Mapping Heart Disease, Stroke and Other Chronic Diseases:

A Program to Enhance GIS Capacity within State Health Departments
Highlights from Arkansas, Massachusetts, Minnesota, Montana, North Carolina, and Utah

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 Nicholas School of the Environment, Duke University

August 2011

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 state health departments for the prevention and treatment of heart disease, stroke, and other chronic diseases. In addition, we extend or deep appreciation to Environmental Systems Research Institute (ESRI) for their generous provision of software grants to the state health departments participating in this project.

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Introduction

Geographic Information Systems (GIS) are powerful tools for enhancing the ability of state health departments to address the public health burden of heart disease, stroke, and other chronic diseases. In order to build the capacity of state 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 Duke University. The central objective of this GIS Surveillance Training Project is to enhance the ability of state 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 state 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, and
- facilitating collaboration within agencies.

In 2010, the following six states were competitively selected to participate in this GIS Surveillance Training Project: Arkansas, Massachusetts, Minnesota, Montana, North Carolina, and Utah. 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 state produced maps to support their state 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 state health departments.

Chronic disease GIS exchange

To see maps from other states that address heart disease, stroke and other chronic diseases, visit the Chronic Disease GIS Exchange at www.cdc.gov/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.

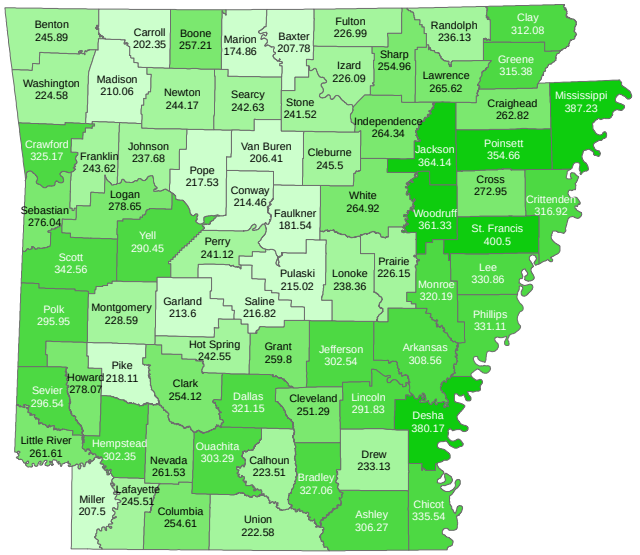
Arkansas: Using GIS to Address Existing Priorities

Documenting Geographic Disparities

Heart disease death rates

Heart disease is the leading cause of death in Arkansas. This county-level map demonstrates the geographic disparities that exist in age-adjusted heart disease death rates in Arkansas, for all ages 35 and olde The range of heart disease death rates extends from 174 to 401 per 100,000. Counties with the highest heart disease death rates (343 – 401 per 100,000) are concentrated primarily along the eastern borde of Arkansas. Counties with the lowest rates (175-218 per 100,000) ar located primarily in the central and northern regions of the state.

Heart Disease Mortality Among Arkansas Population
Age-Adjusted Rates 2000-2007



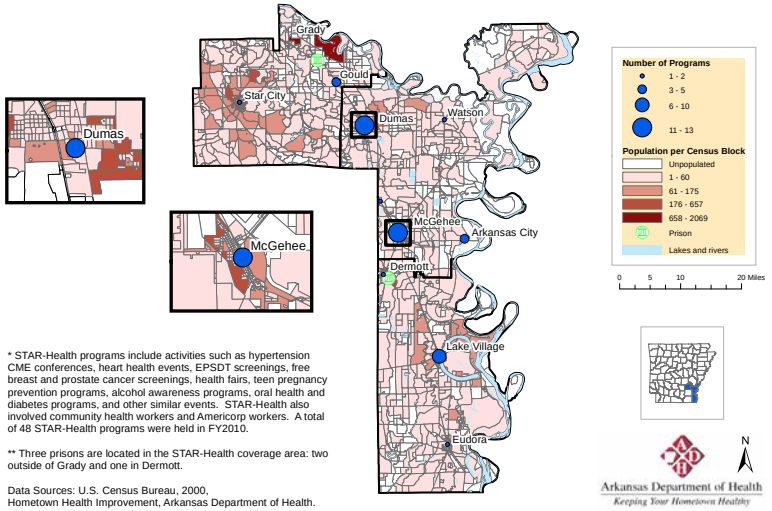
Arkansas Department of Health
Center for Public Health Practice
Analytical Epidemiology Branch

Informing Policy and Program Decisions:

Southeast Targeted Area Resource for Health (STAR Health)

STAR Health is a partnership among the Arkansas Department of Health, numerous other state and local agencies (e.g. education, human services, economic development and workforce development) and universities to increase the reach of their services in three rural Delta counties: Chicot, Desha, and Lincoln. Maps have been developed for STAR-Health to inform pilot intervention activities (e.g. radio and print campaigns for heart disease and stroke prevention, hypertension symposia for health care professionals) and educate policy decision makers in the communities and partnering organizations. This map identifies the location and number of STAR Health programs. A total of 48 STAR-Health programs were held in FY2010.

Southeast Targeted Area Resource Health Initiative
FY2010 Programs



* STAR-Health programs include activities such as hypertension CME conferences, heart health events, EPSDT screenings, free breast and prostate cancer screenings, health fairs, teen pregnancy prevention programs, alcohol awareness programs, oral health and diabetes programs, and other similar events. STAR-Health also involved community health workers and Americorp workers. A total of 48 STAR-Health programs were held in FY2010.

