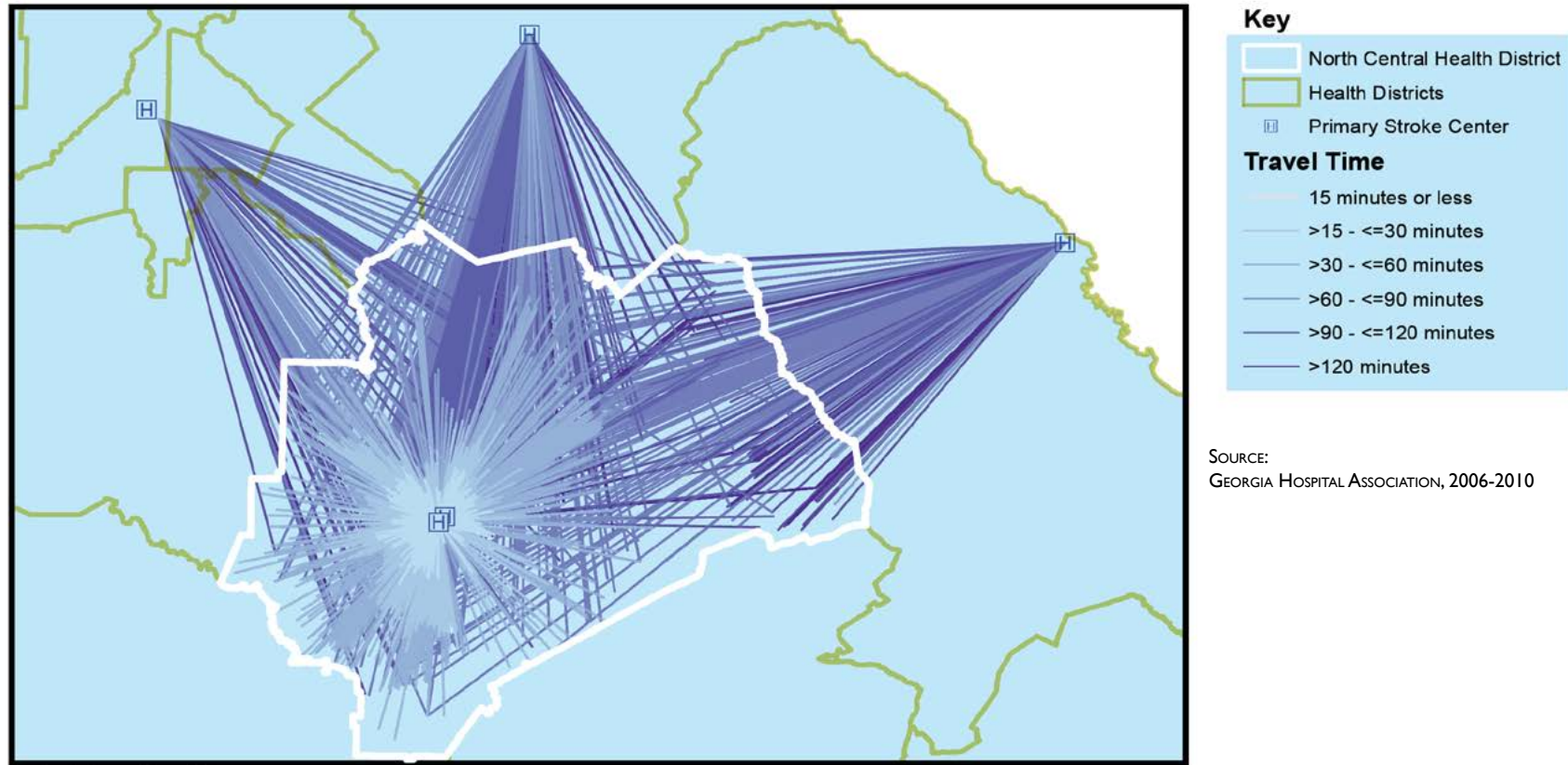


Key Points

- From 2009-2013, there were 572 individuals hospitalized due to type 2 diabetes in the Waycross Public Health District.
- This map shows where diabetes resources are located for patients at, or below the poverty level along with the number of Type 2 diabetes hospitalizations by census tract.
- This map shows that many health care services with diabetes resources are located close to each other, and it reveals geographic areas without diabetes resources.

GEORGIA

Primary Stroke Centers and Travel Time for Acute Stroke and Transient Ischemic Attack Patients, North Central Health District, Georgia, 2006-2010



SOURCE:
GEORGIA HOSPITAL ASSOCIATION, 2006-2010

0 4 8 16 24
Miles



Key Points

- ❑ Patients experiencing acute stroke need to be transported swiftly to stroke-ready hospitals for a better outcome.
- ❑ Drive times from patients' residences to hospitals where they were cared for were calculated. The median travel time was 14.3 minutes (7.3 minutes and 32.8 minutes are the 25th and 75th percentile, respectively), and the majority (63%) were admitted to 5 current Primary Stroke Centers.
- ❑ This map shows that many patients traveled more than 90 minutes to receive care, indicating a need for more stroke-ready hospitals.

Ambulatory Facility* Service Rates for Hypertension, 2008-2012

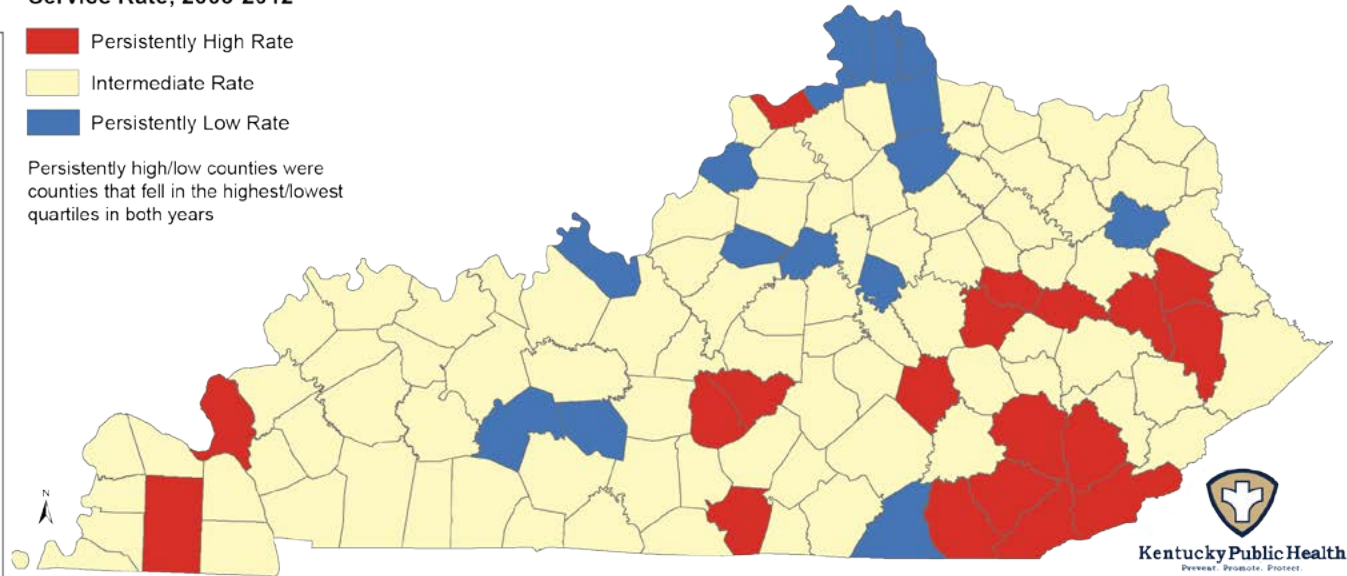
Key Points

- ❑ The Ambulatory Facility Service Rate for hypertension was calculated from all records of services provided on an out-patient basis for hypertension.
- ❑ The two maps at the bottom display rates and total counts for ambulatory services while the center map displays the over all changes for counties between 2008 and 2012.
- ❑ The central map demonstrates clusters of areas with persistently high or low rates of ambulatory facility utilization by those with diagnosed hypertension in 2008 and 2012.

Age-Adjusted Ambulatory Facility Service Rate, 2008-2012

- Persistently High Rate
- Intermediate Rate
- Persistently Low Rate

Persistently high/low counties were counties that fell in the highest/lowest quartiles in both years



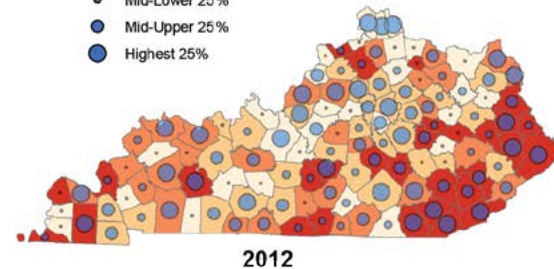
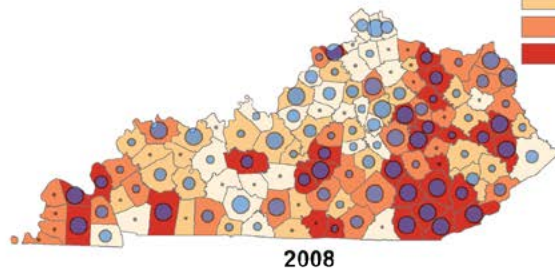
Ambulatory Facility Service Events for Hypertension

Age-Adjusted Rate (Per 100,000; by quartile)

- Bottom 25%
- Mid-Lower 25%
- Mid-Upper 25%
- Highest 25%

Number of Events (Total Count; by quartile)

- Bottom 25%
- Mid-Lower 25%
- Mid-Upper 25%
- Highest 25%



NOTES: *AMBULATORY FACILITIES INCLUDE ANY FACILITY WHERE CARE IS PROVIDED ON AN OUTPATIENT BASIS. INDIVIDUAL RECORDS REPRESENT SINGLE ADMIT-THROUGH-DISCHARGE EVENTS; MULTIPLE ADMISSIONS OF A SINGLE PATIENT CANNOT BE IDENTIFIED, THE NUMBER OF FACILITIES SUBMITTING DATA HAS INCREASED OVER RECENT YEARS, AND DATA ONLY INCLUDE MEDICAL FACILITIES IN KY (THEREFORE DATA ON PATIENTS RECEIVING CARE IN NEIGHBORING STATES ARE NOT INCLUDED). DUE TO LIMITATIONS OF THIS DATA IT IS IMPORTANT TO FOCUS ON GENERAL GEOGRAPHIC PATTERNS INSTEAD OF SPECIFIC RATES.

