WHERE YOU LIVE DOES MATTER: THE IMPACT OF RACIAL RESIDENTIAL SEGREGATION ON RACIAL DISPARITIES IN CANCER INCIDENCE AND MORTALITY IN NORTHEASTERN AND SOUTHERN U.S. COUNTIES, 2005-2009

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WHERE YOU LIVE DOES MATTER: THE IMPACT OF RACIAL RESIDENTIAL SEGREGATION ON RACIAL DISPARITIES IN CANCER INCIDENCE AND MORTALITY IN NORTHEASTERN AND SOUTHERN U.S. COUNTIES, 2005-2009

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This study merges the frameworks of social epidemiology, human ecology, and Critical Race Theory to examine the impact of racial residential segregation on racial disparities in cancer incidence/mortality and characteristics of the social and physical environment. County-level data on cancer incidence, cancer mortality, racial residential segregation, and other characteristics of the social and physical environment are collected from nine publically-available sources.

Regression models identify predictors of the racial disparity in cancer incidence and cancer mortality. Racial residential segregation is not a significant predictor of the racial gap in cancer incidence or the racial gap in cancer mortality after controlling for the racial gap in median household income. Racial disparity in median household income is the most significant predictor of both the racial gap in cancer incidence and the racial gap in cancer mortality. Although there is no significant relationship between racial residential segregation and the racial gap in cancer incidence and cancer mortality was not found, highly segregated areas do face certain forms of disadvantage in several health-protecting resources—housing, exposure to environmental pollutants, educational attainment, and economic opportunities.

In order for interventions and policies to be effective in reducing racial disparities in health outcomes, the structural (i.e., foundational and fundamental) causes of these inequalities—institutional racism, racial residential segregation, economic/educational inequalities—must be addressed. In addition, the methods used to "protect confidentiality" and

"maintain data reliability" of publically available data sources need to be examined through the lens of Critical Race Theory to determine whether these methods are simply supporting the racialized structure and protecting the status quo.

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PREFACE

I would like to express my deepest appreciation to my committee members, Dr. John Marx, Dr. Suzanne Staggenborg, Dr. Melanie Hughes, Dr. Joyce Bell, and Dr. Susan Zickmund, for their support during the completion of this project. In addition, I would like to extend recognition to my colleagues at the Center for Health Equity Research and Promotion (CHERP) at the VA Pittsburgh—especially the members of "TEAM Z"—and my colleagues in the departments of Psychology and Social Work/Criminology at Chatham University for their invaluable support during this process. Finally, I must extend my gratitude to my network of family and friends that have provided so much support during this journey. This work is dedicated to my wife, Mary, because I wouldn't be the person I am today without her love and support.

A listing of abbreviations utilized in the document are included below:

AHRF	Area Health Resources Files
BRFSS	Behavioral Risk Factor Surveillance System (CDC)
CCD	Common Core of Data
CDC	Centers for Disease Control and Prevention
CHIP	Children's Health Insurance Program
CRT	Critical Race Theory
EBV	Epstein-Barr virus

EPA	Environmental Protection Agency
FHA	Federal Housing Administration
FIPS	Federal Information Processing Standards
FOBT	Fecal occult blood testing
GIS	Geographic Information Systems
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HHS	Department of Health and Human Services
HIV	Human Immunodeficiency virus
HPV	Human papilloma virus
HRSA	Health Resources and Services Administration
ICA	International Cartographic Association
IOM	Institutes of Medicine
NATA	National-Scale Air Toxics Assessment (EPA)
NCES	National Center for Education Statistics
NCI	National Cancer Institute
NVSS	National Vital Statistics System (CDC)
PCP	Primary care physician
ppm	Parts per million
SAHIE	Small Area Health Insurance Estimates Program (US Census Bureau)
SEER	Surveillance, Epidemiology, and End Results Program (NCI)
SES	Socioeconomic status
SPSS	Statistical Package for the Social Sciences

SNAP	Supplemental Nutrition Assistance Program
US	United States
UV	Ultraviolet
VIF	Variance inflation factor

A listing of state abbreviations utilized in the document are included below:

AL	Alabama
AR	Arkansas
CT	Connecticut
DC	District of Columbia
DE	Delaware
FL	Florida
GA	Georgia
KY	Kentucky
LA	Louisiana
MA	Massachusetts
MD	Maryland
ME	Maine
MS	Mississippi
NC	North Carolina
NH	New Hampshire
NJ	New Jersey
NY	New York
OK	Oklahoma

PA	Pennsylvania
RI	Rhode Island
SC	South Carolina
TN	Tennessee
TX	Texas
VA	Virginia
VT	Vermont
WV	West Virginia

1.0 INTRODUCTION

In the United States, disparities between blacks and whites are known to exist for many health outcomes, including overall life expectancy, infant/maternal mortality, cardiovascular disease, obesity and diabetes (Berg et al. 2003; Centers for Disease Control and Prevention 2011; Cooper et al. 2000; Hummer 1996; Kaiser Family Foundation 2014; LaVeist et al. 2009; Levine et al. 2001; MacDorman et al. 2002; Wang and Beydoun 2007). This study focuses on the underlying social factors that perpetuate racial disparities in cancer incidence and mortality.

1.1 CANCER INCIDENCE AND MORTALITY

Cancer is the second leading cause of death in the United States. As of January 1, 2012 there were approximately 13.7 million living Americans with a cancer diagnosis.[1] It is estimated that in 2014 approximately 1,665,540 new cancer cases will be diagnosed and 585,720 Americans will die from a cancer-related cause (American Cancer Society 2014a).

[1] This number includes those with either an active case of cancer or cancer in remission.

From 1975-2009, overall age-adjusted[2] cancer incidence rates[3] increased from 400.44 cases per 100,000 population to 470.46 cases per 100,000 population (see Figure 1). Cancer incidence rates peaked in 1992 (510.56 cases per 100,000) and have been decreasing, although the 2009 cancer incidence rate remains higher than the 1975 rate.

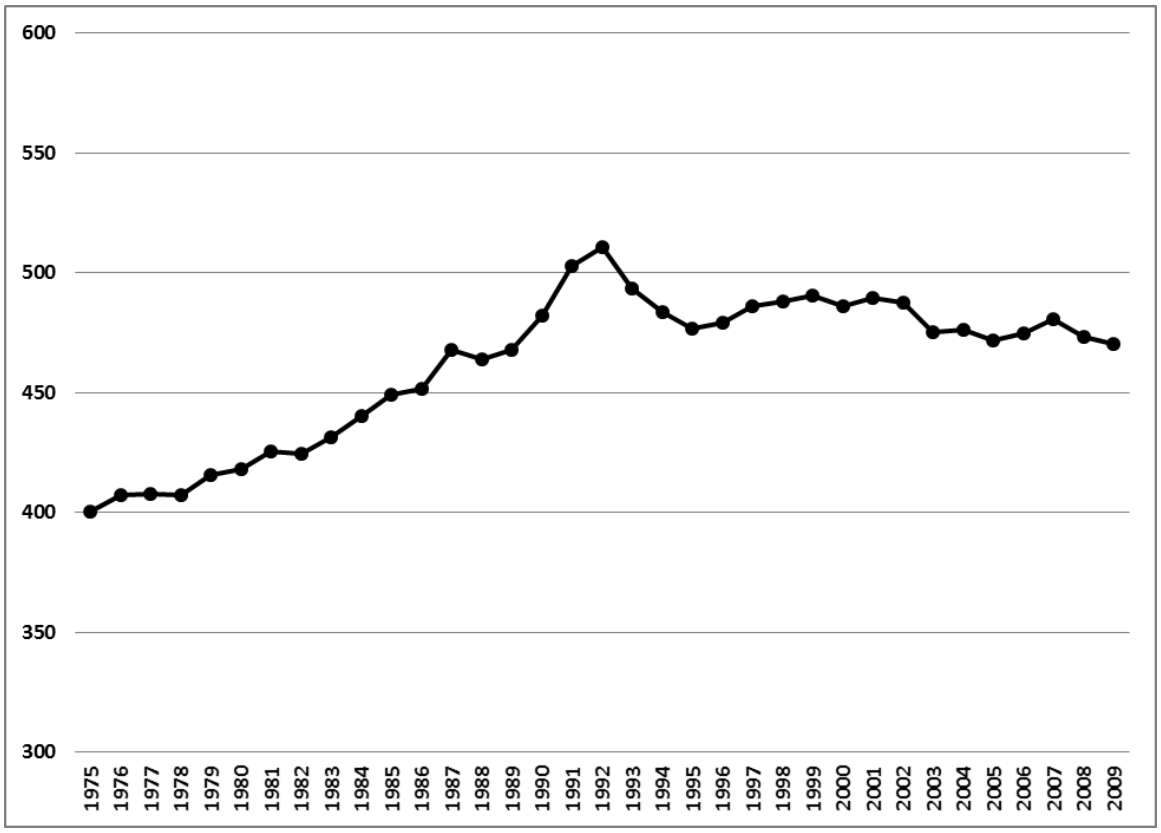

Figure 1. Age-Adjusted Cancer Incidence Rates (All Cancer Sites, All Sexes, All Races), 1975-2009[4]

[2] Age-adjusted rates are calculated using the following steps: (1) determine crude rates (count / population x 100,000) for each of the 19 standard age groups (00 years, 01-04 years, 05-09 years, 10-14 years, 15-19 years, 20-24 years, 25-29 years, 30-34 years, 35-39 years, 40-44 years, 45-49 years, 50-54 years, 55-59 years, 60-64 years, 65-69 years, 70-74 years, 75-79 years, 80-84 years, 85+ years); (2) determine the "weighting" factor for each of the age using the US 2000 "standard populations" (standard population of specific age group / total standard population); (3) multiply the crude rate by the weighting factor; (4) sum these results to determine the rate for that specific year/geographic area/gender/racial group (National Cancer Institute N.d. b).

[3] Incidence is defined as the number of cases of a disease diagnosed or reported for a population during a defined period of time (commonly a year) (Meade and Emch 2010). These age-adjusted incidence rates include all cancer sites, all sexes, and all races combined.

[4] Data obtained from National Cancer Institute (2013).

From 1975-2009, overall age-adjusted cancer mortality rates[5] decreased from 199.14 deaths per 100,000 population to 173.4 deaths per 100,000 population (see Figure 2). Cancer mortality peaked in 1991 with a rate of 215.1 deaths per 100,000 population, but has declined since that time period. Decreasing mortality rates are most likely due to a decline in risk factors (such as tobacco use), innovations in early cancer detection, and innovations in cancer treatment (Byers 2010).

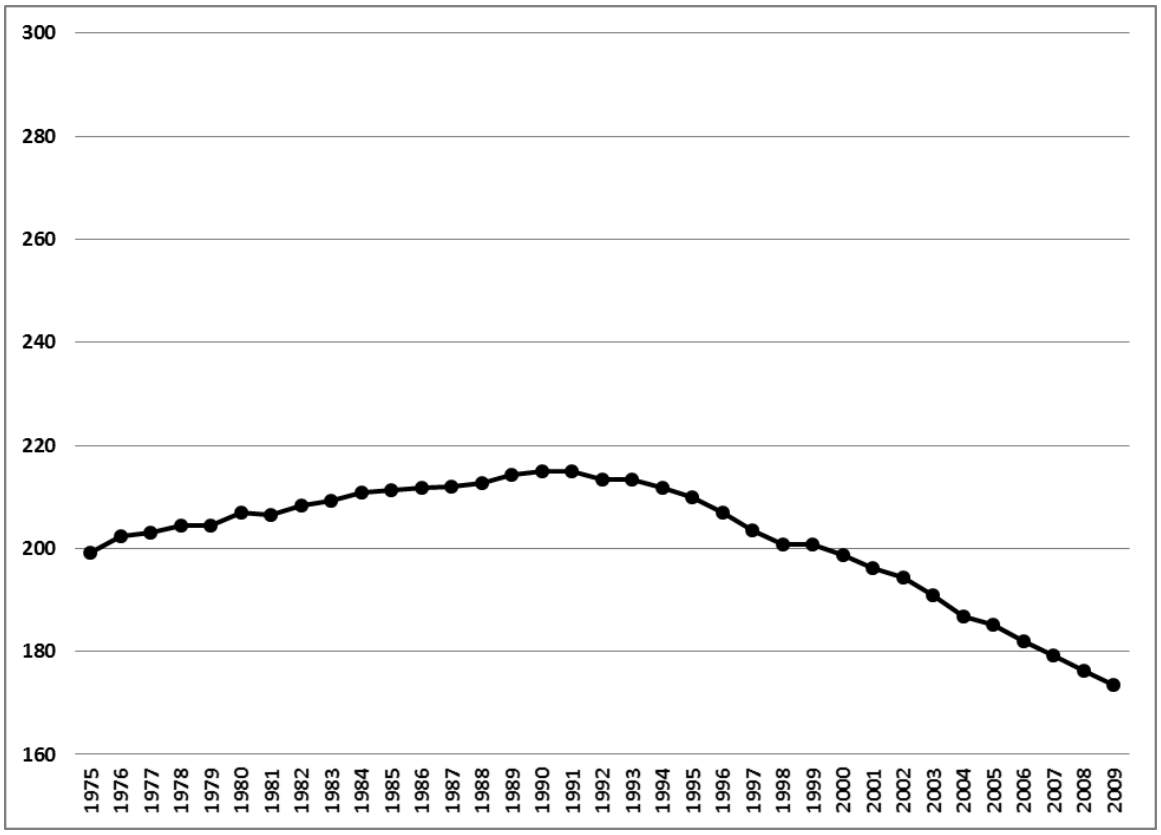

Figure 2. Age-Adjusted Cancer Mortality Rates (All Cancer Sites, All Sexes, All Races), 1975-2009[6]

[5] Overall age-adjusted mortality rates include all cancer sites, all sexes, all races combined.
[6] Data obtained from National Cancer Institute (2013).

1.1.1 Cancer incidence and mortality by race

The first comprehensive data on cancer racial disparities was released by the National Cancer Institute in their 1971 report, "Patterns in Cancer Mortality in the United States, 1950-1967" (Burbank 1971). However, Henschke et al. (1973) noted that this report and the corresponding data set only included data for white versus "nonwhite"[7] groups, and instead located yearly black and white cancer mortality data from "Official Statistics of the United States" report. Based on this data, they concluded that age-adjusted white cancer mortality rates remained unchanged from 1950-1967 (150 per 100,000) but increased 20% for blacks (147 per 100,000 in 1950 and 177 per 100,000 in 1967) (Henschke et al. 1973). Since 1975, race-specific cancer data has been made available through the National Cancer Institute's Surveillance, Epidemiology, and End Results Program (SEER)[8].

From 1975-2009, overall age-adjusted cancer incidence rates increased for both whites and blacks (whites: 402.12 cases per 100,000 population v. 479.12 per 100,000 population; blacks: 426.53 cases per 100,000 population v. 501.62 per 100,000 population). Incidence rates for both white and black populations peaked in 1992 (516.76 per 100,000 population v. 568.46 per 100,000 population, respectively) (see Figure 3). Black cancer incidence rates are consistently higher than white incidence rates; however, the racial gap is erratic (see Figure 4).

[7] All minorities were grouped together in a "nonwhite" category, thus eliminating the ability for researchers to identify disparities between specific racial groups.

[8] Data for whites/blacks was made available starting in 1975. Data for Asian/Pacific Islanders, American Indians/Alaskan Natives, and Hispanics was made available starting in 1992.

The widest gap in cancer incidence rates occurred between 1993-1994[9] (black:white incidence = 1.14) and the smallest gap occurred in 1989 and 2001 (black:white incidence = 1.04).

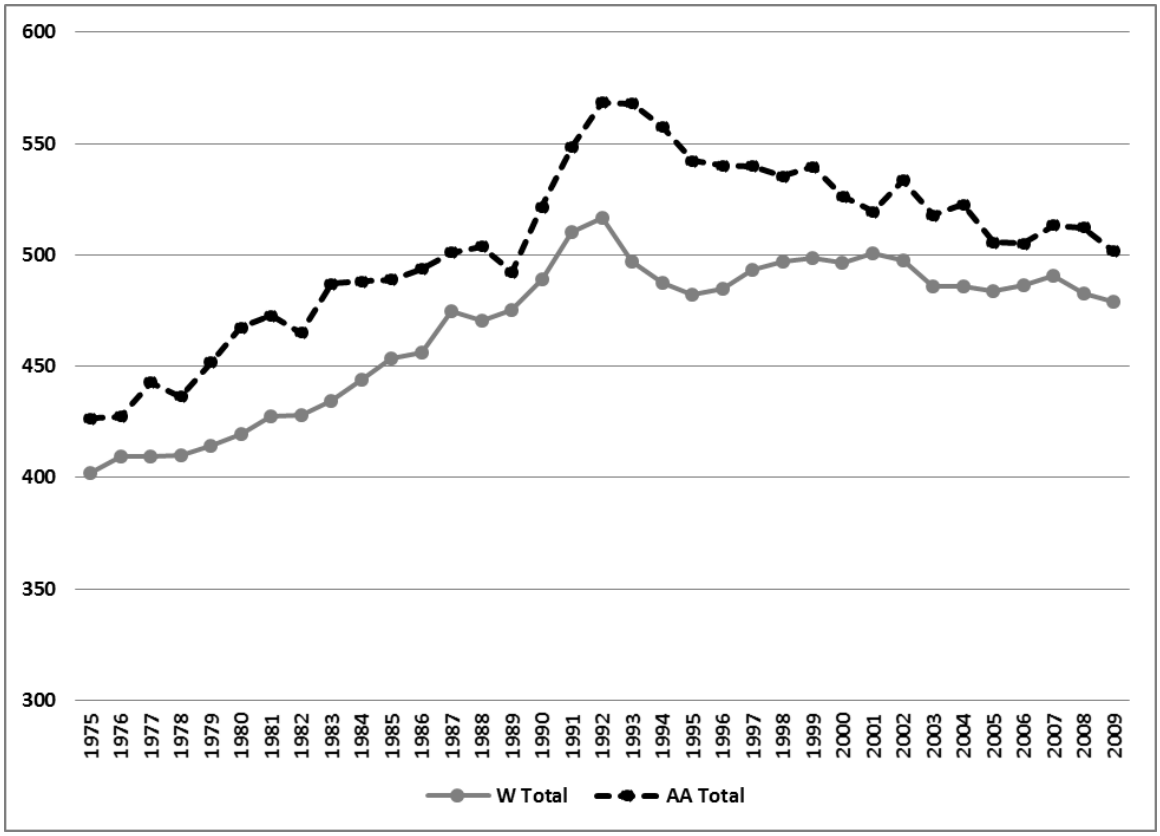

Figure 3. Age-Adjusted Cancer Incidence Rates (All Cancer Sites, All Sexes) By Race, 1975-2009[10]

[9] Black cancer incidence in 1993-1994 was 567.86 cases per 100,000 population and 557.61 cases per 100,000 population, respectively. White cancer incidence in 1993-1994 was 496.89 cases per 100,000 population and 487.33 cases per 100,000 population, respectively (National Cancer Institute 2013).

[10] Data obtained from National Cancer Institute (2013).

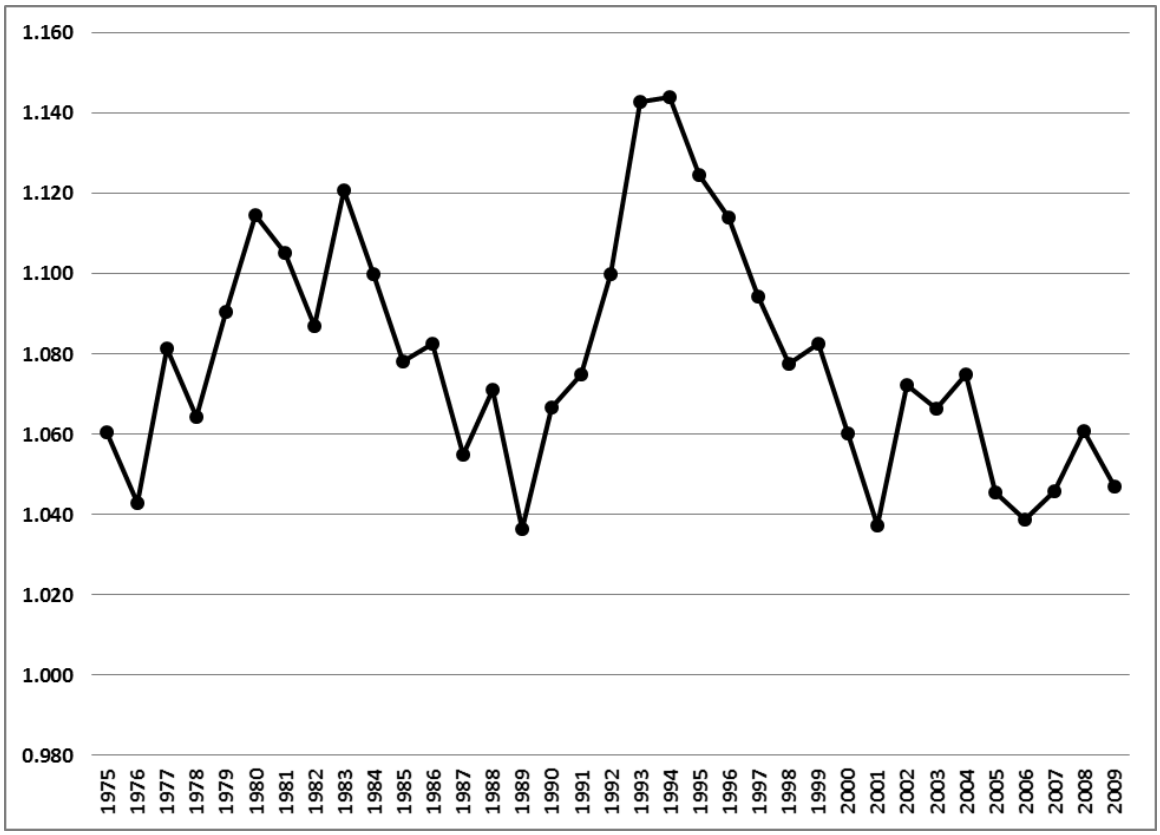

Figure 4. Racial Gap in Age-Adjusted Cancer Incidence Rates (All Sites, All Sexes), 1975-2009[11]

From 1975-2009, age-adjusted cancer mortality rates[12] decreased for both white and black populations (whites: 196.33 deaths per 100,000 population v. 173.03 deaths per 100,000 population; blacks: 235.5 deaths per 100,000 population v. 205.39 deaths per 100,000 population). Mortality rates for whites peaked in 1991 (210.62 deaths per 100,000 population) and for blacks in 1990 (279.3 deaths per 100,000 population). Since 1990-1991, declines in mortality rates for both racial groups have occurred (see Figure 5). Unlike the racial gap in cancer incidence rates, the racial gap in mortality rates follows a smooth curve, with the

[11] Data obtained from National Cancer Institute (2013).
[12] Age-adjusted mortality rates for all cancer sites, all sexes combined.

narrowest racial gap occurring in 2009[13] (black:white = 1.19) and the widest gap occurring in 1990[14] (black:white = 1.33). A downward trend in the racial gap has continued since 1990, with a temporary increase occurring in 2007[15] (see Figure 6).

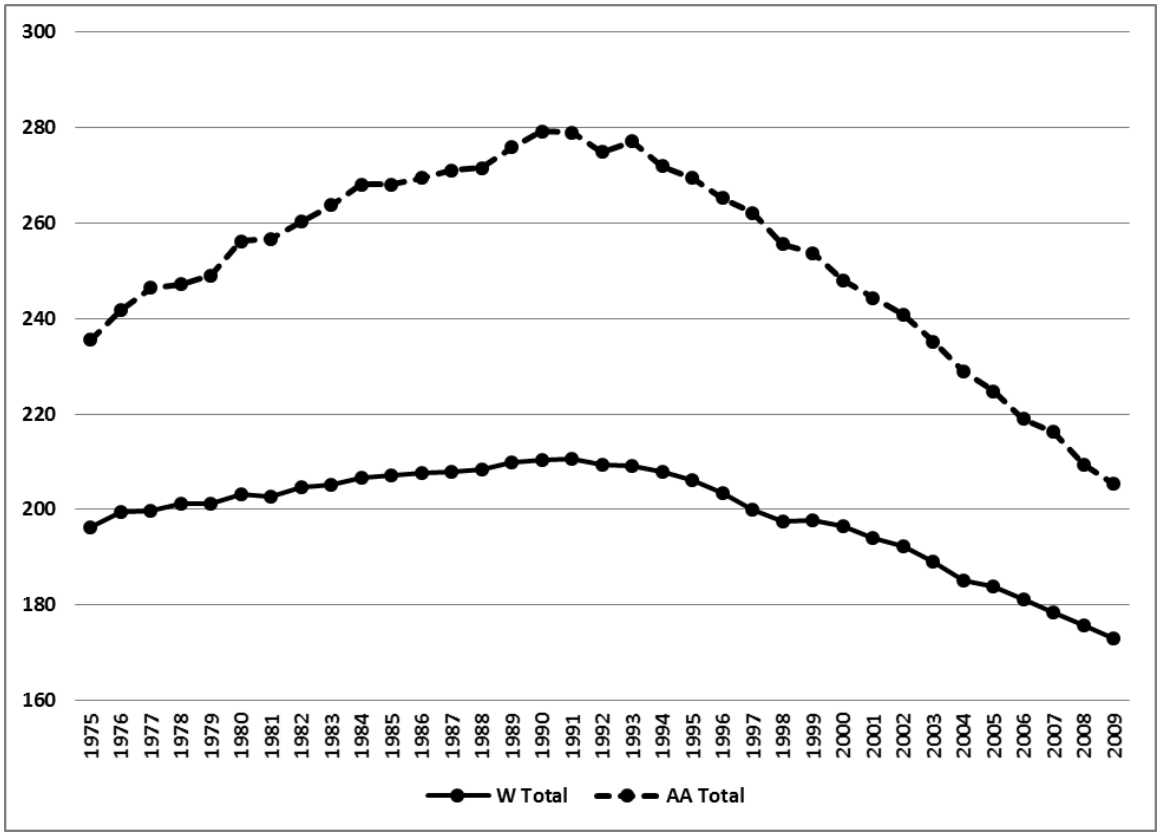

Figure 5. Age-Adjusted Cancer Mortality Rates (All Cancer Sites, All Sexes) By Race, 1975-2009[16]

[13] Black cancer mortality rate of 205.4 deaths per 100,000 population and white cancer mortality rate of 173.0 deaths per 100,000 population (gap = 1.19).
[14] Black cancer mortality rate of 279.3 deaths per 100,000 population and white cancer mortality rate of 210.4 deaths per 100,000 population (gap = 1.33)
[15] The racial gap in 2006 was 1.216 (218.8 deaths per 100,000 black population / 180.0 deaths per 100,000 white population). The racial gap in 2007 was 1.222 (216.3 deaths per 100,000 population / 177.1 deaths per 100,000 white population). (Data obtained from National Cancer Institute (2013)).
[16] Data obtained from National Cancer Institute (2013).

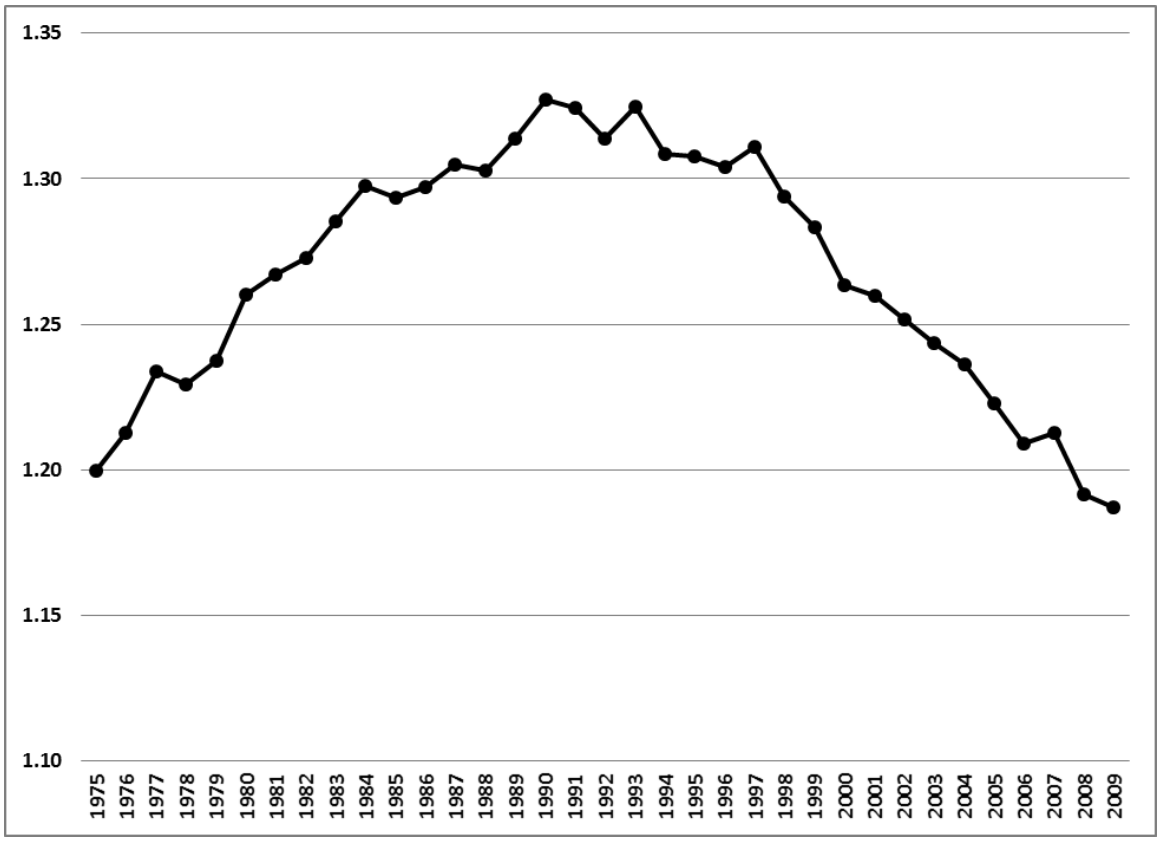

Figure 6. Racial Gap in Age-Adjusted Cancer Mortality Rates (All Sites, All Sexes), 1975-2009[17]

Although we have seen improvements in overall cancer mortality rates since 1975 and overall cancer incidence rates since 1992, the continued presence of racial disparities in both of these health outcomes is concerning. In order to develop effective interventions to reduce overall cancer incidence and mortality rates and to reduce racial disparities in these rates, a better understanding of the factors impacting these rates is needed.

[17] Data obtained from National Cancer Institute (2013).

1.2 EXPLANATIONS FOR RACIAL DISPARITIES

Several explanations for racial disparities in health outcomes have arisen and range from micro-level explanations (physiological) to macro-level (social/physical environment). The intersection of the micro- and macro-environments creates differential participation, differential exposure, and deprivation. Although the most commonly used explanations involve physiological differences between the races and differences in individual behavior, exposure, and deprivation, the impact of the social and physical environment cannot be ignored.

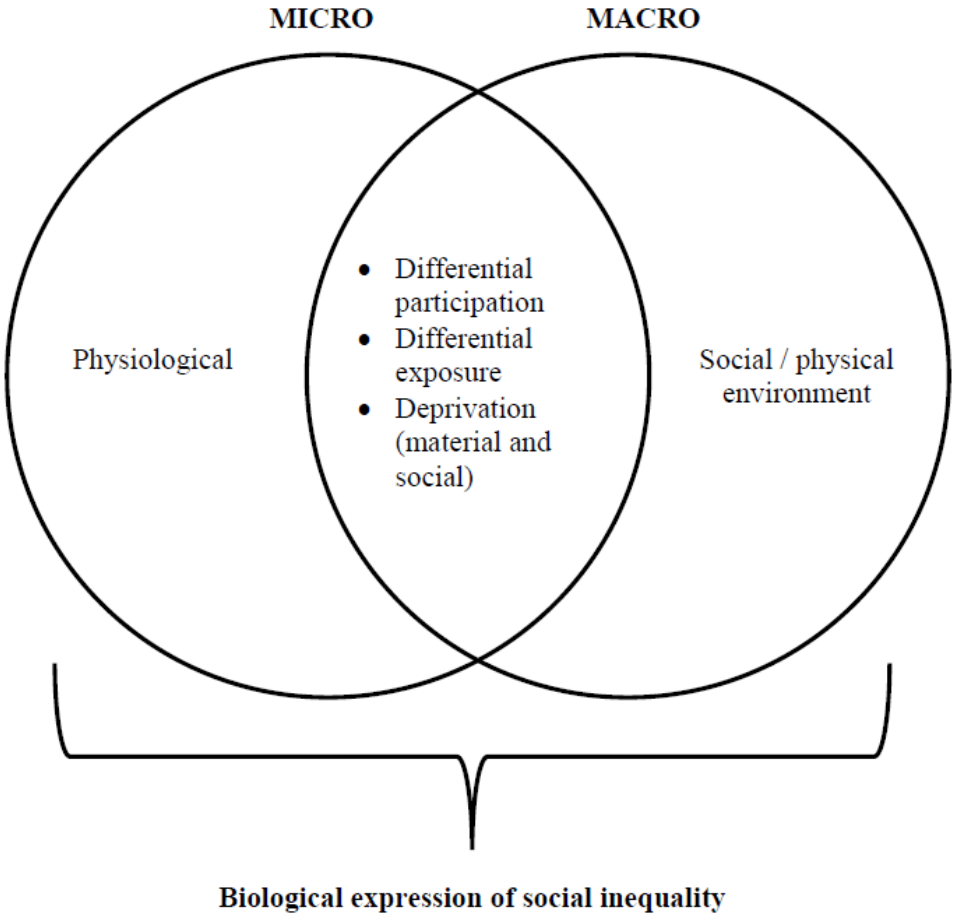

Figure 7. Micro and Macro Explanations of Racial Disparities in Health Outcomes

1.2.1 Physiological explanations

Early explanations of the existence of racial disparities in health status centered on genetic or other physiological differences between the races. Physicians, such as Josiah Nott, commonly reported on the "obvious" physiological differences between whites and blacks:

> "It is well settled by the anatomists and physiologists, that the brain of the Negro compared with the Caucasian, is smaller by a full tenth, that its nerves are larger, the head differently shaped, the facial angle less, and the intellectual powers comparatively defective" (Nott 1843:255).

This common thinking was used to warn against interracial relationships[18] and to justify enslavement of blacks as well as other discriminatory laws and practices—such as segregation (Lillie-Blanton and LaVeist 1996; Nott 1843).

Adler and Rehkopf (2008) evaluated the impact of "genetic vulnerability" on racial disparities in hypertension rates. They examined hypertension prevalence in European Americans (whites), African Americans (blacks), blacks in Caribbean countries, and blacks in Africa. They found that hypertension prevalence rates were highest in African Americans followed by blacks in Caribbean countries. Hypertension prevalence rates in blacks in Africa were similar to rates in whites in the United States. As a result, they concluded that "…higher rates of hypertension for blacks in the United States compared with other racial/ethnic groups are more likely to be due to social factors than to underlying biological vulnerability" (Adler and Rehkopf 2008:237). The lack of evidence to support physiological explanations of racial

[18] Nott (1843) warned that interracial relationships between "Anglo-Saxon" and "Negro" races would result in a "distinct species, and that the offspring of the two is a Hybrid" (Nott 1843:254). Nott referred to this "hybrid" species as "Mulatto" and warned that "the Mulattoes do not make good slaves, and are always leaders in insurrections" (Nott 1843:256).

disparities has been noted by other researchers as well (Bach et al. 2002; Krieger 1987; Lillie-Blanton and LaVeist 1996).

1.2.2 Social and physical environment

The relationship between the social and physical environment and health is dynamic (Link et al. 1998). According to Macintyre and Ellaway (2000), five features of the social and physical environment influence health: (1) physical features of the environment shared by all residents, such as air quality, water quality, and climate; (2) availability of a healthy home, work, and recreational environment, including housing quality and safe recreational spaces; (3) services provided to support individuals, such as education, street cleaning/sanitation, transportation, police/ambulance services, health care services, and welfare; (4) sociocultural features of a neighborhood, including norms and values, crime, networks/social support, and the history of the neighborhood (political, economic, religious, racial/ethnic); and (5) the reputation of the area. The reputation of an area can impact not only the self-esteem and morale of the citizens but can impact migration patterns and funding for infrastructure (transportation, education, etc.).

These characteristics of the social and physical environment have been extensively noted as having a key role in the creation and maintenance of disparities in health (Adler and Rehkopf 2008; Emmons 2000; Lillie-Blanton and LaVeist 1996; Link et al. 1998; Macintyre and Ellaway 2000; Tarlov 1996). The social and physical environment has provided structures of privilege and discrimination, and the historical processes have impacted the current state of education, housing, employment, and income (Lille-Blanton and LaVeist 1996). According to Lillie-Blanton and LaVeist (1996:85-86), the presence of racial disparities in health are not due to

"inherent" physiological differences between whites and blacks, but are due to "social inequities (e.g., differences in educational and economic opportunities related to racial barriers in society)."

The environment both directly and indirectly impacts health. Individuals are exposed to disease agents directly in their home, at work, or within the general community (mold and other allergens, lead paints and contaminated water, diesel exhaust, radiation, sunlight exposure, etc.). The environment can also indirectly impact health by influencing the quality of education, housing quality, community safety, health care access, transportation infrastructure, crime and other stressors, employment opportunities, and influencing individual behavior. Individual behaviors, such as utilizing preventive care or engaging in health-damaging behaviors (tobacco use, risky sexual practices, drug/alcohol use, lack of physical activity, poor nutrition, etc.) are impacted by the surrounding physical and social environment. As a result, "even health behaviors displayed by individuals cannot be understood without taking into account the characteristics of, and processes occurring at, the levels of both the immediate and broader environment" (Macintyre and Ellaway 2000:336).

1.2.3 Impact of social/physical environment on individual experience and behavior: differential participation, differential exposure, and deprivation

Differential participation in risky behaviors has also been used to explain racial disparities in several health outcomes, including cancer incidence/mortality, diabetes, and cardiovascular disease. Tobacco use, excessive consumption of alcohol, poor dietary habits, lack of physical activity, and lack of medical care have been linked to increased risk in each of these health outcomes. Utilizing the differential participation explanation, one would argue that racial disparities in health outcomes are due to blacks having higher rates of tobacco use, excessive

consumption of alcohol, poor dietary habits, decreased physical activity, and lack of utilization of medical care. However, according to 2006-2008 data from the Centers for Disease Control and Prevention's (CDC) Behavioral Risk Factor Surveillance System (BRFSS), consistent race-based patterns in these behaviors do not exist. Although both black males and females have higher rates of obesity than white males and females, white males have higher rates of binge drinking and both white males and females have higher rates of not having had a routine checkup in the past two years. In terms of smoking behavior, black males have higher rates than white males, but white females have higher rates than black females. Finally, in terms of cancer screening, black males have higher rates of not having colorectal cancer screening within the past two years but white females have higher rates of not having a mammogram within the past two years (see Table 1).

Table 1. Major Health Indicators by Race, 2006-2008[19]

	Male		Female	
Health Indicator	Black	White	Black	White
Obesity (%)	**31.0**	24.7	**38.7**	21.4
Current smoker (%)	**26.9**	25.2	18.6	**23.1**
Binge drinking in past 30 days (%)	17.8	**24.8**	--	--
No routine checkup in past 2 years (%)	15.1	**26.2**	8.1	**16.8**
No colorectal cancer screening in past 2 years (%)	**43.2**	40.6	--	--
No mammogram in past 2 years, ages 40-64 (%)	--	--	22.6	**24.0**

[19] Data was compiled from the Kaiser Family Foundation's "State Health Facts: Minority Health" which utilizes 2006-2008 data from the CDC's Behavioral Risk Factor Surveillance System (BRFSS) (Kaiser Family Foundation 2014). The CDC started the BRFSS program in 1984 to conduct monthly telephone surveys to determine prevalence of risk behaviors and preventive health practices. Monthly telephone surveys are conducted by local health departments and transferred to the CDC for aggregation and analysis. (Centers for Disease Control and Prevention 2013a)

Differential exposure to environmental stressors, peer group behaviors, and disease agents also have been used as an explanation of racial disparities in health status. Individuals living in racially and economically segregated environments are exposed to higher rates of crime, poorer air quality, and higher rates of poverty (Clark, Millet and Marshall 2014; LaVeist 1993; Massey, Gross, and Shibuya 1994; Massey, Gross, and Eggers 1991; Shihadeh and Flynn 1996). These exposures not only have a direct impact on mortality, but they can also lead to increased stress and adoption of health damaging behaviors.