** Three prisons are located in the STAR-Health coverage area: two outside of Grady and one in Dermott.

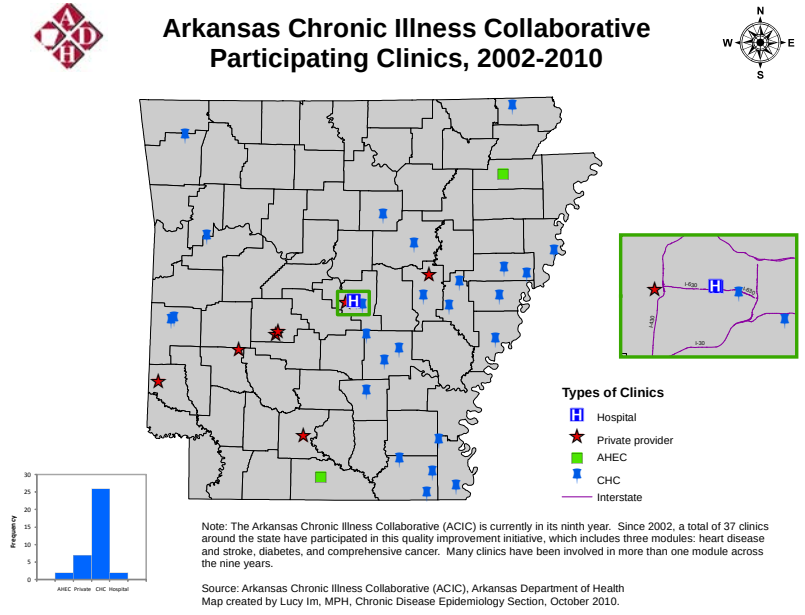
Data Sources: U.S. Census Bureau, 2000,
Hometown Health Improvement, Arkansas Department of Health.

Enhancing Partnerships:

Chronic Illness Collaborative

The Arkansas Chronic Illness Collaborative (ACIC), currently in its ninth year, is a group of health care and public health professionals dedicated to improving the management of chronic diseases. Members of the ACIC are aligning medical practice with evidence-based clinical guidelines in three areas: heart disease and stroke, diabetes, and comprehensive cancer. Current partners include the Arkansas Diabetes Prevention and Control Section, the Arkansas Heart Disease and Stroke Prevention Section, the Community Health Centers of Arkansas, Arkansas Foundation for Medical Care, the Arkansas Area Health Education Centers, and Primary Care Clinics. This map highlights the location and variety of participating clinics.

Arkansas Chronic Illness Collaborative
Participating Clinics, 2002-2010



Note: The Arkansas Chronic Illness Collaborative (ACIC) is currently in its ninth year. Since 2002, a total of 37 clinics around the state have participated in this quality improvement initiative, which includes three modules: heart disease and stroke, diabetes, and comprehensive cancer. Many clinics have been involved in more than one module across the nine years.

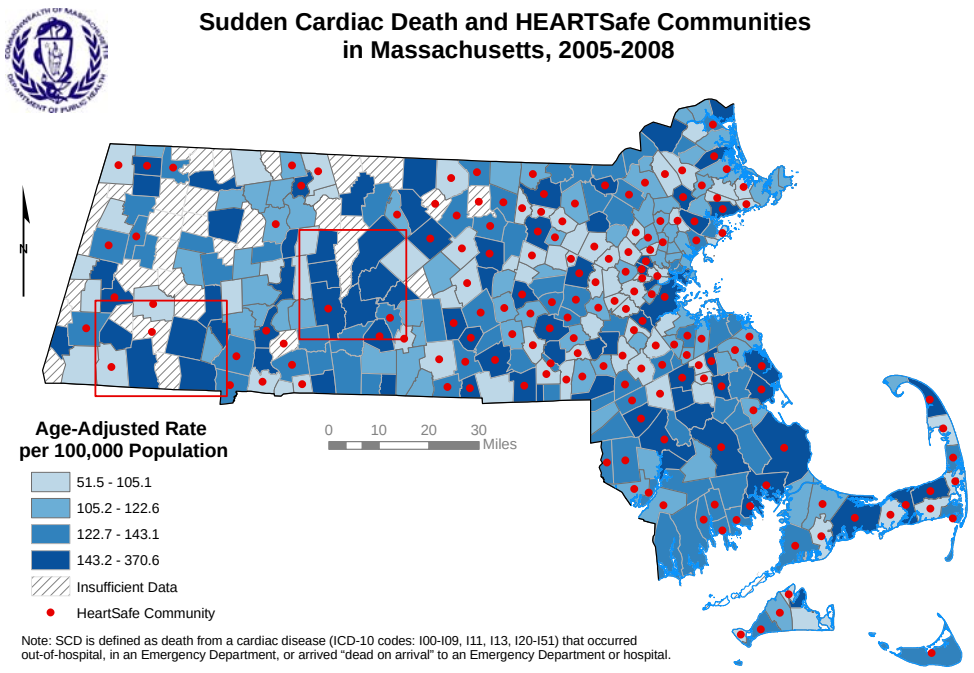
Source: Arkansas Chronic Illness Collaborative (ACIC), Arkansas Department of Health
Map created by Lucy Im, MPH, Chronic Disease Epidemiology Section, October 2010.

Massachusetts: Using GIS to Address Existing Priorities

Documenting Geographic Disparities:

Sudden Cardiac Death and HEARTSafe Communities

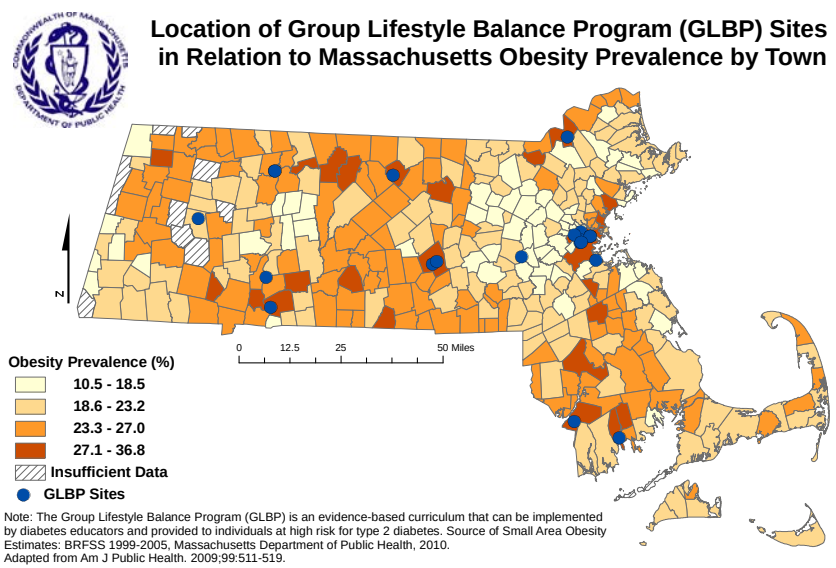
The Massachusetts Department of Public Health, Office of Emergency Medical Services, and the American Heart Association encourage and promote community awareness of the potential for saving the lives of sudden cardiac arrest victims through the HeartSafe Communities initiative. Massachusetts cities and towns can be designated as Heart-Safe Communities if they meet requirements to support the training of the community in CPR and increased public access to defibrilla-tion through strategic placement of automatic external defibrillators (AEDs) for use by public safety professionals and other trained com-munity members. This map shows HeartSafe Communities and sudden cardiac death rates in Massachusetts. It can be used to identify areas with high cardiac death rates that could benefit from increased com-munity awareness and education.