SOURCES: OFFICE OF HEALTH POLICY – HOSPITAL INPATIENT DISCHARGE AND OUTPATIENT SERVICES DATABASE, 2008-2012

KENTUCKY

Colon Cancer in Kentucky

Population Screened for Colon Cancer, by County, and Drive Times to Free Screening Locations

Drive Times

30 minutes

Kentucky Colon Cancer Screening Program Provider

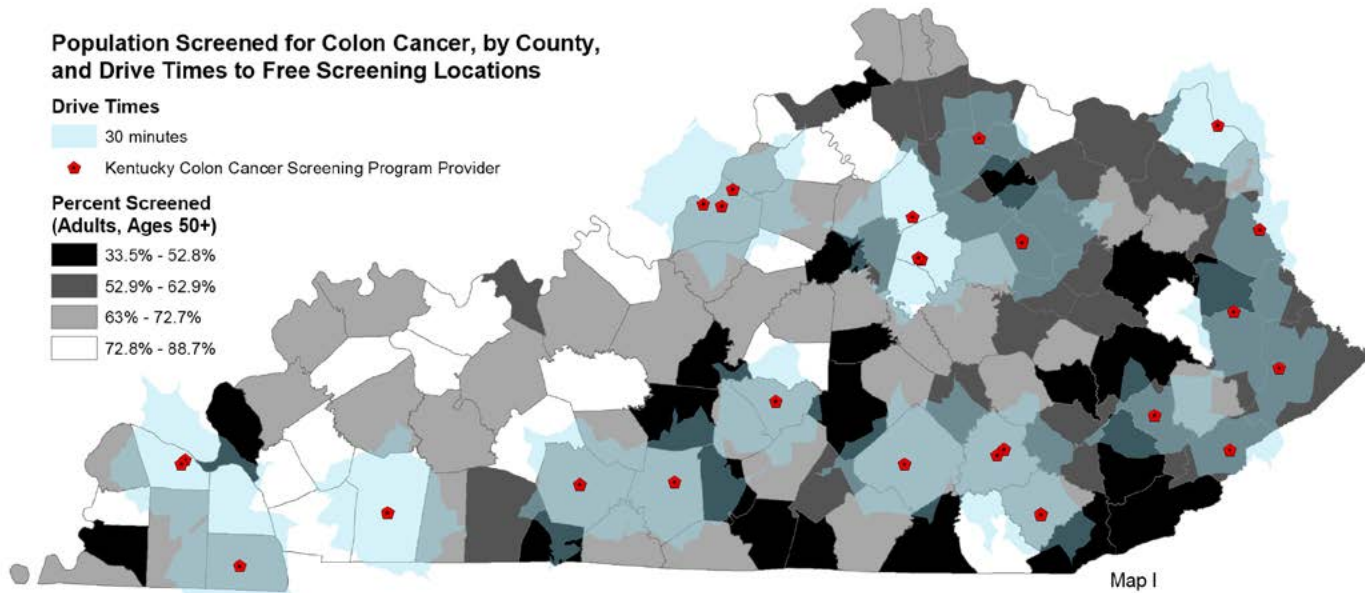
Percent Screened (Adults, Ages 50+)

33.5% - 52.8%

52.9% - 62.9%

63% - 72.7%

72.8% - 88.7%



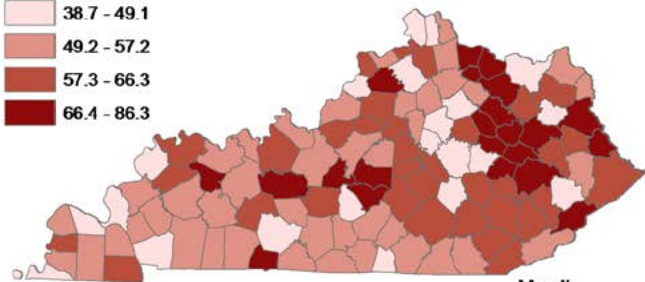
Colon Cancer Incidence Rates per 100,000

38.7 - 49.1

49.2 - 57.2

57.3 - 66.3

66.4 - 86.3

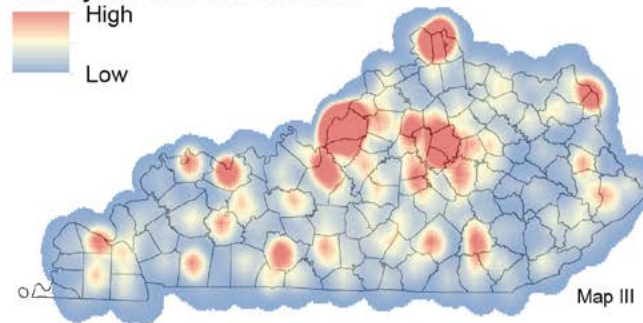


Map II

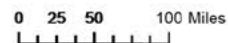
Density of Colon Cancer Deaths

High

Low



Map III



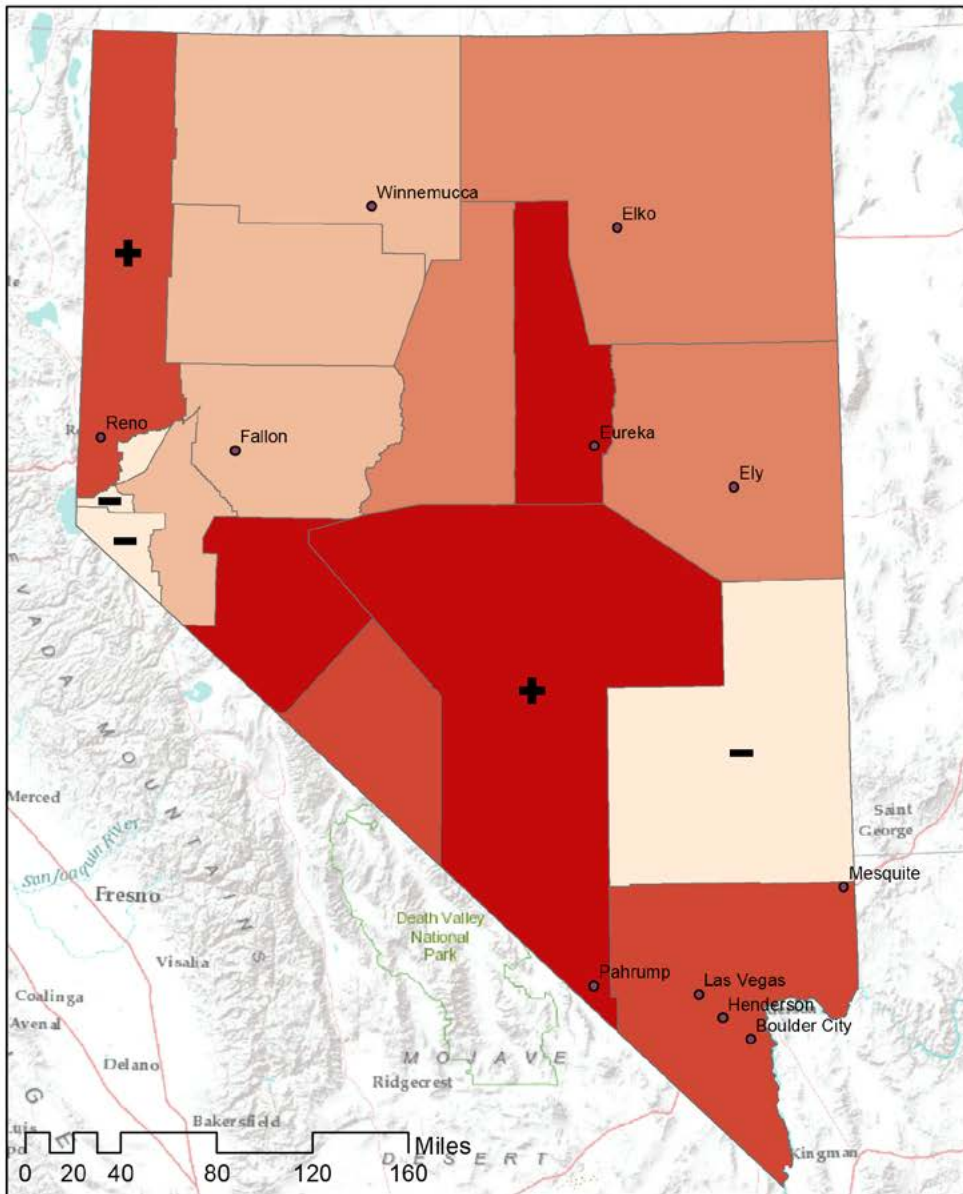
Key Points

- Free Colorectal Cancer (CRC) screenings are provided to low-income, uninsured adults aged 50-64 as part of the Kentucky Colon Cancer Screening Program (KCCSP).
- These maps show incidence rates, density of colon cancer deaths, and population screened along with drive times to free screening locations.
- These maps provide a geographic context and will be used to communicate current efforts and areas in need of additional resources.