Stress impacts our health both directly and indirectly (Straub 2012). The direct effect hypothesis argues that stress directly reduces our immune response by triggering the secretion of hormones, mainly cortisol, which impacts the functioning of white blood cells. The indirect effect hypothesis argues instead that stress can lead individuals to engage in coping behaviors which will negatively impact immune response—poor diet, substance abuse.

Through a process called observational learning (modeling), individuals can acquire a specific behavior by observing another individual engage in the behavior and through witnessing and processing the consequences for that behavior. Edwin Sutherland was the first to argue that the same socialization processes occur whether the witnessed behavior is socially acceptable or deviant (Schaefer 2012). Sutherland[20] introduced the concept of differential association to describe how being exposed to attitudes favorable to a specific behavior can lead to engaging in that behavior—conforming or deviant. However, witnessing a behavior does not automatically lead to an individual engaging in the behavior. Individuals may not engage in a witnessed behavior for several reasons, including: (1) they have not been presented with an opportunity to engage in the behavior; (2) they are fearful of a punishment associated with the behavior; (3)

[20] Sutherland introduced differential association in the text, *Principles of Criminology (11th Ed.)* by Edwin H. Sutherland, Donald R. Cressey, and David F. Luckenbill in 1992.

there is no direct reward associated with engaging in the behavior; (4) they want to avoid disapproval and work to maintain social order[21]; and (5) they have internalized a sense that the behavior is "wrong" and will not engage in the behavior even if there is a direct reward (DeLamater and Myers 2011).

A final explanation of the existence of racial disparities involves the influence of deprivation on health. According to Krieger (2001a), deprivation can be categorized as either material or social and can be defined and measured at both the individual and environmental level. Specifically, material deprivation refers to "dietary, clothing, housing, housing, home facilities, environment, location, and work (paid and unpaid)" (Krieger 2001a:695-696). Social deprivation refers to "rights in relation to employment, family activities, integration into the community, formal participation in social institutions, recreation, and education" (Krieger 2001a:695-696). Health status will be impacted if individuals cannot access nutritional foods, safe housing, adequate kitchen facilities and plumbing, quality education and stable, well-paying work.

Although examining health outcomes by examining differential participation, differential exposure to stress and "deviant" behaviors, and deprivation can provide a better understanding of how individuals react to these exposures and develop personal behavior patterns, a key question is being ignored—why do certain groups experience increased exposure to violence, poor air

[21] According to Kohlberg's (1969) Model of Moral Development, the majority of adults are categorized as having "conventional morality." Individual categorized as having "conventional morality" make judgments based on the social consequences of their actions—to please others or avoid disapproval, or to maintain social order and respect authority. Overall, this model includes three forms of morality: preconventional morality, conventional morality, and postconventional morality. Individuals begin at preconventional morality and should progress to a higher level of morality. Although there are three forms, most adults only progress to the second form—conventional morality. Individuals categorized as having "preconventional morality" make judgments based on external, physical consequences—avoiding punishment or obtaining a reward. Finally, individuals categorized as having "postconventional morality" make judgments based on universal moral and ethical principles—avoid violating the rights of others and adhering to one's principles.

quality, and poverty? Focusing only on individual-level behavior ignores important sociological processes (Acevedo-Garcia et al. 2008; Ford and Airhihenbuwa 2010; Link and Phelan 1995). Link and Phelan (1995:80-81) argue that this reductionist approach could be the result of the individualistic belief system of Western culture that "emphasizes both the ability of the individual to control his or her personal fate and the importance of doing so." Policy reform focused solely on behavior modification "serves equally well as the rallying cry for racism, individual blame, and reaction" (Geiger 1997:11). When individuals do not benefit from interventions offered, the individuals are then blamed for their poor health outcomes (Geiger 1997; Krieger 2001c). Too often poor health outcomes in minority populations are written-off as being caused by "character flaws" of that population (e.g., lack of personal responsibility, lack of family values, lack of trust) (Bonilla-Silva and Baiocchi 2007; Geronimus 2000; Graham et al. 2011). This victim-blaming is evident in an article by Willett, Colditz, and Mueller (1996) discussing ways in which an individual can reduce his or her chance of developing cancer by following "sensible guidelines" related to diet, physical activity, smoking cessation, alcohol reduction, sun exposure, risky sexual behavior, and exposure to known carcinogens. Once the guidelines have been listed, the authors continue to state, "Of course, not everyone will follow this advice, and many others will not heed it consistently" (Willett, Colditz, and Mueller 1996:95). The impact of the social and physical environment on behavior cannot be ignored—"even health behaviors displayed by individuals cannot be understood without taking into account the characteristics of, and processes occurring at, the levels of both the immediate and broader environment" (Macintyre and Ellaway 2000:336).

1.2.4 Biological expressions of social inequality

Focusing on reductionistic explanations of racial disparities in health outcomes ignores the influence of the larger social and physical environment on individual behavior and experience. Although the disease experience is a physiological process, the development and management of the disease is rooted in the social and physical environment. According to Krieger (2001a), a more accurate explanation for the existence of racial disparities in health outcomes is that disease is a "biological expression of social inequality." She specifically states, "biological expressions of social inequality refers to how people literally embody and biologically express experiences of economic and social inequality, from in utero to death, thereby producing social inequalities in health across a wide spectrum of outcomes" (Krieger 2001a:693). Instead of focusing on explaining the presence of disease and racial disparities at the individual level—due to some genetic anomaly common to a specific racial group or due to individual behaviors—we must examine the existence of health outcomes and disparities as being shaped and perpetuated by the larger social and physical environment.

The development of and potential mortality from cancer is a multi-stage process influenced by economic, social, and cultural factors (see Figure 8). Each stage provides an opportunity for the widening of racial disparities in cancer incidence and mortality. Cancer incidence involves stages related to prevention, early detection, and diagnosis. The American Cancer Society categorizes the "known causes of cancer" as genetic factors (inherited and acquired gene mutations), lifestyle factors (diet/physical activity, tobacco use, alcohol

consumption, etc.), infections[22], and environmental exposure to carcinogens[23] (American Cancer Society 2014c). According to Willett, Colditz, and Mueller (1996:95), "…anyone can reduce his or her chance of being afflicted with cancer by following some sensible guidelines: eat plenty of vegetables and fruits; exercise regularly and avoid weight gain; and avoid tobacco smoke, animal fats and red meats, excessive alcohol consumption, the midday sun, risky sexual practices and known carcinogens in the environment or workplace." Methods of early detection, such as mammography, fecal occult blood testing (FOBT) for colon cancer, and colonoscopy/endoscopy, can help identify the growth of abnormal cells and prevent the growth and spread of cancer. Technological advances in screening and diagnostic methods are also key factors.

[22] Infectious agents that have been associated with an increased risk of cancer include human papilloma viruses (HPV; cervical cancer, genital cancer in both males and females, mouth/throat cancer), *Helicobacter pylori* (stomach cancer), *Chlamydia trachomatis* (cervical cancer), Epstein-Barr Virus (EBV; nasopharyngeal cancer), hepatitis B/hepatitis C (HBV, HCV; liver cancer) and Human Immunodeficiency Virus (HIV; Kaposi sarcoma, cervical cancer, lymphoma) (American Cancer Society 2013a).

[23] Commonly referenced carcinogenic compounds at home, work, and/or within the community include: arsenic, asbestos, benzene, formaldehyde, lead, radon, radiation (natural cosmic background, medical equipment such as X-ray machines) and UV exposure. (American Cancer Society 2014b). Please see http://www.cancer.org/cancer/cancercauses/othercarcinogens/generalinformationaboutcarcinogens/known-and-probable-human-carcinogens for a full list of known and probable human carcinogens (American Cancer Society 2013b).

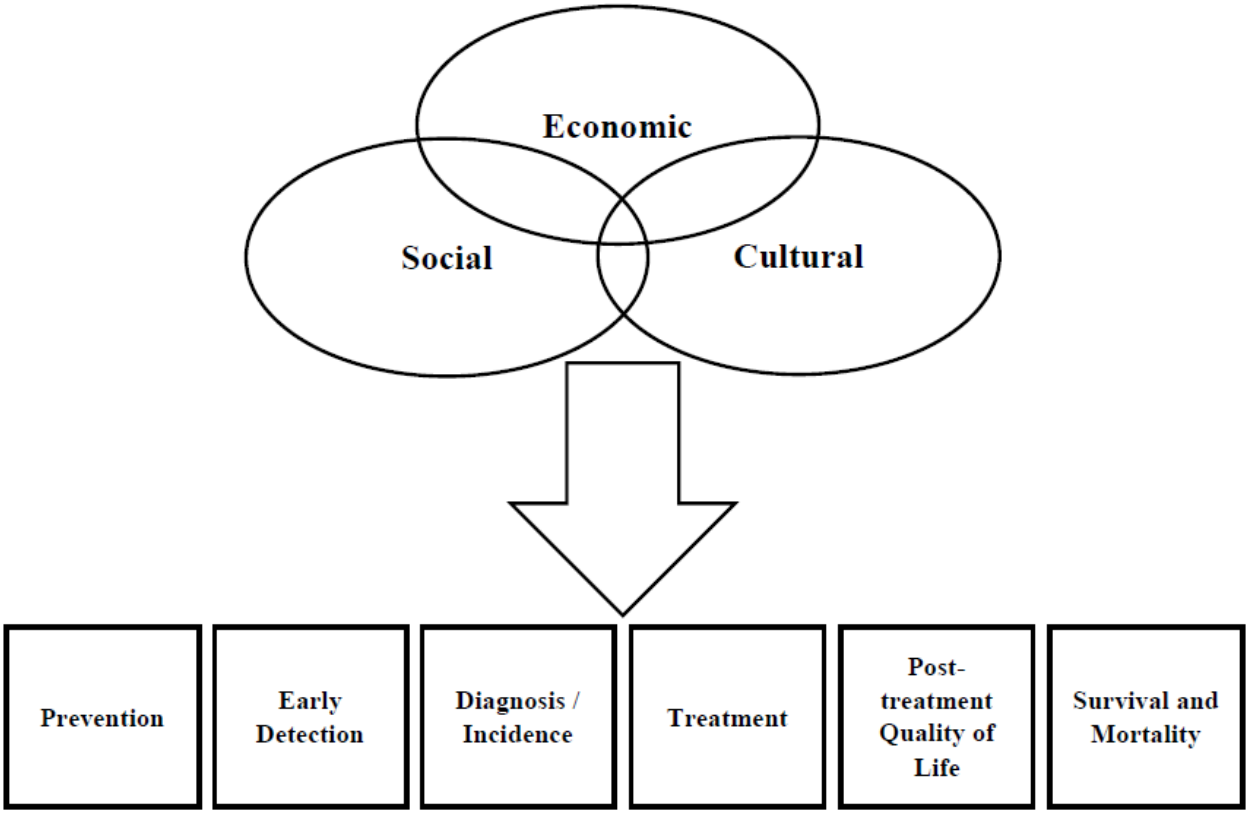

Figure 8. Factors that Influence Social Disparities (Ward et al. 2004)[24]

Cancer survival/mortality involves stages related to stage of cancer at diagnosis, quality of treatment, and post-treatment quality of life. Diagnosing cancers while still localized can improve treatment efficacy and quality of life, but is dependent upon the technology available to detect and diagnose cancer and access to these methods (by both the patient and provider). Structural barriers (access to health insurance, geographic location/transportation infrastructure), physician recommendation of treatment, and patient decision-making impact both access to and quality of treatment. Finally, access to and utilization of social support, follow-up care, and pain management can impact quality of life.

[24] Ward et al. (2004) adapted this model from Freeman's (1989) article, "Cancer in the socioeconomically disadvantaged" and the Institute of Medicine's (2003) report, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*.

Economic, social, and cultural factors impact disparities in cancer incidence and mortality at each of these stages. According to Ward et al. (2004:78-79):

> Socioeconomic factors influence cancer risk factors such as tobacco use, poor nutrition, physical inactivity, and obesity. Income, education, and health insurance coverage influence access to appropriate early detection, treatment, and palliative care. Poor and minority communities are selectively targeted by the marketing strategies of tobacco companies, may have limited access to fresh foods and health nutrition, and are provided with fewer opportunities for safe recreational physical activity. Social inequities, such as the legacy of racial discrimination in the United States, can still influence the interaction between patients and physicians, as noted in the IOM report.[25] Cultural factors also play a role in health behaviors, attitudes toward illness, and belief in modern medicine versus alternative forms of healing.

It is evident that many factors, not just individual-level factors, have a role in racial disparities in cancer outcomes. No single theory can fully explain the continued disparities seen between blacks and whites. Focusing solely on physiological factors or factors of the social and physical environment does not provide an accurate examination of the drivers of racial disparities in cancer outcomes. Although a more comprehensive approach should be advocated, it is important to not diminish the important role played by structural factors in relation to individual behaviors and access to resources.

[25] Institute of Medicine. 2003. *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*. Washington, DC: The National Academies Press.

2.0 THEORETICAL FRAMEWORK

This study utilizes a social epidemiological approach to examine the impact of racial residential segregation on cancer incidence and mortality. Merging social epidemiology's focus on identifying "upstream" risk factors of disease, human ecology's focus on spatial patterns of social phenomena and structural influences on behavior, and Critical Race Theory's emphasis on exploring institutional racism, drives this project's examination of the impact of the social and physical environment on health outcomes.

2.1 SOCIAL EPIDEMIOLOGY

Epidemiology is a field of study that works to identify factors that lead to the development of certain health outcomes and how these health outcomes are distributed within the population. Social epidemiology emerged to counter the focus of traditional epidemiology on proximate, or "downstream"[26] risk factors of disease (e.g., genetics, diet, cholesterol level, hypertension,

[26] The imagery of a "stream" has been utilized in order to critique the focus of health care research on individual-level factors (proximate or "downstream" factors). The most commonly cited description is provided by Irving Zola's address to the United Ostomy Association in 1970: "You know…sometimes it feels like this. There I am standing by the shore of a swiftly flowing river and I hear a cry of a drowning man. So I jump into the river, put my arms around him, pull him to shore and apply artificial respiration. Just when he begins to breathe, there is another cry for help. So I jump into the river, reach him, pull him to shore, apply artificial respiration, and then just as he begins to breathe, another cry for help. So back in the river again, reaching, pulling, applying, breathing and then another yell. Again and again, without end, goes the sequence. You know, I am so busy jumping in, pulling them to

exercise, etc.) (Link and Phelan 1995; McMichael 1999). Although social epidemiology shares the same overall goal of epidemiology—the identification of risk factors for major diseases—the focus is placed on identifying socio-environmental factors that impact disease (McLaren and Hawe 2005; Syme 2000).

Social epidemiologists utilize "webs of causation" to conceptualize which factors may impact a specific health outcome and how those factors relate to each other. The belief is that most disease patterns can be explained by a complex web of factors involving three traditional research targets—disease agents, characteristics of the human host, and characteristics of the environment.[27] These three main research targets span two "levels"—proximate ("downstream") and distal ("upstream") (Gehlert et al. 2008; Weiss and Lonnquist 2009).

Proximate-level factors include the disease agent and characteristics of the human host. These factors can include, but are not limited to: identification of disease agent, method of exposure to disease agent, sex/gender, race/ethnicity, religion, occupational status/income, education level, marital status, health status/comorbidities, health care utilization, and lifestyle factors (diet, physical activity, smoking status, drug/alcohol consumption, etc.). Distal-level factors include characteristics of the social and physical environment such as social support networks, peer group behaviors, poverty rates, unemployment rates/employment opportunities, quality of education, transportation infrastructure, access to health care services (both geographic and affordability), access to fresh fruits/vegetables (both geographic and affordability), and air

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shore, applying artificial respiration, that I have *no time to see who the hell is upstream pushing them all in*" (Zola 1970).

[27] Disease agents include biologic agents (insects, fungi, bacteria, viruses), nutrients (fats, carbohydrates), chemicals (gases, solid particles in the air), and physical agents (radiation, temperature). Characteristics of the human host include demographic factors (age, sex/gender, race/ethnicity, education level, income) and physical condition (diet, smoking status, drug/alcohol use, physical activity, comorbidities). Characteristics of the environment include physical conditions (weather factors, climate, geography), biological exposures (presence/absence of known disease agents) and characteristics of the social and economic environment (location of home, quality of housing, overall economic status of community, access to resources).

quality. Finally, fundamental-level factors are a special category of distal-level factor that influence exposure to multiple risk factors and provide access to important resources (Link and Phelan 1995; Weiss and Lonnquist 2009). Socioeconomic status and race/ethnicity have traditionally been identified as key fundamental factors. However, these factors are still conceptualized as being characteristics of the individual. Fundamental-level factors should be conceptualized at the macro-level and should include factors such as social inequality (based on income, gender, race/ethnicity, religion, sexual orientation, etc.), measures of residential segregation (based on income or race) and policies at the local, state, federal or even international level that impact several factors within the social and physical environment.

Determining disease etiology is difficult due to the multiple factors involved in the development of a specific disease and the inclusion of multiple levels of these factors—proximate, distal, and fundamental. For example, a visual representation of a "web of causation" for cardiovascular disease incidence provides an example of the complexity of identifying factors associated with a specific health outcome and how the factors relate to each other (see Figure 9). In addition, physiological variability in humans makes it difficult to determine how much of a specific behavior or substance is required to develop a specific disease and can also impact latency periods between exposure to the disease agent and the development of the disease (Weiss and Lonnquist 2009).

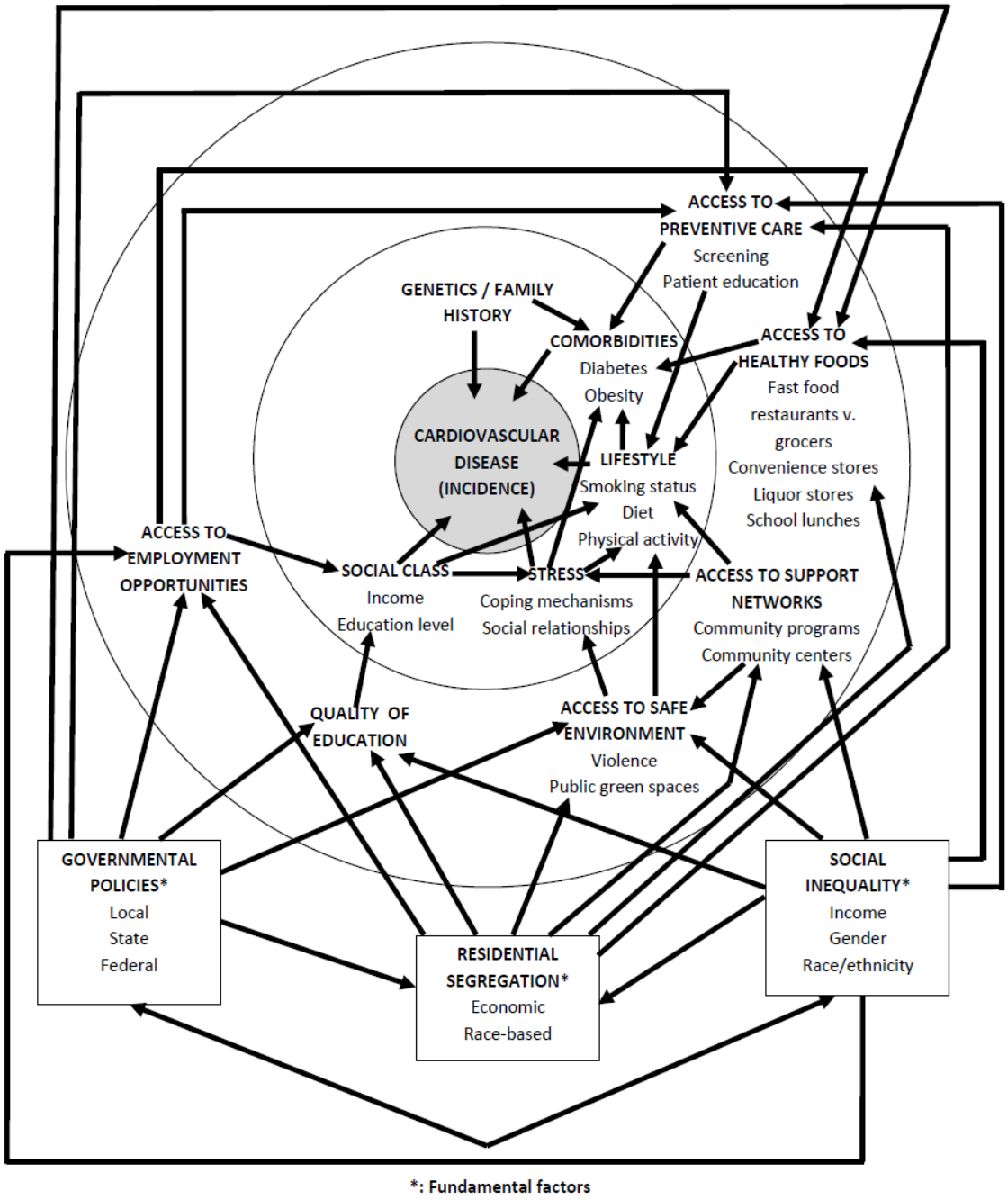

Figure 9. Cardiovascular Disease Incidence Web of Causation[28]

[28] This web of causation was developed for the Sociology of Health and Illness (SOC1450) course at the University of Pittsburgh and the Health Psychology (PSY243) course at Chatham University.

Many studies attempting to explain racial disparities in health outcomes have examined differences in the characteristics of individuals of particular racial groups (Berger 2001; Centers for Disease Control and Prevention 2002; DeClerque et al. 2004; Dranger, Remington and Peppard 2003; Finch 2003; Hummer 1993; Matthews, Curtin and MacDorman 2000; Mayer and Sarin 2005; Phipps et al. 2002; Sastry and Hussey 2003; Strait 2006; Turner 1995; Waidmann and Rajan 2000). However, focusing on individual-level risk factors ignores the influential role the physical and social environment plays in poor health (Bell et al. 2006; Dressler 1993; Susser and Susser 1996).

Krieger (2001c) details three frameworks utilized by social epidemiologists: (1) psychosocial theory; (2) social production of disease and/or political economy of health; and (3) ecosocial theory and related multi-level frameworks. A psychosocial framework focuses on stress-response and its impact on health. A social production of disease and/or political economy of health framework focuses on the upstream and downstream factors that impact health. This framework argues that "economic and political institutions and decisions that create, enforce, and perpetuate economic and social privilege and inequality are root—or 'fundamental'—causes of social inequalities in health" (Krieger 2001c:670). Finally, an ecosocial framework focuses on examining factors that impact disease at each and every level (i.e., cell, organ, organism, individual, family, community, population, society, ecosystem), creating a complex "bush of life intertwined at every scale, micro to macro" (Krieger 2001c:671).

Each of these three models focus on different levels of data collection and intervention. The psychosocial framework involves a solely proximate-level approach—focusing on characteristics of the individual and the impact on the individual's health status. Therefore, interventions are focused on modifying characteristics of the individual—methods of reducing

stress, for example. The social production of disease framework involves a solely distal-level approach—focusing on characteristics of the larger physical and social-structural environment, especially the economic environment, and their impact on health outcomes. Finally, the ecosocial framework approach involves the collection of data at multiple levels in order to capture the true complexity of the relationship between individual-level factors and community-level factors and health outcomes. However, as these models become more complex it becomes difficult to determine where to focus interventions.

Until recently, the predominant focus of epidemiological studies was on proximate-level factors. It is only with the emergence of social construction/production of illness and social ecological frameworks that epidemiological research, policy, and interventions have started to focus on the social conditions that are fundamental causes of health and disease. However, although the social epidemiological perspective emphasizes that factors outside of the individual are instrumental in the development of disease, many epidemiological studies are trying to portray a more socio-environmental approach, but are really just describing their individual level data within the context of a defined "community." Many studies are still ignoring characteristics of the larger social and physical environment which impact health outcomes.[29] According to Krieger (2001b), social epidemiology contributes a more comprehensive approach to examining disease causation and distribution than a more "traditional" epidemiological approach. According to Krieger (2001b:44), "explanations of phenomena that address HOW *and* WHY they occur are more complete than explanations addressing only HOW they occur."

[29] Several epidemiological studies attempt to develop community-level interventions by focusing on a smaller geographic area, but still do not challenge broader social factors—racism, economic inequality, quality and structure of the education system, and national policy—that impact disease. Examples include: Abrams et al. (1994); Davis et al. (1994); Fisher (1995); Glasgow et al. (1995); Glasgow et al. (1996); Heimendinger et al. (1995); Link, Northridge, and Ganz (1998); Power and Matthews (1997); Sloggett and Joshi (1994); Sorensen, Stoddard, and Ockene (1996); Voorhees et al. (1996); Wiist and Flack (1990).

2.2 HUMAN ECOLOGY

Human ecology emphasizes the interrelationship between humans and their physical and social environments. It emerged in the 1920s as a human-focused synthesis of geographic and ecological concepts[30]. The easily identifiable spatial patterning of both plant and human communities led to an early emphasis on studying spatial distributions and factors related to this patterning. Applying the concepts developed by plant ecologists allowed human ecologists to examine spatial distributions of humans and how resources were utilized and distributed between "dominants" and "subdominants" within a specified geographic area[31].

Human ecology became more pronounced in the 1940s-1960s and began to distinguish itself as a school of thought that transcended a purely spatial focus. Although spatial analysis was still an important component of the discipline, the focus was now placed on how humans "organize in order to maintain themselves in given environments" (Hawley 1986:3). As a result, researchers such as Thornthwaite[32] (1940), Hawley (1944; 1984; 1986), and Quinn (1950) worked to identify human ecology as a synthesis of the disciplines of geography, sociology, demography, anthropology, social psychology, economics, and other social sciences.

According to Hawley (1986), the most important contribution of human ecology is that it recognizes that human life is "an adaptive process consisting of an interaction of environment,

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[30] Barrows (1923) believed that geography was the science behind human ecology and that the future of geographical research would focus on human ecology. He emphasized that the "new" geographic research "will aim to make clear the relationship between natural environments and the distribution and activities of man" (Barrows 1923:3)

[31] As described by Hawley (1986:2), "The community, as the association of species is characterized, exhibits a clear temporal and spatial pattern that is expressive of a functional order. A dominant species controls the light, water, and social conditions in the area, and subdominants fit themselves into locations that enable them to utilize diurnal and seasonal variations in light while drawing upon, and assisting in the maintenance of, soil and water resources."

[32] Thornthwaite (1940:347) argued that human ecology was not only interested in geography but in "the development of human communities and the interrelations of these communities with the totality of the environment." Hawley (1944:404) echoed this sentiment when he stated, "…in the simplest terms, human ecology is the descriptive study of human populations to the conditions of their respective physical environments."

population, and organization" (3-4). Adaptation is a process of a collective population, not individuals and as a result, the level of analysis is at the macro-level—the population (Hawley 1944; Hawley 1984; Hawley 1986; Quinn 1950; Schnore 1961; Wirth 1945). The focus of ecological research should not be to explain why individuals engage in certain behaviors, but to explore what conditions of the social and physical environment are present to explain the experiences and behaviors of the population. As Wirth (1945:484) notes, "in human aggregations we find the life of the individuals regulated by conscious controls, by rules, norms, and laws, and by formal organizations and institutions." Within the field of social epidemiology, the human ecology framework is utilized to examine "the ways human behavior, in its cultural and socioeconomic contexts, interacts with environmental conditions to produce or prevent disease among susceptible people" (Meade and Emch 2010:26). Human ecology provides a framework to exploring not only the spatial distribution of populations and health outcomes but also emphasizes the role of the environment in structuring opportunities, behaviors, and outcomes of the populations living within the specific area.

In the 20th century, the focus of research and interventions shifted from the environment to individuals, and this trend has continued (Marmot 1998). This shift to focusing on the individual relegated the ecological approach to "a second-rate way to approach individual risks" (Marmot 1998:57). This emphasis on individual-level studies and interventions resulted in many researchers committing the ecological fallacy[33] due to a lack of individual-level data[34] and the assumption that conclusions about individuals are more important academically than conclusions

[33] When inferences about individuals are made from group-level data, researchers are said to have committed an ecological fallacy (Curtis and Jones 1998; Guthrie and Sheppard 2001; Prehn and West 1998; Selvin eg al. 1984)

[34] Many studies have used ecological data to study individuals because of a lack of individual-level data that was relevant to the research questions (Firebaugh 1978). Researchers assume that because aggregates tend to share similar characteristics (Hammond 1973; Sawicki 1973) any relationships they find using group-level data can be translated to individuals within the aggregate (Goodman 1953).

about groups[35] (Firebaugh 1973; Sawicki 1973; Thomas et al. 1999). However, according to Schwartz (1994), this emphasis on the ecological fallacy creates three additional fallacies:

(1) That individual-level models are more perfectly specified than ecological-level models;

(2) That ecological correlations are all substitutes for individual-level correlations; and

(3) That group level variables do not cause disease (Schwartz 1994:819)

As Thomas et al. (1999:1083) state, "the optimal application of ecologic studies has been hindered by a bias toward individualism, resulting in their being used often as an expedient means of studying risk factors among individuals." In addition, Marmot (1998) argues that if the environment is perceived to be a key factor, then the appropriate level of analysis should be the environment. Specifically, he states, "If the environment is important, the appropriate analysis should be at the environmental level. Thus, ecological analyses are not second-rate but are the most useful way to examine the effect of social environment on health" (Marmot 1998:57).

2.3 CRITICAL RACE THEORY (CRT)

Critical Race Theory (CRT) is a specialized form of critical theory that was developed in the 20th century by progressive legal scholars who were concerned with how the law and research results were being utilized and interpreted and the implications for minority communities. Critical theory focuses on examining the structures in our society (both seen and unseen) that continue to support the status quo (Hartmann and Bell 2010). CRT was developed to "explicitly account for

the influences of racism on both outcomes and research processes" (Ford and Airhihenbuwa 2010:S30).

According to Hartmann and Bell (2010), CRT has four key components: (1) race and racism are deeply embedded in our society; (2) our current arrangements (based on race) are inequitable and unjust; (3) racial disparities are developed through social relationships and should not be explained in a reductionist manner, replacing the true reason (racism) with a lesser factor (income); and (4) racial arrangements are maintained and reproduced by the current structures (both seen and unseen) that work to reproduce the status quo. As a result, researchers are asked to "challenge traditional theories used to explicate the experiences of people of color" and to "put forward transformative solutions to racial, sexual, and class subordination in social and institutional structures" (Graham et al. 2011:91). CRT argues that structural forces drive disparities in health outcomes and that the current approach of focusing on individual and interpersonal mechanisms "inadequately address[es] the complexity with which structural racism influences both health and the production of knowledge about populations, health, and health disparities" (Ford and Airhihenbuwa 2010:S30). CRT provides a framework, similar to social epidemiology, to examine "root" or "fundamental" causes of health disparities. In addition, it shifts the focus from individual-level interventions to the main structural mechanism that drives these disparities—racism.

2.4 RACIAL RESIDENTIAL SEGREGATION: THE TIE THAT BINDS

In ecological studies, spatial distributions are described in terms of concentration, deconcentration, centralization, decentralization, and segregation (Quinn 1950). The most widely

used of these methods is segregation. The ecological approach to segregation conceptualizes it as "a sifting, sorting, or selecting process by which people or institutions are formed into contrasting substantive sub-areas" (Quinn 1950:305). Massey and Denton (1988) worked to quantify residential segregation by identifying five dimensions of spatial variation: evenness, exposure, concentration, centralization, and clustering. Although Massey and Denton (1989) argue that in order to truly understand the severity of segregation faced by blacks in the United States researchers need to examine all five dimensions of spatial variation, evenness is the most commonly used to measure residential segregation (LaVeist 1993; Marshall and Jiobu 1975; South and Deane 1993). Evenness is defined as the "degree to which the percentage of minority members within residential areas equals the citywide minority percentage" (Massey and Denton 1989). The index of dissimilarity is used to quantify evenness[36]:

$$D = \sum_{i=1}^{n} \frac{t_i |p_i - P|}{2TP(1-P)'}$$

The possible values obtained from this index range from 0.0 to 1.0, with values closer to one representing higher segregation. The value of this index can be interpreted as the proportion of the population that would have to relocate in order to achieve an even distribution in the geographic unit of interest (Massey and Denton 1988; Massey and Denton 1989).

Researchers, including Douglas Massey (Massey and Denton 1988; Massey and Denton 1989; Massey and Denton 1993; Massey, Gross and Eggers 1991), have added a more sociological focus to segregation, exploring the historical, social, and structural foundation and function. Examining the geopolitics of race in the United States is important to understanding the

[36] t is the total population or areal unit, i, p_i is the minority proportion of areal unit i, T is the population size of the whole city (or geographic unit of interest) subdivided into n areal units, and P is the minority proportion of the whole city (or geographic unit of interest) subdivided into n areal units.

rationale behind racial residential segregation and why segregation persists as an issue in America today (Delaney 1998). As stated by LaVeist (1993:80), "segregation can be viewed primarily as an easily quantifiable summary measure of differences in the material living conditions of black and white Americans."

2.4.1 A brief history of racial residential segregation in the United States

Blacks are the most racially segregated group in the United States (Massey, White and Phua 1996). Data from the 2000 Census show a national index of dissimilarity of 0.66. This value indicates that 66 percent of blacks would have to relocate in order to eliminate segregation (Massey and Denton 1988).[37] Racial residential segregation in the United States is a product of racist attitudes, private behaviors, and institutional practices. Discrimination in employment and real estate has constrained the social mobility of blacks, resulting in the majority of blacks residing in the least desirable housing options—highly segregated, urban 'ghettos' (Frazier, Margai and Tettey-Fio 2013; Massey and Denton 1993; Williams and Collins 2001).

Prior to 1900, blacks and whites in both the north and south coexisted in common residential areas. In fact, segregation levels in the south were actually lower than the north due to the fact that prior to the Emancipation Proclamation southern urban slaves were intentionally dispersed amongst white residents in order to prevent the formation of a "cohesive African American society" (Massey and Denton 1993:24). Areas that were highly segregated were so primarily for economic reasons (due to employment discrimination) as opposed to discrimination in housing practice. (Massey and Denton 1993)

[37] A dissimilarity index value of 0.60 is considered to be an extremely high level of residential segregation (Massey and Denton 1989).

Post 1900, racial residential segregation increased as a result of the Industrial Revolution and racist real estate practices. The need for jobs in northern states led to a large migration of southern blacks to northern cities. Feeling as if their employment was threatened by minority groups that would work for lower wages, northern whites began to utilize violence and fear to garner support for anti-black policies. In addition, racist real estate practices worked to spatially restrict blacks to highly segregated areas. Although the southern states' paternalistic Jim Crow laws guaranteed subordination of blacks, from 1910 through 1916 several southern cities, including Baltimore (MD), Richmond (VA), Roanoke (VA), Winston-Salem (NC), Louisville (KY), St. Louis (MO), Oklahoma City (OK), New Orleans (LA) and Atlanta (GA), passed city ordinances that established separate white and black neighborhoods.[38] However, after the U.S. Supreme Court ruled these ordinances unconstitutional in 1917, southern states began to utilize the tactics used in northern states to maintain racial residential segregation—fear, violence[39], and racist housing policies. (Delaney 1998; Massey and Denton 1993)

As a result of increasing racial violence in the 1920s, landowners began to enter into restrictive covenants with other property owners to not permit a black person from owning, occupying, or leasing their property[40] (Delaney 1998; Farley and Frey 1994; Massey and Denton 1993). In the 1930s the federal government worked to preserve racially segregated neighborhoods through the creation of the Federal Housing Administration (FHA). Although middle- and low-class families were able to apply for an FHA mortgage, the FHA actually

[38] The ordinance of the city of Louisville states, "An ordinance to prevent conflict and ill-feeling between the white and colored races in the city of Louisville, and to preserve the public peace and promote the general welfare by making reasonable provisions requiring, as far as practicable, the use of separate blocks for residences, places of abode and places of assembly by white and colored people respectively" (quoted in Benson 1915:330).

[39] Firebombing was a common tactic used in cities such as Chicago during the early 1900s to keep blacks out of white neighborhoods. Between 1917 and 1921, 58 firebombings on the city's South Side were reported (Chicago Commission on Race Relations 1922).

[40] According to President Truman's Committee on Civil Rights (1947), by the 1940s an estimated 80 percent of the residential land in Chicago was covered by restrictive covenants.

encouraged local mortgage authorities to develop color-coded maps that would visually represent neighborhoods which were "credit-worthy." Neighborhoods that were determined to be at risk for "racial transition" were color-coded in red on the maps. This practice of "redlining" worked to restrict access to mortgages for both blacks and lower-class white citizens. (Farley and Frey 1994)

During World War II another wave of southern blacks relocated to northern cities. This migration in combination with the extensive suburbanization of the white population during the 1950s and 1960s resulted in the increasing physical boundaries of the urban black "ghetto." During this time, white realtors looking to make a quick profit began to practice "blockbusting." This process involved the white realtors purchasing properties from white residents near the black "ghettos" then turning around and renting the properties (at a high profit) to higher income black residents. Although black residents thought they were finally having an opportunity to escape the oppressive environment of the black "ghetto," in reality the realtors were beginning the process of *racial turnover* and *resegregation*. White residents became fearful of their new black neighbors and began to sell their properties to the white realtors, who would then turn around and rent to black residents, thus expanding the physical boundaries of the original black "ghetto." (Delaney 1998; Massey and Denton 1993)

In the 1960s, racial residential segregation was identified as one of the major causes of racial inequality in the United States. As a result of the 1960 race riots, the Kerner Commission in March 1968 stated that the United States was "moving toward two societies, one black, one white—separate and unequal" (United States National Advisory Commission on Civil Disorders 1988:1). This finding led to the passage of the Fair Housing Act in April 1968. The Fair Housing Act banned discrimination in the sale or rental of housing. As a result, the problem of housing

discrimination was "solved" and residential segregation was dropped from the national agenda. However, this Act never worked to protect blacks from discriminatory housing practices and the nation's largest black communities remained as segregated as ever. In fact, by the 1970s many blacks were forced to reside in public housing "projects" due to the razing of "slum" areas that were threatening white communities and businesses. These "projects" were highly segregated and characterized by extreme social isolation. (Delaney 1998; Frazier et al. 2003; Massey and Denton 1993)

2.4.2 Putting the pieces together

Although the Civil Rights Act of 1964 and the Fair Housing Act of 1968 were meant to decrease racial inequality in the United States, a high level[41] of racial residential segregation still persists. A history of employment and housing discrimination has constrained black American's social mobility, thereby restricting the majority of blacks to live in oppressive, segregated communities. As stated by Marshall and Jiobu (1975:449), "low-status groups tend to be spatially isolated from higher-status groups, partly because high-status persons avoid locating their residences in the same areas, and partly because low-status groups are less able to compete for the more attractive residential sites occupied by high-status groups."

Critical Race Theory (CRT) argues that racial inequalities are "maintained and reproduced within institutional structures and cultural ways of thinking that allow race and racism to be reproduced whether or not individuals see it" (Hartmann and Bell 2010: 265). Our current social structure may not be overtly prejudice or intentionally discriminate against blacks,

[41] Data from the 2000 Census show a national index of dissimilarity of 0.66. A dissimilarity index value of 0.60 is considered to be an extremely high level of residential segregation (Massey and Denton 1989).

but "racial inequality…is perpetuated in historical arrangements and institutions that continue to produce racial inequality" (Hartmann and Bell 2010:267). As Jones (2000) describes in her "Gardener's Tale,"[42] institutional racism is to blame for (1) the initial process of separating the two different types of seeds into the two different types of soil (fertile v. rocky); (2) continuing to maintain the structures that keep the soil separate (the flower boxes); and (3) the act of not addressing the differences between the soils over the years. The fact that we still have high rates of racial residential segregation in our now "colorblind"[43] society shows that institutional racism is still at play—creating unequal distribution and access to resources (employment opportunities, quality education, quality housing, information, social networks, food, etc.) and generally maintaining the status quo.

Yankauer[44] (1950) was the first researcher to link racial residential segregation to health. He found that both black and white infant mortality rates were highest in highly segregated black neighborhoods. Williams and Collins (2001:370) argue that "segregation is a fundamental cause of differences in health status between African Americans and whites because it shapes

[42] Jones' (2000) article, "Levels of Racism: A Theoretic Framework and a Gardener" uses the metaphor of a gardener to describe three levels of racism within our society: (1) institutional racism; (2) personally mediated racism; and (3) internalized racism. According to the metaphor, a gardener has two packets of seeds that are identical except for the color of the blossoms (red v. pink) and two flower boxes (one with newer, more fertile soil and a second with older, rocky soil). The gardener prefers red flowers, so they plant the red seeds in the box with the better soil. As a result, the red flowers grow to be taller and fuller when compared to the pink flowers. As the flowers start to seed, the cycle continues, with the red flowers continuing to be more fruitful than the pink flowers. Several years later, after observing many cycles, the gardener states, "I was right to prefer red over pink! Look how vibrant and beautiful the red flowers look, and look how pitiful and scrawny the pink ones are" (Jones 2000:1213).