Informing Policy and Program Decisions:

Obesity prevalence and diabetes prevention programs

The Group Lifestyle Balance Program is an evidence-based curriculum developed by the University of Pittsburgh Diabetes Prevention Support Center that is designed to help individuals at high risk for type 2 diabetes to make lifestyle changes to prevent diabetes and prevent or control obesity. The Massachusetts Diabetes Prevention and Control Program provides resources for this training. This map shows the location of sites offering the Group Lifestyle Balance Program and obesity prevalence in Massachusetts. This map can be used to inform decisions on which communities should receive the training based on current training capacity and burden of obesity, a risk factor for diabetes.

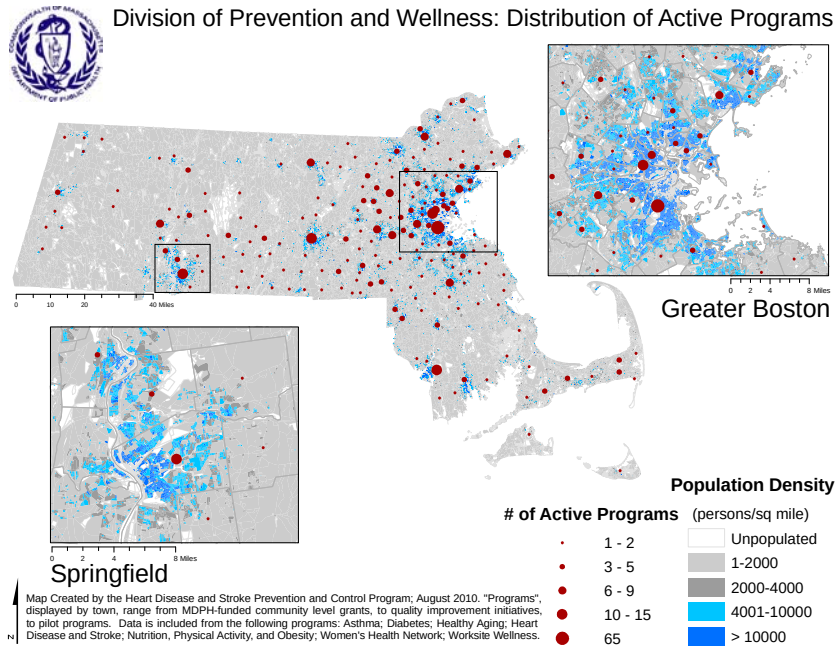


Note: The Group Lifestyle Balance Program (GLBP) is an evidence-based curriculum that can be implemented by diabetes educators and provided to individuals at high risk for type 2 diabetes. Source of Small Area Obesity Estimates: BRFSS 1999-2005, Massachusetts Department of Public Health, 2010.
Adapted from Am J Public Health. 2009;99:511-519.

Enhancing Partnerships:

Community prevention and wellness programs

The Massachusetts Department of Public Health (MDPH) provides funding and/or manpower for a number of community level prevention and wellness programs ranging from community level grants, to quality improvement initiatives, to pilot programs. MDPH programs participating in community initiatives include: Asthma; Diabetes; Healthy Aging; Heart Disease and Stroke; Nutrition, Physical Activity, and Obesity; Women's Health Network; and Worksite Wellness. This map highlights the number of active programs addressing these health topics by town. The map has been shared with the Division of Prevention and Wellness, the Office of Statistics and Evaluation, the Partnership for Heart Healthy Stroke Free Massachusetts Executive Committee, and internal program staff.



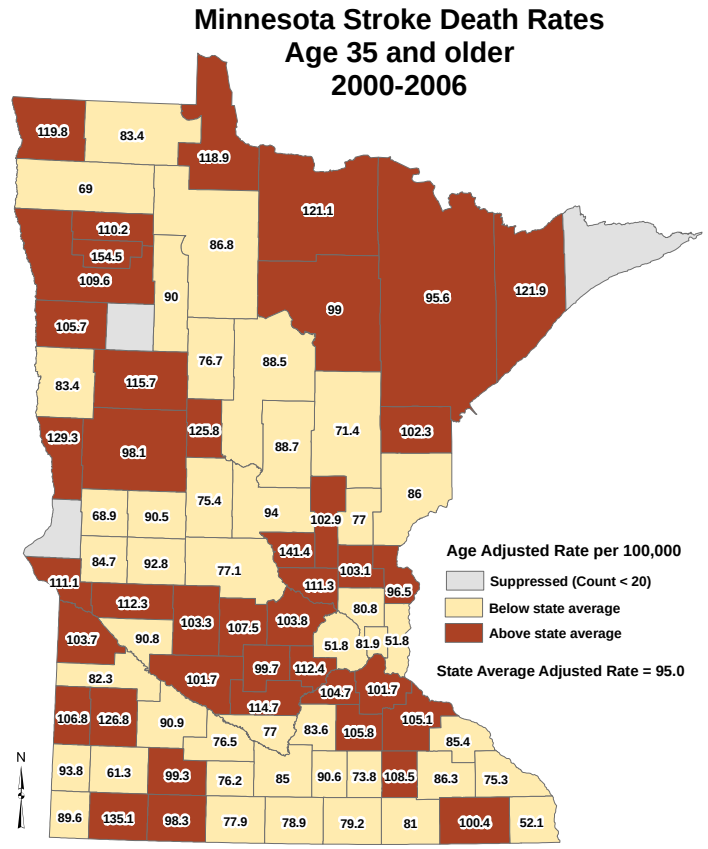
Map Created by the Heart Disease and Stroke Prevention and Control Program; August 2010. "Programs", displayed by town, range from MDPH-funded community level grants, to quality improvement initiatives, to pilot programs. Data is included from the following programs: Asthma; Diabetes; Healthy Aging; Heart Disease and Stroke; Nutrition, Physical Activity, and Obesity; Women's Health Network; Worksite Wellness.