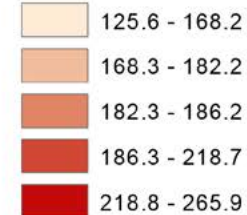
SOURCES: MAP I - KY BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM, 2012-2014; KY COLON CANCER SCREENING PROGRAM; MAP II - KY CANCER REGISTRY RATES – COLON INCLUDING RECTUM, 2008-2012; MAP III - KY VITAL STATISTICS, TOTAL DEATHS, ICD: C18-19, 2010-2014

NEVADA

Heart Disease Mortality Rates for Nevada Residents, 2010 – 2014



Age-adjusted rate per 100,000



State Rate = 196.4 per 100,000

Statistical Significance

- Lower than state rate, difference statistically significant
- None: Difference not statistically significant
- Higher than state rate, difference statistically significant

Key Points

- Heart Disease is the leading cause of death in Nevada.
- This map shows the heart disease mortality rate for Nevada counties, and indicates whether a county's rate is statistically significantly different than the state rate ($p < 0.05$).
- This map will assist in understanding the impact of heart disease and inform activities directed at reducing deaths.

NOTES: HEART DISEASE MORTALITY RATES ARE AGE-ADJUSTED TO 2000 US STANDARD POPULATION, SINGLE AGES. HEART DISEASE DEATHS DEFINED AS PRIMARY DIAGNOSIS CODES (ICD 10): I00 I09, I11, I13, I20 I51.

SOURCES: NV DIVISION OF PUBLIC AND BEHAVIORAL HEALTH, ELECTRONIC DEATH REGISTRY SYSTEM, 2010-2014



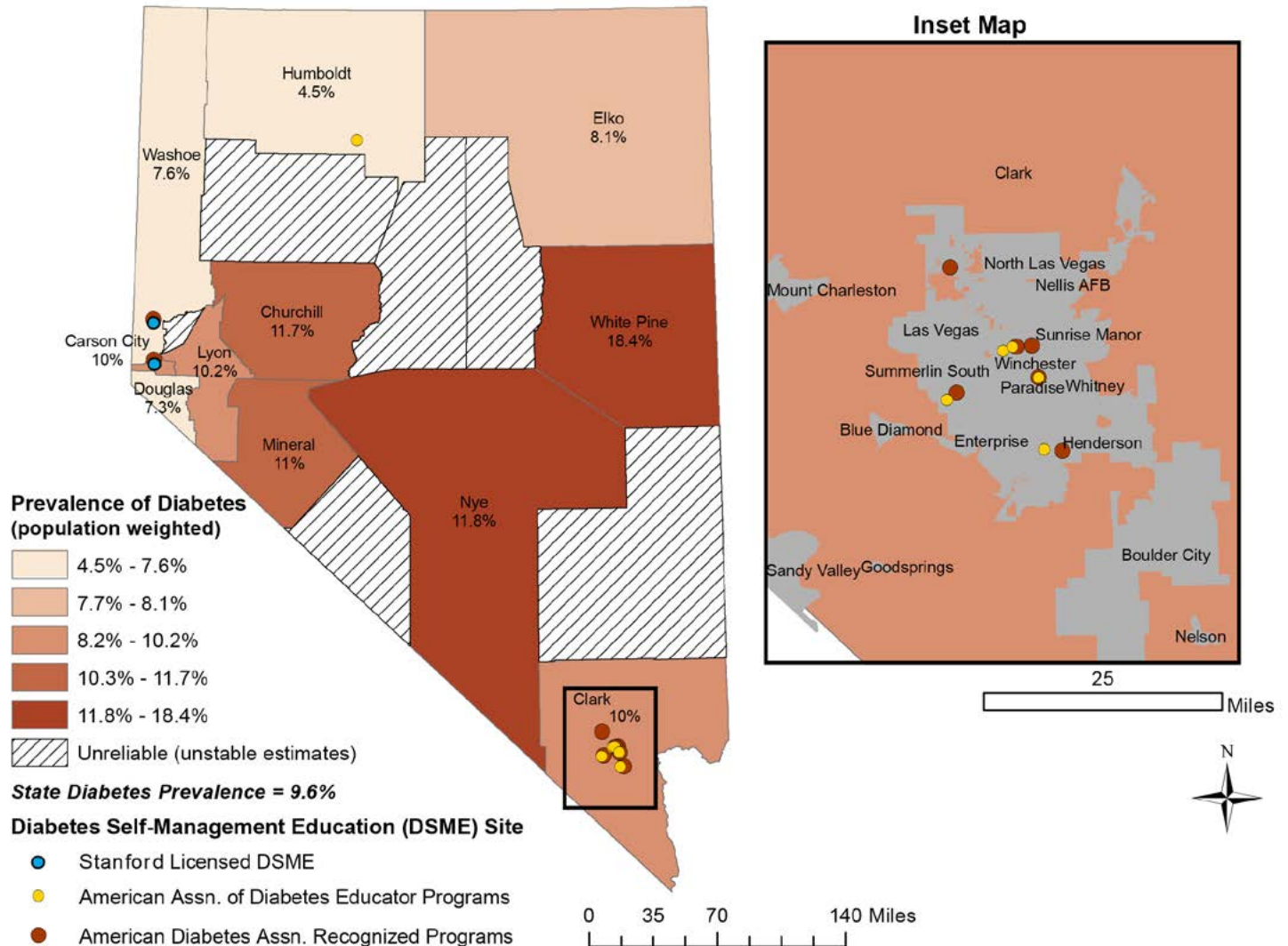
Public Health
Prevent. Promote. Protect.

NEVADA

Prevalence of Diabetes in Nevada, 2011-2014, and Diabetes Self-Management Education (DSME) Locations

Key Points

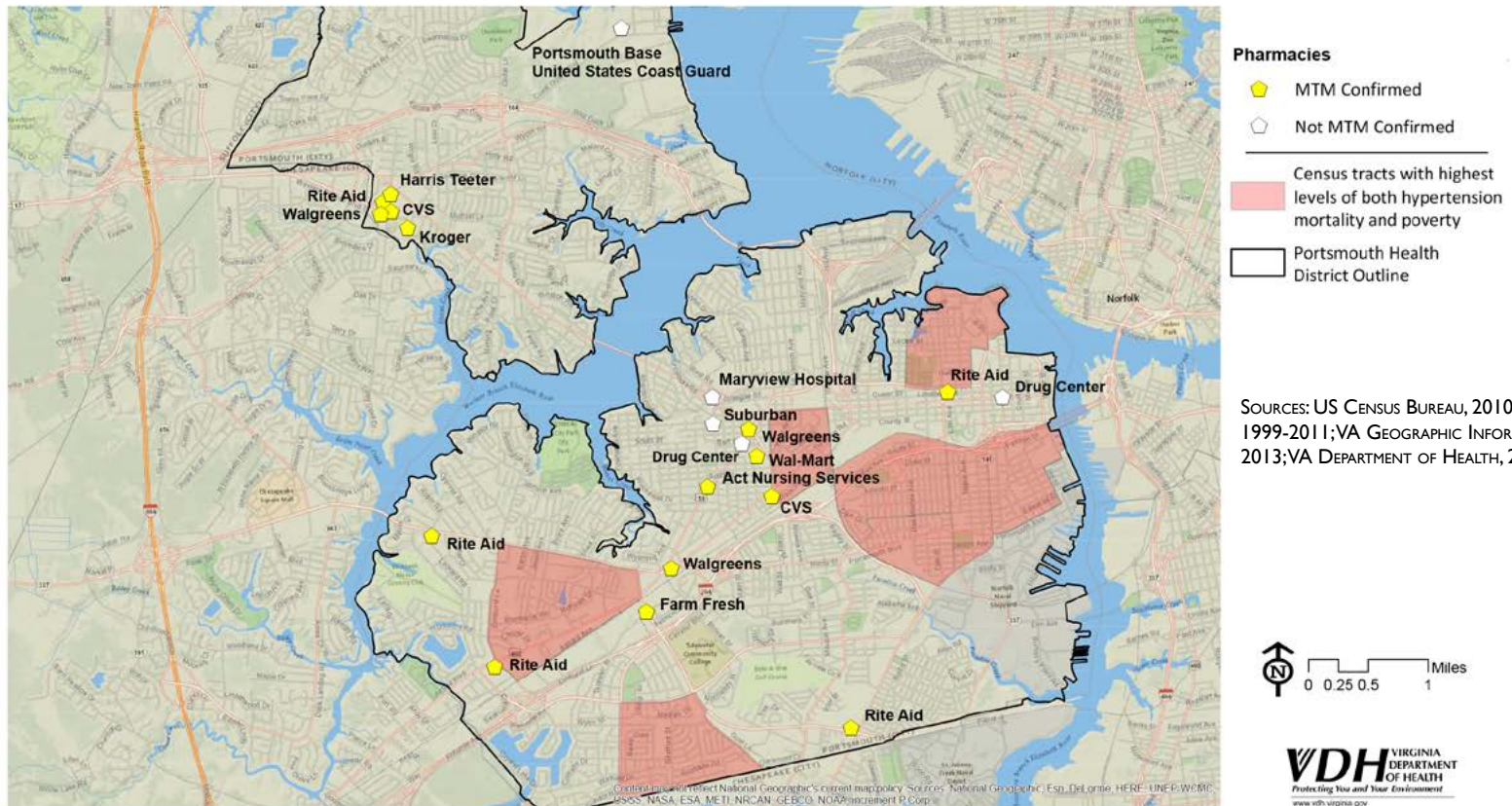
- ❑ This map displays diabetes prevalence among Nevadans aged 18 years and older.
- ❑ Nevada Behavioral Risk Factor Surveillance System (BRFSS) data were aggregated for 2011-2014 to calculate the prevalence of diabetes.
- ❑ This map highlights where DSME resources are located in relation to diabetes prevalence and indicates a need for additional resources in areas with high diabetes prevalence.