[43] According to Hartmann and Bell (2010), claiming "color blindness" leaves no room for structural analyses (examining institutional racism) and actually leads to victim-blaming. Color blindness "rests on the assumption that race should not be important in contemporary society and that today, it is most important to move beyond color and deal with people as individuals, not groups" and that it becomes "difficult, if not impossible, for social actors to recognize persistent racial inequalities and injustices as anything other than the result of poor decisions and actions on the part of disadvantaged people themselves" (Hartmann and Bell 2010:268).

[44] The term "social epidemiology" first appeared in the title of Alfred Yankauer's 1950 article, "The relationship of fetal and infant mortality to residential segregation: an inquiry into social epidemiology" (Krieger 2001c).

socioeconomic conditions[45] for blacks not only at the individual and household levels but also at the neighborhood and community levels." Research has shown that residents of highly segregated areas are disadvantaged in terms of several health-related resources, including housing, exposure to environmental pollutants, educational attainment, employment opportunities, nutrition, access to medical services, access to public services (e.g., fire, police) and social mobility (Berry 1976; Bullard 1983; Collins and Williams 1999; Delaney 1998; Gee and Payne-Sturges 2004; Geronimus 2000; Law 1985; Massey and Denton 1993; Schneider and Logan 1982; Schulz et al. 2002; Smith 2009; Williams and Collins 2001). As Collins and Williams (1999:516) state, "this pattern of findings suggests that there may be some structural characteristics of highly segregated cities that have an adverse impact on all persons who reside there."

2.5 CONCEPTUAL MODEL

Schulz et al. (2002) developed a conceptual model to examine the impact of fundamental, intermediate, and proximate factors on health outcomes (see Figure 10). This model identifies macrosocial factors (e.g., historical conditions, economic structures, racism, etc.), economic inequalities, and race-based residential segregation as "fundamental" risk factors for disease.

[45] According to Jones (2000), the connection between race and socioeconomic status in our society is due to certain historical events; however, it continues because of current structural factors that continue these historical injustices. Jones (2000:1212) states, "…it is because of institutionalized racism that there is an association between socioeconomic status and race in this country."

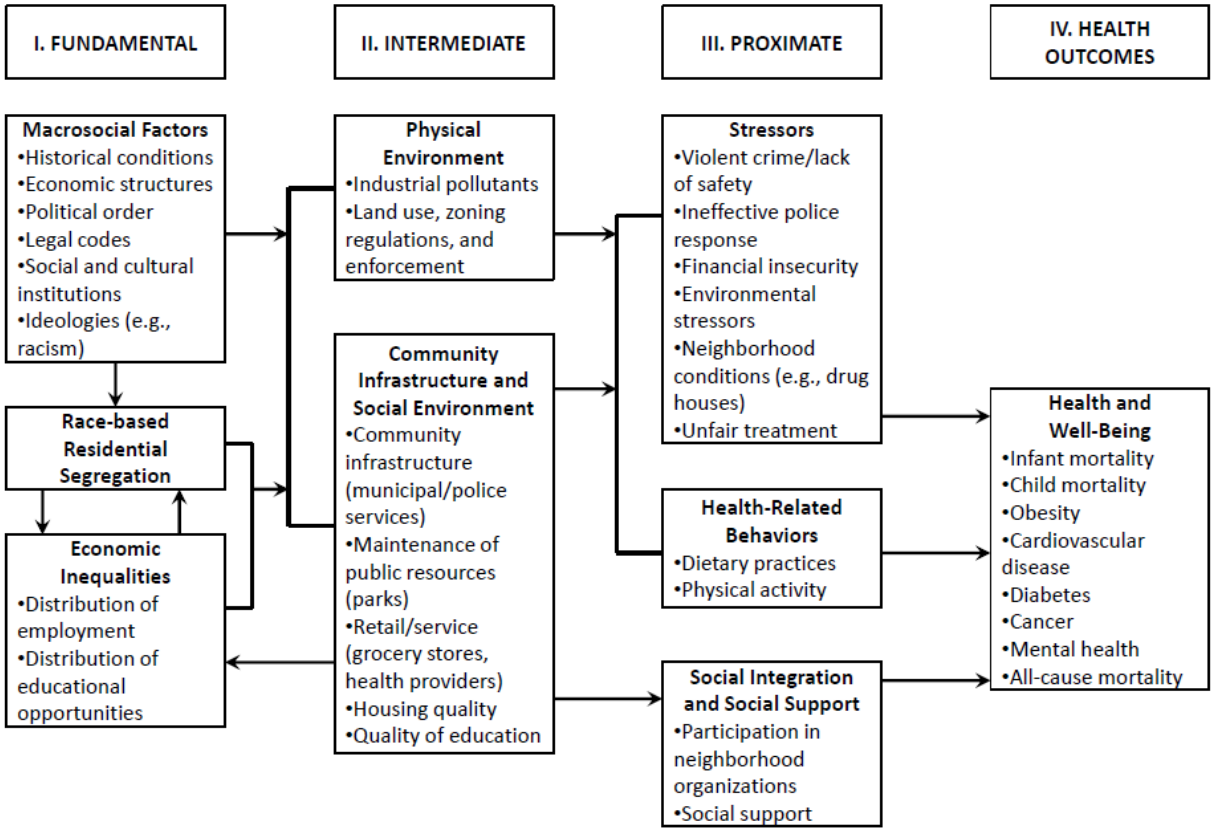

Figure 10. Conceptual Model (Schulz et al. 2002)

Schulz et al.'s (2002) conceptual model has been modified to reflect the goals of this current study and to reflect the importance of institutional racism in the creation of the "foundation" of racial disparities in health outcomes (see Figure 11). A new category, "Foundational," has been created to show the interplay between ideologies (e.g., racism, classism, power, etc.) and macrosocial factors (i.e., historical conditions, economic structures, political order, legal codes, and social and cultural institutions) and how this interrelationship led to the creation of racial residential segregation—the "Fundamental" cause of racial disparities in health outcomes. In addition, it is important to relocate "economic inequalities" from a "Fundamental" factor to an "Intermediate" factor due to the role race-based residential segregation has in the creation of

economic inequalities. Where a person lives either restricts or grants access to quality education, employment opportunities, and educational mobility.

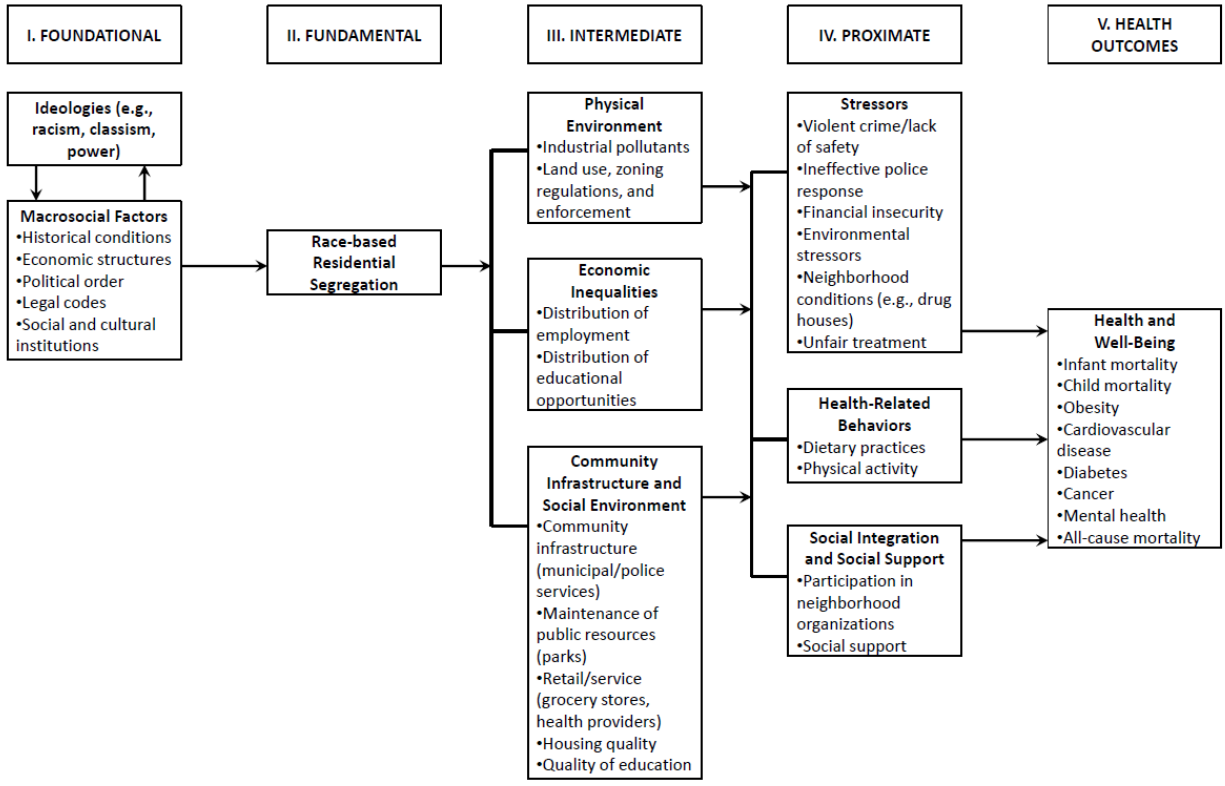

Figure 11. Conceptual Model

Racial residential segregation impacts health by limiting economic opportunities and educational quality, increasing exposure to "unfavorable neighborhood environments" (e.g., environmental hazards, grocery gap/food deserts[46]), and limiting access to health care (Acevedo-Garcia et al. 2008). Research has shown that residing in areas of high concentrations of poverty and economic underdevelopment lead to higher rates of infant mortality and low birth weight (LaVeist 1989; O'Campo et al. 1997; Roberts 1997) and to higher risks of all-cause mortality

[46] The terms "grocery gap" and "food desert" are used to identify areas with limited availability of healthy food outlets (Acevedo-Garcia et al. 2008).

(Anderson et al. 1997; Collins and Williams 1999; Geronimus, Bound, and Waidmann 1999; Geronimus et al. 1996).

This study's focus on examining the impact of racial residential segregation on cancer incidence and mortality will merge social epidemiology's focus on identifying "fundamental" risk factors of disease, human ecology's foci on spatial patterns of social phenomena and impact of structural factors on behavior, and CRT's emphasis on exploring institutional racism.

3.0 METHODOLOGY

This study utilizes a framework based in social epidemiology, human ecology, and Critical Race Theory (CRT) to perform secondary analysis of county-level data to examine the impact of racial residential segregation on racial disparities in cancer incidence/mortality and characteristics of the physical and social environment. This study aims to:

(a) Examine the impact of racial residential segregation on county-level racial disparities in cancer incidence and mortality in Northeastern and Southern U.S. counties.

(b) Examine the spatial distribution of the racial gap in cancer incidence/mortality, racial residential segregation, and characteristics of the physical and social environment in Northeastern and Southern U.S. counties.

(c) Examine the relationship between racial residential segregation and characteristics of the physical and social environment in Northeastern and Southern U.S. counties.

Ecological studies are concerned with community-level data, not individual-level data. In addition, CRT, emphasizing the role of institutional racism, argues that typical analyses focus on individual actions and beliefs and "often overlook the more complicated, insidious, and structural forces behind the production and perpetuation of racial differences and inequalities" (Hartmann and Bell 2010:264). Since ecological studies—based in the human ecological framework—are

interested in examining social structure and its effects on behavior or health outcomes, "the community is the smallest system context for the study of many social phenomena. It is the least reducible universe of system cause and effect relations" (Reiss 1954:52-53). In addition, ecological studies use the same unit and level of analysis in order to avoid the ecological fallacy or atomistic fallacy[47] (Schnore 1961; Selvin et al. 1984; Wakefield and Salway 2001). As a result, it is important that the geographic sub-area selected as the unit and level of analysis makes sense methodologically and also can contribute to meaningful social policy.

For both methodological and policy reasons, Northeastern and Southern counties were used as the unit and level of analysis. Methodologically, collecting data at the county-level and making inferences about northeastern and southern U.S. counties prevent against committing either the ecological or atomistic fallacy. In addition, counties are the geographic unit with the widest variety of publicly available data that can be utilized for this study. Measures of racial residential segregation have not been calculated at the state-level. In addition, utilizing a smaller geographic area—such as census tract or census block—would lead to additional issues with missing cancer incidence and mortality data[48]. In terms of policy, Foley (1977) argues that the county is a valid unit of analysis since counties tend to be used as the level of analysis for health

[47] While the ecological fallacy involves drawing conclusions about individuals from community-level aggregate data, the atomistic fallacy involves drawing conclusions about a group from individual-level data (Curtis and Jones 1998). Some studies have claimed to use an ecological framework, attempting to make inferences about a community or population, but have used data from a small number of individuals from a common geographic area. Although these studies are also making inferences about a group, they are creating models from individual-level data that only represents a small portion of the community (Wakefield and Salway 2001). Although the atomistic fallacy is largely ignored in the literature, it poses a significant methodological concern as it is making inferences about a group based on the data from individuals. In addition, although the researchers may not commit the atomistic fallacy when conducting the study, once the research is utilized to create or change social policy, the atomistic fallacy is committed. For example, research that has utilized individual-level data to identify specific individual-level risk factors for infant mortality (e.g., mother's smoking status, nutrition, utilization of prenatal care, education level, income, and race/ethnicity) has been used to enact policy toward "at-risk populations" (e.g., poor minorities).

[48] Data related to any form of health outcome, particularly mortality, are suppressed for specific geographic areas if there are so few cases (usually less than 3-5) that it may pose a risk for that specific individual to be identified. Utilizing county-level data resulted in 30.7% missing data for cancer incidence and 41.6% missing data for cancer mortality. The rate of missing data would have increased significantly if a smaller geographic unit was utilized.

planners. Counties are beginning to make more governmental influence. According to Menzel et al. (1992:173), "many scholars are attempting to ascertain the importance of all local governments, including counties, as service providers and actors in the American federal system…academic interest has been stirred by a growing realization that counties, although historically little more than 'arms of the state,' may become the local governments of the future."

Northeastern and southern U.S. counties were utilized for both substantive and methodological reasons. The historical significance of segregation in northeastern and southern U.S. counties will provide a context within which to examine and analyze the impact of the physical and social environment on health outcomes. Methodologically, northeastern and southern U.S. counties have higher proportions of black population which helps reduce the amount of missing cancer incidence/mortality data.

3.1 DATA SOURCES

Data was collected from nine publically-available sources, including: (a) State Cancer Profiles, National Cancer Institute (NCI) [2005-2009]; (b) United States Decennial Census [2000]; (c) United States Economic Census [2002]; (d) Small Area Health Insurance Estimates (SAHIE) Program, U.S. Census Bureau [2000]; (e) Common Core of Data (CCD), National Center for Education Statistics (NCES) [2001-2002]; (f) Area Health Resources Files (AHRF), Health Resources and Service Administration (HRSA) [2005]; (g) National-Scale Air Toxics Assessment (NATA), United States Environmental Protection Agency (EPA) [2002]; (h) Racial Segregation Measurement Project, Population Studies Center, University of Michigan [2000]; and (i) Mark L. Burkey, North Carolina Agricultural and Technical State University [2000].

The dependent variables for this study are the racial gap[49] in cancer incidence and racial gap in cancer mortality. Independent variables were selected to reflect the conceptual model (see Figure 11). Independent variables were selected to represent geographic controls (state, region, and division), measures of density/urbanization/segregation, housing characteristics, income/educational opportunities, transportation infrastructure, access to dietary resources, environmental characteristics, and access to healthcare resources.

3.1.1 State Cancer Profiles, National Cancer Institute (NCI), 2005-2009

The State Cancer Profiles provides standardized and age-adjusted cancer incidence, prevalence, and mortality data at the national, state, and county-level. Incidence and prevalence data is compiled from individual state-level public health surveillance systems. Mortality data is provided by the National Vital Statistics System (NVSS)[50]. All data sources have completed quality assurance procedures and are released publically once all data from a given time period are reviewed. This extensive review process usually results in data being released several years after the specified time period. For example, the most recent cancer data available through the State Cancer Profiles is from the 2006-2010 rate period. According to the National Cancer Institute (NCI), the goal of providing this data is to "motivate action, integrate surveillance into cancer control planning, characterize areas and demographic groups, and expose health

[49] These gaps are calculated by creating a ratio of the rate in the black population compared to the rate in the white population. For example, a cancer incidence gap value for Allegheny County, Pennsylvania would be calculated by dividing the black cancer incidence rate (559.0) by the white cancer incidence rate (507.0), resulting in a gap of 1.10. This gap means that black cancer incidence rates are 10% higher that white cancer incidence rates in Allegheny County.

[50] The National Vital Statistics System (NVSS) provides data compiled from agencies and jurisdictions that are responsible for maintaining records of "vital events"—births, deaths, marriages, and divorces (Centers for Disease Control and Prevention 2014).

disparities" (National Cancer Institute N.d.a). Table 2 provides a list of data points provided by this source.

Table 2. Data Points Provided by State Cancer Profiles, NCI, 2005-2009

Variable Name (SPSS)	Variable Description
canincw	White cancer incidence rate, age-adjusted, all cancer sites, both sexes combined
canincb	Black cancer incidence rate, age-adjusted, all cancer sites, both sexes combined
canmortw	White cancer mortality rate, age-adjusted, all cancer sites, both sexes combined
canmortb	Black cancer mortality rate, age-adjusted, all cancer sites, both sexes combined

3.1.2 United States Decennial Census, 2000

The United States Census Bureau collects data on the national population every 10 years as mandated by the U.S. Constitution Article I, Section 2 (United States Census Bureau N.d.c). In 2000, the Census Bureau utilized two questionnaires to collect data about the population and households—a "short form" (D-1) and a "long form" (D-2). The "short form" was administered to 5/6 of the population and the "long form" was administered to 1/6 of the population—through mailings and visits by Census enumerators. The "short form" consisted of 7 questions—6 population-based questions and 1 housing question[51]. The "long form" consisted of 32 population-based questions and 21 housing questions[52]. Approximately 83 million "short forms"

[51] The "short form" (D-1) consisted of 7 questions: household relationship, sex, age, Hispanic/Latino origin, race, tenure (home owned or rented), vacancy characteristics (United States Census Bureau 2001).

[52] The "long form" (D-2) consisted of the 7 questions from the "short form" (D-2) in addition to questions about marital status, place of birth/citizenship/year of entry, school enrollment/educational attainment, ancestry, migration (residence in 1995), language spoken at home/ability to speak English, Veteran status, disability status, grandparents as caregivers, labor force status, place of work/commuting details, occupation/industry/class of worker, work status

and 15 million "long forms" were mailed. Overall, data were collected for 281,421,906 individuals and 115,904,641 housing units. (United States Census Bureau 2009)

This data source provides information relating to geographic controls (state, census region, census division), population density, urban population, housing characteristics, income/education characteristics, and transportation infrastructure were collected for each county. Table 3 provides a list of specific data points provided by this source.

Table 3. Data Points Provided by US Decennial Census, 2000

Variable Name (SPSS)	Variable Description
stcode	State code (FIPS format)
regcode	Region code
divcode	Division code
popden	Population density, total population per mile^2
hden	Housing density, housing units per mile^2
vacant	Vacant housing units, % of total housing units
poptot	Total population (raw)
popw	White population (raw)
popb	Black population (raw)
popurb	Population living in urban area (raw)
occownw	White-owned occupied housing units (raw)
occownb	Black-owned occupied housing units (raw)
occrentw	White-renter occupied housing units (raw)
occrentb	Black-renter occupied housing units (raw)
telw	White-occupied housing units without telephone service (raw)
telb	Black-occupied housing units without telephone service (raw)
plumbw	White-occupied housing units lacking complete plumbing facilities [hot/cold piped water, flushing toilet, bathtub/shower] (raw)
plumbb	Black-occupied housing units lacking complete plumbing facilities [hot/cold piped water, flushing toilet, bathtub/shower] (raw)
kitw	White-occupied housing units lacking complete kitchen facilities [cooking facilities, refrigerator, sink with piped water] (raw)
kitb	Black-occupied housing units lacking complete kitchen facilities [cooking facilities, refrigerator, sink with piped water] (raw)
rentw	White median gross rent as a % of household income in 1999

in 1999, income in 1999, value of home/monthly rent paid, units in housing structure, year housing structure built, number of rooms/number of bedrooms, year moved into residence, plumbing/kitchen facilities, telephone service, vehicles available, heating fuel, farm residence, utilities/mortgage/taxes/insurance/fuel costs (United States Census Bureau 2001).

rentb	Black median gross rent as a % of household income in 1999
valuew	Median value of all white-owner occupied housing units, $
valueb	Median value of all black-owner occupied housing units, $
costw	Median owner costs of all white-owner occupied housing units as a % of household income in 1999
costb	Median owner costs of all black-owner occupied housing units as a % of household income in 1999
unemplw	White unemployment rate, % of civilian labor force aged 16+
unemplb	Black unemployment rate, % of civilian labor force aged 16+
incomew	Median household income in 1999, white householders, $
incomeb	Median household income in 1999, black householders, $
percapw	Per capita income based on 1999 income, white population, $
percapb	Per capita income based on 1999 income, black population, $
povpopw	White population for which poverty status is determined (raw)
povw	White population below poverty level (raw)
povpopb	Black population for which poverty status is determine (raw)
povb	Black population below poverty level (raw)
wm9	White male population aged 25+ with less than a 9^{th} grade education (raw)
wm12	White male population aged 25+ with 9-12^{th} grade education (raw)
wmhs	White male population aged 25+ with high school diploma or equivalent (raw)
wmcoll	White male population aged 25+ who have completed some college (raw)
wmass	White male population aged 25+ with Associate's degree (raw)
wmbach	White male population aged 25+ with Bachelor's degree (raw)
wmgrad	White male population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree (raw)
wmed	White male population aged 25+ (raw)
wf9	White female population aged 25+ with less than a 9^{th} grade education (raw)
wf12	White female population aged 25+ with 9-12^{th} grade education (raw)
wfhs	White female population aged 25+ with high school diploma or equivalent (raw)
wfcoll	White female population aged 25+ who have completed some college (raw)
wfass	White female population aged 25+ with Associate's degree (raw)
wfbach	White female population aged 25+ with Bachelor's degree (raw)
wfgrad	White female population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree (raw)
wfed	White female population aged 25+ (raw)
bm9	Black male population aged 25+ with less than a 9^{th} grade education (raw)
bm12	Black male population aged 25+ with 9-12^{th} grade education (raw)
bmhs	Black male population aged 25+ with high school diploma or equivalent (raw)
bmcoll	Black male population aged 25+ who have completed some college (raw)

bmass	Black male population aged 25+ with Associate's degree (raw)
bmbach	Black male population aged 25+ with Bachelor's degree (raw)
bmgrad	Black male population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree (raw)
bmed	Black male population aged 25+ (raw)
bf9	Black female population aged 25+ with less than a 9^{th} grade education (raw)
bf12	Black female population aged 25+ with 9-12^{th} grade education (raw)
bfhs	Black female population aged 25+ with high school diploma or equivalent (raw)
bfcoll	Black female population aged 25+ who have completed some college (raw)
bfass	Black female population aged 25+ with Associate's degree (raw)
bfbach	Black female population aged 25+ with Bachelor's degree (raw)
bfgrad	Black female population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree (raw)
bfed	Black female population aged 25+ (raw)
carw	White workers aged 16+ traveling by car to work (raw)
pubtransw	White workers aged 16+ traveling by public transit to work (raw)
motorw	White workers aged 16+ traveling by motorcycle to work (raw)
bikew	White workers aged 16+ traveling by bicycle to work (raw)
walkw	White workers aged 16+ walking to work (raw)
homew	White workers aged 16+ working from home (raw)
transw	White workers aged 16+ (raw)
carb	Black workers aged 16+ traveling by car to work (raw)
pubtransb	Black workers aged 16+ traveling by public transit to work (raw)
motorb	Black workers aged 16+ traveling by motorcycle to work (raw)
bikeb	Black workers aged 16+ traveling by bicycle to work (raw)
walkb	Black workers aged 16+ walking to work (raw)
homeb	Black workers aged 16+ working from home (raw)
transb	Black workers aged 16+ (raw)
vehiclew	White-occupied housing units without a vehicle (raw)
vehicleb	Black-occupied housing units without a vehicle (raw)

3.1.3 United States Economic Census, 2002

The United States Census Bureau collects data about the national economic sector every 5 years. Aggregated data is reported for the number of establishments[53], number of employees, payroll, and measures of output (sales, receipts, revenue, value of shipments, or value of construction done) for specific geographic areas (national, state, county, metropolitan/micropolitan areas, ZIP codes). The most detailed data exists for the state level. Data for smaller geographic areas may be suppressed to protect confidentiality of establishments. (United States Census Bureau 2005; United States Census Bureau N.d.b)

Data collection forms are sent to large- and medium-sized businesses and businesses known to have more than one establishment. A small number of smaller businesses are sent forms to complete; however for the majority of smaller businesses, data from existing administrative records from federal agencies are used. Participation in the economic census is mandated by law under Title 13 of the United States Code (sections 131, 191, and 224). Penalties can be assessed to establishments who do not comply, however, some establishments still do not participate. For basic inquiries, the Bureau will attempt to utilize existing administrative records from other federal agencies. For industry-specific inquiries, data will be reported only from establishments completing a report. (United States Census Bureau 2005; United States Census Bureau N.d.b)

This data source provides the raw number of establishments operating in 2002 related to dietary resources (food/beverage stores and food service/beverage establishments),

[53] The U.S Census Bureau defines an establishment as "a single physical location where business is conducted or where services or industrial operations are performed." A company "is comprised of all the establishments that operate under the ownership or control of a single organization" (United States Census Bureau N.d.a)

environmental characteristics (waste management, petroleum/coal manufacturing, and chemical manufacturing), and access to health care resources (pharmacies, ambulatory health care services, and hospitals) were collected for each county. Table 4 provides a list of specific data points provided by this source.

Table 4. Data Points Provided by US Economic Census, 2002

Variable Name (SPSS)	Variable Description
food	Food and beverage stores (raw) Definition: "Industries in the Food and Beverage Stores subsector usually retail food and beverages from fixed point-of-sale locations. Establishments in this subsector have special equipment (e.g., freezers, refrigerated display cases, refrigerators) for displaying food and beverage goods. They have staff trained in the processing of food products to guarantee the proper storage and sanitary conditions required by regulatory authority"
grocery	Grocery stores (raw) Definition: "This industry group comprises establishments primarily engaged in retailing a general line of food products"
specialty	Specialty food stores (raw) Definition: "This industry group comprises establishments primarily engaged in retailing specialized lines of food"
supermarket	Supermarket and other grocery stores (raw) Definition: "This industry comprises establishments generally known as supermarkets and grocery stores primarily engaged in retailing a general line of food, such as canned and frozen foods; fresh fruits and vegetables; and fresh and prepared meats, fish, and poultry. Included in this industry are delicatessen-type establishments primarily engaged in retailing a general line of food"
conven	Convenience stores (raw) Definition: "This industry comprises establishments known as convenience stores or food marts (except those with fuel pumps) primarily engaged in retailing a limited line of goods that generally includes milk, bread, soda, and snacks"
liquor	Beer, wine, and liquor stores (raw) Definition: "This industry comprises establishments primarily engaged in retailing packaged alcoholic beverages, such as ale, beer, wine, and liquor"
gas	Gas stations with convenience stores (raw) Definition: "This industry comprises establishments engaged in retailing automotive fuels (e.g., diesel fuel, gasohol, gasoline) in combination with convenience store or food mart items. These establishments can either be in a convenience store (i.e., food mart) setting or a gasoline station setting. These

	establishments may also provide automotive repair services"
foodsvc	Food service and drinking places (raw) Definition: "Industries in Food Services and Drinking Places subsector prepare meals, snacks, and beverages to customer order for immediate on-premises and off-premises consumption. There is a wide range of establishments in these industries. Some provide food and drink only; while others provide various combinations of seating space, waiter/waitress services and incidental amenities, such as limited entertainment. The industries in the subsector are grouped based on the type and level of services provided. The industry groups are full-service restaurants; limited-service eating places; special food services, such as food service contractors, caterers, and mobile food services; and drinking places"
restfull	Full-service restaurants (raw) Definition: "This industry group comprises establishments primarily engaged in providing food services to patron who order and are served while seated (i.e., waiter/waitress service) and pay after eating. Establishments that provide this type of food service to patrons with any combination of other services, such as take-out services, are classified in this industry"
restlimit	Limited-service eating places (e.g., fast food) (raw) Definition: "This industry group comprises establishments primarily engaged in providing food services where patrons generally order or select items and pay before eating. Most establishments do not have waiter/waitress service, but some provide limited service, such as cooking to order (i.e., per special request), bringing food to seated customers, or providing off-site delivery"
ambu	Ambulatory health care services (raw) Definition: "Industries in the Ambulatory Care Services subsector provide health care services directly or indirectly to ambulatory patients and do not usually provide inpatient services. Health practitioners in this subsector provide outpatient services, with the facilities and equipment not usually being the most significant part of the production process"
ambuer	Freestanding ambulatory surgical and emergency centers (raw) Definition: "This industry comprises establishments with physicians and other medical staff primarily engaged in (1) providing surgical services (e.g., orthoscopic and cataract surgery) on an outpatient basis or (2) providing emergency care services (e.g., setting broken bones, treating lacerations, or tending to patients suffering injuries as a result of accidents, trauma, or medical conditions necessitating immediate medical care) on an outpatient basis. Outpatient surgical establishments have specialized facilities, such as operating and recovery rooms, and specialized equipment, such as anesthetic or X-ray equipment"
phys	Physician offices (raw) Definition: "This industry comprises establishments of health practitioners having the degree of M.D. (Doctor of medicine) or D.O. (Doctor of osteopathy) primarily engaged in independent practice of general or specialized medicine (except psychiatry or psychoanalysis) or surgery. These practitioners operate private or group practices in their own offices (e.g.,

	centers, clinics) or in the facilities of others, such as hospitals or HMO medical centers"
physment	Mental health specialist physician offices (raw) Definition: "This industry comprises establishments of health practitioners having the degree of M.D. (Doctor of medicine) or D.O. (Doctor of osteopathy) primarily engaged in the independent practice of psychiatry or psychoanalysis. These practitioners operate private or group practices in their own offices (e.g., centers, clinics) or in the facilities of others, such as hospitals or HMO medical centers"
famplan	Family planning centers (raw) Definition: "This industry comprises establishments with medical staff primarily engaged in providing a range of family planning services on an outpatient basis, such as contraceptive services, genetic and prenatal counseling, voluntary sterilization, and therapeutic and medically indicated termination of pregnancy"
subabuse	Outpatient mental health and substance abuse centers (raw) Definition: "This industry comprises establishments with medical staff primarily engaged in providing outpatient services related to the diagnosis and treatment of mental health disorders and alcohol and other substance abuse. These establishments generally treat patients who do not require inpatient treatment. They may provide a counseling staff and information regarding a wide range of mental health and substance abuse issues and/or refer patients to more extensive treatment programs, if necessary"
hospital	Hospitals (raw) Definition: "Industries in the Hospitals subsector provide medical, diagnostic, and treatment services that include physician, nursing, and other health services to inpatients and the specialized accommodation services required by inpatients. Hospitals may also provide outpatient services as a secondary activity. Establishments in the Hospitals subsector provide inpatient health services, many of which can only be provided using the specialized facilities and equipment that form a significant and integral part of the production process"
hospgen	General medical and surgical hospitals (raw) Definition: "This industry comprises establishments known and licensed as general medical and surgical hospitals primarily engaged in providing diagnostic and medical treatment (both surgical and nonsurgical) to inpatients with a wide variety of medical conditions. These establishments maintain inpatient beds and provide patients with food services that meet their nutritional requirements. These hospitals have an organized staff of physicians and other medical staff to provide patient care services. These establishments usually provide other services, such as outpatient services, anatomical pathology services, diagnostic X-ray services, clinical laboratory services, operating room services for a variety of procedures, and pharmacy services"
hosppsych	Psychiatric and substance abuse hospitals (raw) Definition: "This industry comprises establishments known and licensed as psychiatric and substance abuse hospitals primarily engaged in providing

	diagnostic, medical treatment, and monitoring services for inpatients who suffer from mental illness or substance abuse disorders. The treatment often requires an extended stay in the hospital. These establishments maintain inpatient beds and provide patients with food services that meet their nutritional requirements. They have an organized staff of physicians and other medical staff to provide patient care services. Psychiatric, psychological, and social work services are available at the facility. These hospitals usually provide other services, such as outpatient services, clinical laboratory services, diagnostic X-ray services, and electroencephalograph services"
pharm	Pharmacies/drug stores (raw) Definition: "This industry comprises establishments known as pharmacies and drug stores engaged in retailing prescription or nonprescription drugs and medicines"
waste	Waste management and remediation services (raw) Definition: "Industries in the Waste Management and Remediation Services subsector group comprise establishments engaged in the collection, treatment, and disposal of waste materials. This includes establishments engaged in local hauling of waste materials; operating materials recovery facilities (i.e., those that sort recyclable materials from the trash stream); providing remediation services (i.e., those that provide for the cleanup of contaminated buildings, mine sites, soil, or ground water); and providing septic pumping and other miscellaneous waste management services. There are three industry groups within the subsector that separate these activities into waste collection, waste treatment and disposal, and remediation and other waste management"
wastetx	Waste treatment and disposal (raw) Definition: "This industry comprises establishments primarily engaged in (1) operating waste treatment or disposal facilities (except sewer systems or sewage treatment facilities) or (2) the combined activity of collecting and/or hauling of waste materials within a local area and operating waste treatment or disposal facilities. Waste combustors or incinerators (including those that may produce byproducts such as electricity), solid waste landfills, and compost dumps are included in this industry"
hazard	Hazardous waste treatment and disposal centers (raw) Definition: "This industry comprises establishments primarily engaged in: (1) operating treatment and/or disposal facilities for hazardous waste or (2) the combined activity of collecting and/or hauling of hazardous waste materials within a local area and operating treatment or disposal facilities for hazardous waste"
landfill	Solid waste landfills (raw) Definition: "This industry comprises establishments primarily engaged in (1) operating landfills for the disposal of nonhazardous solid waste or (2) the combined activity of collecting and/or hauling nonhazardous waste materials within a local area and operating landfills for the disposal of nonhazardous solid waste"
incin	Solid waste combustors and incinerators (raw) Definition: "This industry comprises establishments primarily engaged in

	operating combustors and incinerators for the disposal of nonhazardous solid waste. These establishments may produce byproducts, such as electricity and steam"
coal	Petroleum and coal product manufacturing (raw) Definition: "The Petroleum and Coal Products Manufacturing subsector is based on the transformation of crude petroleum and coal into usable products. The dominant process is petroleum refining that involves the separation of crude petroleum into component products through such techniques as cracking and distillation. In addition, this subsector includes establishments that primarily further process refined petroleum and coal products and produce products, such as asphalt coatings and petroleum lubricating oils"
chem	Chemical manufacturing (raw) Definition: "The Chemical Manufacturing subsector is based on the transformation of organic and inorganic raw materials by a chemical process and the formulation of products. This subsector distinguishes the production of basic chemicals that comprise the first industry group from the production of intermediate and end products produced by further processing of basic chemicals that make up the remaining industry groups"

3.1.4 Small Area Health Insurance Estimates (SAHIE) Program, U.S. Census Bureau, 2000

The Small Area Health Insurance Estimates (SAHIE) program estimates the number/proportion of individuals with and without health insurance coverage for each county and state. The program utilizes data from several sources, including: (a) American Community Survey; (b) demographic population estimates; (c) aggregated federal tax returns; (d) Supplemental Nutrition Assistance Program (SNAP); (e) county business patterns; (f) Medicaid; (g) Children's Health Insurance Program (CHIP); and (h) census 2000 data. (United States Census Bureau 2012)

This data source provides the estimated proportion of the population within each county without health insurance coverage. Table 5 provides a listing of the specific data points provided by this source.

Table 5. Data Points Provided by SAHIE, U.S. Census Bureau, 2000

Variable Name (SPSS)	Variable Description
uninsured	Estimate of all uninsured individuals as a proportion of total population (%)
uninsured18	Estimate of all uninsured individuals under age 18 as a proportion of the total population (%)

3.1.5 Common Core of Data (CCD), National Center for Education Statistics (NCES), 2001-2002

The Common Core of Data (CCD) program annually compiles data about all public schools from the state education agencies including data on student and staff demographics, revenues, demographics, outcomes, and characteristics about the structure of the system. The CCD program is administered by the National Center for Education Statistics (NCES), which is part of the US Department of Education and the Institute of Education Services. NCES is the primary federal agency responsible for collecting and analyzing data on the status on the American education system (National Center for Education Statistics N.d.a; National Center for Education Statistics N.d.b). Table 6 provides a list of the specific data points provided by this source.

Table 6. Data Points Provided by CCD, NCES, 2001-2002

Variable Name (SPSS)	Variable Description
pupil	Pupil : teacher ratio (public schools)

3.1.6 Area Health Resources Files (AHRF), Health Resources and Service Administration (HRSA), 2005

The Area Health Resources Files (AHRF) contain county, state, and national data compiled from over 50 data sources related to the health care professions and hospitals/health care facilities. Data includes the number of providers, provider age, provider gender, specialty of practice, hospital admission, inpatient/outpatient days, beds per facility, expenditures, and revenue data. The AHRF is administered by the Health Resources and Services Administration (HRSA), a division of the U.S. Department of Health and Human Services (HHS) (Health Resources and Services Administration N.d.a; Health Resources and Services Administration N.d.b). Table 7 provides a listing of the specific data points provided by this source.

Table 7. Data Points Provided by AHRF, HRSA, 2005

Variable Name (SPSS)	Variable Description
pcp	Primary care physicians per 100,000 population

3.1.7 National-Scale Air Toxics Assessment (NATA), United States Environmental Protection Agency (EPA), 2002

The National-Scale Air Toxics Assessment (NATA) is an evaluation program conducted by the United States Environmental Protection Agency (EPA). NATA utilizes data from the 2002 National Emissions Inventory for hazardous air pollutants to estimate cancer, neurological, and respiratory risks for each state and county in the United States. Per the EPA, the NATA involves four key steps:

(a) Compiling a national emissions inventory of air toxics emissions from outdoor sources

(b) Estimating ambient concentrations of air toxics across the United States

(c) Estimating population exposures across the United States

(d) Characterizing potential public health risk due to inhalation of air toxics including both cancer and noncancer effects (United States Environmental Protection Agency 2010a)

Cancer, neurological, and respiratory risks are reported for major sources[54], area sources[55], on-road mobile sources[56], non-road mobile sources[57], background concentrations[58], specific air toxics, and overall risk of exposure (United States Environmental Protection Agency 2010a; United States Environmental Protection Agency 2010b). Table 8 provides a listing of the specific data points provided by this source.

Table 8. Data Points Provided by NATA, EPA, 2002

Variable Name (SPSS)	Variable Description
cancerrisk	Overall cancer risk (per million) [59]
neurorisk	Overall neurological risk (per million)
resprisk	Overall respiratory risk (per million)

[54] Major sources are defined as "stationary facilities that emit or have the potential to emit 10 tons of any one toxic air pollutant or 25 tons of more than one toxic air pollutant per year" (United States Environmental Protection Agency 2010c).

[55] Area sources are defined as "facilities that have air toxics emissions below the major source threshold as defined in the air toxics section of the Clean Air Act and thus emit less than 10 tons of a single toxic air pollutant or less than 25 tons of multiple toxic air pollutants in one year" (United States Environmental Protection Agency 2010c).

[56] On-road mobile sources include vehicles found on the roads/highways, such as cars, buses, trucks, and motorcycles (United States Environmental Protection Agency 2010c).

[57] Non-road mobile sources include mobile sources not on roads/highways, such as trains, construction vehicles, farm machinery, airplanes, lawnmowers, etc. (United States Environmental Protection Agency 2010c).

[58] Background concentrations are defined as "the contributions to outdoor air toxics resulting from natural sources" (United States Environmental Protection Agency 2010c).

[59] A risk level of "X" per million means that "X" people per million population who are equally exposed to the air toxics would develop cancer/neurological issue/respiratory issue if exposed 24 hours per day for over 70 years (United States Environmental Protection Agency 2010c).