Minnesota: Using GIS to Address Existing Priorities

Documenting Geographic Disparities:

County stroke death rates; above and below the state average

The Heart Disease and Stroke Prevention Unit at the Minnesota Department of Health is focused on reducing health disparities by race, sex, socioeconomic status, and geography. The state of Minnesota has a very large rural population, with more than one million people living far outside the state's major metropolitan areas. These counties are significantly older than the metropolitan regions, and show somewhat different mortality patterns. This map shows age-adjusted stroke mortality rates from 2000-2006 by county, emphasizing those with rates higher than the state average in ochre. Counties with rates higher than the state average are concentrated in the exurban ring around the Twin Cities and in rural areas of the northeast, northwest, and western parts of the state. This map can be used to target counties and regions of the state where the burden of stroke is highest.

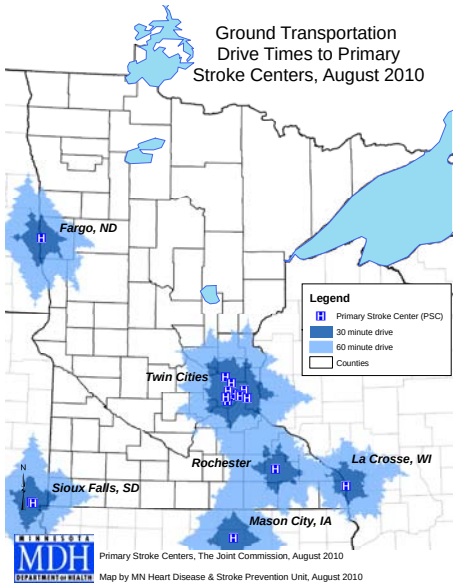


Population Estimates: 2000 US Census
Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999-2006.
CDC WONDER On-line Database, compiled from Compressed Mortality File 1999-2006 Series 20 No. 2L, 2009
Stroke defined by ICD-10 codes I60-I69
Minnesota Department of Health

Informing Policy and Program Decisions:

Drive times to primary stroke centers

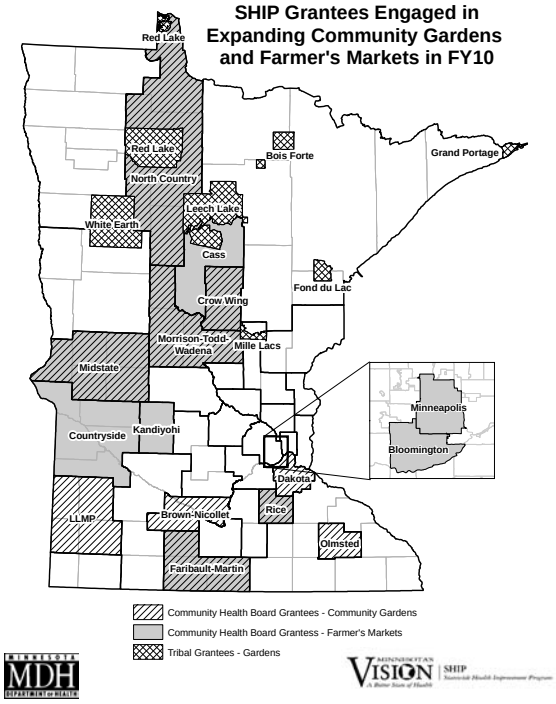
In addition to targeting stroke prevention and signs and symptoms awareness, the Heart Disease & Stroke Prevention Unit at the Minnesota Department of Health has started to assess the medical care infrastructure for the treatment of acute stroke emergencies. Certified Primary Stroke Centers have demonstrated an institutional commitment to providing the highest level of stroke care, including the administration of tPA, in-house neurology consults, stroke care units, and inpatient and outpatient rehabilitation services. This map shows geographic areas within 30 minute and 60 minute drive times to 14 Primary Stroke Centers in Minnesota and 6 in adjacent areas of neighboring states. Using data from the 2010 Census, only 70% of Minnesota's population, and 16% of Minnesota's land area is within 60 minutes of one of these centers. This map helps to identify gaps in emergency and hospital care for acute stroke patients in Minnesota.



Enhancing Partnerships:

Local and tribal governments partner with counties to increase access to healthy foods

The Minnesota Department of Health Statewide Health Improvement Program (SHIP) grants funding to local community health boards and tribal governments across Minnesota. Grantees employ evidence-based strategies to make population-based sustainable changes to reduce tobacco use and exposure and obesity. This map highlights grantees who are partnering with their community to increase access to healthy foods by expanding and creating community gardens and farmers markets; 16 grantees were engaged in these initiatives in the first year of SHIP (FY2010). This map helps to demonstrate to partners and stakeholders the reach of these programs throughout the state and identifies potential areas for expansion.



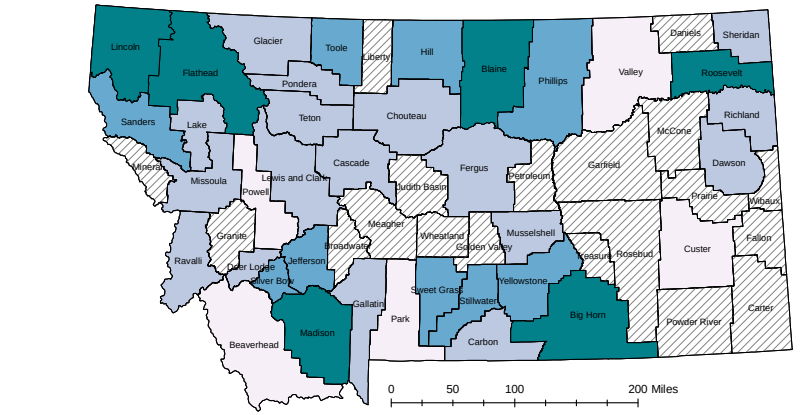
Montana: Using GIS to Address Existing Priorities

Documenting Geographic Disparities:

Stroke death rates

Stroke, the fifth leading cause of death in Montana (approximately 5% of deaths are caused by stroke), remains a serious and disabling disease. This map demonstrates the geographic disparities that exist in age-adjusted stroke death rates in Montana for adults ages 35 and older. Stroke death rates for counties range from 72 to 164 per 100,000. Counties with the highest stroke death rate (120 to 164 per 100,000) are scattered throughout the state.