SOURCES: NEVADA BEHAVIORAL RISK FACTOR SURVEILLANCE SYSTEM (BRFSS) 2011- 2014; AADE ACCREDITED PROGRAMS; ADA RECOGNIZED DIABETES EDUCATION PROGRAMS; NEVADA DIABETES PREVENTION AND CONTROL PROGRAM

VIRGINIA

Medication Therapy Management (MTM) Pharmacies within a 10 Minute Drive Time from High-Need Communities, Portsmouth Health District, 2016

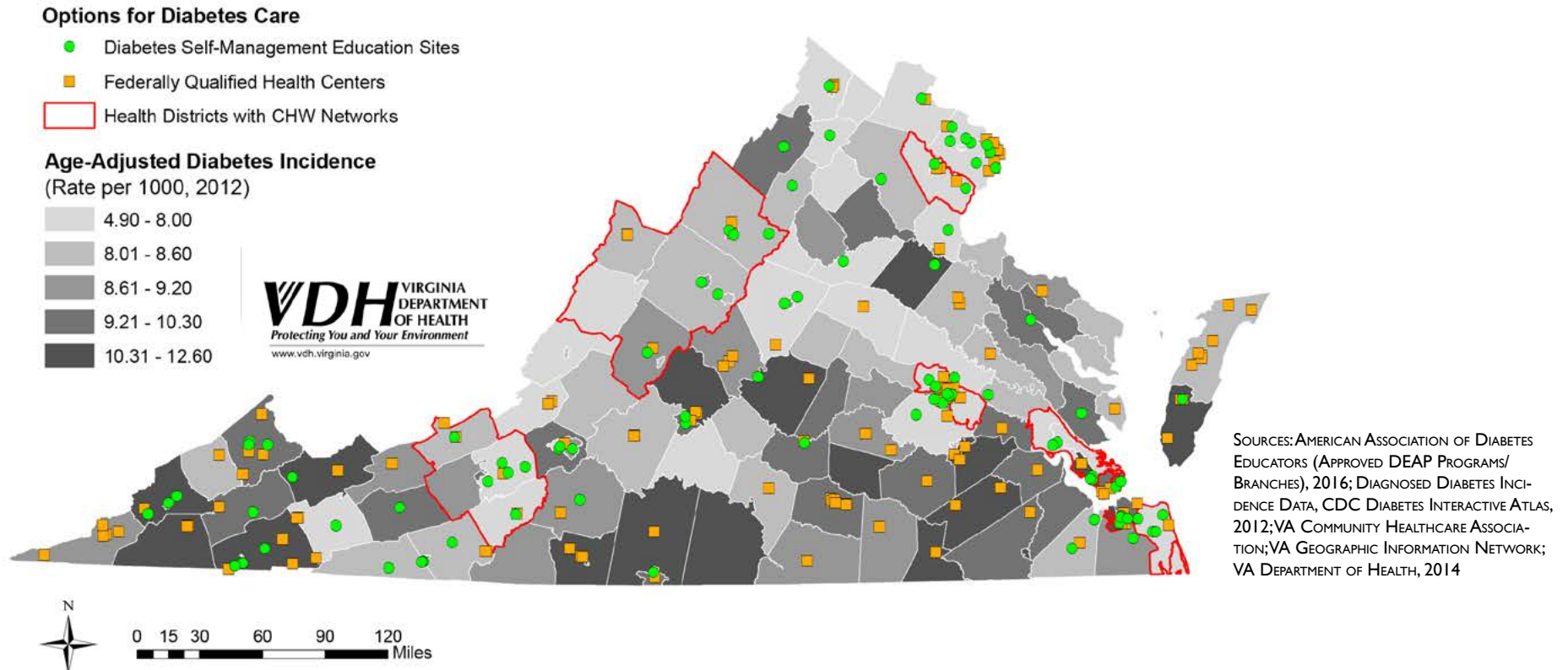


Key Points

- ❑ Medication Therapy Management (MTM) services have been shown to increase medication adherence and improve blood pressure control.
- ❑ High-need communities with high hypertension mortality and poverty face many challenges to hypertension management, including inconsistent access to health care and limited transportation.
- ❑ This map will be used by Community Health Workers to share resource information within their communities and it will be used programmatically to target areas with high hypertension burden that do not have access to Pharmacy MTM resources.

VIRGINIA

Diabetes Rates by County and Location of Three Options for Diabetes Care, Virginia

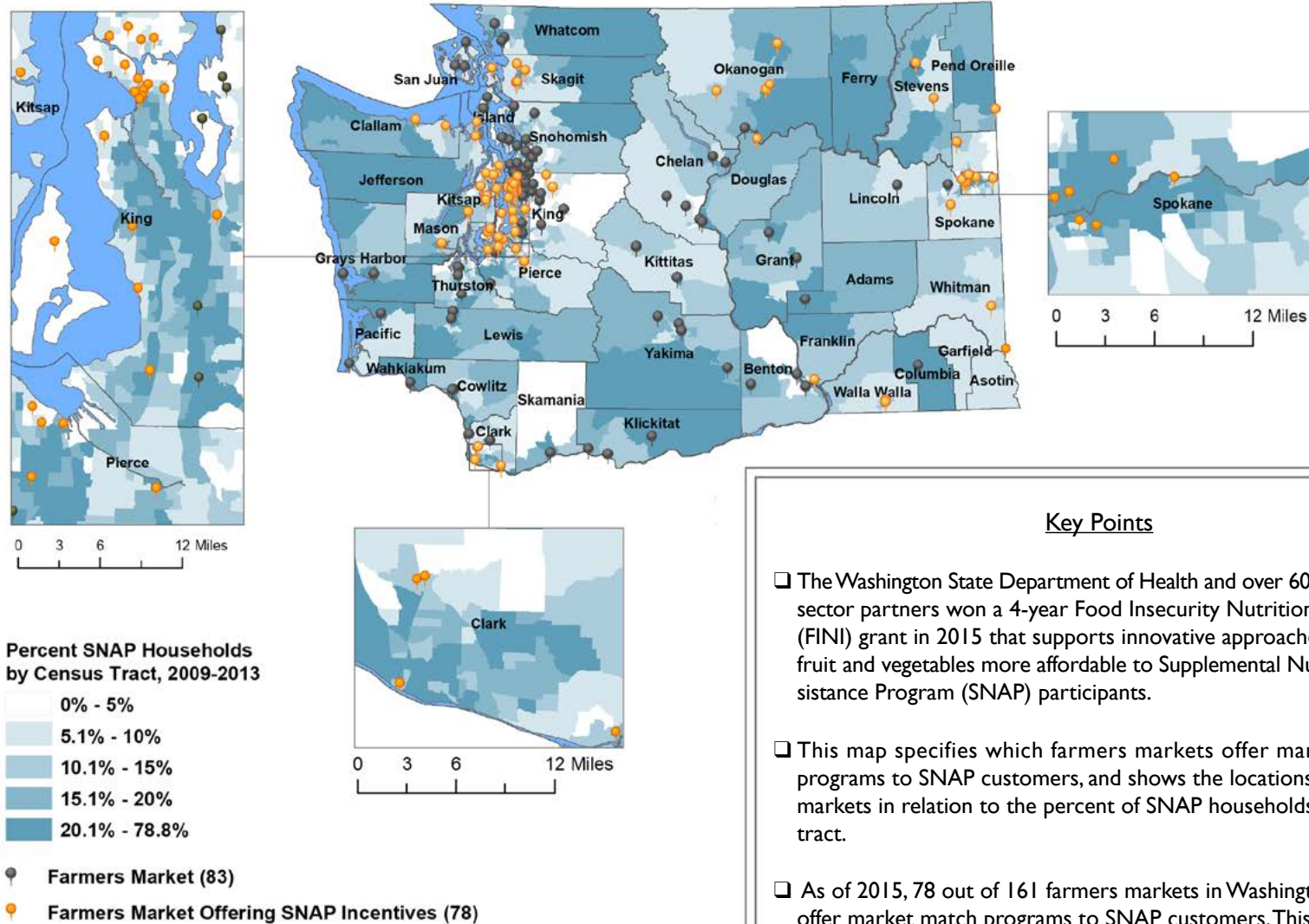


Key Points

- ❑ Screening and preventive efforts are critical to impede complications and risks related to diabetes.
- ❑ Overlaid with diagnosed diabetes incidence are three key resources for diabetes management and prevention: Federally Qualified Health Centers (FQHCs), Community Health Worker (CHW) Networks, and Diabetes Self-Management Education (DMSE) sites.
- ❑ This map will be instrumental in strategic programmatic planning for local health department program staff, FQHC directors, and diabetes self-management educators.