3.1.8 Racial Residential Segregation Measurement Project, Population Studies Center, University of Michigan, 2000

The Racial Residential Segregation Measurement Project at University of Michigan's Population Studies Center has calculated indexes of dissimilarity for all states, all counties, all metropolitan areas, and for all cities with 100,000 or more citizens using Census 2000 data. Indexes of dissimilarity are available for a comparison between 5 racial groups (white, black, American Indian/Alaskan Native, Asian, and Native Hawaiian/Pacific Islander) (Racial Residential Segregation Measurement Project N.d.b). Although indexes of dissimilarity are provided using three different geographic units—census tracts, block groups, and blocks—the index of dissimilarity calculated using census tracts is traditionally used. According to the Racial Residential Segregation Measurement Project, a key reason for this trend to report the index of dissimilarity calculated from census tract data is due to the instability of the measure when the minority population does not outnumber the number of geographic units by a factor of five. As a result, they argue that indexes of dissimilarity "calculated from census tracts or block groups are often more valuable and accurate descriptions of racial residential segregation than indexes of dissimilarity calculated from block data" (Racial Residential Segregation Measurement Project N.d.a). Table 9 provides a listing of the specific data points provided by this source.

Table 9. Data Points Provided by the Racial Residential Segregation Measurement Project, 2000

Variable Name (SPSS)	Variable Description
segtract	White-black index of dissimilarity calculated using census tract-level data

3.1.9 Mark L. Burkey, North Carolina Agricultural and Technical State University, 2000

Mark L. Burkey, Professor of Economics at North Carolina Agricultural and Technical University calculated Gini coefficients for all U.S. states and counties based on Census 2000 data (Burkey N.d.). The Gini coefficient is the most commonly utilized measure of income inequality and represents the extent to which the income distribution of a specific group/geographic region differs from a distribution of absolute equality. The coefficient can range from 0 to 1, with higher values indicating greater income inequality (Burkey N.d.; The World Bank Group 2011). Table 10 provides a listing of the specific data points provided by this source.

Table 10. Data Points Provided by Burkey (ND), 2000

Variable Name (SPSS)	Variable Description
gini	Gini-coefficient based on 2000 Census data

3.2 DATA COLLECTION PROCEDURES

Data was collected for all 1,641 U.S. counties in the northeastern and southern census regions (see Table 11, Figure 12, and Appendix A: List of Northeastern and Southern U.S. Counties) and was entered into a self-designed form in a Microsoft Access database (see Appendix B: Access Database Format).

Table 11. List of Regions, Divisions, and States

Region 1: Northeast (N=217)[60]	**Region 3: South (N=1424)**
Division 1: New England (N=67)	Division 5: South Atlantic (N=590)
Connecticut (N=8)	Delaware (N=3)
Maine (N=16)	District of Columbia (N=1)
Massachusetts (N=14)	Florida (N=67)
New Hampshire (N=10)	Georgia (N=159)
Rhode Island (N=5)	Maryland (N=24)
Vermont (N=14)	North Carolina (N=100)
Division 2: Middle Atlantic (N=150)	South Carolina (N=46)
New Jersey (N=21)	Virginia (N=135)
New York (N=62)	West Virginia (N=55)
Pennsylvania (N=67)	Division 6: East South Central (N=364)
	Alabama (N=67)
	Kentucky (N=120)
	Mississippi (N=82)
	Tennessee (N=95)
	Division 7: West South Central (N=470)
	Arkansas (N=75)
	Louisiana (N=64)
	Oklahoma (N=77)
	Texas (N=254)

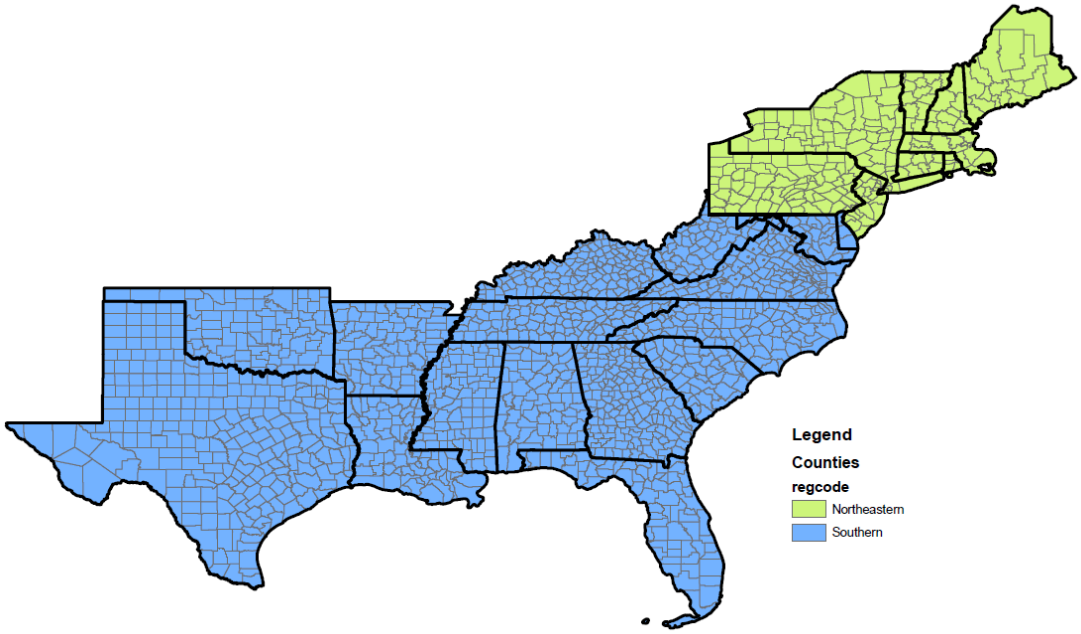

Figure 12. Counties by Region

[60] N=number of counties in specified region, division, and state.

Descriptive statistics were run for each variable to identify any potential data entry errors and missing data. In addition, 10% (n=164) of the overall cases were randomly[61] reviewed for data entry accuracy. No data entry errors were identified. Table 12 reports the frequency [%] of missing data for each variable for both all 1,641 counties and a smaller selection restricted by overall population size ≥25,000 (n=912).

Overall, there are 685/1,641 (41.7%) counties that have missing data for white/black cancer incidence, white/black cancer mortality, and index of dissimilarity. The extensive amount of data missing for black cancer incidence and mortality rates is most likely due to the methods used by the CDC to maintain data reliability and protect patient confidentiality. Specifically, when a geographic area has a count of less than 16 cases over the rate period, those values will be suppressed from the data (Centers for Disease Control and Prevention 2013b). In order to reduce the amount of missing data the sample was restricted to counties with population ≥25,000. When the sample is restricted to counties with population ≥25,000 the amount of missing data for white/black cancer incidence, white/black cancer mortality, and index of dissimilarity is reduced to 259/912 (28.4%).

The extensive amount of missing data from the US Economic Census could be due to several reasons: (1) the reporting method of not listing counties with "0" of the specified establishments makes it difficult to determine if data is actually missing or that none of the specific establishments exist in that area; (2) data will not be reported if there is any potential of being able to identify the specific establishment; (3) establishments could refuse to complete the required survey; and (4) there could be a lack of administrative data at other federal agencies for

[61] Each of the 1,641 counties were given an ID ranging from 1-1,641. A random number generator was utilized to identify 164 unique IDs for review.

the establishments not submitting a survey. Due to the amount of issues surrounding the accuracy of this data, no data related to the Economic Census will be included in data analyses.

Table 12. Missing Data

Variable Name	Brief Description	Missing Data (N=1,641)[62]	Missing Data (N=912)[63]
State Cancer Profiles, NCI, 2005-2009			
canincw	White cancer incidence rate	7 [0.4%]	0 [0.0%]
canincb	Black cancer incidence rate	504 [30.7%]	140 [15.4%]
canmortw	White cancer mortality rate	17 [1.0%]	0 [0.0%]
canmortb	Black cancer mortality rate	683 [41.6%]	258 [28.3%]
U.S. Decennial Census, 2000			
stcode	State code (FIPS format)	0 [0.0%]	0 [0.0%]
regcode	Region code	0 [0.0%]	0 [0.0%]
divcode	Division code	0 [0.0%]	0 [0.0%]
popden	Population density, total population per mile^2	0 [0.0%]	0 [0.0%]
hden	Housing density, housing units per mile^2	0 [0.0%]	0 [0.0%]
vacant	Vacant housing units (% of total units)	0 [0.0%]	0 [0.0%]
poptot	Total population (raw)	0 [0.0%]	0 [0.0%]
popw	Total white population (raw)	0 [0.0%]	0 [0.0%]
popb	Black population (raw)	0 [0.0%]	0 [0.0%]
popurb	Population living in urban area (raw)	0 [0.0%]	0 [0.0%]
occownw	White-owned occupied housing units (raw)	0 [0.0%]	0 [0.0%]
occownb	Black-owned occupied housing units (raw)	0 [0.0%]	0 [0.0%]
occrentw	White-renter occupied housing units (raw)	0 [0.0%]	0 [0.0%]
occrentb	Black-renter occupied housing units (raw)	0 [0.0%]	0 [0.0%]
telw	White-occupied housing units without telephone service (raw)	1 [0.1%]	0 [0.0%]
telb	Black-occupied housing units without telephone service (raw)	340 [20.7%]	74 [8.1%]
plumbw	White-occupied housing units lacking complete plumbing facilities	1 [0.1%]	0 [0.0%]

[62] Percentage of missing data is based on all Northeastern and Southern counties (N=1,641).
[63] Percentage of missing data is based on counties with population ≥25,000 (N=912).

	(raw)		
plumbb	Black-occupied housing units lacking complete plumbing facilities (raw)	340 [20.7%]	74 [8.1%]
kitw	White-occupied housing units lacking complete kitchen facilities (raw)	1 [0.1%]	0 [0.0%]
kitb	Black-occupied housing units lacking complete kitchen facilities (raw)	340 [20.7%]	74 [8.1%]
rentw	White median gross rent as a % of household income in 1999	3 [0.2%]	0 [0.0%]
rentb	Black median gross rent as a % of household income in 1999	0 [0.0%]	0 [0.0%]
valuew	Median value of all white-owner occupied housing units, $	1 [0.1%]	0 [0.0%]
valueb	Median value of all black-owner occupied housing units, $	340 [20.7%]	74 [8.1%]
costw	Median owner costs of all white-owner occupied housing units as a % of household income in 1999	0 [0.0%]	0 [0.0%]
costb	Median owner costs of all black-owner occupied housing units as a % of household income in 1999	0 [0.0%]	0 [0.0%]
unemplw	White unemployment rate, % of civilian labor force aged 16+	1 [0.1%]	0 [0.0%]
unemplb	Black unemployment rate, % of civilian labor force aged 16+	340 [20.7%]	74 [8.1%]
incomew	Median household income in 1999, white householders, $	0 [0.0%]	0 [0.0%]
incomeb	Median household income in 1999, black householders, $	0 [0.0%]	0 [0.0%]
percapw	Per capita income based on 1999 income, white population, $	0 [0.0%]	0 [0.0%]
percapb	Per capita income based on 1999 income, black population, $	0 [0.0%]	0 [0.0%]
povpopw	White population for which poverty status is determined (raw)	0 [0.0%]	0 [0.0%]
povw	White population below poverty level (raw)	0 [0.0%]	0 [0.0%]
povpopb	Black population for which poverty status is determine (raw)	0 [0.0%]	0 [0.0%]
povb	Black population below poverty level (raw)	0 [0.0%]	0 [0.0%]
wm9	White male population aged 25+ with less than a 9^{th} grade education	0 [0.0%]	0 [0.0%]

	(raw)		
wm12	White male population aged 25+ with 9-12th grade education (raw)	0 [0.0%]	0 [0.0%]
wmhs	White male population aged 25+ with high school diploma or equivalent (raw)	0 [0.0%]	0 [0.0%]
wmcoll	White male population aged 25+ who have completed some college (raw)	0 [0.0%]	0 [0.0%]
wmass	White male population aged 25+ with Associate's degree (raw)	0 [0.0%]	0 [0.0%]
wmbach	White male population aged 25+ with Bachelor's degree (raw)	0 [0.0%]	0 [0.0%]
wmgrad	White male population aged 25+ with a graduate or professional degree (raw)	0 [0.0%]	0 [0.0%]
wmed	White male population aged 25+ (raw)	0 [0.0%]	0 [0.0%]
wf9	White female population aged 25+ with less than a 9th grade education (raw)	0 [0.0%]	0 [0.0%]
wf12	White female population aged 25+ with 9-12th grade education (raw)	0 [0.0%]	0 [0.0%]
wfhs	White female population aged 25+ with high school diploma or equivalent (raw)	0 [0.0%]	0 [0.0%]
wfcoll	White female population aged 25+ who have completed some college (raw)	0 [0.0%]	0 [0.0%]
wfass	White female population aged 25+ with Associate's degree (raw)	0 [0.0%]	0 [0.0%]
wfbach	White female population aged 25+ with Bachelor's degree (raw)	0 [0.0%]	0 [0.0%]
wfgrad	White female population aged 25+ with a graduate or professional degree (raw)	0 [0.0%]	0 [0.0%]
wfed	White female population aged 25+ (raw)	0 [0.0%]	0 [0.0%]
bm9	Black male population aged 25+ with less than a 9th grade education (raw)	0 [0.0%]	0 [0.0%]
bm12	Black male population aged 25+ with 9-12th grade education (raw)	0 [0.0%]	0 [0.0%]
bmhs	Black male population aged 25+ with high school diploma or equivalent (raw)	0 [0.0%]	0 [0.0%]
bmcoll	Black male population aged 25+ who	0 [0.0%]	0 [0.0%]

	have completed some college (raw)		
bmass	Black male population aged 25+ with Associate's degree (raw)	0 [0.0%]	0 [0.0%]
bmbach	Black male population aged 25+ with Bachelor's degree (raw)	0 [0.0%]	0 [0.0%]
bmgrad	Black male population aged 25+ with a graduate or professional degree (raw)	0 [0.0%]	0 [0.0%]
bmed	Black male population aged 25+ (raw)	0 [0.0%]	0 [0.0%]
bf9	Black female population aged 25+ with less than a 9th grade education (raw)	0 [0.0%]	0 [0.0%]
bf12	Black female population aged 25+ with 9-12th grade education (raw)	0 [0.0%]	0 [0.0%]
bfhs	Black female population aged 25+ with high school diploma or equivalent (raw)	0 [0.0%]	0 [0.0%]
bfcoll	Black female population aged 25+ who have completed some college (raw)	0 [0.0%]	0 [0.0%]
bfass	Black female population aged 25+ with Associate's degree (raw)	0 [0.0%]	0 [0.0%]
bfbach	Black female population aged 25+ with Bachelor's degree (raw)	0 [0.0%]	0 [0.0%]
bfgrad	Black female population aged 25+ with a graduate or degree (raw)	0 [0.0%]	0 [0.0%]
bfed	Black female population aged 25+ (raw)	0 [0.0%]	0 [0.0%]
carw	White workers aged 16+ traveling by car to work (raw)	0 [0.0%]	0 [0.0%]
pubtransw	White workers aged 16+ traveling by public transit to work (raw)	0 [0.0%]	0 [0.0%]
motorw	White workers aged 16+ traveling by motorcycle to work (raw)	0 [0.0%]	0 [0.0%]
bikew	White workers aged 16+ traveling by bicycle to work (raw)	0 [0.0%]	0 [0.0%]
walkw	White workers aged 16+ walking to work (raw)	0 [0.0%]	0 [0.0%]
homew	White workers aged 16+ working from home (raw)	0 [0.0%]	0 [0.0%]
transw	White workers aged 16+ (raw)	0 [0.0%]	0 [0.0%]
carb	Black workers aged 16+ traveling by car to work (raw)	0 [0.0%]	0 [0.0%]
pubtransb	Black workers aged 16+ traveling by public transit to work (raw)	0 [0.0%]	0 [0.0%]

motorb	Black workers aged 16+ traveling by motorcycle to work (raw)	0 [0.0%]	0 [0.0%]
bikeb	Black workers aged 16+ traveling by bicycle to work (raw)	0 [0.0%]	0 [0.0%]
walkb	Black workers aged 16+ walking to work (raw)	0 [0.0%]	0 [0.0%]
homeb	Black workers aged 16+ working from home (raw)	0 [0.0%]	0 [0.0%]
transb	Black workers aged 16+ (raw)	0 [0.0%]	0 [0.0%]
vehiclew	White-occupied housing units without a vehicle (raw)	0 [0.0%]	0 [0.0%]
vehicleb	Black-occupied housing units without a vehicle (raw)	0 [0.0%]	0 [0.0%]
U.S. Economic Census, 2002			
food	Food and beverage stores (raw)	5 [0.3%]	--
grocery	Grocery stores (raw)	1062 [64.7%]	--
specialty	Specialty food stores (raw)	959 [58.4%]	--
supermarket	Supermarket and other grocery stores (raw)	1200 [73.1%]	--
conven	Convenience stores (raw)	1364 [83.1%]	--
liquor	Beer, wine, and liquor stores (raw)	1343 [81.8%]	--
gas	Gas stations with convenience stores (raw)	751 [45.8%]	--
foodsvc	Food service and drinking places (raw)	12 [0.7%]	--
restfull	Full-service restaurants (raw)	1300 [79.2%]	--
restlimit	Limited-service eating places (e.g., fast food) (raw)	720 [43.9%]	--
ambu	Ambulatory health care services (raw)	128 [7.8%]	--
ambuer	Freestanding ambulatory surgical and emergency centers (raw)	1532 [93.4%]	--
phys	Physician offices (raw)	653 [39.8%]	--
physment	Mental health specialist physician offices (raw)	1403 [85.5%]	--
famplan	Family planning centers (raw)	1605 [97.8%]	--
subabuse	Outpatient mental health and substance abuse centers (raw)	1398 [85.2%]	--
hospital	Hospitals (raw)	1042 [63.5%]	--
hospgen	General medical and surgical hospitals (raw)	1433 (87.3%)	--
hosppsych	Psychiatric and substance abuse hospitals (raw)	1577 (96.1%)	--
pharm	Pharmacies/drug stores (raw)	1214 (74.0%)	--
waste	Waste management and remediation	999 (60.9%)	--

	services (raw)		
wastetx	Waste treatment and disposal (raw)	1542 (94.0%)	--
hazard	Hazardous waste treatment and disposal centers (raw)	1619 (98.7%)	--
landfill	Solid waste landfills (raw)	1574 (95.9%)	--
incin	Solid waste combustors and incinerators (raw)	1569 (95.6%)	--
coal	Petroleum and coal product manufacturing (raw)	1103 (67.2%)	--
chem	Chemical manufacturing (raw)	682 (42.0%)	--
SAHIE, U.S. Census Bureau, 2000			
uninsured	Estimate of all uninsured individuals (% of total population)	1 (0.1%)	0 [0.0%]
uninsured18	Estimate of all uninsured individuals under age 18 (% of total population)	1 (0.1%)	0 [0.0%]
CCD, NCES, 2001-2002			
pupil	Pupil to teacher ratio (public schools)	123 (7.5%)	72 [7.9%]
AHRF, HRSA, 2005			
pcp	Primary care physicians per 100,000 population	1 (0.1%)	0 [0.0%]
NATA, EPA, 2002			
cancerrisk	Overall cancer risk	0 (0.0%)	0 [0.0%]
neurorisk	Overall neurological risk	0 (0.0%)	0 [0.0%]
resprisk	Overall respiratory risk	0 (0.0%)	0 [0.0%]
Racial Residential Segregation Measurement Project, 2000			
segtract	White-black index of dissimilarity (tract-level)	1 (0.1%)	1 (0.1%)
Burkey (N.d.), 2000			
gini	Gini-coefficient based on 2000 census data	0 (0.0%)	0 [0.0%]

3.3 DATA ANALYSIS PLAN

3.3.1 Variable transformation

The majority of the variables collected from the data sources were in raw format (e.g., total population, total white population, total black population, etc.) and required conversion to standardize to the population (e.g., white population as a percentage of total population, black

population as a percentage of total population). In addition, several variables were created to represent the racial gap in certain data points (e.g., racial gap in per capita income). Table 13 contains a listing of the variable transformations performed and Table 14 contains a listing of potential variables for data analysis (see Appendix C for a full listing of variables and variable transformations).

Table 13. Variable Transformations

Variable Name	Variable Description	Transformation Steps
canincratio	Racial gap in cancer incidence	(1) canincratio = canincb/canincw
canmortratio	Racial gap in cancer mortality	(1) canmortratio = canmortb/canmortw
popurbp	Urban population as % of total population	(1) popurbp = popurb/poptot
telratio	Racial gap in occupied housing units without telephone service	(1) telbp = telb/occb (2) telwp = telw/occw (3) telratio = telbp/telwp
plumbratio	Racial gap in occupied housing units lacking complete plumbing facilities	(1) plumbbp = plumbb/occb (2) plumbwp = plumbw/occw (3) plumbratio = plumbbp/plumbwp
kitratio	Racial gap in occupied housing units lacking complete kitchen facilities	(1) kitbp = kitb/occb (2) kitwp = kitw/occw (3) kitratio = kitbp/kitwp
ownratio	Racial gap in occupied housing units owned by householder	(1) ownbp = occownb/occb (2) ownwp = occownw/occw (3) ownratio = ownbp/ownwp
rentratio	Racial gap in occupied housing units rented by householder	(1) rentbp = occrentb/occb (2) rentwp = occrentw/occw (3) rentratio = rentbp/rentwp
rentratio2	Racial gap in median gross rent as a % of household income	(1) rentratio2 = rentb/rentw
valueratio	Racial gap in median value of owner-occupied homes	(1) valueratio = valueb/valuew
costratio	Racial gap in median owner costs of owner-occupied homes as % of household income	(1) costratio = costb/costw
incomeratio	Racial gap in median household income	(1) incomeratio = incomeb/incomew
percapratio	Racial gap in per capita income	(1) percapratio = percapb/percapw

povratio	Racial gap in population living below poverty	(1) povbp = povb/povpopb (2) povwp = povw/povpopw (3) povratio = povbp/povwp
nohsratio	Racial gap in population aged 25+ with less than high school diploma	(1) b9 = bm9+bf9 (2) b12 = bm12+bf12 (3) bnohs = b9+b12 (4) bed = bmed+bfed (5) w9 = wm9+wf9 (6) w12 = wm12+wf12 (7) wnohs = w9+w12 (8) wed = wmed+wfed (9) bnohsp = (bnohs/bed)*100 (10) wnohsp = (wnohs/wed)*100 (11) nohsratio = bnohsp/wnohsp
hsplusratio	Racial gap in population aged 25+ with high school diploma or higher	(1) bhs = bmhs+bfhs (2) bcoll = bmcoll+bfcoll (3) bass = bmass+bfass (4) bbach = bmbach+bfbach (5) bgrad = bmgrad+bfgrad (6) bed = bmed+bfed (7) whs = wmhs+wfhs (8) wcoll = wmcoll+wfcoll (9) wass = wmass+mfass (10) wbach = wmbach+wfbach (11) wgrad = wmgrad+wfgrad (12) wed = wmed+wfed (13) bhsplus = bhs+bcoll+bass+ bbach+bgrad (14) whsplus = whs+wcoll+wass +wbach+wgrad (15) bhsplusp = (bhsplus/bed)*100 (16) whsplusp = (whsplus/wed)*100 (17) hsplusratio = bhsplusp/whsplusp
collplusratio	Racial gap in population aged 25+ with college degree or higher	(1) bass = bmass+bfass (2) bbach = bmbach+bfbach (3) bgrad = bmgrad+bfgrad (4) bed = bmed+bfed (5) wass = wmass+wfass (6) wbach = wmbach+wfbach (7) wgrad = wmgrad+wfgrad (8) wed = wmed+wfed (9) bcollplus = bass+bbach+bgrad (10) wcollplus =

		wass+wbach+wgrad (11) bcollplusp = (bcollplus/bed)*100 (12) wcollplusp = (wcollplus/wed)*100 (13) collplusratio = bcollplusp/wcollplusp
unemplratio	Racial gap in unemployment rate	(1) unemplratio = unemplb/unemplw
carratio	Racial gap in workers aged 16+ utilizing a car to commute to work	(1) carbp = (carb/transb)*100 (2) carwp = (carw/transw)*100 (3) carratio = carbp/carwp
pubtransratio	Racial gap in workers aged 16+ utilizing public transit to commute to work	(1) pubtransbp = (pubtransb/transb)*100 (2) pubtranswp = (pubtransw/transw)*100 (3) pubtransratio = pubtransbp/pubtranswp
motorratio	Racial gap in workers aged 16+ utilizing a motorcycle to commute to work	(1) motorbp = (motorb/transb)*100 (2) motorwp = (motorw/transw)*100 (3) motorratio = motorbp/motorwp
bikeratio	Racial gap in workers aged 16+ utilizing a bicycle to commute to work	(1) bikebp = (bikeb/transb)*100 (2) bikewp = (bikew/transw)*100 (3) bikeratio = bikebp/bikewp
walkratio	Racial gap in workers aged 16+ who walk to work	(1) walkbp = (walkb/transb)*100 (2) walkwp = (walkw/transw)*100 (3) walkratio = walkbp/walkwp
homeratio	Racial gap in workers aged 16+ who work from home	(1) homebp = (homeb/transb)*100 (2) homewp = (homew/transw)*100 (3) homeratio = homebp/homewp
vehicleratio	Racial gap in occupied housing units without a vehicle	(1) vehiclebp = (vehicleb/occb)*100 (2) vehiclewp = (vehiclew/occw)*100 (3) vehicleratio = vehiclebp/vehiclewp

Table 14. List of Potential Variables

	Variable Name
Dependent Variables	
Racial gap in cancer incidence	canincratio
Racial gap in cancer mortality	canmortratio
Independent Variables	
Geographic Controls	
State	stcode
Region	regcode
Division	divcode
Measures of Segregation/Density/Urbanization	
Racial residential segregation (tract)	segtract
Population density, total population per mile^2	popden
Urban population as % of total population	popurbp
Housing Characteristics	
Housing density, housing units per mile^2	hden
Vacant housing units as % of total housing units	vacant
Racial gap in occupied housing units without telephone service	telratio
Racial gap in occupied housing units lacking complete plumbing facilities	plumbratio
Racial gap in occupied housing units lacking complete kitchen facilities	kitratio
Income/Education Characteristics	
Racial gap in occupied housing units owned by householder	ownratio
Racial gap in occupied housing units rented by householder	rentratio
Racial gap in median gross rent as a % of household income	rentratio2
Racial gap in median value of owner-occupied homes	valueratio
Racial gap in median owner costs of owner-occupied homes as % of household income	costratio
Racial gap in median household income	incomeratio
Racial gap in per capita income	percapratio
Racial gap in population living below poverty	povratio
Racial gap in population aged 25+ with less than high school diploma	nohsratio
Racial gap in population aged 25+ with high school diploma or higher	hsplusratio
Racial gap in population aged 25+ with college degree or higher	collplusratio
Racial gap in unemployment rate	unemplratio
Gini coefficient	gini
Pupil : teacher ratio	pupil
Transportation Infrastructure	
Racial gap in workers aged 16+ utilizing a car to commute to work	carratio
Racial gap in workers aged 16+ utilizing public transit to commute to work	pubtransratio
Racial gap in workers aged 16+ utilizing a motorcycle to commute to work	motorratio
Racial gap in workers aged 16+ utilizing a bicycle to commute to work	bikeratio

Racial gap in workers aged 16+ who walk to work	walkratio
Racial gap in workers aged 16+ who work from home	homeratio
Racial gap in occupied housing units without a vehicle	vehicleratio
Environmental Characteristics	
Cancer risk (ppm)	cancerrisk
Neurologic risk (ppm)	neurorisk
Respiratory risk (ppm)	resprisk
Access to Resources (Health Care)	
Primary care physicians per 100,000 population	pcp
Uninsured, all ages (%)	uninsured
Uninsured, under age 18 (%)	uninsured18

3.3.2 Description of sample

Restricting the sample to counties with total population ≥ 25,000 results in a sample size of 912 counties. The average racial gap in cancer incidence is 1.02 (black rate 2% higher than white rate) and the average racial gap in cancer mortality is 1.19 (black rate 19% higher than white rate). On average, these counties have an index of dissimilarity of 42.6, meaning that 42.6% of the population would have to relocate in order to have an even distribution. Means and standard deviations for all potential variables can be found in Table 15.

Table 15. Descriptive Statistics (N=912 counties)

	Variable Name	Mean (SD)	Missing (%)[64]
Dependent Variables			
Racial gap in cancer incidence	canincratio	1.02 (0.18)	140 (15.4)
Racial gap in cancer mortality	canmortratio	1.19 (0.22)	258 (28.3)
Independent Variables			
Measures of Segregation/Density/Urbanization			
Racial residential segregation (tract)	segtract	42.6 (14.5)	1 (0.1)
Population density, total population per mile^2	popden	561.0 (2965.9)	0 (0.0)
Urban population as % of total population	popurbp	55.6 (26.0)	0 (0.0)
Housing Characteristics			
Housing density, housing units per mile^2	hden	237.6 (1380.1)	0 (0.0)
Vacant housing units as % of total housing units	vacant	11.3 (6.9)	0 (0.0)
Racial gap in occupied housing units without telephone service	telratio	3.07 (1.84)	74 (8.1)
Racial gap in occupied housing units lacking complete plumbing facilities	plumbratio	3.06 (3.37)	76 (8.3)
Racial gap in occupied housing units lacking complete kitchen facilities	kitratio	2.74 (4.78)	81 (8.9)
Income/Education Characteristics			
Racial gap in occupied housing units owned by householder	ownratio	0.69 (0.15)	0 (0.0)
Racial gap in occupied housing units rented by householder	rentratio	1.97 (0.43)	0 (0.0)
Racial gap in median gross rent as a % of household income	rentratio2	1.14 (0.28)	0 (0.0)
Racial gap in median value of owner-occupied homes	valueratio	0.74 (0.18)	74 (8.1)
Racial gap in median owner costs of owner-occupied homes as % of household income	costratio	1.21 (0.27)	0 (0.0)
Racial gap in median household income	incomeratio	0.70 (0.31)	0 (0.0)
Racial gap in per capita income	percapratio	0.65 (0.22)	0 (0.0)
Racial gap in population living below poverty	povratio	2.70 (1.02)	0 (0.0)
Racial gap in population aged 25+ with less than high school diploma	nohsratio	1.61 (0.73)	1 (0.1)
Racial gap in population aged 25+ with high	hsplusratio	0.87 (0.16)	1 (0.1)

[64] If a county has a valid count of "0" cases within their white population for any given variable, the ratio of black:white cannot be computed and will be listed as missing.

school diploma or higher			
Racial gap in population aged 25+ with college degree or higher	collplusratio	0.67 (0.44)	1 (0.1)
Racial gap in unemployment rate	unemplratio	2.28 (0.96)	74 (8.1)
Gini coefficient	gini	0.44142 (0.03447)	0 (0.0)
Pupil : teacher ratio	pupil	15.7 (16.5)	72 (7.9)
Transportation Infrastructure			
Racial gap in workers aged 16+ utilizing a car to commute to work	carratio	0.95 (0.11)	1 (0.1)
Racial gap in workers aged 16+ utilizing public transit to commute to work	pubtransratio	5.15 (11.55)	21 (2.3)
Racial gap in workers aged 16+ utilizing a motorcycle to commute to work	motorratio	1.50 (23.93)	148 (16.2)
Racial gap in workers aged 16+ utilizing a bicycle to commute to work	bikeratio	2.44 (7.71)	151 (16.6)
Racial gap in workers aged 16+ who walk to work	walkratio	2.19 (2.50)	1 (0.1)
Racial gap in workers aged 16+ who work from home	homeratio	0.53 (0.93)	1 (0.1)
Racial gap in occupied housing units without a vehicle	vehicleratio	2.98 (1.73)	0 (0.0)
Environmental Characteristics			
Cancer risk (ppm)	cancerrisk	2.558^{-5} (1.022^{-5})	0 (0.0)
Neurologic risk (ppm)	neurorisk	0.06020 (0.15671)	0 (0.0)
Respiratory risk (ppm)	resprisk	2.31402 (1.83495)	0 (0.0)
Access to Resources (Health Care)			
Primary care physicians per 100,000 population	pcp	71.2 (45.3)	0 (0.0)
Uninsured, all ages (%)	uninsured	14.3 (4.1)	0 (0.0)
Uninsured, under age 18 (%)	uninsured18	11.7 (4.7)	0 (0.0)

Although restricting the sample to counties with total population ≥ 25,000 did reduce the overall amount of missing data, key variables including racial gap in cancer incidence (canincratio) and racial gap in cancer mortality (canmortratio) still have an extensive amount of missing data (15.4% v. 28.3% respectively). Overall, 653/912 (71.6%) cases are not missing white/black cancer incidence, white/black cancer mortality, and index of dissimilarity data. Due to the amount of missing data that would further restrict the N for analysis, variables related to racial gap in occupied housing units without telephone service (telratio), racial gap in occupied

housing units lacking complete plumbing facilities (plumbratio), racial gap in occupied housing units lacking complete kitchen facilities (kitratio), pupil:teacher ratio (pupil), racial gap in workers aged 16+ utilizing public transit to commute to work (pubtransratio), racial gap in workers aged 16+ utilizing a motorcycle to commute to work (motorratio), and racial gap in workers aged 16+ utilizing a bicycle to commute to work (bikeratio), were removed as potential variables. Means and standard deviations for each of the remaining potential variables can be found in Table 16.

Table 16. Descriptive Statistics (N=653 counties)

	Variable Name	**Mean (SD)**
Dependent Variables		
Racial gap in cancer incidence	canincratio	1.02 (0.14)
Racial gap in cancer mortality	canmortratio	1.19 (0.22)
Independent Variables		
Measures of Segregation/Density/Urbanization		
Racial residential segregation (tract)	segtract	43.0 (14.8)
Population density, total population per mile^2	popden	704.7 (3461.3)
Urban population as % of total population	popurbp	60.5 (25.3)
Housing Characteristics		
Housing density, housing units per mile^2	hden	298.4 (1614.5)
Vacant housing units as % of total housing units	vacant	10.2 (6.0)
Racial gap in occupied housing units without telephone service	telratio	--
Racial gap in occupied housing units lacking complete plumbing facilities	plumbratio	--
Racial gap in occupied housing units lacking complete kitchen facilities	kitratio	--
Income/Education Characteristics		
Racial gap in occupied housing units owned by householder	ownratio	0.70 (0.13)
Racial gap in occupied housing units rented by householder	rentratio	1.93 (0.38)
Racial gap in median gross rent as a % of	rentratio2	1.17 (0.15)

household income		
Racial gap in median value of owner-occupied homes	valueratio	0.71 (0.13)
Racial gap in median owner costs of owner-occupied homes as % of household income	costratio	1.23 (0.14)
Racial gap in median household income	incomeratio	0.64 (0.12)
Racial gap in per capita income	percapratio	0.61 (0.12)
Racial gap in population living below poverty	povratio	2.85 (0.86)
Racial gap in population aged 25+ with less than high school diploma	nohsratio	1.71 (0.61)
Racial gap in population aged 25+ with high school diploma or higher	hsplusratio	0.85 (0.11)
Racial gap in population aged 25+ with college degree or higher	collplusratio	0.58 (0.21)
Racial gap in unemployment rate	unemplratio	2.39 (0.81)
Gini coefficient	gini	0.44348 (0.03594)
Pupil : teacher ratio	pupil	--
Transportation Infrastructure		
Racial gap in workers aged 16+ utilizing a car to commute to work	carratio	0.97 (0.06)
Racial gap in workers aged 16+ utilizing public transit to commute to work	pubtransratio	--
Racial gap in workers aged 16+ utilizing a motorcycle to commute to work	motorratio	--
Racial gap in workers aged 16+ utilizing a bicycle to commute to work	bikeratio	--
Racial gap in workers aged 16+ who walk to work	walkratio	1.96 (1.24)
Racial gap in workers aged 16+ who work from home	homeratio	0.45 (0.38)
Racial gap in occupied housing units without a vehicle	vehicleratio	3.27 (1.00)
Environmental Characteristics		
Cancer risk (ppm)	cancerrisk	2.654^{-5} (1.018^{-5})
Neurologic risk (ppm)	neurorisk	0.06200 (0.17095)
Respiratory risk (ppm)	resprisk	2.60292 (1.95170)
Access to Resources (Health Care)		
Primary care physicians per 100,000 population	pcp	73.2 (47.1)
Uninsured, all ages (%)	uninsured	14.6 (3.7)
Uninsured, under age 18 (%)	uninsured18	12.2 (4.1)

To determine if there are any regional differences in both the dependent and independent variables, independent samples t-tests were run for each variable between northeastern and southern counties. The results are shown in Table 17 and indicate that there are several variables for which the northeastern and southern counties differ significantly. As a result, a new dummy variable was created (northern) for use in regression analysis.

Table 17. Independent Samples t-Test Results (North v. South) (N=653)

		Northeastern Counties (N=88)	***Southern Counties (N=565)***	
Variable	**Variable Description**	***Mean (SD)***	***Mean (SD)***	***p***
canincratio	Racial gap in cancer incidence	1.00 (0.15)	1.03 (0.14)	0.182
canmortratio	Racial gap in cancer mortality	1.12 (0.22)	1.20 (0.22)	0.002
segtract	Racial residential segregation (tract)	58.1 (12.8)	40.7 (13.6)	0.000
popden	Population density	2935.2 (8897.8)	357.3 (860.5)	0.008
popurbp	Urban population (% of total population)	78.0 (20.9)	57.8 (24.8)	0.000
hden	Housing density	1233.9 (4184.0)	152.7 (393.9)	0.017
vacant	Vacant housing units (% of total housing units)	9.0 (8.8)	10.4 (5.4)	0.164
ownratio	Racial gap in occupied housing units owned by householder	0.56 (0.15)	0.73 (0.11)	0.000
rentratio	Racial gap in occupied housing units rented by householder	2.19 (0.43)	1.88 (0.36)	0.000
rentratio2	Racial gap in median gross rent as a % of household income	1.10 (0.10)	1.18 (0.16)	0.000
valueratio	Racial gap in median value of owner-occupied homes	0.74 (0.16)	0.70 (0.13)	0.027
costratio	Racial gap in median owner costs of	1.17 (0.10)	1.24 (0.14)	0.000

	owner-occupied homes as % of household income			
incomeratio	Racial gap in median household income	0.67 (0.15)	0.63 (0.12)	0.005
percapratio	Racial gap in per capita income	0.64 (0.14)	0.61 (0.12)	0.036
povratio	Racial gap in population living below poverty	3.20 (0.93)	2.79 (0.84)	0.000
nohsratio	Racial gap in population aged 25+ with less than high school diploma	1.83 (0.63)	1.69 (0.61)	0.050
hsplusratio	Racial gap in population aged 25+ with high school diploma or higher	0.85 (0.12)	0.85 (0.10)	0.711
collplusratio	Racial gap in population aged 25+ with college degree or higher	0.63 (0.22)	0.57 (0.21)	0.028
unemplratio	Racial gap in unemployment rate	2.30 (0.61)	2.40 (0.83)	0.165
gini	Gini coefficient	0.43499 (0.03465)	0.44480 (0.03599)	0.017
carratio	Racial gap in workers aged 16+ utilizing a car to commute to work	0.88 (0.10)	0.98 (0.04)	0.000
walkratio	Racial gap in workers aged 16+ who walk to work	2.24 (1.04)	1.92 (1.25)	0.024
homeratio	Racial gap in workers aged 16+ who work from home	0.51 (0.28)	0.44 (0.40)	0.129
vehicleratio	Racial gap in occupied housing units without a vehicle	2.87 (0.92)	3.34 (1.00)	0.000
cancerrisk	Cancer risk (ppm)	3.637^{-5} (1.395^{-5})	2.520^{-5} (0.851^{-5})	0.000
neurorisk	Neurologic risk (ppm)	0.07436 (0.04149)	0.06008 (0.18301)	0.466
resprisk	Respiratory risk (ppm)	4.13339 (2.84565)	2.36454 (1.65287)	0.000
pcp	Primary care	93.7 (44.3)	70.0 (46.7)	0.000

	physicians per 100,000 population			
uninsured	Uninsured, all ages (%)	10.9 (3.1)	15.2 (3.4)	0.000
uninsured18	Uninsured, under age 18 (%)	7.5 (2.2)	12.9 (3.9)	0.000

3.3.3 Regression analysis

Multivariate regression analysis was utilized to create models that provided the best explanatory power (based on adjusted R^2) but also included variables with conceptual importance. All models included racial residential segregation (tractseg) as the key independent variable and the "northern" dummy variable and % urban population (popurbp) as control variables.