Age-adjusted stroke mortality rates per 100,000 people 35 years and older, by county, Montana, 2000-2006



Age Adjusted Rate per 100,000

- 71.8 - 76.7
- 76.7 - 102.8
- 102.8 - 120.2
- 120.2 - 164.4

MONTANA CARDIOVASCULAR HEALTH PROGRAM

Stroke defined by ICD-10 codes I60-I69

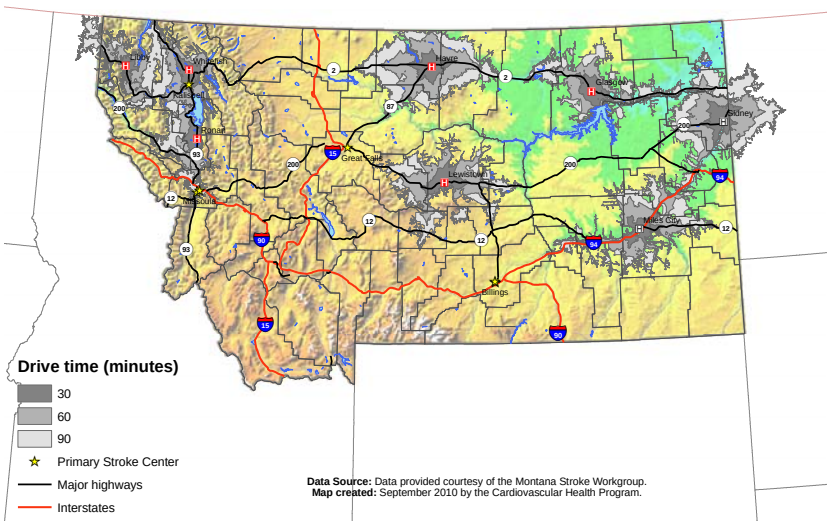
Suggested Citation: Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File

Informing Policy and Program Decisions:

Drive times to current and projected telestroke sites

Rural communities lack comprehensive local access to rapid, acute advanced stroke care. Through a 2-way interactive telestroke system installed in seven hospitals, the Montana Cardiovascular Health Program and Stroke Workgroup have improved the capacity of rural hospitals to conduct stroke consults with neurologists from stroke centers. The telestroke system can facilitate rapid administration of a time-dependent, clot-busting medication at a rural facility. In addition, the passage of a statewide pre-hospital stroke protocol may enhance emergency response to an acute stroke. This map shows drive times to current and projected telestroke sites and will be used when working with partners to identify telestroke locations to improve stroke systems of care, especially in rural areas.

30-, 60-, and 90- minute drive times to current and projected telestroke sites, Montana, September 2010.

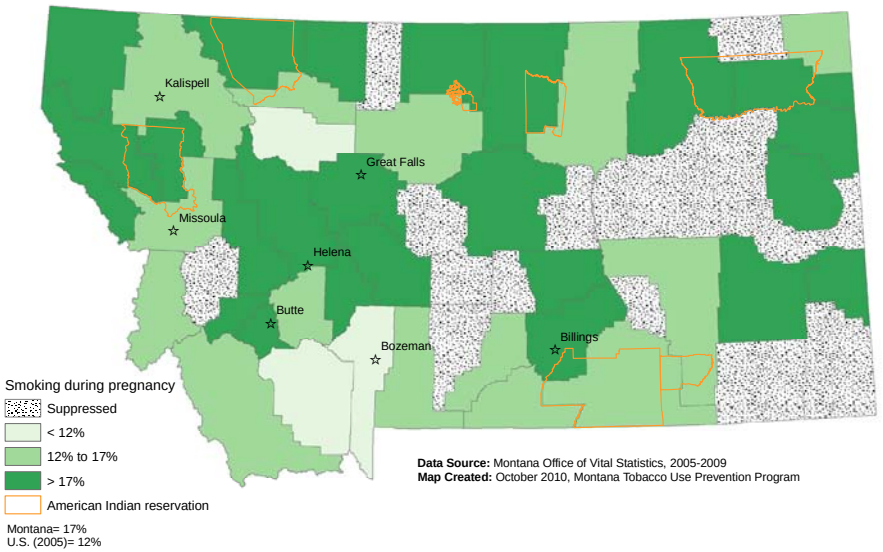


Enhancing Partnerships:

Smoking during pregnancy

The prevalence of smoking during pregnancy has, historically, been very high in Montana. This map shows the percentage of women who reported smoking during their pregnancy. For the years 2005-2009, 17% of women smoked at some point during their pregnancy in Montana compared to 12% in the United States (2005). During this same time period, the smoking prevalence among women of child bearing age (18 to 44 years) was 19% (compared to 17% among all adults) (Adult Tobacco Survey, 2005-2009). The Montana Tobacco Use Prevention Program's strategies to decrease the prevalence of smoking during pregnancy include mass media campaigns targeted to Medicaid clients and their providers, and offering free or reduced-cost cessation medications through the telephone quit line. Since 2005, approximately 30% of the callers to the Montana Tobacco Quit-line have been women of child bearing age. This map can be used by Montana Tobacco Use Prevention Program's partners to advance and target their programs.