WASHINGTON

Strengthening the Connection: Supplemental Nutrition Assistance Program Recipients and Farmers Markets



SOURCES: US CENSUS BUREAU, AMERICAN COMMUNITY SURVEY, 2009-2013, 5-YR ESTIMATES; DEPARTMENT OF HEALTH SNAP-ED AND HEALTHY EATING ACTIVE LIVING PROGRAMS

Key Points

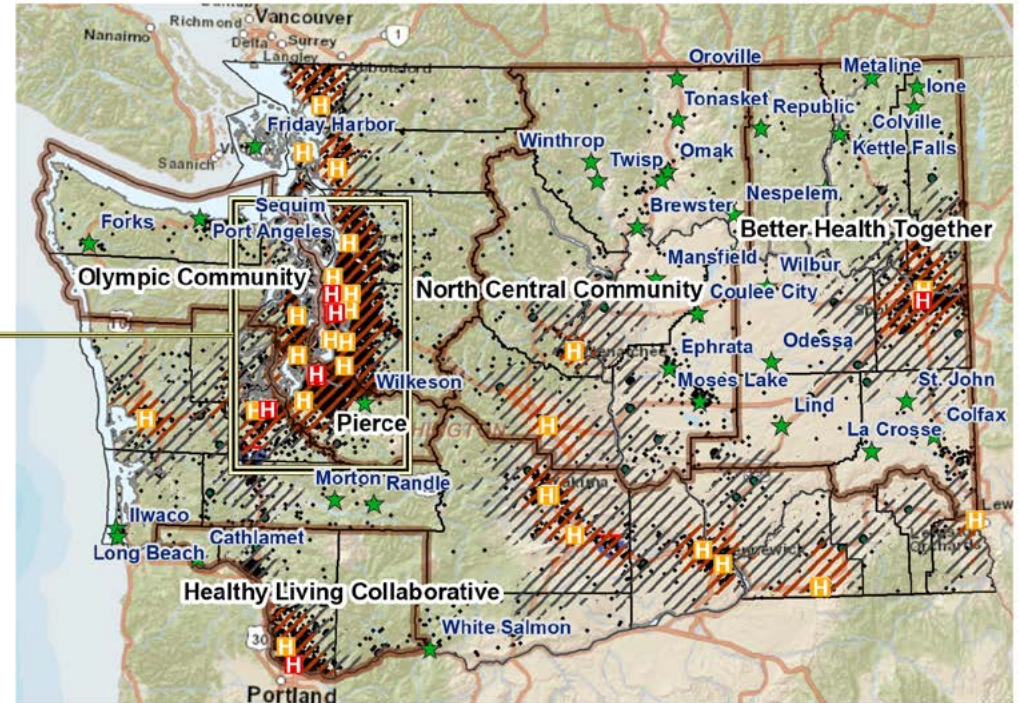
- ❑ The Washington State Department of Health and over 60 multi-sector partners won a 4-year Food Insecurity Nutrition Incentives (FINI) grant in 2015 that supports innovative approaches to make fruit and vegetables more affordable to Supplemental Nutrition Assistance Program (SNAP) participants.
- ❑ This map specifies which farmers markets offer market match programs to SNAP customers, and shows the locations of farmers markets in relation to the percent of SNAP households by census tract.
- ❑ As of 2015, 78 out of 161 farmers markets in Washington (48%) offer market match programs to SNAP customers. This map will be used to increase the number of farmers markets that provide SNAP incentives.

WASHINGTON

Drive Time to Stroke Center Hospitals and Population Centers: Planning Information for CDC I422 Grantees, Washington State 2015

Key Points

- ❑ Stroke patients who are treated at a stroke center within 2 hours of symptom onset are less likely to experience adverse outcomes.
- ❑ The map illustrates the extent and reach of the network of level I and II stroke centers in Washington State, and identifies regions of the state not currently covered.
- ❑ Areas identified as lacking timely access to stroke center hospitals may be targeted for alternative strategies to improve stroke treatment.



Stroke Center Hospitals

- H Level I
- H Level II
- 30 minute drive to level I or level II stroke center
- 60 minute drive to level I or level II stroke center

Population Distribution

- 1 dot = 500 people
- ★ Major cities over 60 minutes from stroke center
- WA Counties
- 1422 Grantee Regions

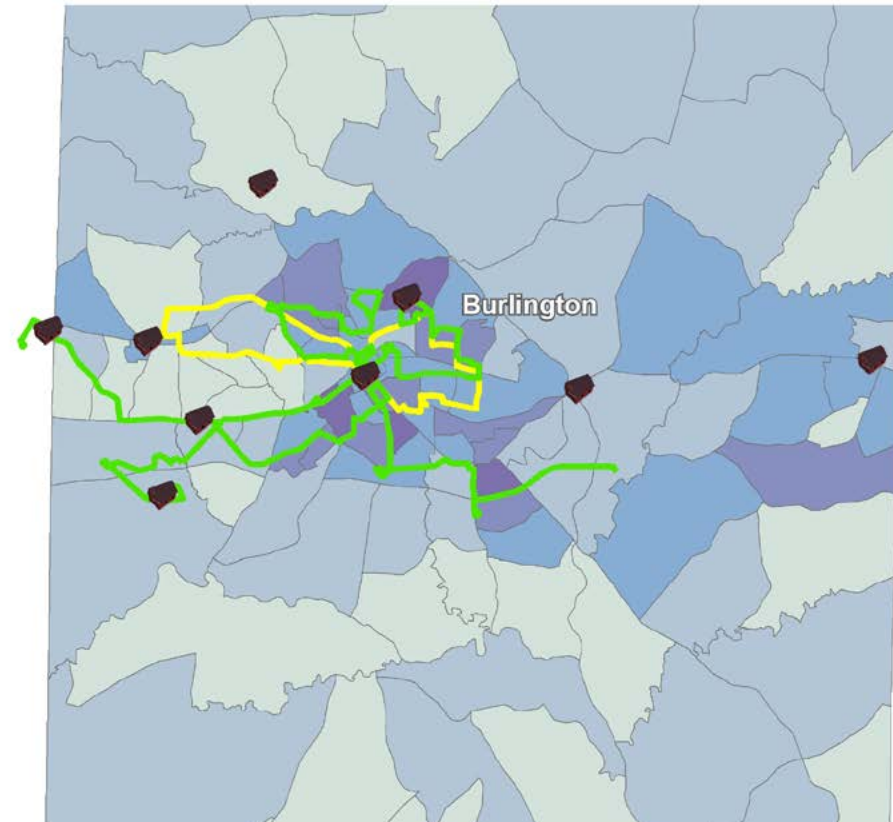
SOURCES: HOSPITAL LOCATIONS, 2013 – GEOCODED BY WASHINGTON STATE DEPARTMENT OF HEALTH, DIVISION OF INFORMATION RESOURCES MANAGEMENT. DRIVE TIMES USED NAVTEQ 2010 STREET NETWORK.

ALAMANCE COUNTY, NORTH CAROLINA

Farmer's Market Transit Access for Female Head of Households

Key Points

- ❑ Farmers markets are a promising means of increasing accessibility to fresh fruits and vegetables.
- ❑ This map shows the locations of farmers markets, bus routes, and the percentage of female-headed households in Alamance County, NC.
- ❑ We hope to use this map to promote policy change, including expansion of the transit system and other focused interventions aimed at increasing access to healthy food and promoting health.



Key

- Farmer's Markets
- Bio Bus Routes
- Proposed Bus Routes

Female Head of Household (Percentage by Block Group)

- 0.00 - 7.00
- 7.01 - 15.00
- 15.01 - 22.00
- 22.01 - 30.00
- 30.01 - 46.00

NOTES: FEMALE HEAD OF HOUSEHOLDS WERE MAPPED IN ORDER TO DETERMINE WHETHER THE PROPOSED TRANSIT SYSTEM WILL IMPACT MATERNAL HEALTH AS WELL AS VULNERABLE POPULATIONS.