The models for both the racial gap in cancer incidence and racial gap in cancer mortality were created by identifying the best individual predictors from the list of potential variables. To identify potential independent variables for inclusion, Pearson correlation coefficients were calculated between the dependent variable (racial gap in cancer incidence or racial gap in cancer mortality) and the potential independent variables. Tables 18 and 19 provide the correlation coefficients for all counties (N=912), and for northeastern (N=88) and southern (N=565) counties.

Table 18. Pearson Correlation Coefficients for Racial Disparity in Cancer Incidence

		All Counties (N=653)		***Northeastern Counties (N=88)***		***Southern Counties (N=565)***	
Variable	**Variable Description**	***r***	***p***	***r***	***p***	***r***	***p***
segtract	Racial residential segregation (tract)	0.075	0.055	0.084	0.437	0.109	0.010
popden	Population density	0.014	0.724	-0.008	0.942	0.140	0.001
popurbp	Urban population (% of total population)	0.045	0.249	-0.189	0.078	0.097	0.022
hden	Housing density	0.017	0.665	0.004	0.972	0.132	0.002
vacant	Vacant housing units (% of total housing units)	-0.097	0.013	0.028	0.796	-0.137	0.001
ownratio	Racial gap in occupied housing units owned by householder	-0.044	0.257	-0.180	0.093	-0.054	0.198
rentratio	Racial gap in occupied housing units rented by householder	-0.017	0.660	0.079	0.462	-0.019	0.654
rentratio2	Racial gap in median gross rent as a % of household income	0.043	0.268	0.196	0.068	0.018	0.669
valueratio	Racial gap in median value of owner-occupied homes	-0.085	0.030	-0.218	0.041	-0.053	0.212
costratio	Racial gap in median owner costs of owner-occupied homes as % of household income	0.071	0.068	-0.267	0.012	0.102	0.015
incomeratio	Racial gap in median household income	-0.152	0.000	-0.302	0.004	-0.115	0.006
percapratio	Racial gap in per capita income	-0.103	0.009	-0.056	0.604	-0.107	0.011
povratio	Racial gap in population living	0.044	0.262	0.240	0.024	0.019	0.648

	below poverty						
nohsratio	Racial gap in population aged 25+ with less than high school diploma	0.050	0.202	0.253	0.017	0.021	0.622
hsplusratio	Racial gap in population aged 25+ with high school diploma or higher	-0.054	0.165	-0.306	0.004	-0.007	0.873
collplusratio	Racial gap in population aged 25+ with college degree or higher	-0.064	0.104	-0.239	0.025	-0.029	0.491
unemplratio	Racial gap in unemployment rate	0.060	0.128	-0.013	0.907	0.066	0.115
gini	Gini coefficient	0.107	0.006	0.019	0.862	0.116	0.006
carratio	Racial gap in workers aged 16+ utilizing a car to commute to work	-0.007	0.866	-0.091	0.401	-0.029	0.495
walkratio	Racial gap in workers aged 16+ who walk to work	-0.003	0.942	0.205	0.055	-0.026	0.545
homeratio	Racial gap in workers aged 16+ who work from home	-0.040	0.308	-0.139	0.198	-0.026	0.544
vehicleratio	Racial gap in occupied housing units without a vehicle	0.038	0.331	0.165	0.124	0.010	0.817
cancerrisk	Cancer risk (ppm)	-0.030	0.437	-0.151	0.161	0.025	0.545
neurorisk	Neurologic risk (ppm)	0.007	0.863	-0.092	0.395	0.012	0.769
resprisk	Respiratory risk (ppm)	-0.104	0.008	-0.204	0.056	-0.064	0.127
pcp	Primary care physicians per 100,000 population	0.012	0.757	-0.102	0.344	0.041	0.336
uninsured	Uninsured, all ages (%)	0.078	0.047	-0.069	0.521	0.082	0.052
uninsured18	Uninsured, under age 18 (%)	0.084	0.032	-0.077	0.479	0.082	0.051

Based on the correlation coefficients (both direction and magnitude) and p-values, key variables for inclusion in the model explaining the racial gap in cancer incidence include: (a) % of total population without insurance coverage (uninsured); (b) racial gap in population aged 25+ with a college degree or higher (collplusratio); and (c) racial gap in median household income (incomeratio). Although percentage of vacant housing units (vacant) had a significant relationship with the racial gap in cancer incidence, it was a very weak, negative relationship, so it was not included as a variable. Racial gap in per capita income (percapratio) was excluded since racial gap in median income (incomeratio) had a stronger relationship. The gini coefficient for each county was excluded because using incomeratio made more sense conceptually as it explains race-specific income inequality. Finally, percentage of all ages uninsured (uninsured) was selected over percentage of those under age 18 uninsured (uninsured18) because the relationship was slightly stronger and more significant (see Table 18).

Table 19. Pearson Correlation Coefficients for Racial Disparity in Cancer Mortality

		All Counties (N=653)		***Northeastern Counties (N=88)***		***Southern Counties (N=565)***	
Variable		***r***	***p***	***r***	***p***	***r***	***p***
segtract	Racial residential segregation (tract)	0.088	0.024	0.073	0.498	0.163	0.000
popden	Population density	0.001	0.976	-0.025	0.820	0.192	0.000
popurbp	Urban population (% of total population)	0.080	0.040	-0.034	0.754	0.140	0.001
hden	Housing density	0.007	0.857	-0.013	0.904	0.190	0.000
vacant	Vacant housing units (% of total housing units)	-0.025	0.517	-0.077	0.474	-0.025	0.549
ownratio	Racial gap in occupied housing units owned by householder	-0.096	0.014	-0.188	0.080	-0.168	0.000
rentratio	Racial gap in occupied housing units rented by householder	-0.014	0.716	-0.019	0.859	0.028	0.501
rentratio2	Racial gap in median gross rent as a % of household income	0.021	0.584	0.026	0.811	-0.004	0.918
valueratio	Racial gap in median value of owner-occupied homes	-0.248	0.000	-0.196	0.068	-0.248	0.000
costratio	Racial gap in median owner costs of owner-occupied homes as % of household income	0.071	0.069	-0.266	0.012	0.087	0.040
incomeratio	Racial gap in median household income	-0.243	0.000	-0.294	0.005	-0.221	0.000
percapratio	Racial gap in per capita income	-0.220	0.000	-0.143	0.185	-0.225	0.000
povratio	Racial gap in population living below poverty	0.094	0.017	0.200	0.062	0.101	0.016
nohsratio	Racial gap in population aged 25+ with less than high school diploma	0.166	0.000	0.263	0.013	0.164	0.000
hsplusratio	Racial gap in	-0.127	0.001	-0.248	0.020	-0.105	0.013

	population aged 25+ with high school diploma or higher						
collplusratio	Racial gap in population aged 25+ with college degree or higher	-0.181	0.000	-0.192	0.073	-0.170	0.000
unemplratio	Racial gap in unemployment rate	0.063	0.105	0.001	0.995	0.066	0.119
gini	Gini coefficient	0.260	0.000	0.141	0.191	0.268	0.000
carratio	Racial gap in workers aged 16+ utilizing a car to commute to work	0.000	0.994	-0.177	0.099	-0.056	0.185
walkratio	Racial gap in workers aged 16+ who walk to work	-0.026	0.504	0.210	0.049	-0.045	0.288
homeratio	Racial gap in workers aged 16+ who work from home	-0.030	0.437	0.042	0.699	-0.031	0.465
vehicleratio	Racial gap in occupied housing units without a vehicle	0.111	0.004	0.013	0.901	0.105	0.012
cancerrisk	Cancer risk (ppm)	-0.018	0.642	0.001	0.990	0.039	0.349
neurorisk	Neurologic risk (ppm)	0.059	0.135	-0.043	0.693	0.069	0.101
resprisk	Respiratory risk (ppm)	-0.098	0.013	-0.052	0.627	-0.068	0.106
pcp	Primary care physicians per 100,000 population	0.148	0.000	0.105	0.332	0.183	0.000
uninsured	Uninsured, all ages (%)	0.157	0.000	-0.071	0.509	0.146	0.001
uninsured18	Uninsured, under age 18 (%)	0.152	0.000	-0.115	0.285	0.131	0.002

Based on the correlation coefficients (both direction and magnitude) and p-values, key variables for inclusion in the model explaining the racial gap in cancer mortality include: (a) % of total population without insurance coverage (uninsured); (b) primary care physicians per 100,000 population (pcp); (c) racial gap in population aged 25+ with college degree or higher

(collplusratio); (d) racial gap in median value of owner-occupied homes (valueratio); and (e) racial gap in median household income (incomeratio). Although racial gap in occupied housing units owned by householder (ownratio) and racial gap in population living below poverty (povratio) had a significant relationship with racial gap in cancer mortality, the correlation coefficients were weak, so they were excluded as potential variables in the final models. Racial gap in per capita income (percapratio) was excluded since racial gap in median income (incomeratio) had a stronger relationship. The Gini coefficient for each county was excluded because using incomeratio made more sense conceptually as it explains race-specific income inequality. The racial gap in population aged 25+ with a college degree or higher (collplusratio) was selected over racial gap in population aged 25+ with high school diploma or higher (hsplusratio) and racial gap in population less than high school diploma (nohsratio) since the relationship was strong and significant both overall and for each region separately (northeastern v. southern). Finally, percentage of all ages uninsured (uninsured) was selected over percentage of those under age 18 uninsured (uninsured18) since the relationship was slightly stronger (see Table 19).

3.3.4 Spatial analysis

ArcGIS[65] was utilized to visually represent the geographic distribution of the dependent and independent variables. The Access database was imported into ArcMap 10.2.2 and a series of quartile choropleth[66] maps were created to represent the distribution of each variable. The use of

[65] ArcGIS is a collection of software products utilized for managing, displaying, and analyzing spatial data. The specific program used to create the cholopleth maps for this study was ArcMap 10.2.2.

[66] The International Cartographic Association (ICA) defines choropleth maps as "a method of cartographic representation which employs distinctive color or shading" (Dent 2002 quoted in Curtis and Leitner 2006)

spatial analysis allows for the identification of “hot spots” and clusters of poor health outcomes, high rates of racial residential segregation, lack of access to health care resources, lack of access to dietary resources, poor housing characteristics, harmful environmental conditions, lack of transportation, and economic/educational deprivation.

4.0 RESULTS

Results are reported to address each of the three aims of this study:

(a) Examine the impact of racial residential segregation on county-level racial disparities in cancer incidence and mortality in northeastern and southern U.S. counties (see Section 4.1 Regression Analysis).

(b) Examine the spatial distribution of the racial gap in cancer incidence/mortality, racial residential segregation, and characteristics of the physical and social environment in northeastern and southern U.S. counties (see Section 4.2 Spatial Analysis).

(c) Examine the relationship between racial residential segregation and characteristics of the physical and social environment in northeastern and southern U.S. counties (see Section 4.3 Identification of Factors Related to Racial Residential Segregation).

4.1 REGRESSION ANALYSIS

Models were created for both the racial gap in cancer incidence and the racial gap in cancer mortality. The models were assessed by evaluating adjusted R^2 values and the significance of the change in F-statistic between each model. In addition, all models were assessed for

multicollinearity by examining the tolerance and variance inflation factor (VIF) values[67]. No values of tolerance were less than 0.10 and no values of VIF were greater than 10.0. This indicates that multicollinearity is not an issue with the independent variables selected for the models.

4.1.1 Racial gap in cancer incidence

This set of models includes the key independent variable (racial residential segregation), two control variables (a dummy variable to indicate northeastern location; urban population as a percentage of total population), and three additional independent variables of interest based on direction and magnitude of the correlation coefficients (percentage of total population without insurance coverage; racial gap in population aged 25+ with college degree or higher, and racial gap in median household income) (see Table 20).

The first model includes only the key independent variable (racial residential segregation) and resulted in an F-statistic of 3.699 (p=0.055). The standardized coefficient (β) indicates a positive relationship between the level of racial residential segregation and racial gap in cancer incidence; however, this relationship is only significant at the 0.10 level (p=0.075). Overall, this model only explains 0.4% of the variance in the racial gap in cancer incidence.

The second model adds in the two control variables—northeastern location and urban population. The addition of these two variables increased the adjusted R^2 to 0.9% and results in a change in the F-statistic that is significant at the 0.10 level (F-change=2.729; p=0.066). The

[67] Tolerance is the % of variance in the predictor that cannot be accounted for by other predictors. Small values (<0.10) usually indicate that the variable is redundant. Large values of VIF (>10.0) indicate that the variable is too strongly related to another predictor in the model.

standardized coefficients (β) show that when controlling for whether a county is in the northeastern region and its urban population, the level of racial residential segregation now becomes a significant predictor of the racial gap in cancer incidence at the 0.05 level (p=0.028).

The third model adds in the percentage of the total population without insurance coverage. The addition of this variable increased the adjusted R^2 to 1.1%; however, this change was non-significant (F-change=2.103; p=0.147). The standardized coefficients (β) show that when controlling for northeastern county status, urban population, and percentage of total population without insurance coverage, the impact of racial residential segregation remains significant (p=0.043) and is the strongest predictor of the racial gap in cancer incidence compared to other predictors. The model only explains 1.1% of the variance in the racial gap in cancer incidence.

The fourth model adds in the racial gap in population aged 25+ with a college degree or higher. This addition increased the adjusted R^2 to 1.3%, but resulted in a non-significant change in the F-statistic (F-change=2.102; p=0.148). The standardized coefficients (β) show that when controlling for northeastern location, urban population, percentage of total population without insurance coverage, and racial gap in population aged 25+ with college degree or higher, the impact of racial residential segregation is reduced in significance (p=0.093); however, it is still the strongest predictor of racial gap in cancer incidence. The addition of the racial gap in population aged 25+ with a college degree or higher to this model did not result in a significant change in the F-statistic from Model 3.

The final model added in the racial gap in median household income. This addition significantly increased the adjusted R^2 value to 2.4% (F-change=8.795; p=0.003). The standardized coefficients (β) show that when controlling for all other variables, the strongest (and

only significant) predictor of the racial gap in cancer incidence is the racial gap in median household income. The standardized coefficient (β=-0.145) indicates that as the median household income of black households increases compared to white median household income, the racial gap in cancer incidence will narrow.

Overall, although the addition of percentage of total population without insurance coverage and the racial gap in population aged 25+ with a college degree or higher did not significantly increase the adjusted R^2 values of their respective models, these variables have theoretical importance. In addition, these variables taken together with the racial gap in median household income create a significant model to predict the racial gap in cancer incidence rates. This model indicates that regional differences (northeastern v. southern region) exist, with northeastern counties having narrower racial gaps in cancer incidence rates than southern counties, even when controlling for all other factors—segregation, urban population, insurance status, education, and income differences. Overall, the strongest predictor of a county's racial gap in cancer incidence is the racial gap in median household income, with larger ratios of black to white median household income relating to narrower racial gaps in cancer incidence.

Table 20. Summary of Multivariate Regression Analysis for Variables Predicting Racial Gap in Cancer Incidence (N=635)

	Model 1			Model 2			Model 3		
Variable	**B**	**SEB**	**β**	**B**	**SEB**	**β**	**B**	**SEB**	**β**
constant	0.992	0.017		0.979	0.019		0.943	0.031	
Racial residential segregation	0.000	0.000	0.075†	0.001	0.000	0.108*	0.001	0.000	0.100*
Northeastern region				-0.042	0.018	-0.100*	-0.030	0.019	-0.073
Urban population, % of total population				0.000	0.000	0.014	0.000	0.000	0.021
Uninsured, all ages (%)							0.002	0.002	0.062
Racial gap in population aged 25+ with college degree or higher									
Racial gap in median household income									
Adj. R^2	0.004			0.009			0.011		
F	3.699†			3.059*			2.824*		
F for change in R^2	3.699†			2.729†			2.103		

	Model 4			Model 5		
Variable	**B**	**SEB**	**β**	**B**	**SEB**	**β**
constant	0.966	0.035		1.062	0.047	
Racial residential segregation	0.001	0.000	0.093†	0.001	0.000	0.062
Northeastern region	-0.029	0.019	-0.069	-0.025	0.019	-0.059
Urban population, % of total population	0.000	0.000	0.031	0.000	0.000	0.043
Uninsured, all ages (%)	0.002	0.002	0.060	0.002	0.002	0.040
Racial gap in population aged 25+ with college degree or higher	-0.038	0.026	-0.057	0.014	0.032	0.021
Racial gap in median household income				-0.168	0.057	-0.145**
Adj. R^2	0.013			0.024		
F	2.683*			3.729***		
F for change in R^2	2.102			8.795**		

† p<0.10; * p<0.05; ** p<0.01; *** p<0.001

4.1.2 Racial gap in cancer mortality

This set of models includes the key independent variable (racial residential segregation), two control variables (a dummy variable to indicate northeastern counties; urban population as a percentage of total population), and five additional independent variables of interest based on direction and magnitude of the correlation coefficients (percentage of total population without insurance coverage; primary care physicians per 100,000 population; racial gap in population

aged 25+ with a college degree or higher; racial gap in median value of owner-occupied homes; and racial gap in median household income) (see Table 21).

The first model includes only the key independent variable (racial residential segregation) and the standardized coefficient (β) indicates a significant, positive relationship between the level of racial residential segregation in a county and its racial gap in cancer mortality. Overall, this model only explains 0.6% of the variance in the racial gap in cancer incidence.

The second model adds in the two control variables—northeastern region and urban population. The addition of these two variables increases the adjusted R^2 to 3.6% and results in a significant change in the F-statistic (F-change=10.994; p=0.000). The standardized coefficients (β) show that when controlling for whether a county is in the northeastern region and urban population, the level of racial residential segregation now becomes a stronger predictor of the racial gap in cancer mortality (p=0.006). When controlling for all other factors, the strongest predictor of the racial gap in cancer mortality is whether the county is in the northeastern region. The standardized coefficient (β=-0.193) indicates that northeastern counties have narrower racial gaps in cancer mortality compared to southern counties.

The third model adds in variables representing the percentage of the total population without insurance coverage and primary care physicians per 100,000 population. The addition of these variables increases the adjusted R^2 to 6.6% and results in a significant change in the F-statistic (F-change=11.550; p=0.000). The standardized coefficients (β) show that when controlling for northeastern location, urban population, uninsured, and PCPs, the impact of racial residential segregation on the racial gap in cancer mortality is still significant, however the strongest predictor now becomes primary care physicians per 100,000 population (β=0.170;

p=0.000). This coefficient indicates that there is a significant positive relationship between the number of PCPs a county has and the racial gap in cancer mortality.

The fourth model adds in a variable representing the racial gap in population aged 25+ with a college degree or higher. The addition of this variable results in a significant increase of the adjusted R^2 to 8.6% (F-change=15.065; p=0.000). The standardized coefficients (β) show that when controlling for all other variables, the impact of racial residential segregation is reduced (β=0.087; p=0.068). The strongest predictor of the racial gap in cancer mortality becomes the racial gap in population aged 25+ with a college degree or higher (β=-0.151; p=0.000). This coefficient indicates that as a higher proportion of the black population attains a college degree or higher when compared to the white population, the racial gap in cancer mortality will narrow.

The final model includes variables related to the racial gap in median value of owner-occupied homes and the racial gap in median household income. The addition of these variables significantly increase the adjusted R^2 to 10.4% (F-change=7.292; p=0.001). The standardized coefficients (β) show that when controlling for all other variables, the impact of racial residential segregation becomes non-significant (p=0.574) but remains positive. When controlling for all other factors, the strongest predictor of the racial gap in cancer mortality is the racial gap in median household income. The standardized coefficient (β=-0.130) indicates that as the median household income of black households decreases compared to white median household income, the racial gap in cancer incidence will widen. Overall, this model provides best set of predictors of the racial gap in cancer mortality.

Table 21. Summary of Multivariate Regression Analysis for Variables Predicting Racial Gap in Cancer Mortality

(N=635)

	Model 1			Model 2			Model 3		
Variable	**B**	**SEB**	**β**	**B**	**SEB**	**β**	**B**	**SEB**	**β**
constant	1.136	0.026		1.093	0.028		0.953	0.047	
Racial residential segregation	0.001	0.001	0.088*	0.002	0001	0.133**	0.001	0.001	0.102*
Northeastern region				-0.123	0.027	-0.193***	-0.083	0.029	-0.131**
Urban population, % of total population				0.001	0.000	0.061	0.000	0.000	-0.004
Uninsured, all ages (%)							0.009	0.003	0.150***
Primary care physicians per 100,000 population							0.001	0.000	0.170***
Racial gap in population aged 25+ with college degree or higher									
Racial gap in median value of owner-occupied homes									
Racial gap in median household income									
Adj. R^2	0.006			0.036			0.066		
F	5.110*			9.085***			10.248***		
F for change in R^2	5.110*			10.994***			11.550***		

	Model 4			Model 5		
Variable	**B**	**SEB**	**β**	**B**	**SEB**	**β**
constant	1.051	0.053		1.275	0.080	
Racial residential segregation	0.001	0.001	0.087†	0.000	0.001	0.028
Northeastern region	-0.077	0.028	-0.122**	-0.064	0.029	-0.101*
Urban population, % of total population	0.000	0.000	0.040	0.001	0.000	0.063
Uninsured, all ages (%)	0.008	0.002	0.139***	0.007	0.002	0.112**
Primary care physicians per 100,000 population	0.001	0.000	0.132**	0.001	0.000	0.121**
Racial gap in population aged 25+ with college degree or higher	-0.154	0.040	-0.151***	-0.040	0.050	-0.039
Racial gap in median value of owner-occupied homes				-0.133	0.090	-0.083
Racial gap in median household income				-0.230	0.093	-0.130*
Adj. R^2	0.086			0.104		
F	11.236***			10.414***		
F for change in R^2	15.065***			7.292***		

† p<0.10; * p<0.05; ** p<0.01; *** p<0.001

4.2 SPATIAL ANALYSIS

ArcGIS is utilized to visually represent the geographic distributions of the dependent and independent variables. Unlike the regression analysis, this spatial analysis utilizes data from all counties with available data. Due to the large amount of missing data for the racial gaps in cancer incidence and cancer mortality (30.8% and 41.7% respectively), the spatial analysis of cancer incidence and mortality focuses on identifying basic patterns in distribution and counties with the largest racial gaps. A more extensive spatial analysis of racial residential segregation, urban population, racial disparity in home ownership, income disparities (median household income, Gini coefficient, and poverty), educational attainment, air toxics, and primary care availability is conducted.

4.2.1 Racial gap in cancer incidence and cancer mortality

A quartile choropleth map of the ratio of black to white cancer incidence identifies five clusters of counties with ratios at or above 1.03: (1) southeastern Louisiana; (2) southeastern Texas; (3) western Mississippi; (4) eastern Mississippi; and (5) southern Virginia. Six counties were identified as having a ratio of black to white cancer incidence ≥ 2.00, with Fentress, Tennessee having a black cancer incidence rate 27.17 times the white cancer incidence rate (see Figure 13 and Table 22). Table 22 provides the black cancer incidence rate, white cancer incidence rate, and ratio of black to white cancer incidence for these six counties.

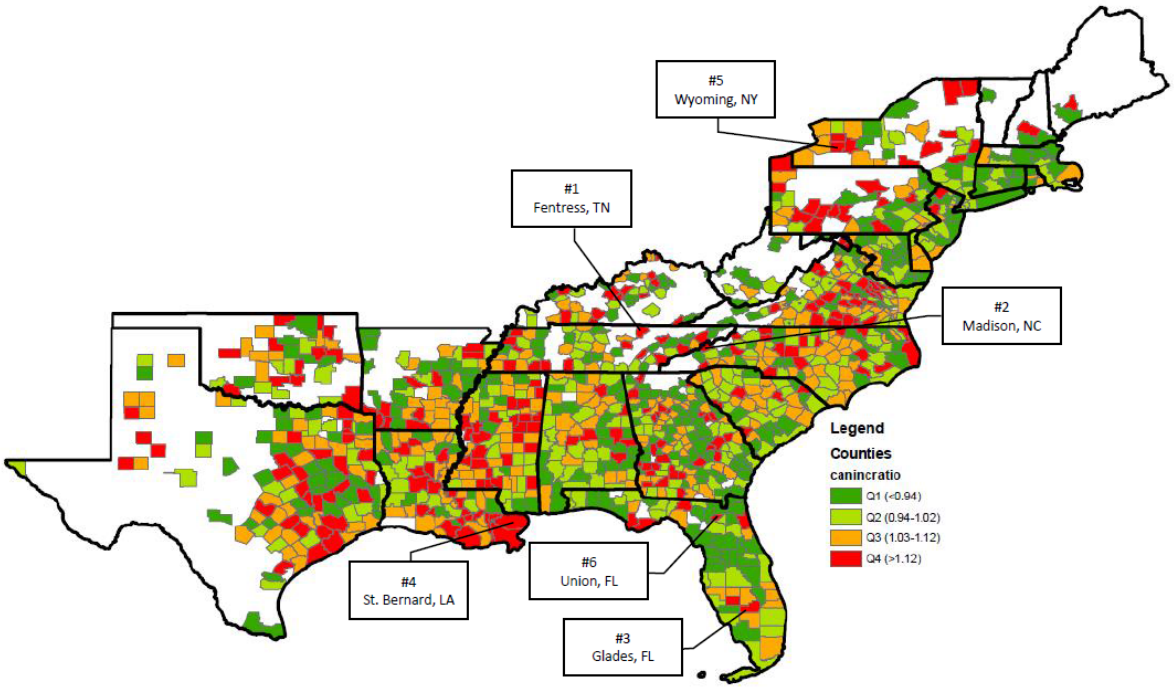

Figure 13. Ratio of Black to White Cancer Incidence by Quartile, 2005-2009[68]

Table 22. Counties with Ratio of Black to White Cancer Incidence ≥2.00 (canincratio), 2005-2009 (N=6)

Rank	Black Incidence	White Incidence	canincratio	County
1	14508.4	534.0	27.17	Fentress, TN
2	7596.9	527.4	14.40	Madison, NC
3	774.9	307.3	2.52	Glades, FL
4	955.4	417.4	2.29	St. Bernard, LA
5	1222.2	581.9	2.10	Wyoming, NY
6	2273.6	1133.0	2.01	Union, FL

A quartile choropleth map of the ratio of black to white cancer mortality identifies three clusters of counties with ratios at or above 1.18: (1) southeastern Louisiana around St. Bernard Parrish; (2) northeastern Louisiana, Western Mississippi, and southeastern Iowa; and (3) eastern Mississippi. Ten counties were identified as having a ratio of black to white cancer incidence ≥

[68] Counties with ratio of black to white cancer incidence ≥2.00 have been identified. The ratio of black to white cancer incidence could not be calculated for 505 counties due to missing black/white cancer incidence data.

2.00, with Colorado, Texas having a black cancer mortality rate 2.46 times the white cancer mortality rate (see Figure 14 and Table 23). Table 23 provides the black cancer mortality rate, white cancer mortality rate, and ratio of black to white cancer mortality for these ten counties.

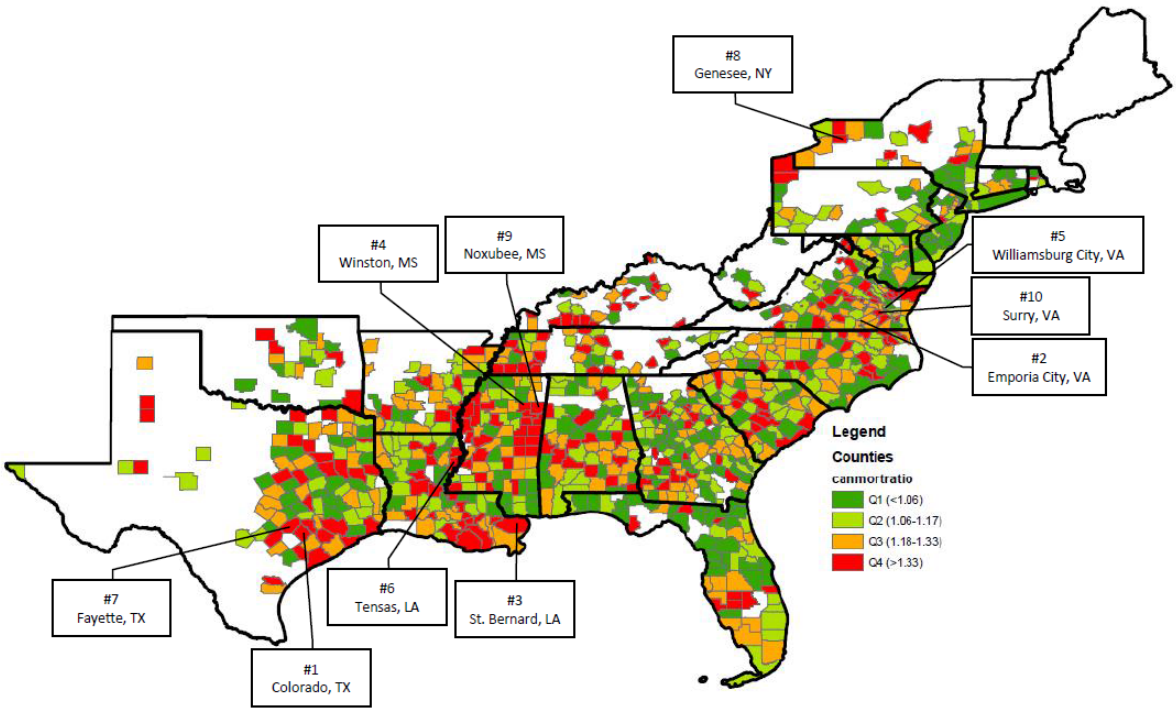

Figure 14. Ratio of Black to White Cancer Mortality by Quartile, 2005-2009[69]

Table 23. Counties with Ratio of Black to White Cancer Mortality ≥2.00 (canmortratio), 2005-2009 (N=10)

Rank	Black Mortality	White Mortality	canmortratio	County
1	370.0	150.4	2.46	Colorado, TX
2	264.0	112.7	2.34	Emporia (city), VA
3	552.9	238.4	2.32	St. Bernard, LA
4	311.5	137.0	2.27	Winston, MS
5	358.5	161.5	2.22	Williamsburg (city), VA
6	328.9	149.0	2.21	Tensas, LA
7	342.3	158.1	2.17	Fayette, TX
8	364.3	172.9	2.11	Genesee, NY
9	240.5	113.9	2.11	Noxubee, MS
10	276.4	137.1	2.02	Surry, VA

[69] Counties with ratio of black to white cancer mortality greater than 1.99 have been identified. The ratio of black to white cancer mortality could not be calculated for 684 counties due to missing black/white cancer mortality data.

The large amount of missing data for both cancer incidence and cancer mortality makes it impossible to display and describe spatial distributions that accurately represent the reality of racial disparities in cancer incidence and mortality. In addition, it becomes difficult to identify spatial patterns in variables thought to be related to racial disparities in incidence and mortality—segregation, income disparity, education disparity, environmental air quality, etc.

4.2.2 Racial residential segregation

A quartile choropleth map of racial residential segregation, as represented by the index of dissimilarity, identifies several clusters of counties with segregation rates falling within the highest quartile (greater than 47.7). The largest cluster exists within Pennsylvania, New York, New Jersey, Massachusetts, and Connecticut, followed by another large cluster in Florida. Ten counties were identified as having the highest rates of racial residential segregation, ranging from 79.4 to 86.2 (see Figure 15 and Table 24).

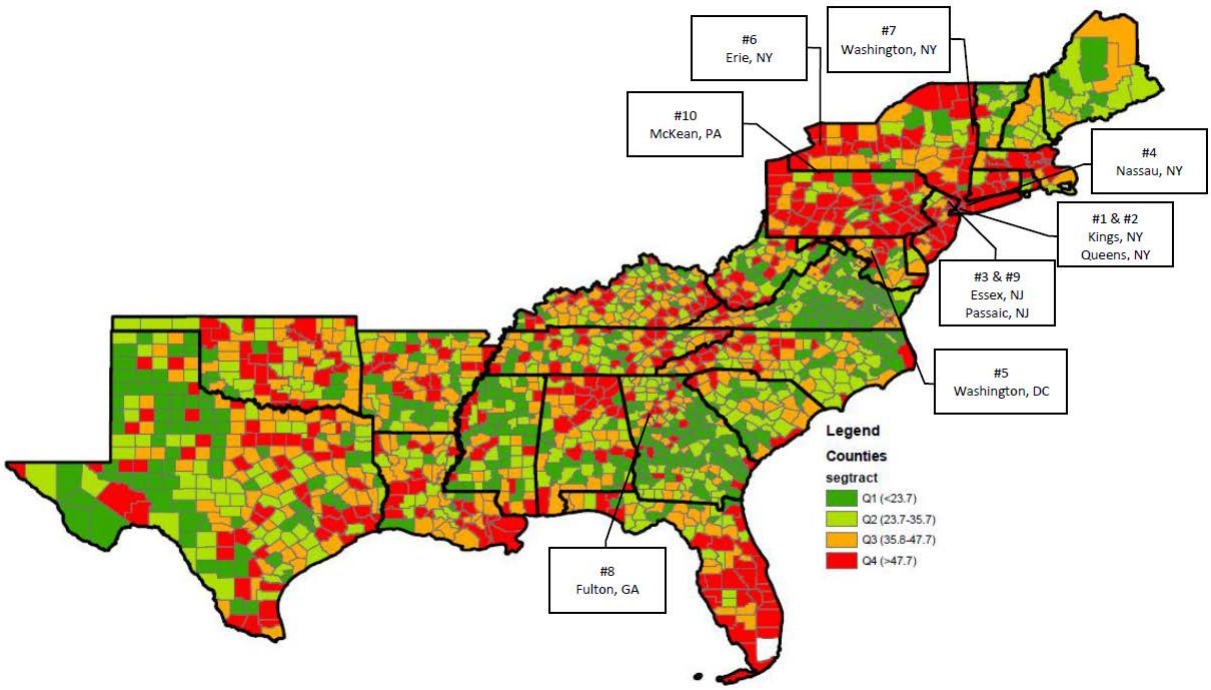

Figure 15. Racial Residential Segregation (Index of Dissimilarity) by Quartile, 2000[70]

Table 24. Counties with Highest Racial Residential Segregation (segtract), 2000 (N=10)

Rank	segtract	County
1	86.2	Kings, NY
2	82.9	Queens, NY
3	81.1	Essex, NJ
4	80.7	Nassau, NY
5	80.3	Washington, DC
6	79.8	Erie, NY
7	79.8	Washington, NY
8	79.5	Fulton, GA
9	79.5	Passaic, NJ
10	79.4	McKean, PA

[70] Racial residential segregation (index of dissimilarity) is missing for one county (Miami-Dade).

4.2.3 Urban population

There are several clusters of counties with more than 64.5% of the population living in urban areas, with the largest cluster in central Maryland, southeastern Pennsylvania, New Jersey, southeastern New York, central Connecticut, Rhode Island, and Massachusetts. Other large clusters exist in southeastern Louisiana and Florida. Thirty-three counties/cities[71] report 100% of their population residing in urban centers (see Figure 16 and Table 25).

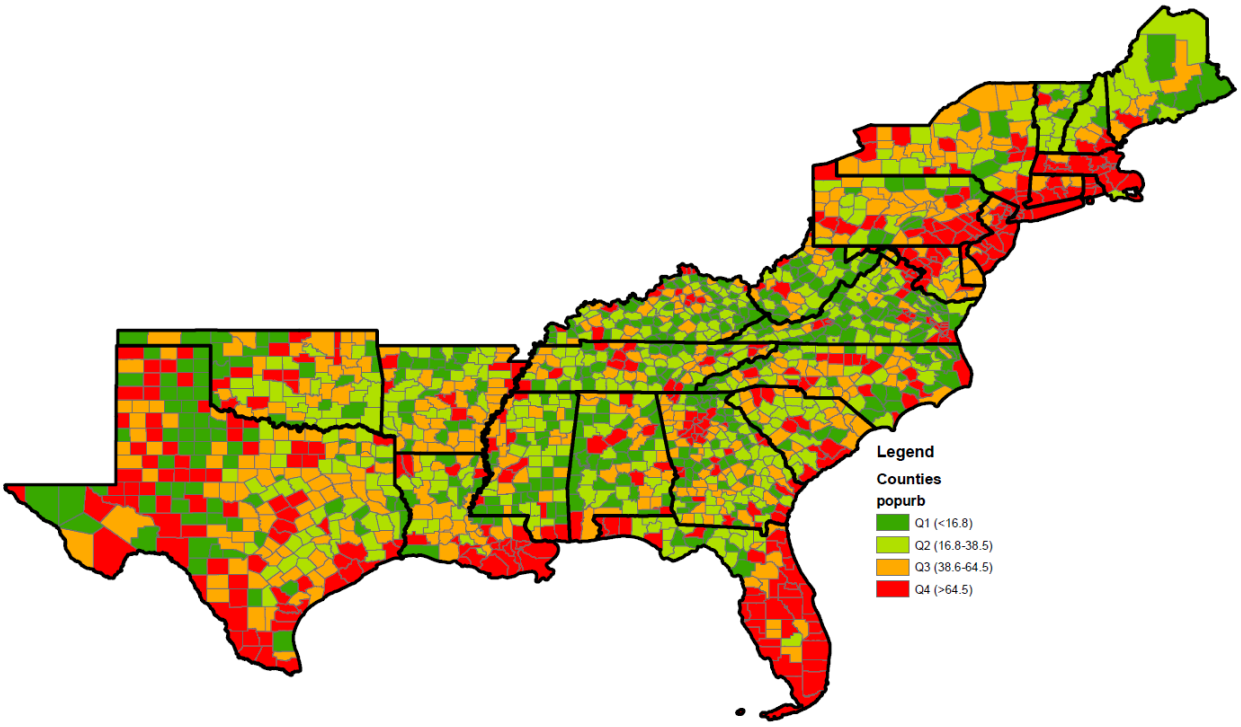

Figure 16. Urban Population (%) by Quartile, 2000[72]

[71] Several cities within Virginia are recognized in a similar fashion to counties.
[72] No individual counties have been flagged as 33 counties have urban population of 100.0%.

Table 25. Counties with Highest Urban Population (%) (popurb), 2000 (N=33)

Rank	popurb	County
1	100.0	Washington, DC
2	100.0	Baltimore city, MD
3	100.0	Suffolk, MA
4	100.0	Hudson, NJ
5	100.0	Union, NJ
6	100.0	Bronx, NY
7	100.0	Kings, NY
8	100.0	New York, NY
9	100.0	Queens, NY
10	100.0	Richmond, NY
11	100.0	Philadelphia, PA
12	100.0	Arlington, VA
13	100.0	Alexandria (city), VA
14	100.0	Bedford (city), VA
15	100.0	Charlottesville (city), VA
16	100.0	Clifton Forge (city), VA
17	100.0	Colonial Heights (city), VA
18	100.0	Covington (city), VA
19	100.0	Fairfax (city), VA
20	100.0	Falls Church (city), VA
21	100.0	Hopewell (city), VA
22	100.0	Lexington (city), VA
23	100.0	Manassas (city), VA
24	100.0	Manassas Park (city), VA
25	100.0	Martinsville (city), VA
26	100.0	Newport News (city), VA
27	100.0	Norfolk (city), VA
28	100.0	Portsmouth (city), VA
29	100.0	Richmond (city), VA
30	100.0	Roanoke (city), VA
31	100.0	Salem (city), VA
32	100.0	Williamsburg (city), VA
33	100.0	Winchester (city), VA

4.2.4 Racial disparity in home ownership

The quartile choropleth map of the ratio of black to white housing units owned by householders shows a large concentration of counties reporting a ratio in the lowest quartile (below 0.65) within the whole northeastern region (Pennsylvania, New York, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine). Sixteen counties were identified as having a ratio of black to white housing units owned by householders of 0.00. This value indicates that within these counties no black households were owned by their occupants (see Figure 17 and Table 26).