Smoking during pregnancy, by county, Montana, 2005-2009

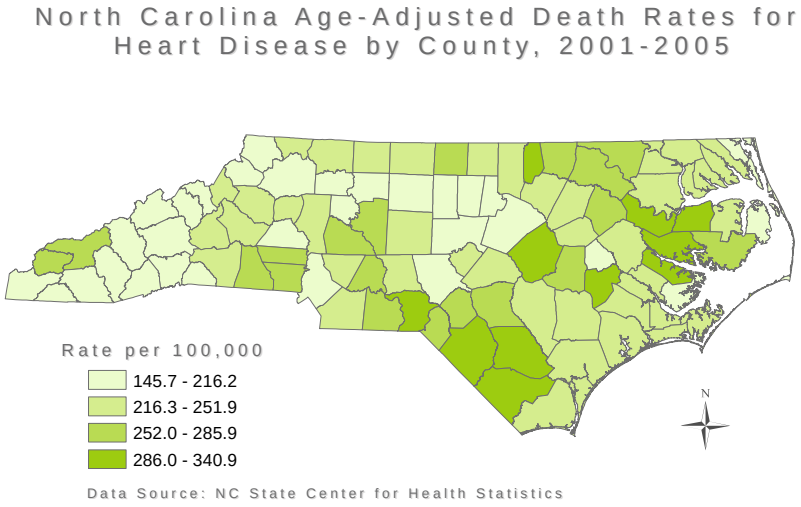


North Carolina: Using GIS to Address Existing Priorities

Documenting Geographic Disparities:

Heart disease death rates

The Heart Disease and Stroke Prevention Branch (HDSP) creates and distributes an annual disease burden document. The content includes the documentation of the burden of heart disease and stroke on both statewide and local levels. Each county's age-adjusted rate is one of the most important data presented. This map displays the 2001to 2005 N.C. age-adjusted mortality rates for heart disease. The noticeably higher rates in the eastern region demonstrate there is a geographic component to heart disease in the state. This and similar maps will be used in various documents in order to provide a visual representation of the burden of disease in North Carolina.



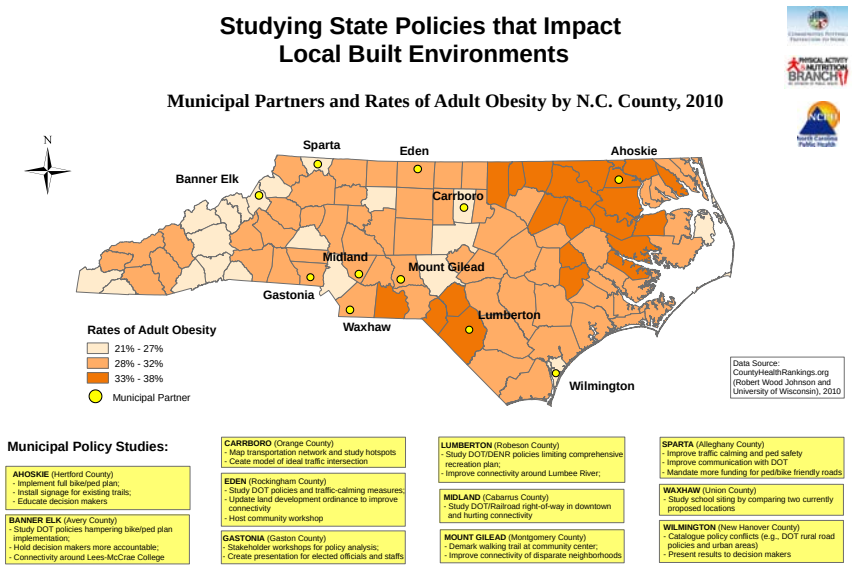
Start Your Heart

Chronic Disease and Injury Section
NC Integration Project

Informing Policy and Program Decisions:

Studying state policies that impact the built environments

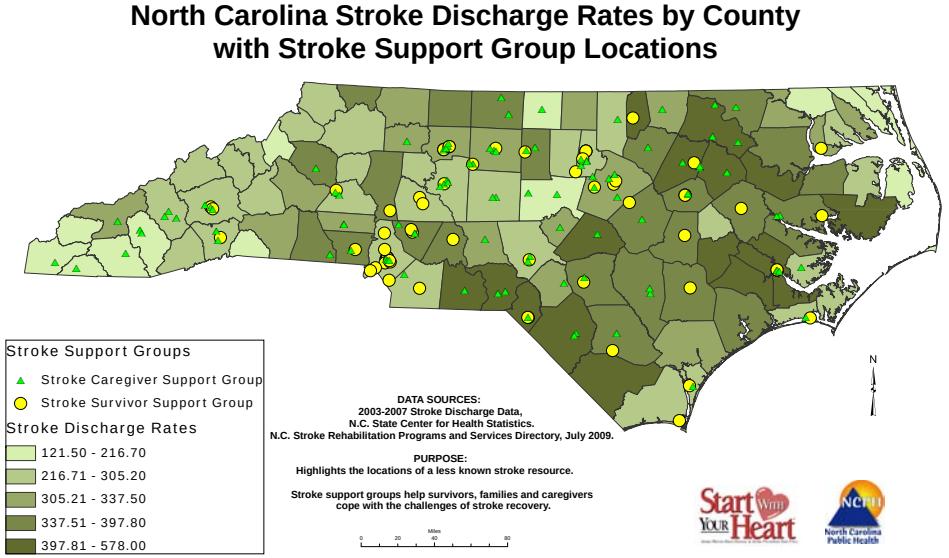
In October 2010 the Physical Activity and Nutrition Branch (PAN) at the NC Division of Public Health (NCDPH) and 11 municipalities developed a partnership to examine the impact of state policies on communities seeking to improve their local built environment. This map identifies each participating municipality layered with the 2010 rates of adult obesity in each county. In addition, municipal policy studies at each site are listed in the boxes below. The program and policy decisions made by PAN and NCDPH can be enhanced with the information provided by this map.



Enhancing Partnerships:

Addressing gaps in locations of stroke support groups

In 2009 the Heart Disease and Stroke Prevention Branch (HDSP) at the NC Division of Public Health (NCDPH) located and identified various rehabilitation resources for stroke patients across the state. This information was printed in a publication entitled *North Carolina Stroke Rehabilitation Programs and Services* and it was added to the online referral site NC Care Link. Stroke support groups were one type of resource included in this research. This map shows the locations of stroke support groups layered over the 2003-2007 stroke discharge rates by county. It can be used by HDSP to identify communities, with the highest rates and fewest resources, in which it is important to develop partnerships to eliminate gaps in stroke patient rehabilitation services.