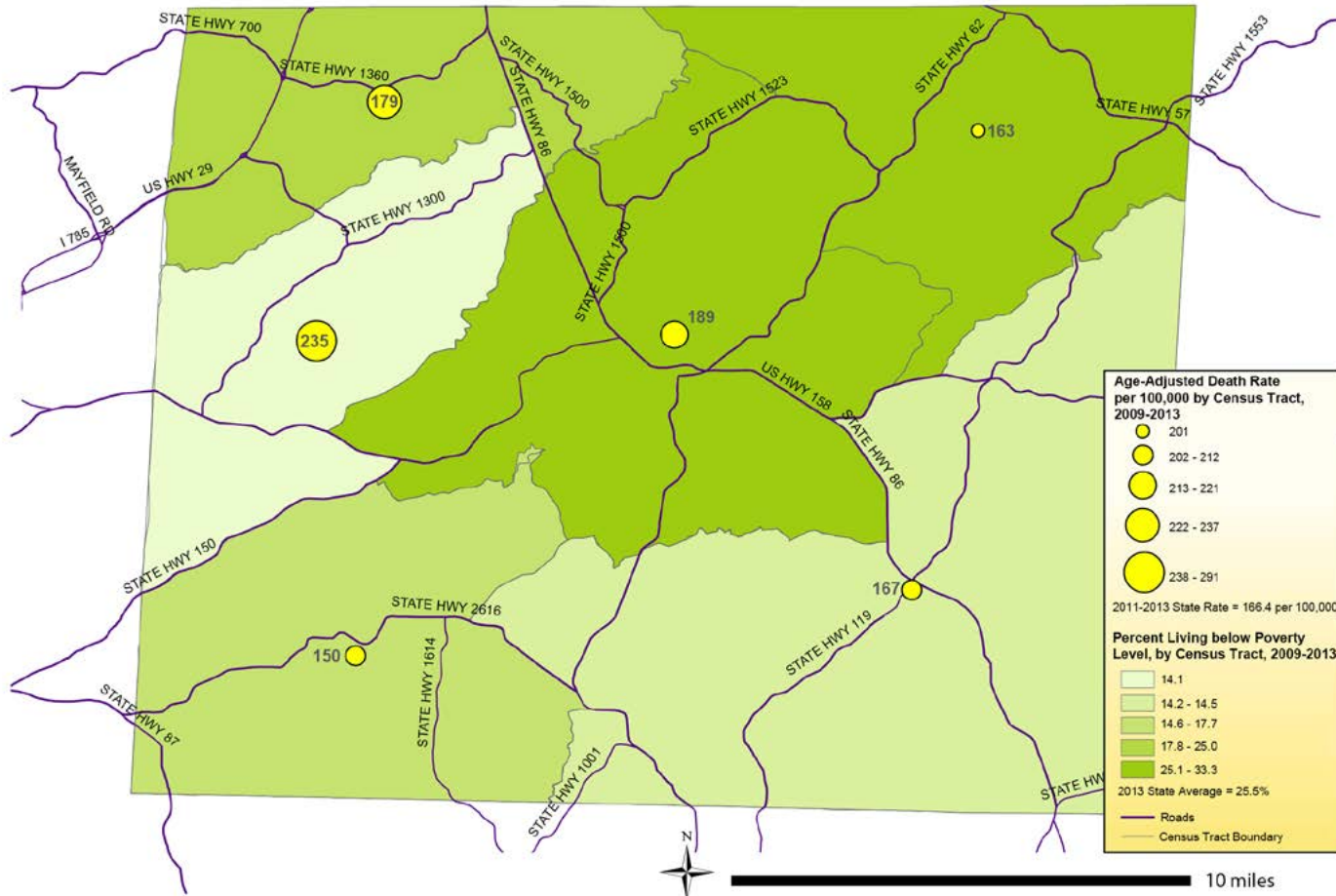
BioBUS is a bus system provided by ELON UNIVERSITY THAT IS AVAILABLE TO THE COMMUNITY AND STUDENTS.

SOURCE: U.S. CENSUS BUREAU, 2010



CASWELL COUNTY, NORTH CAROLINA

Heart Disease Death Rates (2009-2013) and Poverty Percentages by Census Tract, Caswell County, NC



Key Points

- ❑ Poverty is an important risk factor for heart disease and other chronic diseases.
- ❑ This map illustrates the percentage of population living in poverty and the age-adjusted heart disease death rates by census tract.
- ❑ This map can be used to begin to understand the relationship between poverty and heart disease deaths.

SOURCES: US CENSUS BUREAU, AMERICAN COMMUNITY SURVEY, 2009-2013, 5-YR ESTIMATES; NC STATE CENTER FOR HEALTH STATISTICS, 2009-2013

CHATHAM COUNTY, NORTH CAROLINA

Expanding Tobacco Free Zones in County Property, Chatham County, NC

Key Points

- ❑ Chatham County staff and policymakers used GIS to implement a policy aimed at preventing tobacco exposure on county property.
- ❑ Staff mapped areas owned, maintained and leased by the county and used these maps to expand tobacco-free zones and assign locations for proposed tobacco-free signs.
- ❑ The new policy doubled the number of tobacco-free signs and expanded coverage in county buildings, parking lots, and grounds. This innovative approach involved the collaboration of local, regional and state partners.

SOURCE:
CHATHAM COUNTY PUBLIC HEALTH DEPARTMENT, 2015



Map Key

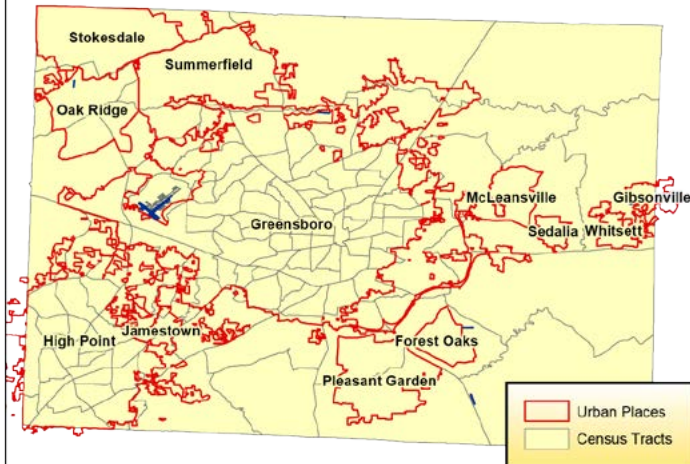
- ⊘ Proposed Tobacco Signs
- Tobacco-free Zone



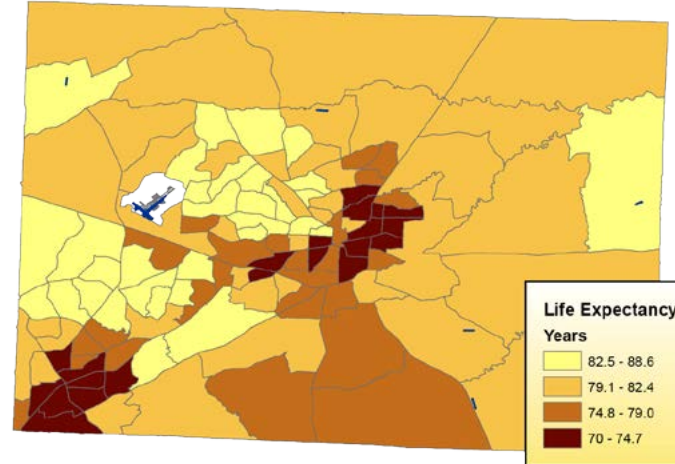
0 100 200 300 400 500 Feet

GUILFORD COUNTY, NORTH CAROLINA

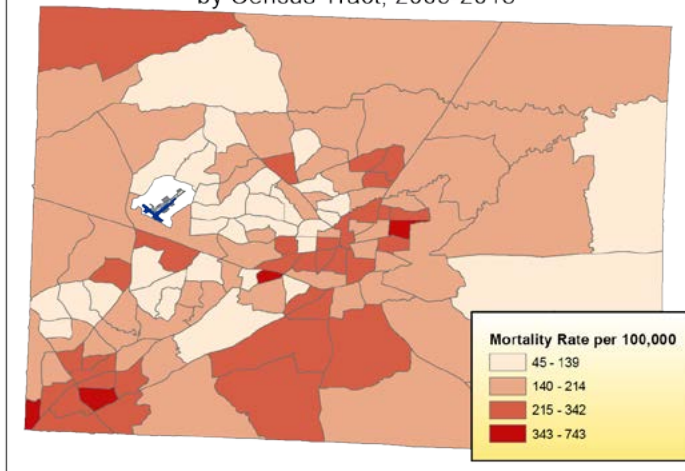
Census Tracts and Urban Places in Guilford County, NC



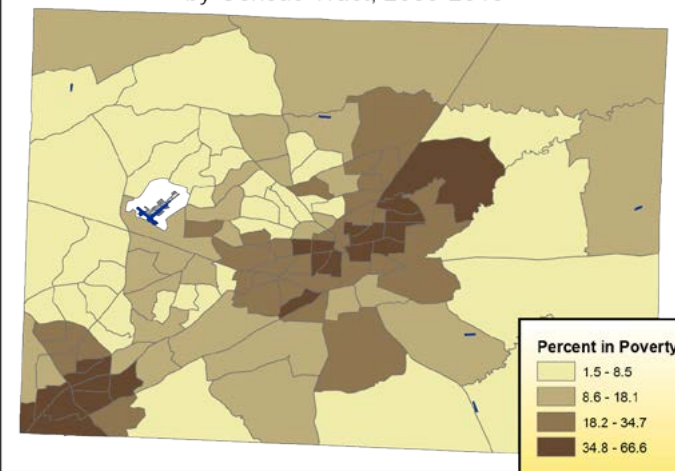
Life Expectancy at Birth, by Census Tract, 2009-2013



Age-Adjusted Heart Disease Mortality Rates by Census Tract, 2009-2013



Percent of Population living below Poverty Level by Census Tract, 2009-2013



SOURCES: US CENSUS BUREAU, AMERICAN COMMUNITY SURVEY, 2009-2013, 5-YR ESTIMATES, 2009-2013; NC STATE CENTER FOR HEALTH STATISTICS, 2009-2013

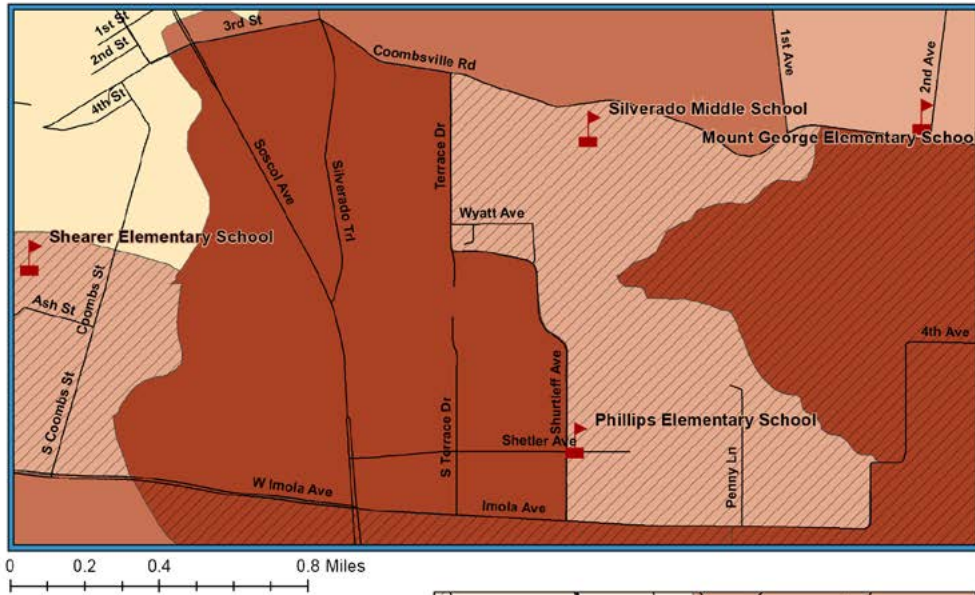
NOTES: THE CENSUS BUREAU IDENTIFIES TWO TYPES OF URBAN PLACES: 1. URBANIZED AREAS OF 50,000 OR MORE PEOPLE, OR 2. URBAN CLUSTERS OF AT LEAST 2,500 AND LESS THAN 50,000 PEOPLE.