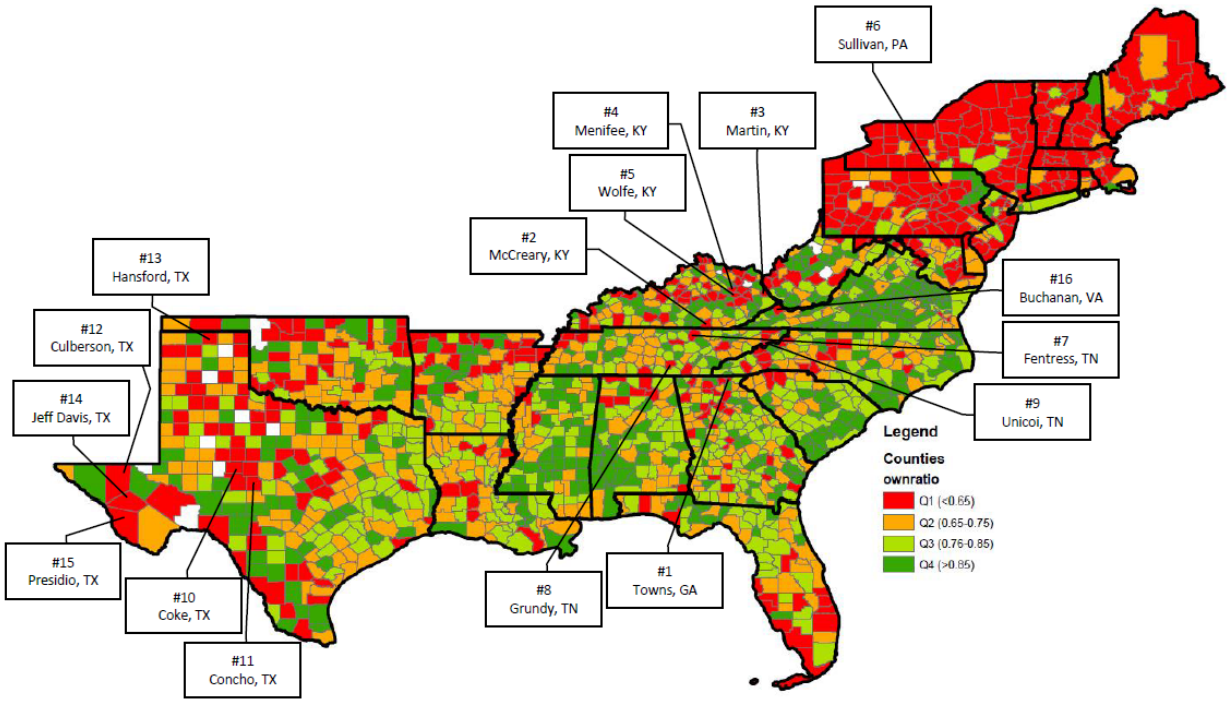

Figure 17. Ratio of Black to White Occupied Housing Units Owned by Householder by Quartile, 2000[73]

[73] Ratio of black to white occupied housing units owned by householder (ownratio) is missing for 16 counties.

Table 26. Counties with Lowest Ratio of Black to White Housing Units Owned by Householders (ownratio), 2000

(N=16)

Rank	ownratio	County
1	0.00	Towns, GA
2	0.00	McCreary, KY
3	0.00	Martin, KY
4	0.00	Menifee, KY
5	0.00	Wolfe, KY
6	0.00	Sullivan, PA
7	0.00	Fentress, TN
8	0.00	Grundy, TN
9	0.00	Unicoi, TN
10	0.00	Coke, TX
11	0.00	Concho, TX
12	0.00	Culberson, TX
13	0.00	Hansford, TX
14	0.00	Jeff Davis, TX
15	0.00	Presidio, TX
16	0.00	Buchanan, VA

4.2.5 Racial disparity in median household income

The quartile choropleth map of the ratio of black to white median household income shows two large clusters of counties with ratios falling within the lowest quartile (less than 0.53): (1) Louisiana, southern Iowa, and western Mississippi; and (2) eastern Mississippi and western/central Alabama. Thirty-four counties were identified as having a ratio of black to white median household income of 0.00. This value indicates that within these counties the median black household income was $0.00 compared to any white median household income (see Figure 18 and Table 27).

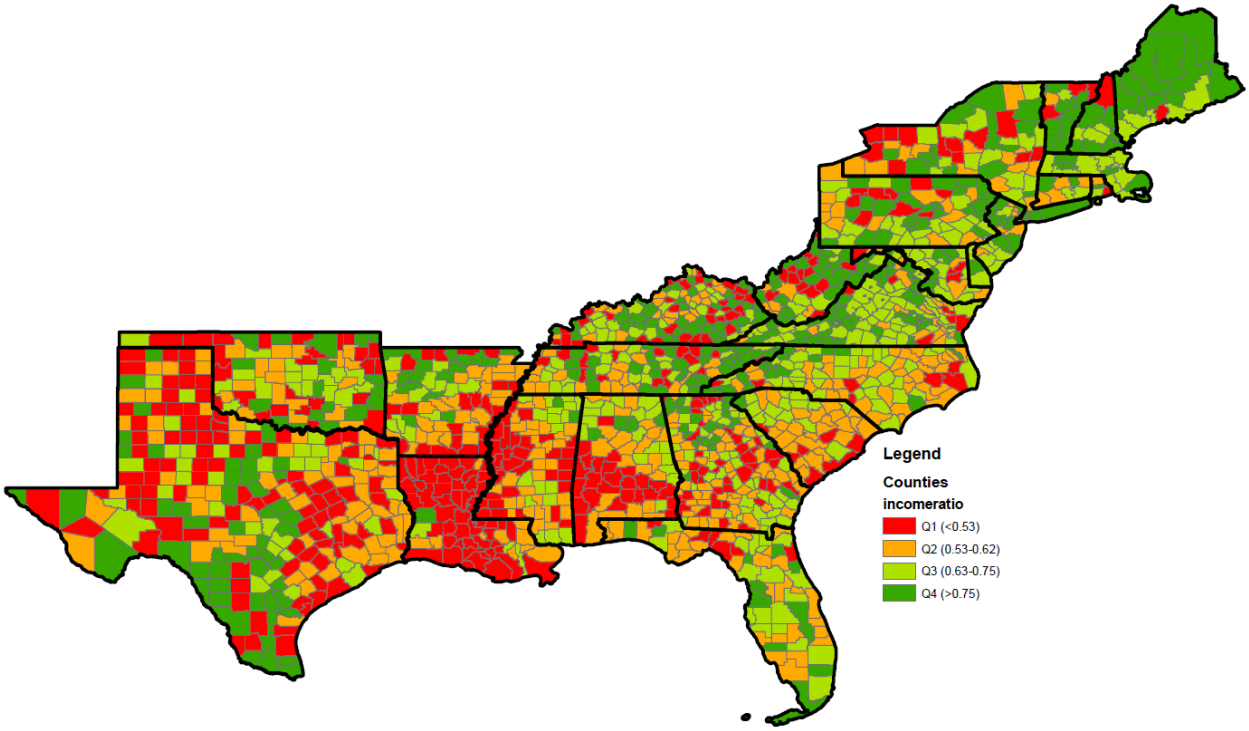

Figure 18. Ratio of Black to White Median Household Income by Quartile, 2000[74]

Table 27. Counties with Smallest Ratio of Black to White Per Capita Income (percapratio), 2000 (N=34)

Rank	percapratio	County	Rank	percapratio	County
1	0.00	Fulton, AR	18	0.00	Hansford, TX
2	0.00	Marion, AR	19	0.00	King, TX
3	0.00	Montgomery, AR	20	0.00	Loving, TX
4	0.00	Breathitt, KY	21	0.00	Ochiltree, TX
5	0.00	Elliott, KY	22	0.00	Roberts, TX
6	0.00	Estill, KY	23	0.00	Sterling, TX
7	0.00	Jackson, KY	24	0.00	Terrell, TX
8	0.00	Owsley, KY	25	0.00	Throckmorton, TX
9	0.00	Graham, NC	26	0.00	Zapata, TX
10	0.00	Ellis, OK	27	0.00	Highland, VA
11	0.00	Harper, OK	28	0.00	Calhoun, WV
12	0.00	Roger Mills, OK	29	0.00	Doddridge, WV
13	0.00	Unicoi, TN	30	0.00	Lincoln, WV
14	0.00	Armstrong, TX	31	0.00	Nicholas, WV
15	0.00	Borden, TX	32	0.00	Tucker, WV
16	0.00	Crockett, TX	33	0.00	Webster, WV
17	0.00	Hamilton, TX	34	0.00	Wirt, WV

[74] Specific counties are not identified in the map due to 34 counties having a ratio of black to white median household income (incomeratio) of 0.00.

4.2.6 Overall income inequality (Gini coefficient)

The quartile choropleth map of the Gini coefficient shows three large clusters of counties with Gini coefficients falling within the highest quartile (greater than 0.47225): (1) southern Texas; (2) central/eastern Louisiana, southern Iowa, western/central Mississippi, central Alabama, southwest Georgia, and central/eastern South Carolina; and (3) eastern Kentucky and southeastern West Virginia. Ten counties were identified as having the highest Gini coefficients, ranging from 0.56084-0.60499 (see Figure 19 and Table 28).

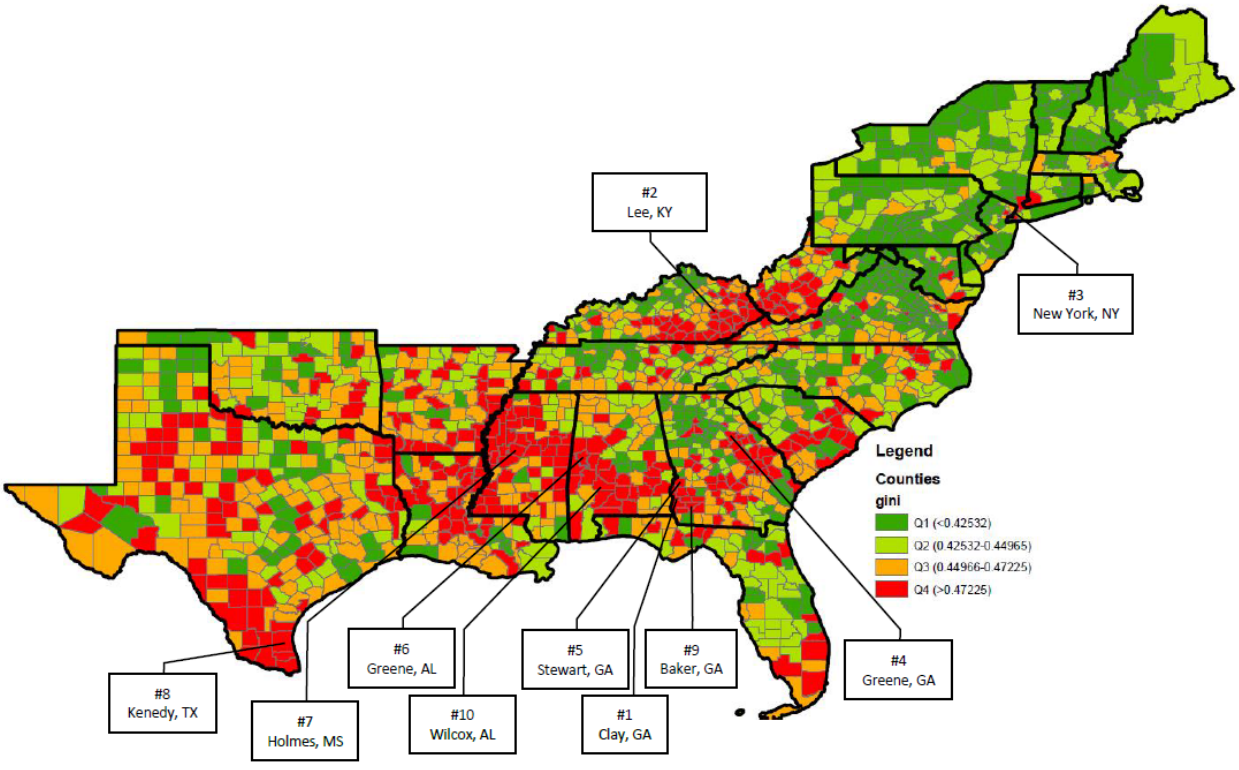

Figure 19. Gini Coefficient by Quartile, 2000

Table 28. Counties with Largest Gini Coefficients, 2000 (N=10)

Rank	gini	County
1	0.60499	Clay, GA
2	0.58587	Lee, KY
3	0.58556	New York, NY
4	0.58300	Greene, GA
5	0.58128	Stewart, GA
6	0.57602	Greene, AL
7	0.57046	Holmes, MS
8	0.56598	Kenedy, TX
9	0.56275	Baker, GA
10	0.56084	Wilcox, AL

4.2.7 Racial disparity in poverty

The quartile choropleth map of the ratio of the proportion of black to the proportion of white population living in poverty shows several small clusters of counties with ratios falling within the highest quartile (greater than 3.26). The two largest clusters exist in (1) Louisiana, Iowa, Mississippi, Alabama, Georgia, and Florida; and (2) Virginia and North Carolina. Ten counties with the highest ratios were identified and flagged, with Hartley, Texas having the highest racial disparity (16.80) (see Figure 20 and Table 29).

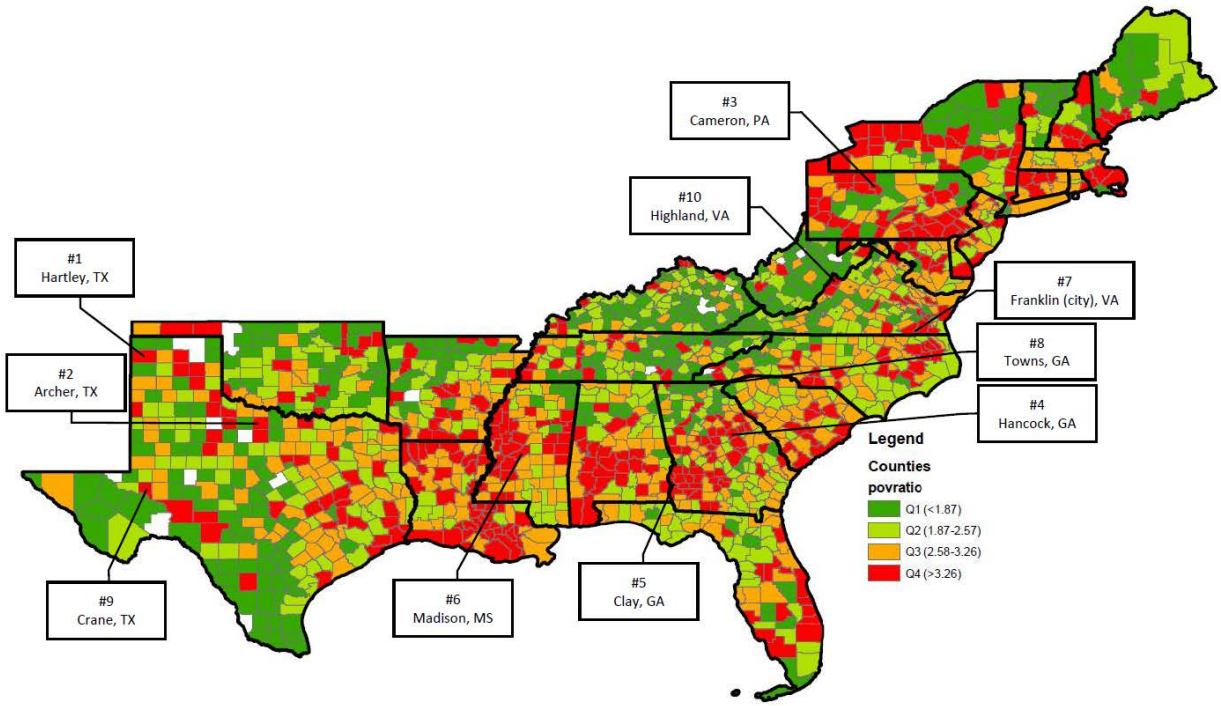

Figure 20. Ratio of Black to White Population (%) Living in Poverty by Quartile, 2000[75]

Table 29. Counties with Largest Ratio of Black to White Population (%) Living in Poverty (povratio), 2000 (N=10)

Rank	povratio	County
1	16.80	Hartley, TX
2	10.94	Archer, TX
3	10.93	Cameron, PA
4	9.38	Hancock, GA
5	8.81	Clay, GA
6	8.76	Madison, MS
7	8.64	Franklin (city), VA
8	8.51	Towns, GA
9	8.11	Crane, TX
10	8.01	Highland, VA

[75] The ratio of black to white population (%) living in poverty (povratio) is missing for 23 counties.

4.2.8 Racial disparity in educational attainment

Educational attainment can be examined using three metrics: (1) proportion of those aged 25+ within a given population without a high school degree or equivalent; (2) proportion of those aged 25+ within a given population with a high school degree/equivalent or a higher degree; or (3) proportion of those aged 25+ within a given population with a college degree or higher. Quartile choropleth maps were constructed for the racial disparities in each of these metrics.

The quartile choropleth map of the ratio of the proportion of black to the proportion of white population aged 25+ with less than a high school degree/equivalent shows several small clusters of counties with ratios falling within the highest quartile (greater than 1.93). The largest cluster is located in New York. Several southern states, including Virginia, North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, and Louisiana, have a majority of their counties falling within the worst two quartiles (1.56-1.93; >1.93). Ten counties with the highest ratios were identified and flagged, with Nantucket, Massachusetts having the highest racial disparity (10.04) (see Figure 21 and Table 30).

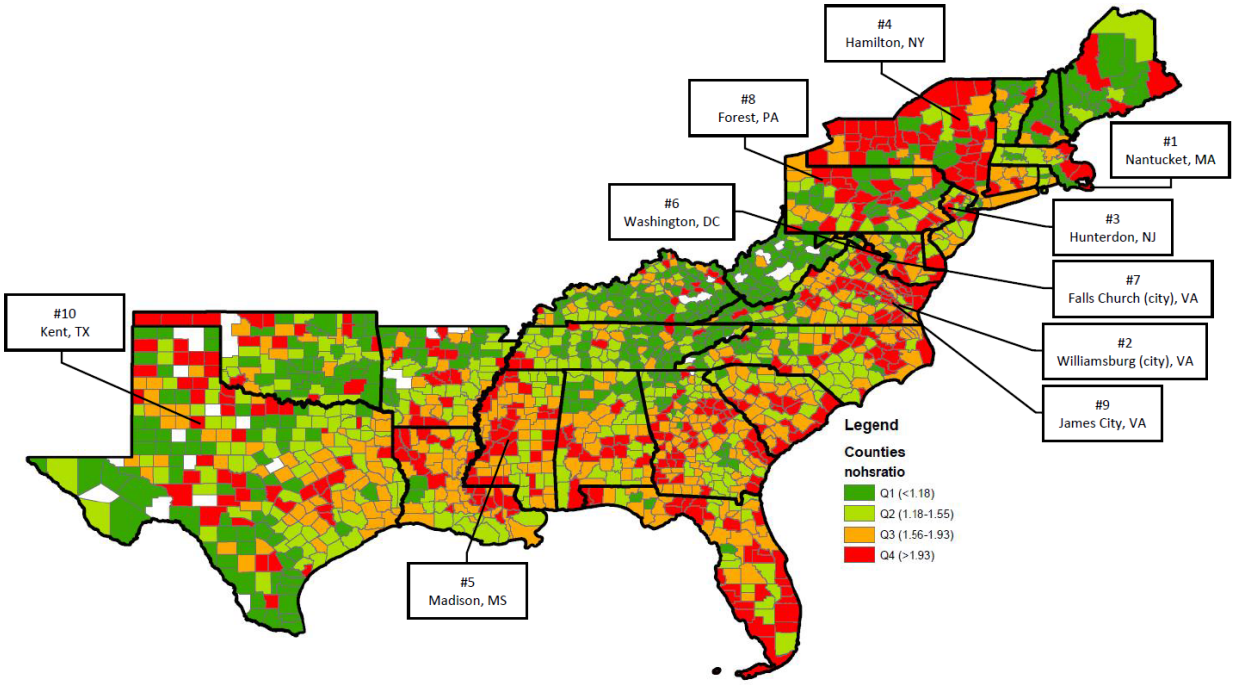

Figure 21. Ratio of Black to White Population Aged 25+ (%) with Less Than a High School Diploma by Quartile, 2000[76]

Table 30. Counties with Largest Ratio of Black to White Population Aged 25+ (%) with Less Than a High School Diploma (nohsratio), 2000 (N=10)

Rank	nohsratio	County
1	10.04	Nantucket, MA
2	6.91	Williamsburg (city), VA
3	6.21	Hunterdon, NJ
4	6.09	Hamilton, NY
5	5.73	Madison, MS
6	5.32	Washington, DC
7	5.05	Falls Church (city), VA
8	5.03	Forest, PA
9	4.97	James City, VA
10	4.85	Kent, TX

[76] The ratio of black to white population aged 25+ (%) with less than a high school diploma (nohsratio) is missing for 35 counties.

The quartile choropleth map of the ratio of the proportion of black to the proportion of white population aged 25+ with a high school degree/equivalent or greater shows several small clusters of counties with ratios falling within the lowest quartile (less than 0.76). The two largest clusters exist in (1) Louisiana, Mississippi, Alabama, Georgia, and Florida; and (2) Virginia and North Carolina. Fifteen counties were identified as having a ratio of proportion of black population to proportion of white population aged 25+ with a high school degree/equivalent or higher of 0.00. This value indicates that no black residents aged 25+ within that county received a high school degree or greater (see Figure 22 and Table 31).

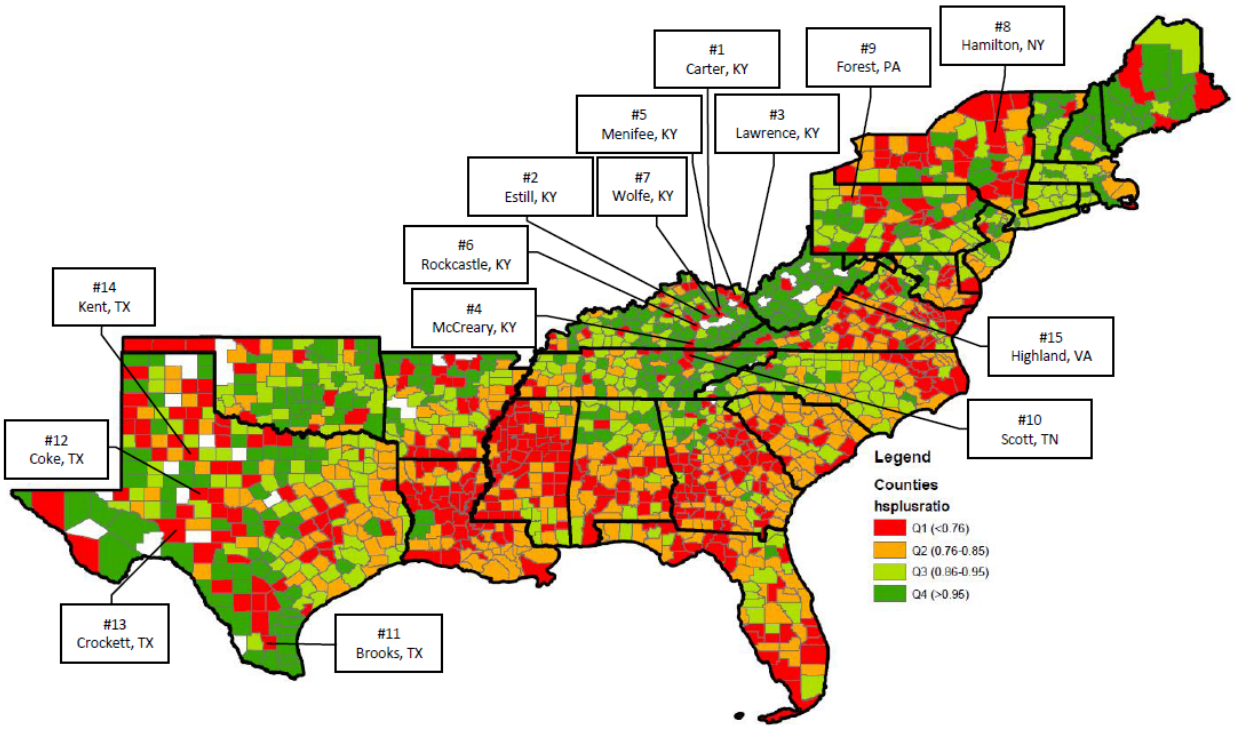

Figure 22. Ratio of Black to White Population Aged 25+ (%) with High School Diploma or Higher by Quartile, 2000[77]

[77] The ratio of black to white population aged 25+ (%) with high school diploma or higher (hsplusratio) is missing for 35 counties.

Table 31. Counties with Smallest Ratio of Black to White Population Aged 25+ (%) with High School Diploma or Higher (hsplusratio), 2000 (N=15)

Rank	hsplusratio	County
1	0.00	Carter, KY
2	0.00	Estill, KY
3	0.00	Lawrence, KY
4	0.00	McCreary, KY
5	0.00	Menifee, KY
6	0.00	Rockcastle, KY
7	0.00	Wolfe, KY
8	0.00	Hamilton, NY
9	0.00	Forest, PA
10	0.00	Scott, TN
11	0.00	Brooks, TX
12	0.00	Coke, TX
13	0.00	Crockett, TX
14	0.00	Kent, TX
15	0.00	Highland, VA

The quartile choropleth map of the ratio of the proportion of black to the proportion of white population aged 25+ with a college degree or greater shows several small clusters of counties with ratios falling within the lowest quartile (less than 0.37). The largest clusters include: (1) northern Texas and western Oklahoma; (2) central/southern Texas; (3) northeastern New York; (4) southwest Georgia and northwest Florida; and (5) northeast Georgia and western South Carolina (see Figure 23). One hundred-twenty-two counties were identified as having a ratio of 0.00. This value indicates that no black residents aged 25+ within that county received a college degree or greater (data not shown).

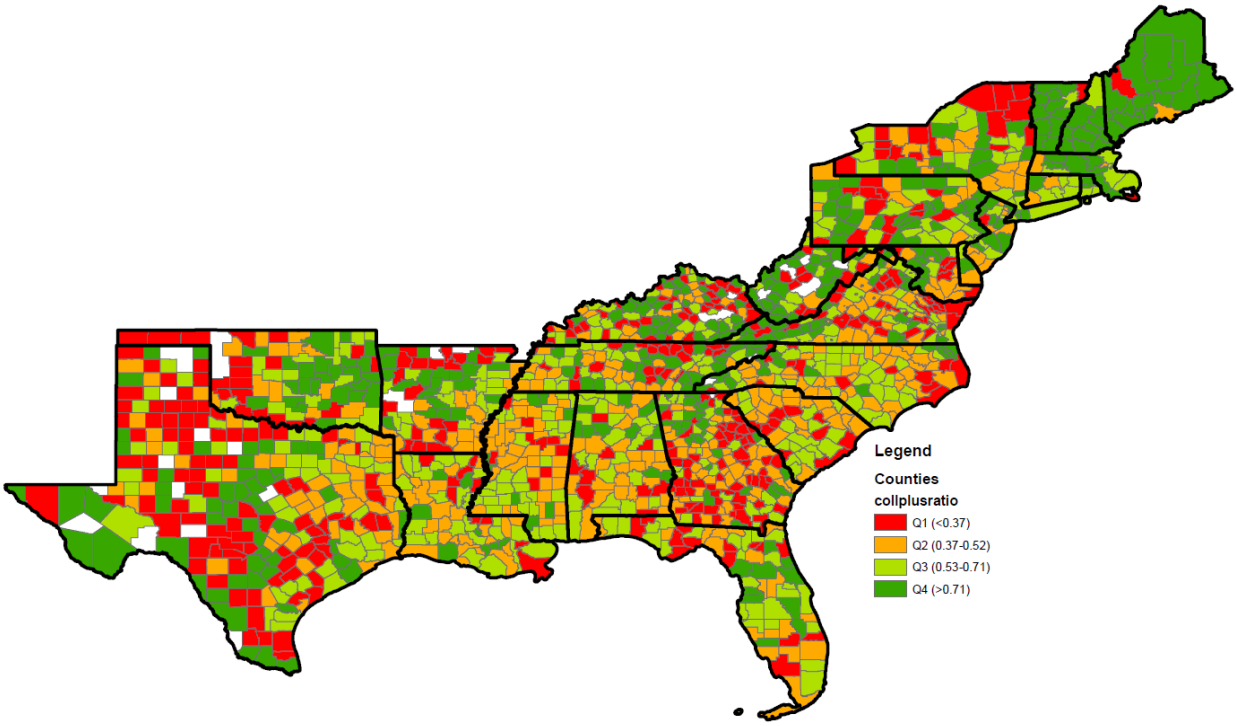

Figure 23. Ratio of Black to White Population Aged 25+ (%) with College Degree or Higher by Quartile, 2000[78]

4.2.9 Environmental air toxics exposure

Environmental air toxics exposure can be assessed by examining cancer risk, neurologic risk, and respiratory risk. The quartile choropleth map of cancer risk shows several clusters of counties with cancer risk assessments falling within the highest quartile (greater than 0.000025ppm). The largest clusters exist in: (1) central/southern Florida; (2) northwestern Georgia; and (3) central Maryland, Delaware, New Jersey, eastern Pennsylvania, southeastern New York, Connecticut, Rhode Island, Massachusetts, southern New Hampshire, and southwestern Maine. Ten counties with the highest cancer risk estimates were identified and

[78] The ratio of black to white population aged 25+ (%) with college degree or higher (collplusratio) is missing for 35 counties.

flagged with Tippah, Mississippi having the highest risk (0.00014393ppm) (see Figure 24 and Table 32).

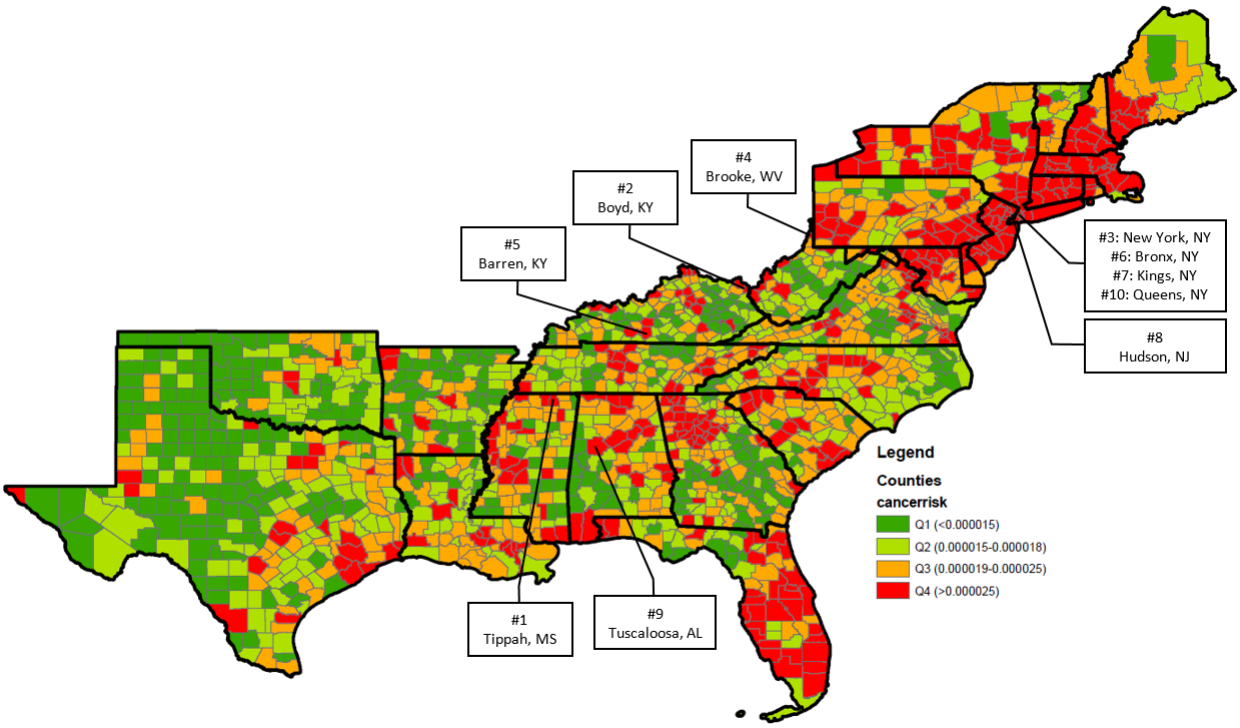

Figure 24. Cancer Risk by Quartile, 2002

Table 32. Counties with Highest Cancer Risk (cancerrisk) (N=10)

Rank	cancerrisk (ppm)	County
1	0.00014393	Tippah, MS
2	0.00010596	Boyd, KY
3	0.00010405	New York, NY
4	0.00010316	Brooke, WV
5	0.00009406	Barren, KY
6	0.00007593	Bronx, NY
7	0.00007065	Kings, NY
8	0.00006740	Hudson, NJ
9	0.00006676	Tuscaloosa, AL
10	0.00006437	Queens, NY

The quartile choropleth map of neurologic risk shows several clusters of counties with cancer risk assessments falling within the highest quartile (greater than 0.048004ppm). The largest clusters exist in: (1) central/southern Florida; (2) central Maryland, Delaware, New Jersey, eastern Pennsylvania, southeastern New York, Connecticut, Rhode Island, and Massachusetts. Ten counties with the highest neurologic risk estimates were identified and flagged with Highlands, Florida having the highest risk (4.0608346ppm) (see Figure 25 and Table 33).

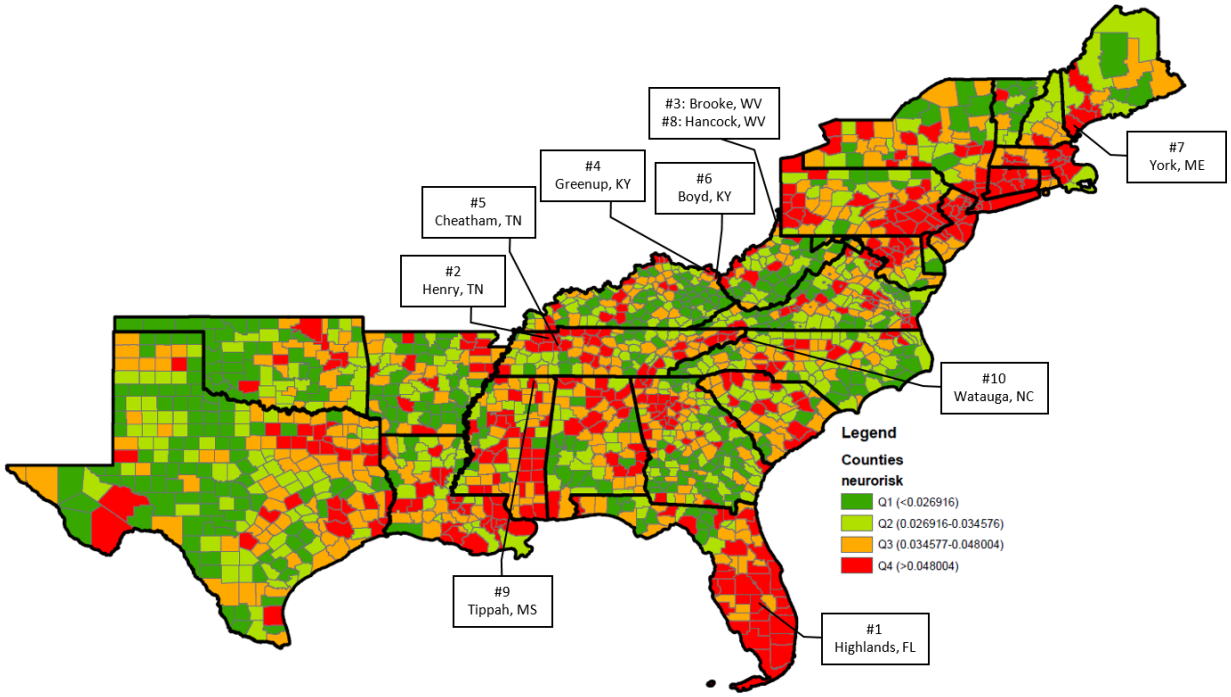

Figure 25. Neurological Risk by Quartile, 2002

Table 33. Counties with Highest Neurological Risk (neurorisk) (N=10)

Rank	neurorisk (ppm)	County
1	4.0608346	Highlands, FL
2	1.6002695	Henry, TN
3	1.5272957	Brooke, WV
4	0.6124103	Greenup, KY
5	0.4932255	Cheatham, TN
6	0.4299278	Boyd, KY
7	0.4296979	York, ME
8	0.3895941	Hancock, WV
9	0.3534074	Tippah, MS
10	0.3079329	Watauga, NC

The quartile choropleth map of respiratory risk shows several clusters of counties with cancer risk assessments falling within the highest quartile (greater than 2.15607ppm). The largest clusters exist in: (1) eastern/central/southern Florida; (2) northwest Florida, southern/eastern Alabama, southwest/northwest Georgia; and (3) central Maryland, Delaware, New Jersey, eastern Pennsylvania, southeastern New York, Connecticut, Rhode Island, Massachusetts, and southern New Hampshire. Ten counties with the highest respiratory risk estimates were identified and flagged with Baker, Florida having the highest risk (15.650748ppm) (see Figure 26 and Table 34).

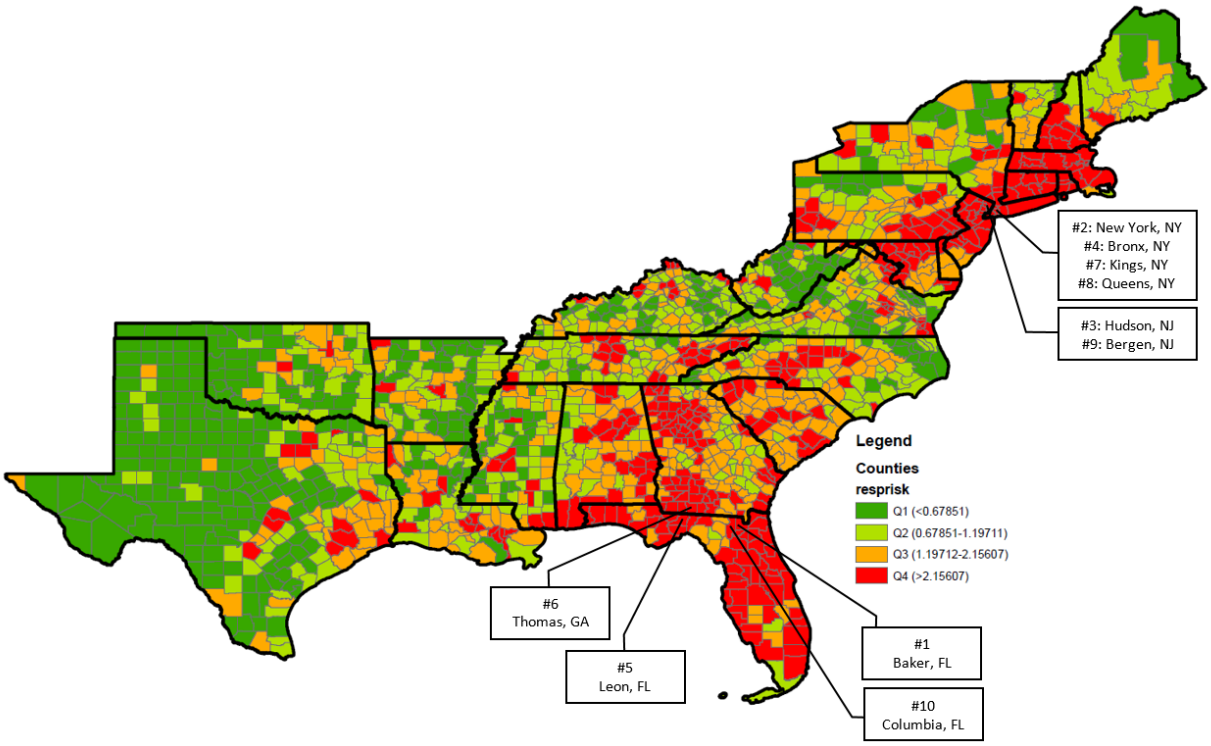

Figure 26. Respiratory Risk by Quartile, 2002

Table 34. Counties with Highest Respiratory Risk (resprisk) (N=10)

Rank	resprisk (ppm)	County
1	15.650748	Baker, FL
2	15.478647	New York, NY
3	12.472677	Hudson, NJ
4	12.296665	Bronx, NY
5	11.933869	Leon, FL
6	11.099520	Thomas, GA
7	10.428712	Kings, NY
8	9.516233	Queens, NY
9	9.349628	Bergen, NJ
10	9.328145	Columbia, FL

4.2.10 Primary care availability

The quartile choropleth map of primary care physicians (PCPs) per 100,000 population shows several small clusters of counties with rates of PCPs falling within the lowest quartile (lower than 29.2 PCPs per 100,000 population). The majority of the counties with low rates of PCPs occur within southern counties (see Figure 27). Seventy-nine counties reported a rate of 0.0 primary care physicians per 100,000 population (data not shown).