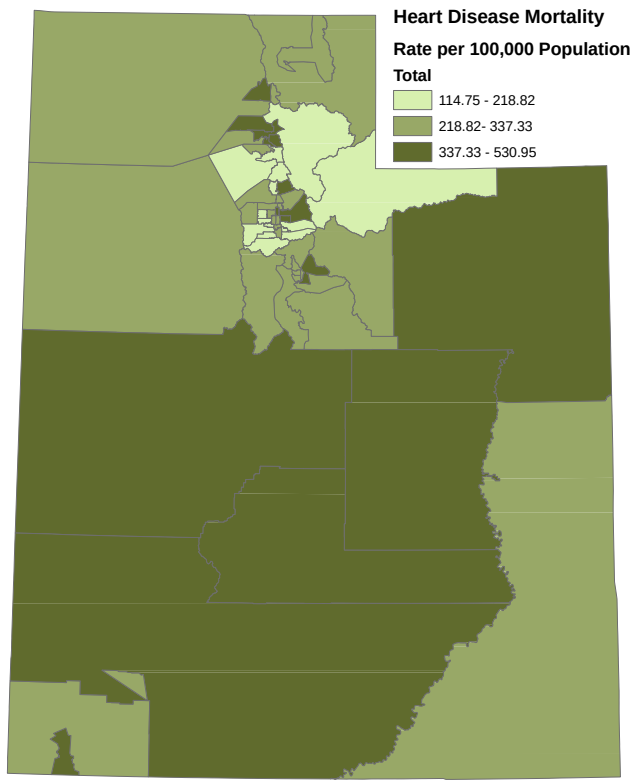
Utah: Using GIS to Address Existing Priorities

Documenting Geographic Disparities:

Stroke death rates

Heart disease is the leading cause of death in Utah and a leading cause of disability. In 2009, heart disease and stroke accounted for 25 percent of all deaths in Utah. This map demonstrates the geographic disparities that exist in age-adjusted heart disease death rates in Utah, for ages 35 and older. In order to show community level information, Utah has created small areas which are determined based on criteria including population size, political boundaries of cities and towns, and economic similarity. The heart disease death rates range from 115 to 531 per 100,000. Small areas with the highest heart disease death rates are concentrated primarily in the central and southwestern parts of the state as well as along the Wasatch Front, a metropolitan corridor that extends from Ogden to Provo. Small areas with the lowest rates are located primarily in the north central region of the state.

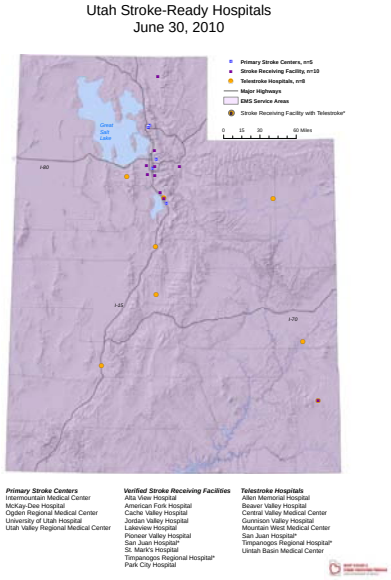
Utah Heart Disease Mortality Rate for Adults 35+ Years of Age by Small Area, 2002-2008 Combined



Informing Policy and Program Decisions:

Utah stroke-ready hospitals

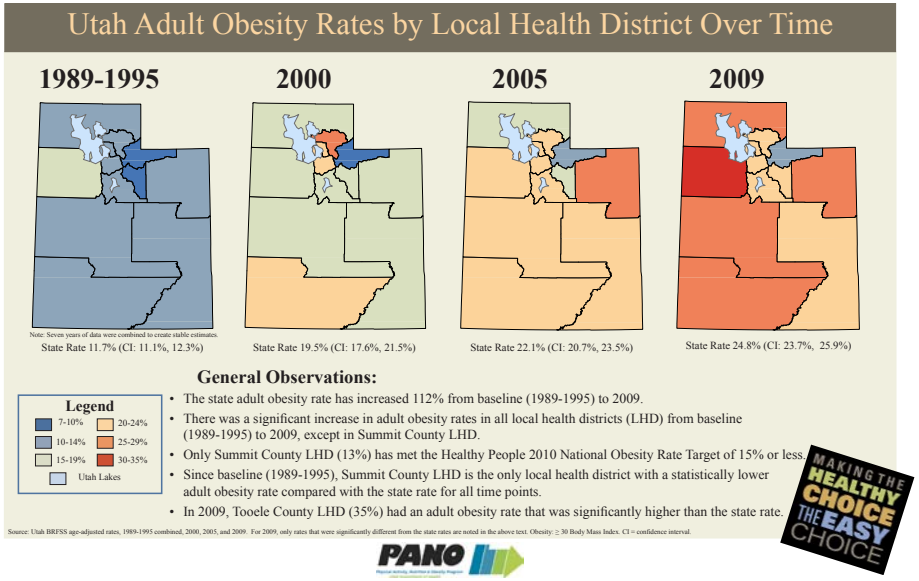
The Utah Department of Health, the Utah Hospitals and Health Systems Association, and the Alliance for Cardiovascular Health in Utah have worked in collaboration to develop the Utah Stroke System. The goal of the Utah Stroke System is to provide quality and timely emergency care to every stroke patient in the state in order to reduce morbidity and mortality caused by stroke. Hospitals can voluntarily become verified as Stroke Receiving Facilities, which are defined as hospitals having procedures, equipment, and protocols in place to provide time-critical emergency stroke care in consultation with one of the Primary Stroke Centers (certified by the Joint Commission). These hospitals commit to follow national guidelines in treating patients arriving to the emergency department with symptoms of stroke. This map shows the locations of Primary Stroke Centers, Stroke Receiving Facilities, and hospitals with Telestroke capabilities in Utah.



Enhancing Partnerships:

Partnerships to address obesity

Obesity in Utah is at a record high with more than half of adults either overweight or obese. The percentage of obese adults in Utah has more than doubled (a 112% increase) since 1989. This series of maps shows the county trends in prevalence of adult obesity in Utah from 1989-1995 to 2009. To address this public health issue, the Utah Department of Health's Physical Activity, Nutrition and Obesity (PANO) Program works with public and private partners associated with the Utah Partnership for Healthy Weight. The PANO Program partners with local health departments, other state public agencies, and nonprofit and private organizations to enhance local capacity to deliver physical activity, nutrition, and obesity programs; develop surveillance and evaluation capacity; and implement the goals and strategies identified in the state plan for nutrition and physical activity.