Key Points

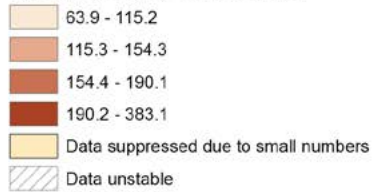
- Heart Disease is the second leading cause of death in Guilford County.
- Census Tracts with high heart disease mortality rates tend to have a greater percentage of population living in poverty and a lower life expectancy at birth.
- These maps will be used in the 2016 Community Health Assessment and in a community planning action process to understand the factors that contribute to high heart disease mortality.

NAPA COUNTY, CALIFORNIA

Heart Disease Death Rates by Census Tract, 2009-2012 Phillips Neighborhood and City of Napa



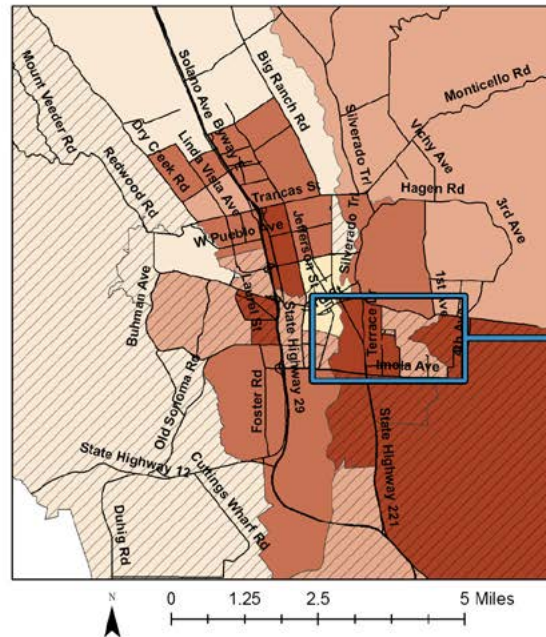
Age Adjusted Heart Disease Death Rate/100,000, by Census Tract



State Rate = 154.4 per 100,000



Schools



Key Points

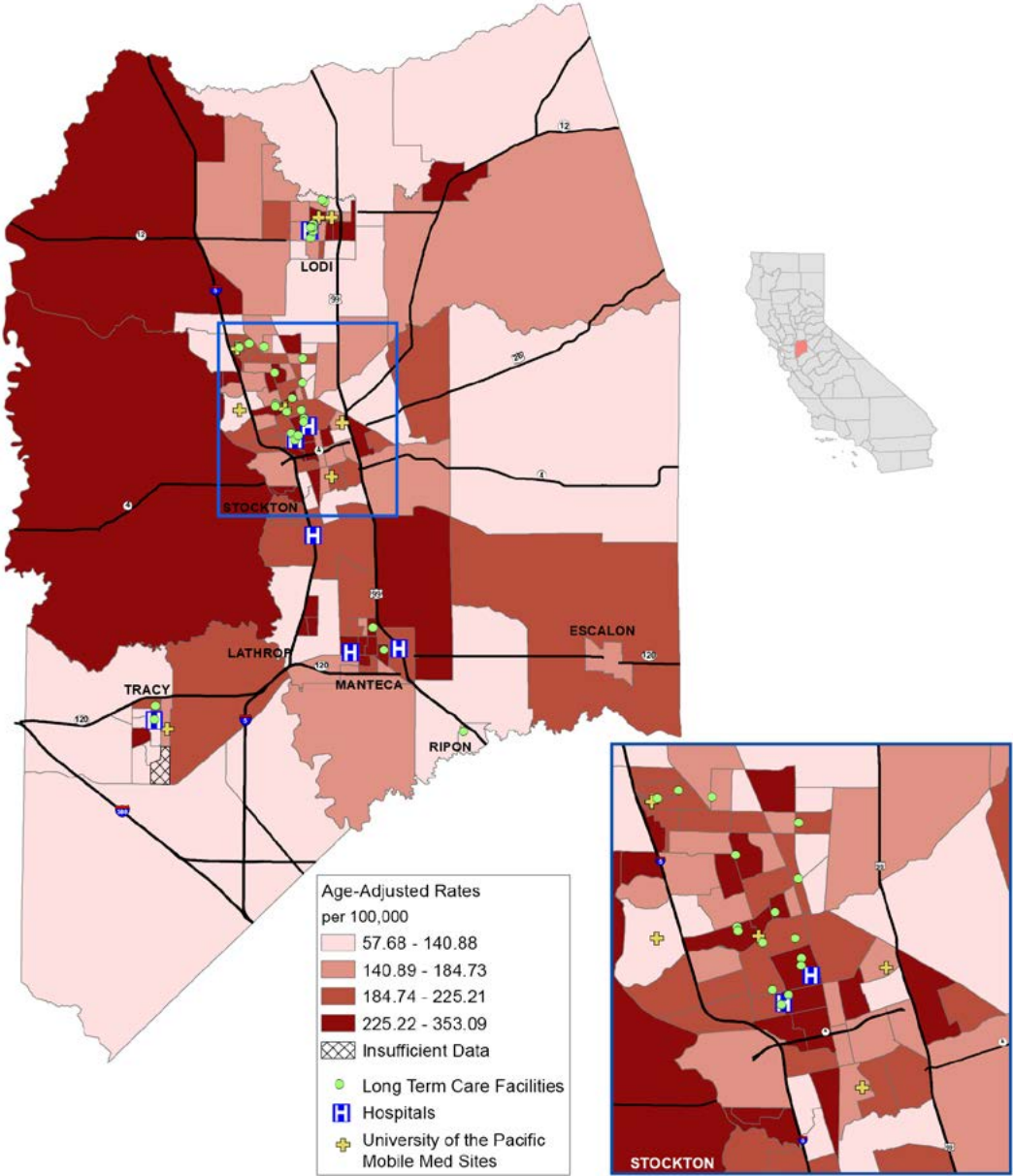
- These maps display heart disease mortality rates by census tract both within Napa County and within a focused neighborhood within the City of Napa.
- Differences in health outcomes exist at the neighborhood level.
- These maps will be used to better understand heart disease mortality within Napa County and will be shared within the agency and with community partners to help determine where to focus future public health efforts.

SOURCES: NAPA COUNTY DEATH STATISTICAL MASTER FILES, 2009-2012; US CENSUS BUREAU, AMERICAN COMMUNITY SURVEY, 2009-2013, 5-YR ESTIMATES.

NOTES: DATA WERE AGE-ADJUSTED TO THE 2000 STANDARD POPULATION.

SAN JOAQUIN COUNTY, CALIFORNIA

Census Tract Level Heart Disease Mortality Rates, San Joaquin County, 2009-2011



Key Points

- ❑ The average rate of heart disease mortality in San Joaquin County is 134.6 per 100,000, which is higher than the state average of 122.4.
- ❑ The University of the Pacific's (UOP) Mobile Medicare Clinics provide Medicare part D beneficiaries with comprehensive guidance on medication and prescription drug plans as well as preventive services, including screenings, immunizations, and more.
- ❑ The map will help UOP, San Joaquin Public Health Services, and other stakeholders strategically plan where new clinic sites will be implemented.

SOURCES: SAN JOAQUIN DEPARTMENT OF PUBLIC HEALTH SERVICES. HEART DISEASE DEATHS DEFINED AS ICD-10 CODES: 100-109, 111, 113, 120-151.

NOTES: MAP IS BASED ON AVERAGE ANNUAL AGE-ADJUSTED HEART DISEASE DEATHS OVER A 3-YEAR PERIOD FOR CENSUS TRACTS FOR THE COUNTY OF SAN JOAQUIN, CALIFORNIA. AGE-ADJUSTED TO 2000 U.S. STANDARD POPULATION.