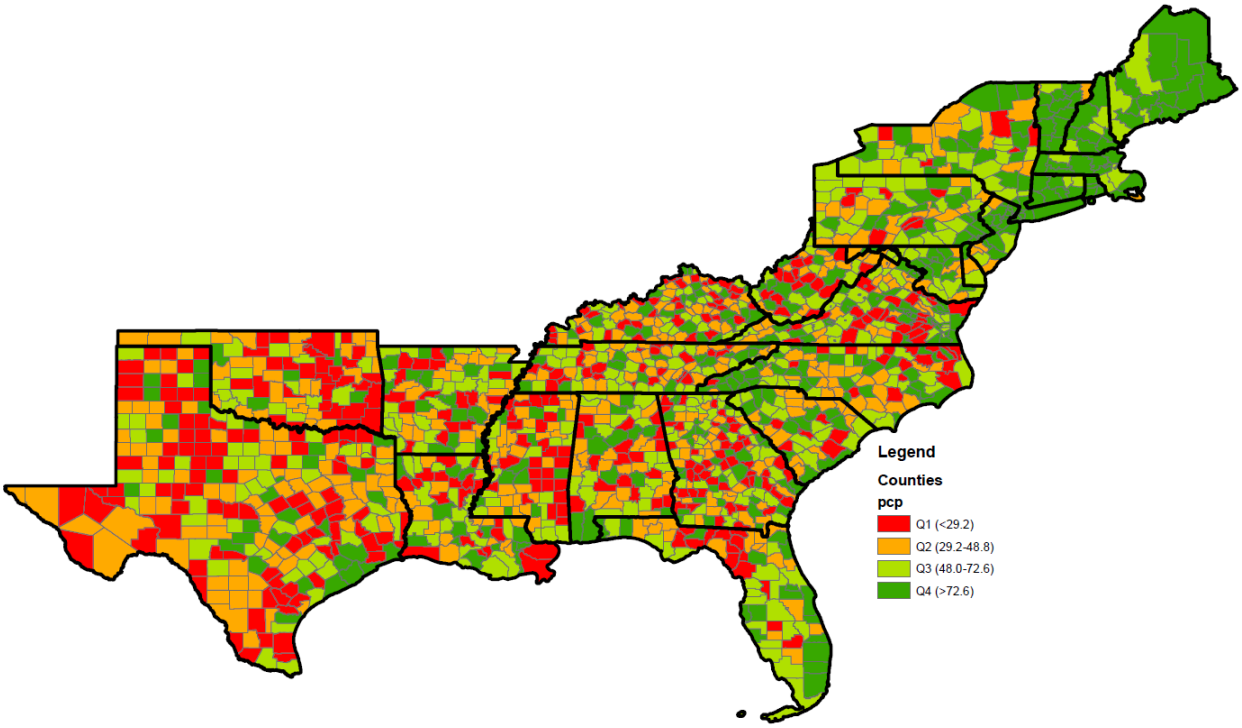

Figure 27. Primary Care Physicians (PCPs) Per 100,000 Population by Quartile, 2005[79]

[79] Rate of primary care physicians per 100,000 population (pcp) is missing for 1 county (Clifton Forge, VA).

4.3 IDENTIFICATION OF FACTORS RELATED TO RACIAL RESIDENTIAL SEGREGATION

Factors related to racial residential segregation were identified by examining Pearson correlation coefficients for all counties and between northeastern and southern counties (see Table 35).

Table 35. Pearson Correlation Coefficients for Racial Residential Segregation, All Counties with Data

	All Counties			***Northeastern Counties***			***Southern Counties***		
Variable	***r***	***p***	***N***	***r***	***p***	***N***	***r***	***p***	***N***
popurbp	0.419	0.000	1640	0.535	0.000	217	0.368	0.000	1423
ownratio	-0.298	0.000	1624	-0.081	0.234	216	-0.249	0.000	1408
incomeratio	0.013	0.595	1640	-0.274	0.000	217	0.019	0.478	1423
gini	-0.009	0.709	1640	0.382	0.000	217	0.020	0.441	1423
povratio	0.075	0.003	1617	0.273	0.000	217	0.013	0.630	1400
nohsratio	0.060	0.015	1605	0.241	0.000	217	-0.015	0.565	1388
hsplusratio	0.056	0.026	1605	-0.327	0.000	217	0.119	0.000	1388
collplusratio	0.004	0.886	1605	-0.377	0.000	217	0.029	0.282	1388
cancerrisk	0.381	0.000	1640	0.487	0.000	217	0.295	0.000	1423
neurorisk	0.089	0.000	1640	0.333	0.000	217	0.075	0.005	1423
resprisk	0.336	0.000	1640	0.478	0.000	217	0.250	0.000	1423
pcp	0.264	0.000	1639	0.081	0.237	217	0.244	0.000	1422

4.3.1 Racial residential segregation and urban population

There is a highly-significant, moderate[80], positive relationship between racial residential segregation and the proportion of the population living in urban areas. The clustering of racial residential segregation and urban population share similar patterns, with the largest cluster

[80] According to Dancey and Reidy (2004), Pearson correlation coefficients can be categorized into five categories: (1) "perfect" (r=1.0); (2) "strong" (r=0.7-0.9); (3) "moderate" (r=0.4-0.6); (4) "weak" (r=0.1-0.3); and (5) "zero" (r=0.0).

existing in central Maryland, southeastern Pennsylvania, New Jersey, southeastern New York, central Connecticut, Rhode Island, and Massachusetts. Another large cluster in Florida exists for both variables. The relationship between racial segregation and urban population is stronger in northeastern counties ($r = 0.535$ v. $r = 0.368$, respectively) (see Table 35).

4.3.2 Racial residential segregation and racial disparity in home ownership

Overall, there is a significant, although weak, negative relationship between racial residential segregation and the ratio of black to white housing units owned by the householder. Overall, higher rates of racial segregation are related to a worsening of the racial disparity in home ownership. This relationship holds true within southern counties and although the direction of the relationship holds true within northeastern counties, the relationship is not significant ($r = -0.249$, $p = 0.000$ v. $r = -0.081$, $p = 0.234$) (see Table 35).

4.3.3 Racial residential segregation and racial disparity in median household income

Although the relationship between racial residential segregation and the ratio of black to white median household income is not significant for all counties as a whole or for southern counties, there is a significant, although weak, negative relationship in northeastern counties ($r = -0.274$; $p = 0.000$). Within northeastern counties, higher rates of racial residential segregation are related to a worsening of the racial disparity in median household income (see Table 35).

4.3.4 Racial residential segregation and overall income inequality (Gini coefficient)

Although there is no significant relationship between racial residential segregation and overall income inequality (as indicated by the Gini coefficient) within southern counties and all counties overall, there is a highly significant positive relationship between segregation and income inequality within northeastern counties ($r = 0.382$; $p = 0.000$). So, within northeastern counties, as segregation rates increase income inequality increases (see Table 35).

4.3.5 Racial residential segregation and racial disparity in poverty

Although there is not a significant relationship between racial residential segregation and the ratio of the proportion of the black population to proportion of the white population living in poverty in southern counties, there is a significant, although weak, positive relationship both overall and in northeastern counties ($r = 0.075$, $p = 0.003$ and $r = 0.273$, $p = 0.000$, respectively). In northeastern counties and overall, higher rates of racial residential segregation are related to a worsening of the racial disparity in poverty (see Table 35).

4.3.6 Racial residential segregation and racial disparities in educational attainment

Overall, there is a significant, but very weak, positive relationship between racial residential segregation and the ratio of the proportion of the black population to the proportion of the white population aged 25+ without a high school diploma or equivalent ($r = 0.060$; $p = 0.015$). Overall, higher rates of racial residential segregation are related to a worsening in the racial disparity in failure to complete high school. Although this relationship is not significant for

southern counties, the relationship is stronger and significant for northeastern counties (r = -0.015, p=0.565; r = 0.241, p=0.000) (see Table 35).

For the counties overall, there is a significant, but very weak, positive relationship between racial residential segregation and the ratio of the proportion of black population to the proportion of the white population aged 25+ with a high school diploma/equivalent or higher (r = 0.056; p=0.026). This positive relationship holds true for southern counties, but the relationship becomes stronger and negative in northeastern counties (r = 0.119, p=0.000; r = -0.327, p=0.000). For counties overall and southern counties, higher rates of racial residential segregation are related to an improvement in the racial gap, within northeastern counties higher rates of racial residential segregated are related to a worsening of the racial gap in high school degree attainment or higher (see Table 35).

Although there is no significant relationship between racial residential segregation and the ratio of the proportion of the black population to the proportion of the white population aged 25+ with a college degree or higher both overall and in southern counties, there is a highly significant negative relationship in northeastern counties (r = -0.377, p = 0.000). In northeastern counties, higher rates of racial residential segregation are related to a worsening of the racial disparity in college education and advance degree attainment (see Table 35).

4.3.7 Racial residential segregation and environmental air toxics exposure

A highly significant positive relationship exists between racial residential segregation and air toxics exposure (cancer risk, neurologic risk, and respiratory risk). In general, as racial residential segregation rates increase the overall environmental air toxics exposure increases,

which increases cancer, neurologic, and respiratory risk. The strongest relationship between these factors occurs within northeastern counties (see Table 35).

4.3.8 Racial residential segregation and primary care availability

Although there is no significant relationship between racial residential segregation and the rate of primary care physicians per 100,000 population in northeastern counties, there is a significant, although weak, positive relationship in southern counties and overall ($r = 0.244$, $p = 0.000$; $r = 0.264$, $p = 0.000$). In general, higher rates of racial residential segregation are related to more primary care physicians per 100,000 population (see Table 35).

5.0 DISCUSSION

5.1 INCOME INEQUALITY AS THE STRONGEST PREDICTOR OF RACIAL DISPARITIES IN CANCER INCIDENCE AND MORTALITY

A county's level of racial residential segregation is a significant predictor of a county's racial disparity in cancer incidence and cancer mortality; however, this no longer holds true after controlling for the racial disparity in median household income. A county's racial disparity in median household income is the strongest predictor of both a county's racial disparity in cancer incidence and the racial disparity in cancer mortality. Socioeconomic status (SES) is consistently mentioned as a key "fundamental" factor of disease causation (Link and Phelan 1995; Link et al. 1998). SES can provide or restrict access to several resources that are key to maintaining good health—education, access to health care services, and access to healthy foods. Those who have better access to resources are able to engage in strategies to protect and improve their health, while those without access to these valuable resources are struggling to just protect their health.

It is extremely important to frame the discussion of income inequality in a way that recognizes and addresses the role of institutionalized racism in both creating and perpetuating this differential. As many researchers and policymakers attempt to argue that we live in a "post-racial" or "colorblind" society, race-based income inequality is being framed as a difference in individual work ethic and determination. Racial differences in SES are explained as individuals

not being able to "pull themselves up by their bootstraps." This framing is ignoring the racial inequalities that exist in accessing those bootstraps. We must recognize and accept that this continued association between race and SES in the United States is not due to individual differences in work ethic, but is rooted in historical injustices that were created and continue to be supported through institutional racism (Hartmann and Bell 2010; Jones 2000; Jones 2002). All researchers, policymakers, educators, and health care professionals must not distort the significance of a "race effect" by failing to explain the connection between research results and racism—especially when other factors, such as income, prove to be more significant.

5.1.1 Conceptual model revisited

The results of the regression analysis force a re-analysis of the conceptual model created for this study. The conceptual model modified Schulz et al.'s (2002) model to create a new factor called "Foundational" to show the impact ideologies and macrosocial factors (i.e., historical conditions, economic structures, political order, legal codes, and social and cultural institutions) have on "Fundamental" factors. Although inequalities in income/SES ("economic inequalities") is consistently mentioned as a "fundamental" factor of inequalities in health outcomes, this factor was originally relocated from a "Fundamental" factor to an "Intermediate" factor. The rationale behind this decision was to emphasize the role that race-based residential segregation has in the creation of economic inequalities—that where a person lives either restricts or grants access to quality education, employment opportunities, and educational mobility (see Figure 28).

Although racial residential segregation was not found to be a significant predictor of the racial disparities in cancer incidence and mortality, the fact that the racial disparity in median household income was found to be a predictor supports the importance of ideology and

macrosocial factors as "foundational" factors of racial disparities in health outcomes. In addition, a significant relationship was found between racial residential segregation and the racial disparity in median household income within northeastern counties (see Section 4.3.3). As a result of these findings, the conceptual model has been modified to contain both race-based residential segregation and economic inequalities as "Fundamental" factors (see Figure 29). Regardless of this relocation, it is important to continue to recognize the role that "Foundational" factors have in the development and continuation of key "Fundamental" factors of health disparities.

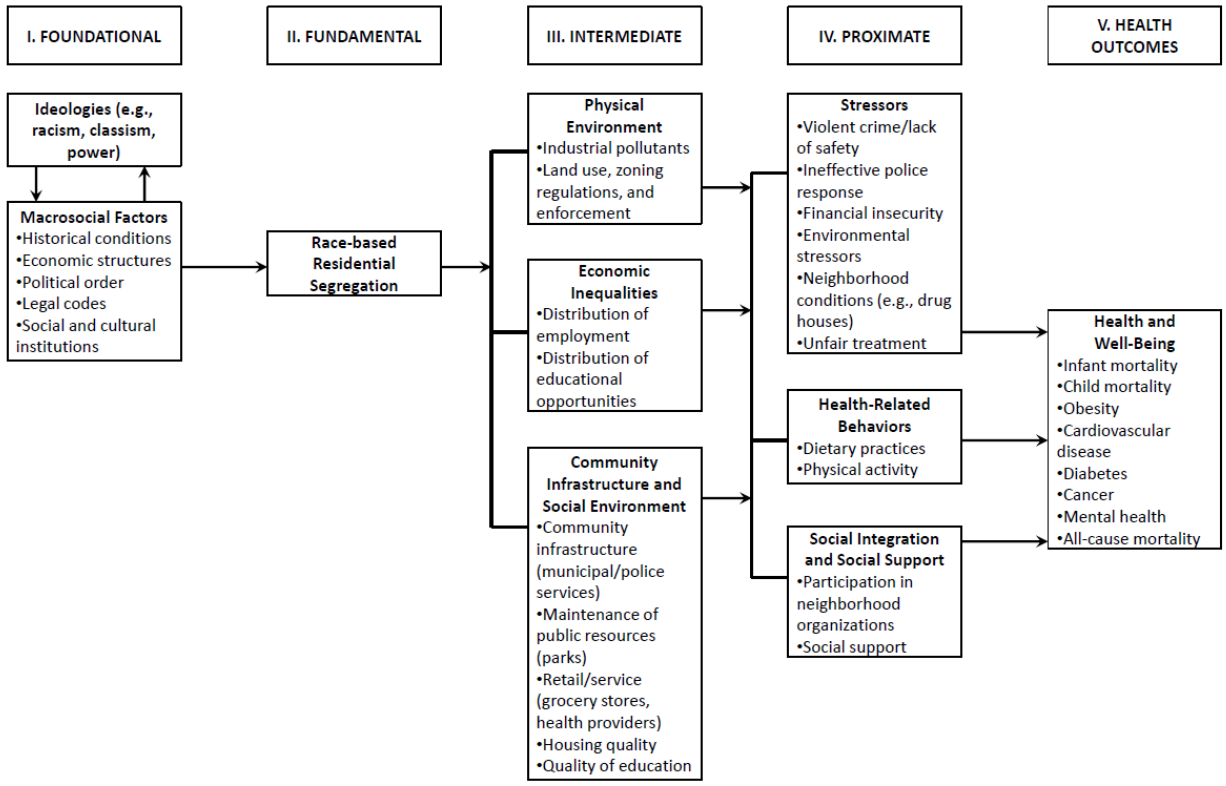

Figure 28. Original Conceptual Model

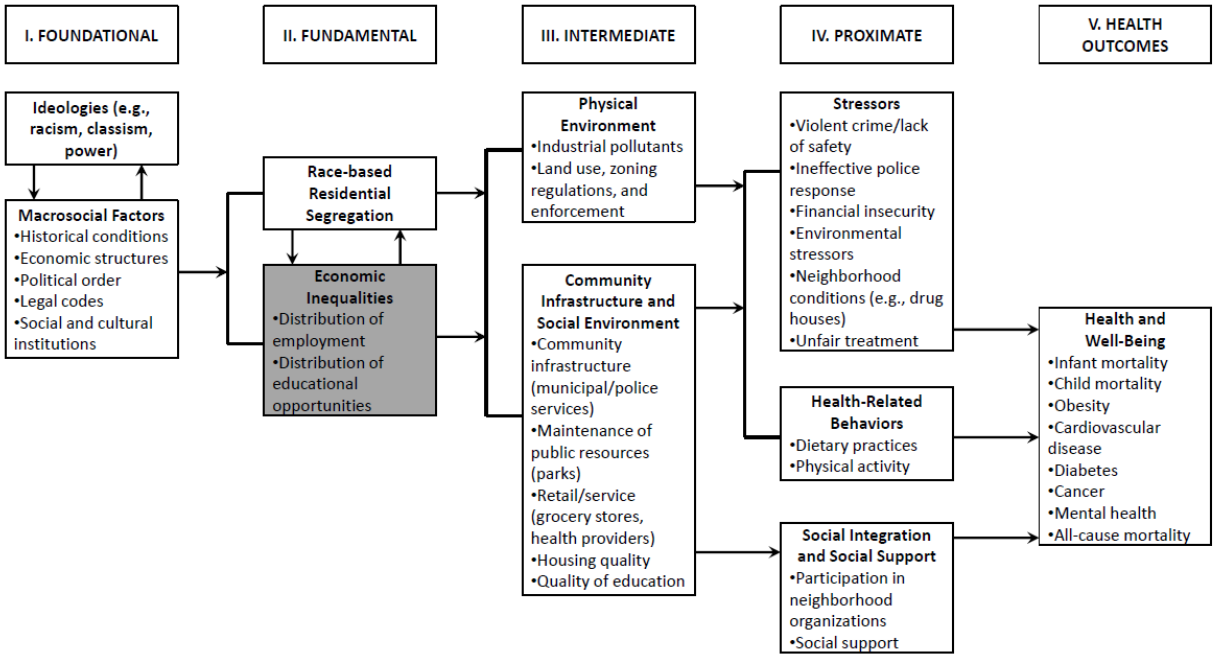

Figure 29. Revised Conceptual Model

5.2 WHERE YOU LIVE DOES MATTER!

Although a significant relationship between racial residential segregation and racial disparities in cancer incidence and mortality was not found, the location of where an individual lives can place them in an environment of disadvantage which can both directly and indirectly impact their health. The extent of segregation within a county can impact racial disparities in several key factors. Overall, racial residential segregation can be connected to increased air toxic exposure (cancer risk, neurologic risk, and respiratory risk) and to racial disparities in home ownership, poverty, and high school completion. Racial residential segregation is related to increased air toxic exposure in both northeastern and southern counties; however, the similarities end there. Racial residential segregation is related to increased racial disparities in home ownership in

southern counties while racial residential segregation is related to increased overall economic inequality (Gini coefficient) and increased disparities in median household income, poverty, high school completion and college graduation in northeastern counties (see Table 35). These findings are supported by research indicating that residents of highly segregated areas are disadvantaged in terms of several health-protecting and health-damaging resources—housing, exposure to environmental pollutants, educational attainment, employment opportunities, nutrition, access to medical services, access to public services, and social mobility (Berry 1976; Bullard 1983; Collins and Williams 1999; Delaney 1998; Gee and Payne-Sturges 2004; Geronimus 2000; Law 1985; Massey and Denton 1993; Schneider and Logan 1982; Schulz et al. 2002; Smith 2009; Williams and Collins 2001).

A key question to address at this point is why do northeastern counties have a stronger relationship between racial residential segregation and racial disparities and risk exposure than southern counties? One argument is that the spatial variation is due to a "compositional effect"—that the northeastern and southern counties differ in terms of the "type" of individual that reside in those locations. This argument would explain the current racial disparities as being rooted in the individual—that northeastern blacks and whites are inherently different in their occupational choices, their intelligence, and motivation—and that these differences explain the racial disadvantage faced in northeastern counties. A more "contextual" explanation of these regional differences would explore the characteristics of the social or physical environment which impact health in addition to exploring the historical context within which these environments were constructed. Historically, the north created environments of disadvantage through racist real estate practices to both constrain the black population and deter additional blacks from migrating from the south. The segregation of blacks into the least desirable communities created a

complicated structure of oppression and decreased resource access whose lingering effects can still be felt today.

We have to move beyond arguing that individuals have the ability to exercise ultimate agency in terms of their health. Although we may have the ultimate decision-making power over our individual behavior, the social and physical environment in which a person resides can restrict or provide the options from which an individual chooses. We have to recognize that not every individual has equal access to the full range of options on which to exercise agency. We have to continue to push to recognize and examine the influence of the physical and social environment on health and health behaviors (Emmons 2000; Macintyre and Ellaway 2000).

5.3 SIGNIFICANCE AND POLICY IMPLICATIONS

5.3.1 Novel conceptual model

The conceptual model developed for this study is novel in that it creates a new category of factor—"Foundational"—to be recognized and addressed in all future research, policy, and education regarding racial disparities in health outcomes. Although the importance of recognizing the role of ideology and macrosocial factors (i.e., historical conditions, economic structures, political order, legal codes, and social and cultural institutions) has been recognized by many in the fields of medical sociology, public health, and Critical Race Theory (CRT), not utilizing a conceptual framework that explicitly addresses these "Foundational" factors ignores the important role these ideologies and macrosocial factors have on the creation and continuation of racial disparities in health outcomes.

The exclusion of "Foundational," and even "Fundamental" factors from conceptual models, policy, and education will continue to perpetuate these disparities. Through excluding these key factors, researchers may be able to vaguely address, or even ignore, the role that racism has on racial disparities in health outcomes. Policymakers could continue to emphasize individual-level policy and interventions—focusing on encouraging individuals to seek medical care, improve their diet, exercise more, and cease health-damaging behaviors without addressing the structural environment that denies access to resources needed to engage in these behaviors. In addition, academics must continue to challenge the notion that our society is now "colorblind" or "post-racial." The students we train will be the next generation of researchers, health care providers, policymakers, and academics. If we do not continue to challenge students to recognize the importance of these "foundational" and "fundamental" factors, the structures that create and perpetuate these racial inequalities will continue to be hidden and support the status quo.

5.3.2 Policy and interventions focusing on fundamental and foundational factors

Modern epidemiological research—and the policies and interventions based on the results—tend to explain the racial gap in health status between blacks and whites by examining differences in the characteristics of individuals within the two groups (Berger 2001; Centers for Disease Control and Prevention 2002; DeClerque et al. 2004; Dranger, Remington and Peppard 2003; Finch 2003; Hummer 1993; Matthews, Curtin and MacDorman 2000; Mayer and Sarin 2005; Phipps et al. 2002; Sastry and Hussey 2003; Strait 2006; Turner 1995; Waidmann and Rajan 2000). This focus on individual risk factors could be the result of the individualistic belief system of Western culture that "emphasizes both the ability of the individual to control his or her personal fate and the importance of doing so" (Link and Phelan 1995: 80-81). Although, as

individuals, we are ultimately responsible for our choices, forces in the community that shape available choices and preferences must be acknowledged and examined (Syme 1994).

Current interventions to improve health outcomes are based on modifying or eliminating certain risky behaviors (e.g., smoking, drinking, poor nutrition, adequate prenatal care, etc.) in "at-risk" populations. However, most health policy interventions are based on voluntary participation. Mechanic (2002) argues that these prevention efforts are not truly reaching those individuals that are the most disadvantaged. In addition, Geiger (1997:11) argues that policy reform focused at the individual-level "serves equally well as the rallying cry for racism, individual blame, and reaction." When individuals do not benefit from the help that is offered, then the individuals are blamed for their poor health outcomes (Geiger 1997; Krieger 2001c).

In order for current interventions and policies to be effective in reducing racial disparities in health outcomes, the structural (i.e., foundational and fundamental) causes of these inequalities must be addressed[81] (Emmons 2000; Ford and Airhihenbuwa 2010; Harawa and Ford 2009; Link and Phelan 1995). Although individual solutions are more "palatable" because they do not require us to challenge (or attempt to change) the current social structure, they are "indeed supportive of social structures and forces that many agree produced the problem in the first place" (Meyer and Schwartz 2000:1190). Racial disparities in health outcomes can only be eliminated (or even reduced) when the target of policy and intervention is shifted from the individual to the deadly "spiders"[82] that reside in the complex web of causation. If researchers,

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[81] According to Ford and Airhihenbuwa (2010:1395), "structural determinism posits that macro-level factors and systemic forces are what fundamentally drive population level inequities. Research and interventions, therefore, should target these factors operating at the macro levels of the socioecologic framework. The structural nature of racialization is what enables it to persist across time and place."

[82] The term "spider" was utilized by Krieger (1994) in her article, "Epidemiology and the web of causation: has anyone seen the spider?" These "spiders" represent "fundamental" factors of health disparities. Collins and Williams (1999) argue that racial residential segregation is one of the most important "spiders" responsible for racial

policy makers, and health care professional continue to ignore these "spiders," we will continue to have a revolving door of individuals entering the "at-risk" population and drowning as they float downstream[83]. Researchers and policymakers must continue to explore the three main ways in which racism can affect blacks: (1) significant disparities in SES indicators due to restricted access to quality education; (2) restricted access to health-protecting resources such as healthcare, housing, public education, and recreational opportunities; and (3) daily exposure to both perceived and actual racism, which can cause psychological stress and impact utilization of resources (Williams and Collins 1995). Recognizing that we live in a racialized social system which negatively impacts the life chances and health of blacks is essential and is the first step in understanding and developing effective policy and interventions.

5.4 LIMITATIONS

5.4.1 Missing data and generalizability

Of the 1,641 northeastern and southern counties in the United States, data for white/black cancer incidence, white/black cancer mortality, and index of dissimilarity was missing for 685 counties (41.7%). By far the majority of the missing data was for black cancer incidence and black cancer mortality rates. The extensive amount of missing data for black cancer incidence and mortality is most likely due to data suppression methods used by CDC to protect patient confidentiality and

disparities in health. In addition, Link and Phelan (1995) and Link et al. (1998) cite differentials in socioeconomic status as being a key fundamental factor in health disparities.

[83] Syme (2000: x) argues that we will continuously have individuals entering the "at-risk" population if interventions continue to be focused on individual behavior since nothing is being done to change "those forces in the community that caused the problem in the first place." Syme's arguments echo the sentiments of Irving Zola's address to the United Ostomy Association in 1970 regarding "upstream" v. "downstream" factors.

maintain data reliability[84]. The extensive amount of missing data forced a restriction of the available counties for analysis. The sample was restricted to counties with population ≥25,000 (N=912), which resulted in a reduction of missing data to 28.4% of the sample (259/912). The restriction of the sample for regression analysis results in the research findings only being generalizable to 653/1,641 (39.8%) of counties in the northeastern and southern regions.

5.4.1.1 Protecting confidentiality or protecting the status quo?

Critical Race Theory (CRT) was developed to "explicitly account for the influences of racism on both outcomes and research processes" (Ford and Airhihenbuwa 2010:S30). Suppression of data when a geographic area has less than 16 cases over the rate period, although justified as a method to protect patient confidentiality, can become problematic in geographic areas with small segregated minority populations. Therefore, the population that would be of the most interest to examine—a small, highly segregated population—is being removed from the available data for analysis.

Methods of data suppression need to be examined to ensure that minority populations are accurately represented in health outcomes data. If researchers cannot access data that accurately represents the health status reality of black Americans, effective policy and interventions cannot be developed. Why must blacks not only shoulder the burden of increased cancer incidence and cancer mortality rates, but also shoulder the burden of having their data eliminated from public discourse? If studies continue to utilize this inaccurate data, and continue to identify individual-level factors as the key predictors of health outcomes (not structural issues which drive these

[84] When a geographic area has a count of less than 16 cases over the rate period, those values will be suppressed from the available data (Centers for Disease Control and Prevention 2013b).

inequalities), should we start to question whether this data suppression is really protecting patient confidentiality or is it just helping to support the status quo?

5.4.2 Explanatory power

In addition to having limited generalizability, the regression models also have very low explanatory power. The best model constructed to predict the racial disparity in cancer incidence could only explain 2.4% of the variability in the racial disparity using segregation, northeastern region, urban population, proportion of population uninsured, racial disparity in college education, and racial disparity in median household income as predictors. The best model constructed to predict the racial disparity in cancer mortality could only explain 10.4% of the variability using segregation, northeastern region, urban population, proportion of population uninsured, primary care availability (PCPs per 100,000 population), racial disparity in college education, racial disparity in home value, and racial disparity in median household income as predictors.

Determining disease etiology is difficult due to the involvement of multiple factors, physiological variability in individuals, and difficulty identifying how much exposure is needed to develop a disease. Cancer etiology is particularly difficult to determine due to the complex "web of causation" involving factors at all levels (i.e., proximate, distal, fundamental, foundational). Although 2.4% of the variability in cancer incidence disparity and 10.4% of the variability in cancer mortality disparity can be explained by the selected social-structural (ecological) factors, the complexity of cancer development and the treatment process creates a multitude of potential factors that could be included in future models. As shown in Ward et al.'s (2004) model (see Figure 30), disparities are created through the interaction of social, economic,

and cultural factors and these disparities can increase (or sometimes decrease) at each of the stages of the disease process—prevention, early detection, diagnosis, treatment, post-treatment quality of life, and survival/mortality. The large number of sites where disparities can widen and the lack of clear identification of cancer risk factors will lead to low explanatory power in models unless every single potential factor is identified and included.

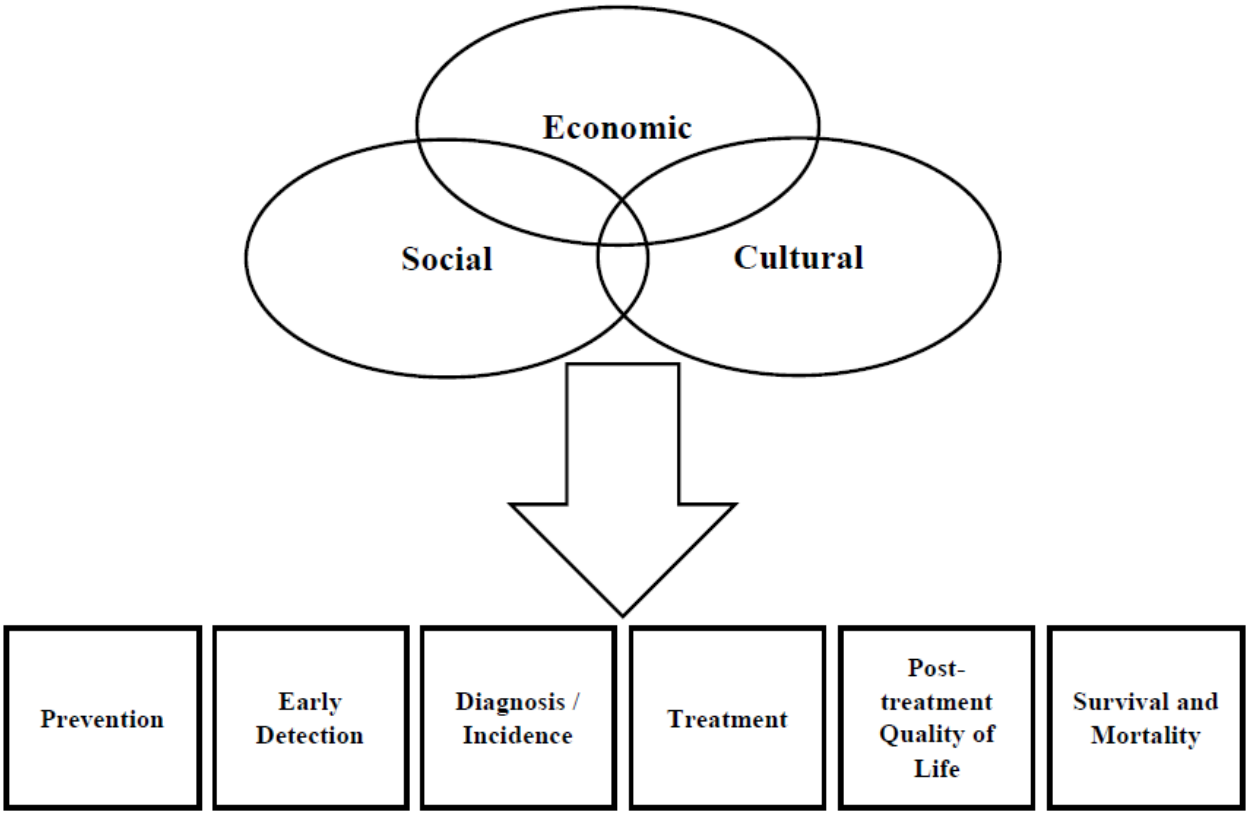

Figure 30. Factors that Influence Social Disparities (Ward et al. 2004)[85]

The explanatory power of the regression models is also limited by not including individual-level factors related to income, education, health-damaging behaviors (e.g., smoking

[85] Ward et al. (2004) adapted this model from Freeman's (1989) article, "Cancer in the socioeconomically disadvantaged" and the Institute of Medicine's (2003) report, *Unequal Treatment: Confronting Racial and Ethnic Disparities in Healthcare*.

status, alcohol use, etc.), dietary practices, physical activity, and healthcare utilization. Although these factors have been identified as key factors in cancer development and mortality, these specific individual-level factors are influenced by structural factors (e.g., income inequality, education inequality, racial residential segregation, healthcare availability/access). Finding that any portion of the variability in cancer incidence disparity and cancer mortality disparity can be explained by these structural factors showcases the importance of continuing to explore the relationship health outcomes has to the larger social structure.

Finally, the explanatory power of the cancer mortality model is limited by a lack of data on cancer type and stage at diagnosis. The type of cancer dictates treatment options and diagnosing cancers while still localized can improve treatment efficacy and quality of life. Racial differences in cancer type and stage at diagnosis may be key predictors of racial disparities in mortality and should be included in future models.

5.4.3 County-level data

Counties were selected as the unit of analysis as they were the geographic unit with the widest variety of publicly available data. Larger-scale geographic areas (i.e., states) could not be utilized since measures of racial residential segregation have not been calculated at the state-level. Smaller-scale geographic areas (i.e., census tracts or census blocks) would lead to additional issues with missing cancer incidence and mortality data. Selection of counties as the unit has led to some potential issues with using racial residential segregation as a predictor.

Northeastern and southern counties vary greatly in terms of geographic area (1.99 to 6,671.54 miles^2) and population (67 to 3,400,578 residents); however, it assumed that any data are equally distributed within each county. In reality, the data may actually be clustered in a

smaller geographic sub-section of the county (which could also have higher or lower racial residential segregation than indicated by the county value). For example, County A has 6 sub-sections and reports a black cancer incidence of 6.0 cases per 100,000 population. By using county-level values, we have to assume that those 6 cases are equally distributed throughout the 6 sub-sections (see Figure 31). However, those 6 cases may be concentrated in a single sub-section and each of those sub-sections could have varying levels of segregation (see Figure 32). Although smaller geographic areas may more accurately represent the relationship between racial residential segregation and racial disparities in cancer incidence and mortality, until the methodology the CDC utilizes to "suppress" data is evaluated and modified, smaller units of analysis will be infeasible to use.

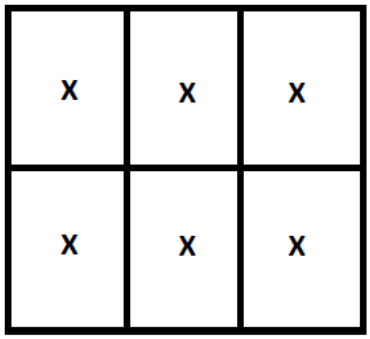

Figure 31. County A with Equal Cancer Incidence Distribution

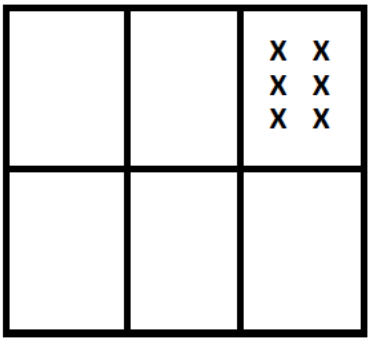

Figure 32. County A with Unequal Cancer Incidence Distribution

5.5 FUTURE RESEARCH DIRECTIONS

This research has provided an extensive amount of quantitative and spatial data. Future research directions will both expand the amount of quantitative data points and will focus on a more extensive analysis of the "hot spots" identified through this spatial analysis.

5.5.1 Additional data collection

The current database can be expanded to include more recent data from all of the data sources, in particular data from the U.S. Census and the National Cancer Institute. The database can also be expanded to address limitations of the current study. Cancer mortality data by gender and type of cancer can be collected to determine if there are gender differences in cancer incidence and mortality both within and between races. In addition, cancer incidence and cancer mortality data can be collected by cancer type to determine if there are specific gender/race differences by cancer type.

The theoretical framework and conceptual model from this study can be applied to criminology research. Data can be collected on crime rates and incarceration rates by county and incorporated into the current database. Statistical analyses can be conducted to determine the impact of racial residential segregation and characteristics of the physical and social environment on racial disparities in incarceration rates and crime incidence/prevalence.

5.5.2 Spatial analysis

"Hot spots" of racial residential segregation, air toxics exposure, primary care availability, and racial disparities in cancer incidence, cancer mortality, home ownership, household income, income inequality, poverty, and educational attainment can be evaluated more extensively to identify additional factors which may explain the clustering of these counties. Analysis of historical documents, internet sources and news reports, and additional county-specific data sources may help identify factors of importance.

In addition, data related to crime incidence/prevalence and racial disparities in incarceration rates can be analyzed spatially through ArcGIS to identify individual counties and clusters of counties with the highest crime rates and racial disparities in incarceration rates.

5.6 CONCLUSION

This study merged the frameworks of social epidemiology, human ecology, and Critical Race Theory to examine the impact of racial residential segregation on racial disparities in cancer incidence/mortality and characteristics of the social and physical environment. Regression models utilized northeastern and southern counties with population ≥ 25,000 with no missing data for cancer incidence, cancer mortality, or racial residential segregation (653/1641; 39.8%). Racial disparity in median household income was found to be the most significant predictor of both the racial gap in cancer incidence and the racial gap in cancer mortality. Racial residential segregation was found to have a positive relationship with both the racial gap in cancer incidence and the racial gap in cancer mortality, although the relationship was not significant after

controlling for income disparity. Significant relationships between racial residential segregation and exposure to air toxics, economic inequality (Gini coefficient), and disparities in median household income, poverty, high school completion and college graduation were identified in northeastern counties. Racial residential segregation was found to be significantly related to racial disparities in home ownership and increased exposure to air toxics in southern counties. Although a significant relationship between racial residential segregation and the racial gap in cancer incidence and cancer mortality could not be found, these findings do indicate that residents of highly segregated areas can be disadvantaged in terms of several health-protecting resources—housing, exposure to environmental pollutants, educational attainment, and economic opportunities. In order for interventions and policies to be effective in reducing racial disparities in health outcomes, the structural (i.e., foundational and fundamental) causes of these inequalities—institutional racism, racial residential segregation, economic/educational inequalities—must be addressed. In addition, researchers, policymakers, and academics utilize the lens of Critical Race Theory to examine available data and methods utilized to "protect confidentiality" and "maintain data reliability" to ensure that these methods are not supporting the racialized structure and protecting the status quo.