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 four 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; here are the chronic disease units that were represented in each of the participating state health departments:

Arkansas Department of Health

Name	Chronic Disease Unit
Gina Redford	Health Statistics Branch
Lucy Im	Chronic Disease Epidemiology Section, Analytical Epi Branch
Brandy Sutphin	Lifestage Health Branch
Wanda Simon	Tobacco Prevention Cessation Branch

Massachusetts Department of Public Health

Name	Chronic Disease Unit
Katrina D'Amore	Heart Disease and Stroke Prevention and Control Program
Erin Kulick	Heart Disease and Stroke Prevention and Control Program
Paul Oppedisano	Diabetes Prevention and Control Program
Cynthia Lamond	Nutrition, Physical Activity and Obesity Unit

Minnesota Department of Health

Name	Chronic Disease Unit
Jay Desai	Diabetes Unit
Jim Peacock	Heart Disease and Stroke Prevention Unit
Paula Lindgren	Chronic Disease & Environmental Epidemiology Section
Joanna Moze	Statewide Health Improvement Program

Montana Department of Public Health & Human Services

Name	Chronic Disease Unit
Jessie Frazier	Asthma Control Program and Injury Prevention Program
Laura Biazzo	Tobacco Use Prevention Program
Carrie Oser	Cardiovascular Health Program
Cody Custis	Cancer Surveillance and Epidemiology Program

North Carolina Division of Public Health

Name	Chronic Disease Unit
Jenni Albright	Physical Activity and Nutrition Branch
Alexander White	Heart Disease and Stroke Prevention
Paige Bennett	Heart Disease and Stroke Prevention
Katie Harmon	Injury & Violence Prevention Branch
Rocky Payne	Physical Activity and Nutrition Branch

Utah Department of Health

Name	Chronic Disease Unit
MaryCatherine Jones	Heart Disease and Stroke Prevention Program
Diane Hartford	Bureau of Emergency Medical Services
Mike Friedrichs	Bureau of Health Promotion
Nicole Bissonette	Heart Disease and Stroke Prevention Program
Karen Nellist	Physical Activity, Nutrition and Obesity Program

Presentations

National Institute for Heart Disease and Stroke Prevention Centers for Disease Control and Prevention, Atlanta, GA 2010

Planning for enhanced use of GIS within state health departments to address heart disease and stroke prevention

Paige Bennet, North Carolina Department of Health and Human Services
Mary Catherine Jones, Utah Department of Health
Lucy Im, Arkansas Department of Health
James Peacock, Minnesota Department of Health
Katrina D'Amore, Massachusetts Department of Public Health
Carrie Oser, Montana Department of Public Health and Human Services
Michele Casper, Centers for Disease Control and Prevention
Linda Schieb, Centers for Disease Control and Prevention
Marie Lynn Miranda CEHI, Duke University
Joshua Tootoo CEHI, Duke University

Environmental Public Health Tracking Program Seminar Series St Paul, MN 2010

Geovisualization, GIS and Chronic Disease

Eric Hanson, Minnesota Department of Health
James Peacock, Minnesota Department of Health

Esri Health GIS Conference Denver, CO 2010

Building Capacity for State GIS Surveillance for Heart Disease, Stroke, and Other Chronic Diseases

Michele Casper, CDC, Division for Heart Disease Stroke Prevention
Joshua Tootoo, CEHI, Duke University
Paige Bennet, North Carolina Department of Health and Human Services
Mary Catherine Jones, Utah Department of Health
Lucy Im, Arkansas Department of Health
James Peacock, Minnesota Department of Health
Katrina D'Amore, Massachusetts Department of Public Health
Carrie Oser, Montana Department of Public Health and Human Services

Council of State and Territory Epidemiologists Pittsburgh, PA 2011

A strong suite: Project based training, geographic information systems (GIS), and chronic disease surveillance

Michele Casper CDC, Division for Heart Disease Stroke Prevention
Joshua Tootoo CEHI, Duke University
Linda Schieb CDC, Division for Heart Disease Stroke Prevention
Marie Lynn Miranda CEHI, Duke University

Esri User Conference, San Diego, CA 2011

Hotspot Analysis of Chronic Disease Burden for Statewide Program Planning

Katrina D'Amore, Massachusetts Department of Public Health
Erin Kulick, Massachusetts Department of Public Health

Posters

Esri Health GIS Conference Denver, CO 2010

Burden of Chronic Disease Hospitalizations and Division of Prevention and Wellness Programs across Massachusetts
Erin Kulick and Katrina D'Amore, Massachusetts Department of Public Health

Chronic Disease GIS Exchange
Linda Schieb Michele Casper Ishmael Williams, Centers for Disease Control and Prevention
Joshua Tootoo Christopher Fresco Marie Lynn Miranda, CEHI, Duke University

GIS State Surveillance Training: Examples of How State Health Departments Are Using GIS to Address Heart Disease and Stroke Prevention Priorities
Joshua Tootoo CEHI, Duke University

Massachusetts Adult Obesity and Grocery Store Density by City and Town
Cynthia Lamond, Massachusetts Department of Public Health

N.C. DPH's Policy Study Partners and State Obesity Rates
Rocky Payne, North Carolina Division of Public Health

N.C. HD Hospitalization and Fast Food
Paige Bennett, North Carolina Division of Public Health

N.C. Stroke Discharge Rate by County and Stroke Support Group Locations
Alexander White, North Carolina Division of Public Health

2011 NC Eastern Regional Stroke Conference, Greenville, NC

Drive Times for NC Stroke Care Collaborative Hospital Sites and Census Tracts with High Proportion of Aged 65 and Over Populations
Paige Bennett, North Carolina Dept of Health and Human Services

N.C. Stroke Mortality Hotspots 1979-2009
Paige Bennett and Katherine Harmon, North Carolina Dept of Health and Human Services

Council of State and Territory Epidemiologists Pittsburgh, PA 2011

Innovative and enhanced chronic disease surveillance and program planning using GIS
Erin Kulick, Massachusetts Department of Public Health

Leading causes of chronic disease and injury mortality in North Carolina: Persistence of spatial clusters, 1979-2009
Katherine Harmon, North Carolina Department of Health and Human Services

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