REGION FIVE, NORTH CAROLINA

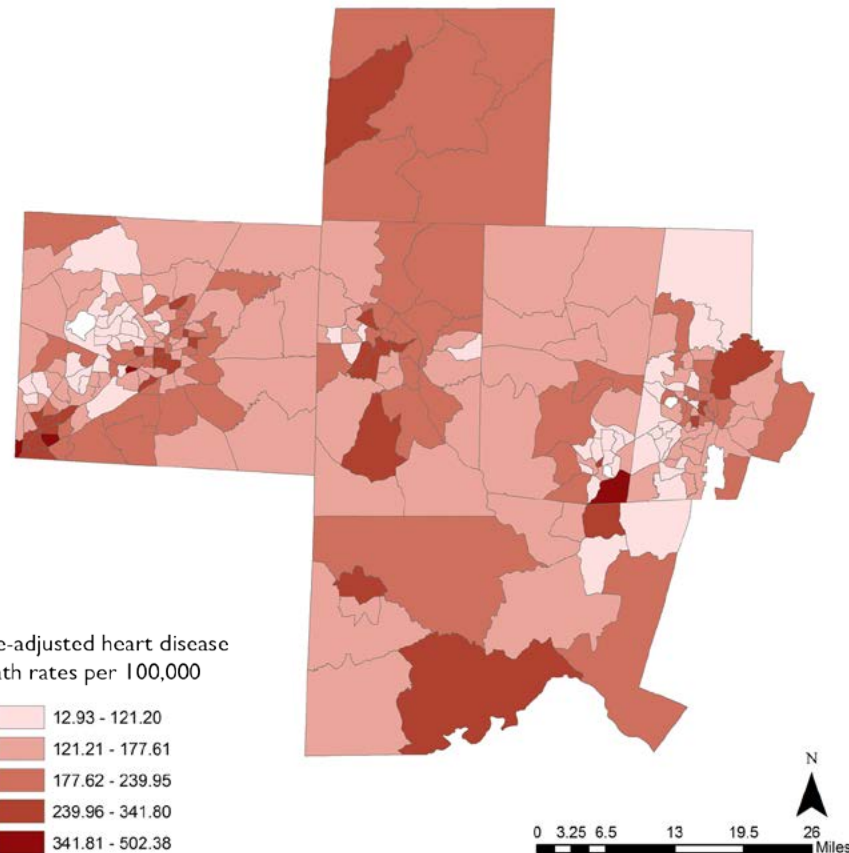
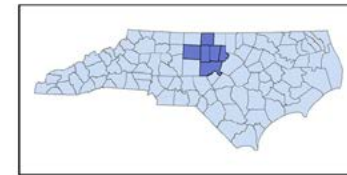
Heart Disease Death Rates, Region Five, 2009-2013

Key Points

- ❑ The rate of heart disease mortality in North Carolina is 179.3 deaths per 100,000 people.
- ❑ Region Five counties created a map of age-adjusted mortality rates for heart disease. Counties that appear on this map include, Alamance, Caswell, Chatham, Durham, Guilford, and Orange Counties.
- ❑ This regional map will be used to identify the scope of heart disease burden and compare rates across the region.

SOURCES: US CENSUS BUREAU,
AMERICAN COMMUNITY SURVEY,
2009-2013, 5-YR ESTIMATES;
NC STATE CENTER FOR HEALTH
STATISTICS, 2009-2013

Age-adjusted heart disease
death rates per 100,000



Facilitating Collaboration State Health Departments

The GIS Surveillance Training Program was intentionally designed to develop a GIS infrastructure that would facilitate collaboration among an array of chronic disease units within each health department, yet with a focus on heart disease and stroke. To that end, the staff members from each health department that participated in the training represented different chronic disease units. Each 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:

Georgia Department of Public Health

Name

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Victoria Davis
Rana Bayakly
Gayathri Kumar

Chronic Disease Unit

Georgia Coverdell Acute Stroke Registry
Chronic Disease, Healthy Behaviors, and Injury Epidemiology Section
Chronic Diseases, Healthy Behavior and Injury Epidemiology Section
Centers for Disease Control and Prevention



Kentucky Department of Health and Environment

Name

Peter Rock
Janie Cambron
Sarojini Kanotra
Vivian Lasley-Bibbs

Chronic Disease Unit

Heart Disease and Stroke Prevention Department
Environmental Public Health Tracking Network
Kentucky Department for Public Health
Kentucky Office of Health Equity



Nevada Department of Health

Name

Allen Pai
Brittany Morey
Jay Kvam
Adel Mburia-Mwalili
David Olsen (not pictured)

Chronic Disease Unit

Nevada Division of Public and Behavioral Health
Nevada Department of Health & Human Services
Division of Public and Behavioral Health
Nevada Division of Public and Behavioral Health
Nevada Division of Public and Behavioral Health



Facilitating Collaboration State Health Departments

Virginia Department of Health

Name

Brendan Noggle

Waqas Humayon

Patrick Wiggins

Djibril Camara

Elizabeth Ferree (not pictured)

Chronic Disease Unit

Office of Family Health Services

Virginia Department of Health

Virginia Department of Health

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Washington Department of Health

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Facilitating Collaboration Local Health Departments

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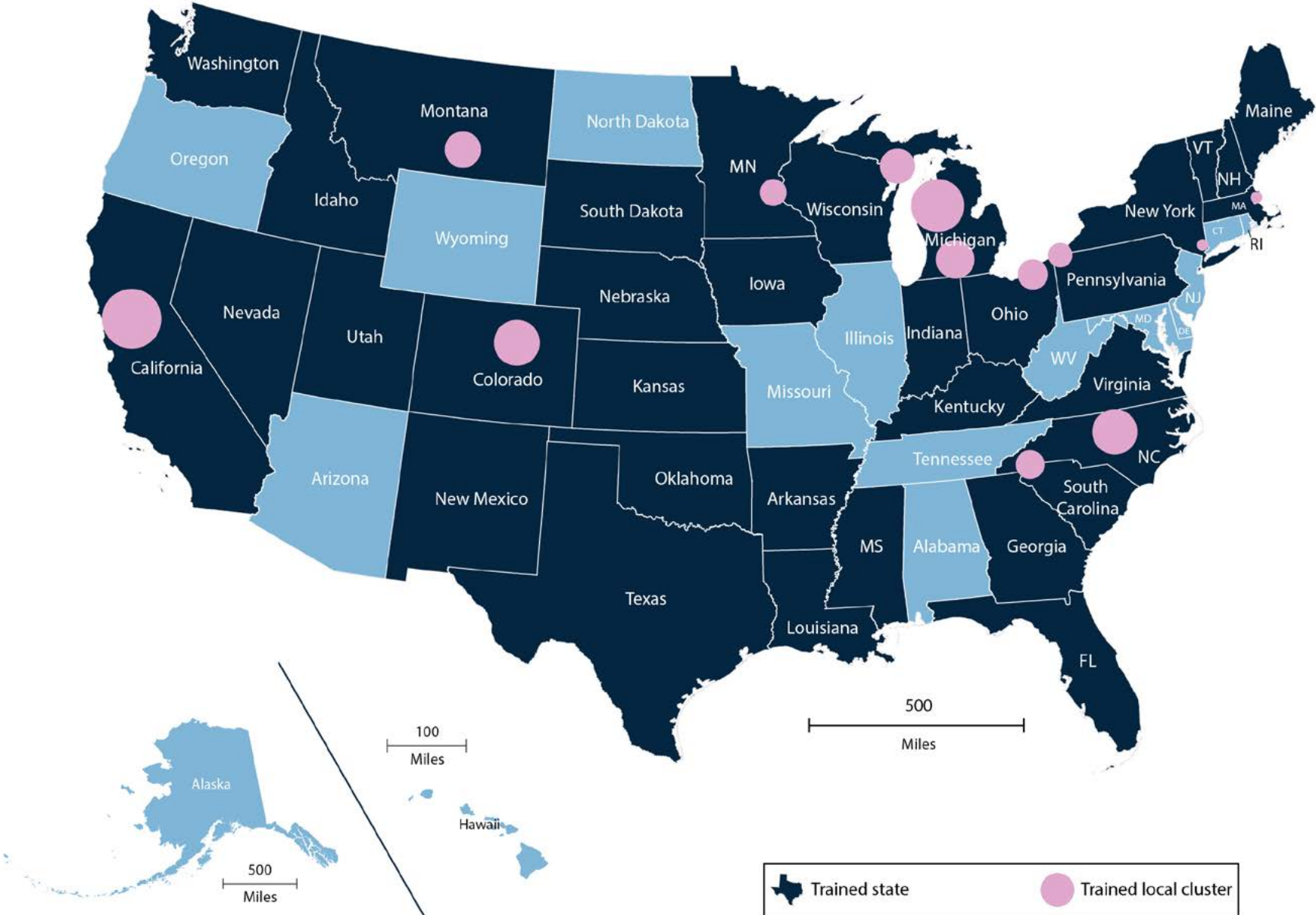


Solano County, CA

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PARTICIPANTS TO DATE



BUILDING GIS CAPACITY FOR CHRONIC DISEASE SURVEILLANCE

This project builds GIS capacity within state and local health departments for the surveillance and prevention of heart disease, stroke and other chronic diseases. Learn more about this work here: www.cdc.gov/dhdsp/maps/gisx.

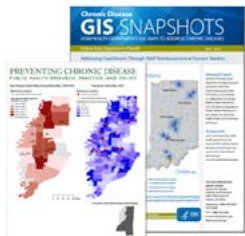


HIGHLIGHTS REPORTS



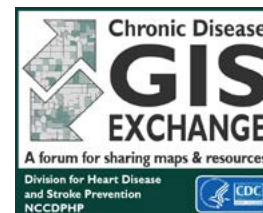
These reports showcase work from health departments that have participated in the Capacity Building project. See how health departments are using maps that document burden, inform policy, and enhance partnerships.

GIS SNAPSHOTS



Maps from many participants have been published as GIS Snapshots in CDC's Preventing Chronic Disease Journal. Several one page fact sheets were also disseminated.

CHRONIC DISEASE GIS EXCHANGE



An online community forum for public health professionals and community leaders to learn and share techniques for using GIS to enhance chronic disease prevention and treatment.



<http://www.cehi.rice.edu>