APPENDIX A

LIST OF NORTHEASTERN AND SOUTHERN U.S. COUNTIES

Table A-1. List of Northeastern and Southern US Counties

NORTHEASTERN COUNTIES **[REGION 1]** (N=217)							
New England **[Division 1]** (N=67)							
Connecticut [STATE CODE: 09] (N=8)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Fairfield	*09001*		*Middlesex*	*09007*		*Tolland*	*09013*
Hartford	*09003*		*New Haven*	*09009*		*Windham*	*09015*
Litchfield	*09005*		*New London*	*09011*			
Maine [STATE CODE:23] (N=16)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Androscoggin	*23001*		*Knox*	*23013*		*Somerset*	*23025*
Aroostook	*23003*		*Lincoln*	*23015*		*Waldo*	*23027*
Cumberland	*23005*		*Oxford*	*23017*		*Washington*	*23029*
Franklin	*23007*		*Penobscot*	*23019*		*York*	*23031*
Hancock	*23009*		*Piscataquis*	*23021*			
Kennebec	*23011*		*Sagadahoc*	*23023*			
Massachusetts [STATE CODE:25] (N=14)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Barnstable	*25001*		*Franklin*	*25011*		*Norfolk*	*25021*
Berkshire	*25003*		*Hampden*	*25013*		*Plymoth*	*25023*
Bristol	*25005*		*Hampshire*	*25015*		*Suffolk*	*25025*
Dukes	*25007*		*Middlesex*	*25017*		*Worcester*	*25027*
Essex	*25009*		*Nantucket*	*25019*			

New Hampshire [STATE CODE:33] (N=10)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Belknap	*33001*		*Grafton*	*33009*		*Strafford*	*33017*
Carroll	*33003*		*Hillsborough*	*33011*		*Sullivan*	*33019*
Cheshire	*33005*		*Merrimack*	*33013*			
Coos	*33007*		*Rockingham*	*33015*			

Rhode Island [STATE CODE:44] (N=5)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Bristol	*44001*		*Newport*	*44005*		*Washington*	*44009*
Kent	*44003*		*Providence*	*44007*			

Vermont [STATE CODE:50] (N=14)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Addison	*50001*		*Franklin*	*50011*		*Rutland*	*50021*
Bennington	*50003*		*Grand Isle*	*50013*		*Washington*	*50023*
Caledonia	*50005*		*Lamoille*	*50015*		*Windham*	*50025*
Chittenden	*50007*		*Orange*	*50017*		*Windsor*	*50027*
Essex	*50009*		*Orleans*	*50019*			

Mid Atlantic **[Division 2]** (N=150)

Pennsylvania [STATE CODE: 42] (N=67)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Adams	*42001*		*Elk*	*42047*		*Montour*	*42093*
Allegheny	*42003*		*Erie*	*42049*		*Northampton*	*42095*
Armstrong	*42005*		*Fayette*	*42051*		*Northumberland*	*42097*
Beaver	*42007*		*Forest*	*42053*		*Perry*	*42099*
Bedford	*42009*		*Franklin*	*42055*		*Philadelphia*	*42101*
Berks	*42011*		*Fulton*	*42057*		*Pike*	*42103*
Blair	*42013*		*Greene*	*42059*		*Potter*	*42105*
Bradford	*42015*		*Huntingdon*	*42061*		*Schuykill*	*42107*
Bucks	*42017*		*Indiana*	*42063*		*Snyder*	*42109*
Butler	*42019*		*Jefferson*	*42065*		*Somerset*	*42111*
Cambria	*42021*		*Juniata*	*42067*		*Sullivan*	*42113*
Cameron	*42023*		*Lackawanna*	*42069*		*Susquehanna*	*42115*
Carbon	*42025*		*Lancaster*	*42071*		*Tioga*	*42117*
Centre	*42027*		*Lawrence*	*42073*		*Union*	*42119*
Chester	*42029*		*Lebanon*	*42075*		*Venango*	*42121*
Clarion	*42031*		*Lehigh*	*42077*		*Warren*	*42123*
Clearfield	*42033*		*Luzerne*	*42079*		*Washington*	*42125*
Clinton	*42035*		*Lycoming*	*42081*		*Wayne*	*42127*

Columbia	*42037*		*McKean*	*42083*		*Westmoreland*	*42129*
Crawford	*42039*		*Mercer*	*42085*		*Wyoming*	*42131*
Cumberland	*42041*		*Mifflin*	*42087*		*York*	*42133*
Dauphin	*42043*		*Monroe*	*42089*			
Delaware	*42045*		*Montgomery*	*42091*			
New York [STATE CODE: 36] (N=62)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Albany	*36001*		*Herkimer*	*36043*		*Richmond*	*36085*
Allegany	*36003*		*Jefferson*	*36045*		*Rockland*	*36087*
Bronx	*36005*		*Kings*	*36047*		*St. Lawrence*	*36089*
Broome	*36007*		*Lewis*	*36049*		*Saratoga*	*36091*
Cattaraugus	*36009*		*Livingston*	*36051*		*Schenectady*	*36093*
Cayuga	*36011*		*Madison*	*36053*		*Schoharie*	*36095*
Chautaqua	*36013*		*Monroe*	*36055*		*Schuyler*	*36097*
Chemung	*36015*		*Montgomery*	*36057*		*Seneca*	*36099*
Chenango	*36017*		*Nassau*	*36059*		*Steuben*	*36101*
Clinton	*36019*		*New York*	*36061*		*Suffolk*	*36103*
Columbia	*36021*		*Niagara*	*36063*		*Sullivan*	*36105*
Cortland	*36023*		*Oneida*	*36065*		*Tioga*	*36107*
Delaware	*36025*		*Onondaga*	*36067*		*Tompkins*	*36109*
Dutchess	*36027*		*Ontario*	*36069*		*Ulster*	*36111*
Erie	*36029*		*Orange*	*36071*		*Warren*	*36113*
Essex	*36031*		*Orleans*	*36073*		*Washington*	*36115*
Franklin	*36033*		*Oswego*	*36075*		*Wayne*	*36117*
Fulton	*36035*		*Otsego*	*36077*		*Westchester*	*36119*
Genesee	*36037*		*Putnam*	*36079*		*Wyoming*	*36121*
Greene	*36039*		*Queens*	*36081*		*Yates*	*36123*
Hamilton	*36041*		*Rensselaer*	*36083*			
New Jersey [STATE CODE: 34] (N=21)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Atlantic	*34001*		*Gloucester*	*34015*		*Ocean*	*34029*
Bergen	*34003*		*Hudson*	*34017*		*Passaic*	*34031*
Burlington	*34005*		*Hunterdon*	*34019*		*Salem*	*34033*
Camden	*34007*		*Mercer*	*34021*		*Somerset*	*34035*
Cape May	*34009*		*Middlesex*	*34023*		*Sussex*	*34037*
Cumberland	*34011*		*Monmouth*	*34025*		*Union*	*34039*
Essex	*34013*		*Morris*	*34027*		*Warren*	*34041*

SOUTHERN COUNTIES **[REGION 3]** (N=1,424)

South Atlantic **[Division 5]** (N=590)

Delaware [STATE CODE: 10] (N=3)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Kent	*10001*		*New Castle*	*10003*		*Sussex*	*10005*

District of Columbia [STATE CODE: 11] (N=1)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
District of Columbia	*11001*						

Florida [STATE CODE: 12] (N=67)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Alachua	*12001*		*Hardee*	*12047*		*Okeechobee*	*12093*
Baker	*12003*		*Hendry*	*12049*		*Orange*	*12095*
Bay	*12005*		*Hernando*	*12051*		*Osceola*	*12097*
Bradford	*12007*		*Highlands*	*12053*		*Palm Beach*	*12099*
Brevard	*12009*		*Hillsborough*	*12055*		*Pasco*	*12101*
Broward	*12011*		*Holmes*	*12057*		*Pinellas*	*12103*
Calhoun	*12013*		*Indian River*	*12059*		*Polk*	*12105*
Charlotte	*12015*		*Jackson*	*12061*		*Putnam*	*12107*
Citrus	*12017*		*Jefferson*	*12063*		*St. Johns*	*12109*
Clay	*12019*		*Lafayette*	*12065*		*St. Lucie*	*12111*
Collier	*12021*		*Lake*	*12067*		*Santa Rosa*	*12113*
Columbia	*12023*		*Lee*	*12069*		*Sarasota*	*12115*
DeSoto	*12025*		*Leon*	*12071*		*Seminole*	*12117*
Dixie	*12027*		*Levy*	*12073*		*Sumter*	*12119*
Duval	*12029*		*Liberty*	*12075*		*Suwannee*	*12121*
Escambia	*12031*		*Madison*	*12077*		*Taylor*	*12123*
Flagler	*12033*		*Manatee*	*12079*		*Union*	*12125*
Franklin	*12035*		*Marion*	*12081*		*Volusia*	*12127*
Gadsden	*12037*		*Martin*	*12083*		*Wakulla*	*12129*
Gilchrist	*12039*		*Miami-Dade*	*12085*		*Walton*	*12131*
Glades	*12041*		*Monroe*	*12087*		*Washington*	*12133*
Gulf	*12043*		*Nassau*	*12089*			
Hamilton	*12045*		*Okaloosa*	*12091*			

Georgia [STATE CODE: 13] (N=159)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Appling	*13001*		*Evans*	*13109*		*Newton*	*13217*
Atkinson	*13003*		*Fannin*	*13111*		*Oconee*	*13219*

Bacon	*13005*		*Fayette*	*13113*		*Oglethorpe*	*13221*
Baker	*13007*		*Floyd*	*13115*		*Paulding*	*13223*
Baldwin	*13009*		*Forsyth*	*13117*		*Peach*	*13225*
Banks	*13011*		*Franklin*	*13119*		*Pickens*	*13227*
Barrow	*13013*		*Fulton*	*13121*		*Pierce*	*13229*
Bartow	*13015*		*Filmer*	*13123*		*Pike*	*13231*
Ben Hill	*13017*		*Glascock*	*13125*		*Polk*	*13233*
Berrien	*13019*		*Glynn*	*13127*		*Pulaski*	*13235*
Bibb	*13021*		*Gordon*	*13129*		*Putnam*	*13237*
Bleckley	*13023*		*Grady*	*13131*		*Quitman*	*13239*
Brantley	*13025*		*Greene*	*13133*		*Rabun*	*13241*
Brooks	*13027*		*Gwinett*	*13135*		*Randolph*	*13243*
Bryan	*13029*		*Habersham*	*13137*		*Richmond*	*13245*
Bulloch	*13031*		*Hall*	*13139*		*Rockdale*	*13247*
Burke	*13033*		*Hancock*	*13141*		*Schley*	*13249*
Butts	*13035*		*Haralson*	*13143*		*Screven*	*13251*
Calhoun	*13037*		*Harris*	*13145*		*Seminole*	*13253*
Camden	*13039*		*Hart*	*13147*		*Spalding*	*13255*
Candler	*13043*		*Heard*	*13149*		*Stephens*	*13257*
Carroll	*13045*		*Henry*	*13151*		*Stewart*	*13259*
Catoosa	*13047*		*Houston*	*13153*		*Sumter*	*13261*
Charlton	*13049*		*Irwin*	*13155*		*Talbot*	*13263*
Chatham	*13051*		*Jackson*	*13157*		*Taliaferro*	*13265*
Chattahoochee	*13053*		*Jasper*	*13159*		*Tattnall*	*13267*
Chattooga	*13055*		*Jeff Davis*	*13161*		*Taylor*	*13269*
Cherokee	*13057*		*Jefferson*	*13163*		*Telfair*	*13271*
Clarke	*13059*		*Jenkins*	*13165*		*Terrell*	*13273*
Clay	*13061*		*Johnson*	*13167*		*Thomas*	*13275*
Clayton	*13063*		*Jones*	*13169*		*Tift*	*13277*
Clinch	*13065*		*Lamar*	*13171*		*Toombs*	*13279*
Cobb	*13067*		*Lanier*	*13173*		*Towns*	*13281*
Coffee	*13069*		*Laurens*	*13175*		*Treutlen*	*13283*
Colquitt	*13071*		*Lee*	*13177*		*Troup*	*13285*
Columbia	*13073*		*Liberty*	*13179*		*Turner*	*13287*
Cook	*13075*		*Lincoln*	*13181*		*Twiggs*	*13289*
Coweta	*13077*		*Long*	*13183*		*Union*	*13291*
Crawford	*13079*		*Lowndes*	*13185*		*Upson*	*13293*
Crisp	*13081*		*Lumpkin*	*13187*		*Walker*	*13295*
Dade	*13083*		*Macon*	*13193*		*Walton*	*13297*
Dawson	*13085*		*Madison*	*13195*		*Ware*	*13299*
Decatur	*13087*		*Marion*	*13197*		*Warren*	*13301*
DeKalb	*13089*		*McDuffie*	*13189*		*Washington*	*13303*
Dodge	*13091*		*McIntosh*	*13191*		*Wayne*	*13305*
Dooly	*13093*		*Meriwether*	*13199*		*Webster*	*13307*
Dougherty	*13095*		*Miller*	*13201*		*Wheeler*	*13309*

Douglas	*13097*		*Mitchell*	*13205*		*White*	*13311*
Early	*13099*		*Monroe*	*13207*		*Whitfield*	*13313*
Echols	*13101*		*Montgomery*	*13209*		*Wilcox*	*13315*
Effingham	*13103*		*Morgan*	*13211*		*Wilkes*	*13317*
Elbert	*13105*		*Murray*	*13213*		*Wilkinson*	*13319*
Emanuel	*13107*		*Muscogee*	*13215*		*Worth*	*13321*
Maryland [STATE CODE: 24] (N=24)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Allegany	*24001*		*Charles*	*24017*		*Prince George's*	*24033*
Anne Arundel	*24003*		*Dorchester*	*24019*		*Queen Anne's*	*24035*
Baltimore	*24005*		*Frederick*	*24021*		*St. Mary's*	*24037*
Baltimore City	*24510*		*Garrett*	*24023*		*Somerset*	*24039*
Calvert	*24009*		*Harford*	*24025*		*Talbot*	*24041*
Caroline	*24011*		*Howard*	*24027*		*Washington*	*24043*
Carroll	*24013*		*Kent*	*24029*		*Wicomico*	*24045*
Cecil	*24015*		*Montgomery*	*24031*		*Worcester*	*24047*
North Carolina [STATE CODE: 37] (N=100)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Alamance	*37001*		*Franklin*	*37069*		*Pamlico*	*37137*
Alexander	*37003*		*Gaston*	*37071*		*Pasquotank*	*37139*
Alleghany	*37005*		*Gates*	*37073*		*Pender*	*37141*
Anson	*37007*		*Graham*	*37075*		*Perquimans*	*37143*
Ashe	*37009*		*Granville*	*37077*		*Person*	*37145*
Avery	*37011*		*Greene*	*37079*		*Pitt*	*37147*
Beaufort	*37013*		*Guilford*	*37081*		*Polk*	*37149*
Bertie	*37015*		*Halifax*	*37083*		*Randolph*	*37151*
Bladen	*37017*		*Harnett*	*37085*		*Richmond*	*37153*
Brunswick	*37019*		*Haywood*	*37087*		*Robeson*	*37155*
Buncombe	*37021*		*Henderson*	*37089*		*Rockingham*	*37157*
Burke	*37023*		*Hertford*	*37091*		*Rowan*	*37159*
Cabarrus	*37025*		*Hoke*	*37093*		*Rutherford*	*37161*
Caldwell	*37027*		*Hyde*	*37095*		*Sampson*	*37163*
Camden	*37029*		*Iredell*	*37097*		*Scotland*	*37165*
Carteret	*37031*		*Jackson*	*37099*		*Stanly*	*37167*
Caswell	*37033*		*Johnston*	*37101*		*Stokes*	*37169*
Catawba	*37035*		*Jones*	*37103*		*Surry*	*37171*
Chatham	*37037*		*Lee*	*37105*		*Swain*	*37173*
Cherokee	*37039*		*Lenoir*	*37107*		*Transylvania*	*37175*
Chowan	*37041*		*Lincoln*	*37109*		*Tyrrell*	*37177*
Clay	*37043*		*McDowell*	*37111*		*Union*	*37179*
Cleveland	*37045*		*Macon*	*37113*		*Vance*	*37181*
Columbus	*37047*		*Madison*	*37115*		*Wake*	*37183*

Craven	*37049*		*Martin*	*37117*		*Warren*	*37185*
Cumberland	*37051*		*Mecklenburg*	*37119*		*Washington*	*37187*
Currituck	*37053*		*Mitchell*	*37121*		*Watauga*	*37189*
Dare	*37055*		*Montgomery*	*37123*		*Wayne*	*37191*
Davidson	*37057*		*Moore*	*37125*		*Wilkes*	*37193*
Davie	*37059*		*Nash*	*37127*		*Wilson*	*37195*
Duplin	*37061*		*New Hanover*	*37129*		*Yadkin*	*37197*
Durham	*37063*		*Northampton*	*37131*		*Yancey*	*37199*
Edgecombe	*37065*		*Onslow*	*37133*			
Forsyth	*37067*		*Orange*	*37135*			

South Carolina [STATE CODE: 45] (N=46)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Abbeville	*45001*		*Dillon*	*45033*		*McCormick*	*45065*
Aiken	*45003*		*Dorchester*	*45035*		*Marion*	*45067*
Allendale	*45005*		*Edgefield*	*45037*		*Marlboro*	*45069*
Anderson	*45007*		*Fairfield*	*45039*		*Newberry*	*45071*
Bamberg	*45009*		*Florence*	*45041*		*Oconee*	*45073*
Barnwell	*45011*		*Georgetown*	*45043*		*Orangburg*	*45075*
Beaufort	*45013*		*Greenville*	*45045*		*Pickens*	*45077*
Berkeley	*45015*		*Greenwood*	*45047*		*Richland*	*45079*
Calhoun	*45017*		*Hampton*	*45049*		*Saluda*	*45081*
Charleston	*45019*		*Horry*	*45051*		*Spartanburg*	*45083*
Cherokee	*45021*		*Jasper*	*45053*		*Sumter*	*45085*
Chester	*45023*		*Kershaw*	*45055*		*Union*	*45087*
Chesterfield	*45025*		*Lancaster*	*45057*		*Williamsburg*	*45089*
Clarendon	*45027*		*Laurens*	*45059*		*York*	*45091*
Colleton	*45029*		*Lee*	*45061*			
Darlington	*45031*		*Lexington*	*45063*			

Virginia [STATE CODE: 51] (N=135)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Accomack	*51001*		*Franklin city*	*51620*		*Norton city*	*51720*
Albemarle	*51003*		*Franklin County*	*51067*		*Nottoway*	*51135*
Alexandria city	*51510*		*Frederick*	*51069*		*Orange*	*51137*
Alleghany	*51005*		*Fredericksburg city*	*51630*		*Page*	*51139*
Amelia	*51007*		*Galax city*	*51640*		*Patrick*	*51141*
Amherst	*51009*		*Giles*	*51071*		*Petersburg city*	*51730*
Appomattox	*51011*		*Gloucester*	*51073*		*Pittsylvania*	*51143*
Arlington	*51013*		*Goochland*	*51075*		*Poquoson city*	*51735*
Augusta	*51015*		*Grayson*	*51077*		*Portsmouth city*	*51740*
Bath	*51017*		*Greene*	*51079*		*Powhatan*	*51145*
Bedford city	*51515*		*Greensville*	*51081*		*Prince Edward*	*51147*

Bedford County	*51019*		*Halifax*	*51083*		*Prince George*	*51149*
Bland	*51021*		*Hampton city*	*51650*		*Prince William*	*51153*
Botetourt	*51023*		*Hanover*	*51085*		*Pulaski*	*51155*
Bristol city	*51520*		*Harrisonburg city*	*51660*		*Radford city*	*51750*
Brunswick	*51025*		*Henrico*	*51087*		*Rappahannock*	*51157*
Buchanan	*51027*		*Henry*	*51089*		*Richmond city*	*51760*
Buckingham	*51029*		*Highland*	*51091*		*Richmond County*	*51159*
Buena Vista city	*51530*		*Hopewell city*	*51670*		*Roanoke city*	*51770*
Campbell	*51031*		*Isle of Wight*	*51093*		*Roanoke County*	*51161*
Caroline	*51033*		*James City*	*51095*		*Rockbridge*	*51163*
Carroll	*51035*		*King George*	*51099*		*Rockingham*	*51165*
Charles City	*51036*		*King William*	*51101*		*Russell*	*51167*
Charlotte	*51037*		*King and Queen*	*51097*		*Salem city*	*51775*
Charlottesville city	*51540*		*Lancaster*	*51103*		*Scott*	*51169*
Chesapeake city	*51550*		*Lee*	*51105*		*Shenandoah*	*51171*
Chesterfield	*51041*		*Lexington city*	*51678*		*Smyth*	*51173*
Clarke	*51043*		*Loudoun*	*51107*		*Southampton*	*51175*
Clifton Forge city	*51560*		*Louisa*	*51109*		*Spotsylvania*	*51177*
Colonial Heights city	*51570*		*Lunenburg*	*51111*		*Stafford*	*51179*
Covington city	*51580*		*Lynchburg city*	*51680*		*Staunton city*	*51790*
Craig	*51045*		*Madison*	*51113*		*Suffolk city*	*51800*
Culpeper	*51047*		*Manassas city*	*51683*		*Surry*	*51181*
Cumberland	*51049*		*Manassas Park city*	*51685*		*Sussex*	*51183*
Danville city	*51590*		*Martinsville city*	*51690*		*Tazewell*	*51185*
Dickenson	*51051*		*Mathews*	*51115*		*Virginia Beach city*	*51810*
Dinwiddie	*51053*		*Mecklenburg*	*51117*		*Warren*	*51187*
Emporia city	*51595*		*Middlesex*	*51119*		*Washington*	*51191*
Essex	*51057*		*Montgomery*	*51121*		*Waynesboro city*	*51820*
Fairfax city	*51600*		*Nelson*	*51125*		*Westmoreland*	*51193*
Fairfax County	*51059*		*New Kent*	*51127*		*Williamsburg city*	*51830*
Falls Church city	*51610*		*Newport News city*	*51700*		*Winchester city*	*51840*
Fauquier	*51061*		*Norfolk city*	*51710*		*Wise*	*51195*
Floyd	*51063*		*Northampton*	*51131*		*Wythe*	*51197*
Fluvanna	*51065*		*Northumberland*	*51133*		*York*	*51199*
West Virginia [STATE CODE: 54] (N=55)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Barbour	*54001*		*Kanawha*	*54039*		*Preston*	*54077*

Berkeley	*54003*		*Lewis*	*54041*		*Putnam*	*54079*
Boone	*54005*		*Lincoln*	*54043*		*Raleigh*	*54081*
Braxton	*54007*		*Logan*	*54045*		*Randolph*	*54083*
Brooke	*54009*		*McDowell*	*54047*		*Ritchie*	*54085*
Cabell	*54011*		*Marion*	*54049*		*Roane*	*54087*
Calhoun	*54013*		*Marshall*	*54051*		*Summers*	*54089*
Clay	*54015*		*Mason*	*54053*		*Taylor*	*54091*
Doddridge	*54017*		*Mercer*	*54055*		*Tucker*	*54093*
Fayette	*54019*		*Mineral*	*54057*		*Tyler*	*54095*
Gilmer	*54021*		*Mingo*	*54059*		*Upshur*	*54097*
Grant	*54023*		*Monongalia*	*54061*		*Wayne*	*54099*
Greenbrier	*54025*		*Monroe*	*54063*		*Webster*	*54101*
Hampshire	*54027*		*Morgan*	*54065*		*Wetzel*	*54103*
Hancock	*54029*		*Nicholas*	*54067*		*Wirt*	*54105*
Hardy	*54031*		*Ohio*	*54069*		*Wood*	*54107*
Harrison	*54033*		*Pendleton*	*54071*		*Wyoming*	*54109*
Jackson	*54035*		*Pleasants*	*54073*			
Jefferson	*54037*		*Pocahontas*	*54075*			
East South Central **[Division 6]** (N=364)							
Alabama [STATE CODE: 01] (N=67)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Autauga	*01001*		*Dallas*	*01047*		*Marion*	*01093*
Baldwin	*01003*		*DeKalb*	*01049*		*Marshall*	*01095*
Barbour	*01005*		*Elmore*	*01051*		*Mobile*	*01097*
Bibb	*01007*		*Escambia*	*01053*		*Monroe*	*01099*
Blount	*01009*		*Etowah*	*01055*		*Montgomery*	*01101*
Bullock	*01011*		*Fayette*	*01057*		*Morgan*	*01103*
Butler	*01013*		*Franklin*	*01059*		*Perry*	*01105*
Calhoun	*01015*		*Geneva*	*01061*		*Pickens*	*01107*
Chambers	*01017*		*Greene*	*01063*		*Pike*	*01109*
Cherokee	*01019*		*Hale*	*01065*		*Randolph*	*01111*
Chilton	*01021*		*Henry*	*01067*		*Russell*	*01113*
Choctaw	*01023*		*Houston*	*01069*		*St. Clair*	*01115*
Clarke	*01025*		*Jackson*	*01071*		*Shelby*	*01117*
Clay	*01027*		*Jefferson*	*01073*		*Sumter*	*01119*
Cleburne	*01029*		*Lamar*	*01075*		*Talladega*	*01121*
Coffee	*01031*		*Lauderdale*	*01077*		*Tallapoosa*	*01123*
Colbert	*01033*		*Lawrence*	*01079*		*Tuscaloosa*	*01125*
Conecuh	*01035*		*Lee*	*01081*		*Walker*	*01127*
Coosa	*01037*		*Limestone*	*01083*		*Washington*	*01129*
Covington	*01039*		*Lowndes*	*01085*		*Wilcox*	*01131*
Crenshaw	*01041*		*Macon*	*01087*		*Winston*	*01133*
Cullman	*01043*		*Madison*	*01089*			
Dale	*01045*		*Marengo*	*01091*			

Kentucky [STATE CODE: 21] (N=120)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Adair	*21001*		*Grant*	*21081*		*Mason*	*21161*
Allen	*21003*		*Graves*	*21083*		*Meade*	*21163*
Anderson	*21005*		*Grayson*	*21085*		*Menifee*	*21165*
Ballard	*21007*		*Green*	*21087*		*Mercer*	*21167*
Barren	*21009*		*Greenup*	*21089*		*Metcalfe*	*21169*
Bath	*21011*		*Hancock*	*21091*		*Monroe*	*21171*
Bell	*21013*		*Hardin*	*21093*		*Montgomery*	*21173*
Boone	*21015*		*Harlan*	*21095*		*Morgan*	*21175*
Bourbon	*21017*		*Harrison*	*21097*		*Muhlenberg*	*21177*
Boyd	*21019*		*Hart*	*21099*		*Nelson*	*21179*
Boyle	*21021*		*Henderson*	*21101*		*Nicholas*	*21181*
Bracken	*21023*		*Henry*	*21103*		*Ohio*	*21183*
Breathitt	*21025*		*Hickman*	*21105*		*Oldham*	*21185*
Breckinridge	*21027*		*Hopkins*	*21107*		*Owen*	*21187*
Bullitt	*21029*		*Jackson*	*21109*		*Owsley*	*21189*
Butler	*21031*		*Jefferson*	*21111*		*Pendleton*	*21191*
Caldwell	*21033*		*Jessamine*	*21113*		*Perry*	*21193*
Calloway	*21035*		*Johnson*	*21115*		*Pike*	*21195*
Campbell	*21037*		*Kenton*	*21117*		*Powell*	*21197*
Carlisle	*21039*		*Knott*	*21119*		*Pulaski*	*21199*
Carroll	*21041*		*Knox*	*21121*		*Robertson*	*21201*
Carter	*21043*		*Larue*	*21123*		*Rockcastle*	*21203*
Casey	*21045*		*Laurel*	*21125*		*Rowan*	*21205*
Christian	*21047*		*Lawrence*	*21127*		*Russell*	*21207*
Clark	*21049*		*Lee*	*21129*		*Scott*	*21209*
Clay	*21051*		*Leslie*	*21131*		*Shelby*	*21211*
Clinton	*21053*		*Letcher*	*21133*		*Simpson*	*21213*
Crittenden	*21055*		*Lewis*	*21135*		*Spencer*	*21215*
Cumberland	*21057*		*Lincoln*	*21137*		*Taylor*	*21217*
Daviess	*21059*		*Livingston*	*21139*		*Todd*	*21219*
Edmonson	*21061*		*Logan*	*21141*		*Trigg*	*21221*
Elliott	*21063*		*Lyon*	*21143*		*Trimble*	*21223*
Estill	*21065*		*McCracken*	*21145*		*Union*	*21225*
Fayette	*21067*		*McCreary*	*21147*		*Warren*	*21227*
Fleming	*21069*		*McLean*	*21149*		*Washington*	*21229*
Floyd	*21071*		*Madison*	*21151*		*Wayne*	*21231*
Franklin	*21073*		*Magoffin*	*21153*		*Webster*	*21233*
Fulton	*21075*		*Marion*	*21155*		*Whitley*	*21235*
Gallatin	*21077*		*Marshall*	*21157*		*Wolfe*	*21237*
Garrard	*21079*		*Martin*	*21159*		*Woodford*	*21239*

Mississippi [STATE CODE: 28] (N=82)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Adams	*28001*		*Itawamba*	*28057*		*Pike*	*28113*
Alcorn	*28003*		*Jackson*	*28059*		*Pontotoc*	*28115*
Amite	*28005*		*Jasper*	*28061*		*Prentiss*	*28117*
Attala	*28007*		*Jefferson*	*28063*		*Quitman*	*28119*
Benton	*28009*		*Jefferson Davis*	*28065*		*Rankin*	*28121*
Bolivar	*28011*		*Jones*	*28067*		*Scott*	*28123*
Calhoun	*28013*		*Kemper*	*28069*		*Sharkey*	*28125*
Carroll	*28015*		*Lafayette*	*28071*		*Simpson*	*28127*
Chickasaw	*28017*		*Lamar*	*28073*		*Smith*	*28129*
Choctaw	*28019*		*Lauderdale*	*28075*		*Stone*	*28131*
Claiborne	*28021*		*Lawrence*	*28077*		*Sunflower*	*28133*
Clarke	*28023*		*Leake*	*28079*		*Tallahatchie*	*28135*
Clay	*28025*		*Lee*	*28081*		*Tate*	*28137*
Coahoma	*28027*		*Leflore*	*28083*		*Tippah*	*28139*
Copiah	*28029*		*Lincoln*	*28085*		*Tishomingo*	*28141*
Covington	*28031*		*Lowndes*	*28087*		*Tunica*	*28143*
De Soto	*28033*		*Madison*	*28089*		*Union*	*28145*
Forrest	*28035*		*Marion*	*28091*		*Walthall*	*28147*
Franklin	*28037*		*Marshall*	*28093*		*Warren*	*28149*
George	*28039*		*Monroe*	*28095*		*Washington*	*28151*
Greene	*28041*		*Montgomery*	*28097*		*Wayne*	*28153*
Grenada	*28043*		*Neshoba*	*28099*		*Webster*	*28155*
Hancock	*28045*		*Newton*	*28101*		*Wilkinson*	*28157*
Harrison	*28047*		*Noxubee*	*28103*		*Winston*	*28159*
Hinds	*28049*		*Okitbbeha*	*28105*		*Yalobusha*	*28161*
Holmes	*28051*		*Panola*	*28107*		*Yazoo*	*28163*
Humphreys	*28053*		*Pearl River*	*28109*			
Issaquena	*28055*		*Perry*	*28111*			

Tennessee [STATE CODE: 47] (N=95)

County	*County Code*		*County*	*County Code*		*County*	*County Code*
Anderson	*47001*		*Hamilton*	*47065*		*Morgan*	*47129*
Bedford	*47003*		*Hancock*	*47067*		*Obion*	*47131*
Benton	*47005*		*Hardeman*	*47069*		*Overton*	*47133*
Bledsoe	*47007*		*Hardin*	*47071*		*Perry*	*47135*
Blount	*47009*		*Hawkins*	*47073*		*Pickett*	*47137*
Bradley	*47011*		*Haywood*	*47075*		*Polk*	*47139*
Campbell	*47013*		*Henderson*	*47077*		*Putnam*	*47141*
Cannon	*47015*		*Henry*	*47079*		*Rhea*	*47143*
Carroll	*47017*		*Hickman*	*47081*		*Roane*	*47145*

Carter	*47019*		*Houston*	*47083*		*Robertson*	*47147*
Cheatham	*47021*		*Humphreys*	*47085*		*Rutherford*	*47149*
Chester	*47023*		*Jackson*	*47087*		*Scott*	*47151*
Claiborne	*47025*		*Jefferson*	*47089*		*Sequatchie*	*47153*
Clay	*47027*		*Johnson*	*47091*		*Sevier*	*47155*
Cocke	*47029*		*Knox*	*47093*		*Shelby*	*47157*
Coffee	*47031*		*Lake*	*47095*		*Smith*	*47159*
Crockett	*47033*		*Lauderdale*	*47097*		*Stewart*	*47161*
Cumberland	*47035*		*Lawrence*	*47099*		*Sullivan*	*47163*
Davidson	*47037*		*Lewis*	*47101*		*Sumner*	*47165*
Decatur	*47039*		*Lincoln*	*47103*		*Tipton*	*47167*
DeKalb	*47041*		*Loudon*	*47105*		*Trousdale*	*47169*
Dickson	*47043*		*McMinn*	*47107*		*Unicoi*	*47171*
Dyer	*47045*		*McNairy*	*47109*		*Union*	*47173*
Fayette	*47047*		*Macon*	*47111*		*Van Buren*	*47175*
Fentress	*47049*		*Madison*	*47113*		*Warren*	*47177*
Franklin	*47051*		*Marion*	*47115*		*Washington*	*47179*
Gibson	*47053*		*Marshall*	*47117*		*Wayne*	*47181*
Giles	*47055*		*Maury*	*47119*		*Weakley*	*47183*
Grainger	*47057*		*Meigs*	*47121*		*White*	*47185*
Greene	*47059*		*Monroe*	*47123*		*Williamson*	*47187*
Grundy	*47061*		*Montgomery*	*47125*		*Wilson*	*47189*
Hamblen	*47063*		*Moore*	*47127*			
West South Central **[Division 7]** (N=470)							
Arkansas [STATE CODE: 05] (N=75)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Arkansas	*05001*		*Garland*	*05051*		*Newton*	*05101*
Ashley	*05003*		*Grant*	*05053*		*Ouachita*	*05103*
Baxter	*05005*		*Greene*	*05055*		*Perry*	*05105*
Benton	*05007*		*Hempstead*	*05057*		*Phillips*	*05107*
Boone	*05009*		*Hot Spring*	*05059*		*Pike*	*05109*
Bradley	*05011*		*Howard*	*05061*		*Poinsett*	*05111*
Calhoun	*05013*		*Independence*	*05063*		*Polk*	*05113*
Carroll	*05015*		*Izard*	*05065*		*Pope*	*05115*
Chicot	*05017*		*Jackson*	*05067*		*Prairie*	*05117*
Clark	*05019*		*Jefferson*	*05069*		*Pulaski*	*05119*
Clay	*05021*		*Johnson*	*05071*		*Randolph*	*05121*
Cleburne	*05023*		*Lafayette*	*05073*		*St. Francis*	*05123*
Cleveland	*05025*		*Lawrence*	*05075*		*Saline*	*05125*
Columbia	*05027*		*Lee*	*05077*		*Scott*	*05127*
Conway	*05029*		*Lincoln*	*05079*		*Searcy*	*05129*
Craighead	*05031*		*Little River*	*05081*		*Sebastian*	*05131*
Crawford	*05033*		*Logan*	*05083*		*Sevier*	*05133*
Crittenden	*05035*		*Lonoke*	*05085*		*Sharp*	*05135*

Cross	*05037*		*Madison*	*05087*		*Stone*	*05137*
Dallas	*05039*		*Marion*	*05089*		*Union*	*05139*
Desha	*05041*		*Miller*	*05091*		*Van Buren*	*05141*
Drew	*05043*		*Mississippi*	*05093*		*Washington*	*05143*
Faulkner	*05045*		*Monroe*	*05095*		*White*	*05145*
Franklin	*05047*		*Montgomery*	*05097*		*Woodruff*	*05147*
Fulton	*05049*		*Nevada*	*05099*		*Yell*	*05149*
Louisiana [STATE CODE: 22] (N=64)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Acadia	*22001*		*Iberia*	*22045*		*St. Charles*	*22089*
Allen	*22003*		*Iberville*	*22047*		*St. Helena*	*22091*
Ascension	*22005*		*Jackson*	*22049*		*St. James*	*22093*
Assumption	*22007*		*Jefferson*	*22051*		*St. John the Baptist*	*22095*
Avoyelles	*22009*		*Jefferson Davis*	*22053*		*St. Landry*	*22097*
Beauregard	*22011*		*Lafayette*	*22055*		*St. Martin*	*22099*
Bienville	*22013*		*Lafourche*	*22057*		*St. Mary*	*22101*
Bossier	*22015*		*La Salle*	*22059*		*St. Tammany*	*22103*
Caddo	*22017*		*Lincoln*	*22061*		*Tangipahoa*	*22105*
Calcasieu	*22019*		*Livingston*	*22063*		*Tensas*	*22107*
Caldwell	*22021*		*Madison*	*22065*		*Terrebonne*	*22109*
Cameron	*22023*		*Morehouse*	*22067*		*Union*	*22111*
Catahoula	*22025*		*Natchitoches*	*22069*		*Vermilion*	*22113*
Claiborne	*22027*		*Orleans*	*22071*		*Vernon*	*22115*
Concordia	*22029*		*Ouachita*	*22073*		*Washington*	*22117*
De Sota	*22031*		*Plaquemines*	*22075*		*Webster*	*22119*
East Baton Rouge	*22033*		*Pointe Coupee*	*22077*		*West Baton Rouge*	*22121*
East Carroll	*22035*		*Rapides*	*22079*		*West Carroll*	*22123*
East Feliciana	*22037*		*Red River*	*22081*		*West Feliciana*	*22125*
Evangeline	*22039*		*Richland*	*22083*		*Winn*	*22127*
Franklin	*22041*		*Sabine*	*22085*			
Grant	*22043*		*St. Bernard*	*22087*			
Oklahoma [STATE CODE: 40] (N=77)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Adair	*40001*		*Grant*	*40053*		*Nowata*	*40105*
Alfalfa	*40003*		*Greer*	*40055*		*Okfuskee*	*40107*
Atoka	*40005*		*Harmon*	*40057*		*Oklahoma*	*40109*
Beaver	*40007*		*Harper*	*40059*		*Okmulgee*	*40111*
Beckham	*40009*		*Haskell*	*40061*		*Osage*	*40113*
Blaine	*40011*		*Hughes*	*40063*		*Ottawa*	*40115*
Bryan	*40013*		*Jackson*	*40065*		*Pawnee*	*40117*
Caddo	*40015*		*Jefferson*	*40067*		*Payne*	*40119*

Canadian	*40017*		*Johnston*	*40069*		*Pittsburg*	*40121*
Carter	*40019*		*Kay*	*40071*		*Pontotoc*	*40123*
Cherokee	*40021*		*Kingfisher*	*40073*		*Pottawatomie*	*40125*
Choctaw	*40023*		*Kiowa*	*40075*		*Pushmataha*	*40127*
Cimarron	*40025*		*Latimer*	*40077*		*Roger Mills*	*40129*
Cleveland	*40027*		*Le Flore*	*40079*		*Rogers*	*40131*
Coal	*40029*		*Lincoln*	*40081*		*Seminole*	*40133*
Comanche	*40031*		*Logan*	*40083*		*Sequoyah*	*40135*
Cotton	*40033*		*Love*	*40085*		*Stephens*	*40137*
Craig	*40035*		*McClain*	*40087*		*Texas*	*40139*
Creek	*40037*		*McCurtain*	*40089*		*Tillman*	*40141*
Custer	*40039*		*McIntosh*	*40091*		*Tulsa*	*40143*
Delaware	*40041*		*Major*	*40093*		*Wagoner*	*40145*
Dewey	*40043*		*Marshall*	*40095*		*Washington*	*40147*
Ellis	*40045*		*Mayes*	*40097*		*Washita*	*40149*
Garfield	*40047*		*Murray*	*40099*		*Woods*	*40151*
Garvin	*40049*		*Muskogee*	*40101*		*Woodward*	*40153*
Grady	*40051*		*Noble*	*40103*			
Texas [STATE CODE: 48] (N=254)							
County	*County Code*		*County*	*County Code*		*County*	*County Code*
Anderson	*48001*		*Gillespie*	*48171*		*Moore*	*48341*
Andrews	*48003*		*Glasscock*	*48173*		*Morris*	*48343*
Angelina	*48005*		*Goliad*	*48175*		*Motley*	*48345*
Aransas	*48007*		*Gonzales*	*48177*		*Nacogdoches*	*48347*
Archer	*48009*		*Gray*	*48179*		*Navarro*	*48349*
Armstrong	*48011*		*Grayson*	*48181*		*Newton*	*48351*
Atascosa	*48013*		*Gregg*	*48183*		*Nolan*	*48353*
Austin	*48015*		*Grimes*	*48185*		*Nueces*	*48355*
Bailey	*48017*		*Guadalupe*	*48187*		*Ochiltree*	*48357*
Bandera	*48019*		*Hale*	*48189*		*Oldham*	*48359*
Bastrop	*48021*		*Hall*	*48191*		*Orange*	*48361*
Baylor	*48023*		*Hamilton*	*48193*		*Palo Pinto*	*48363*
Bee	*48025*		*Hansford*	*48195*		*Panola*	*48365*
Bell	*48027*		*Hardeman*	*48197*		*Parker*	*48367*
Bexar	*48029*		*Hardin*	*48199*		*Parmer*	*48369*
Blanco	*48031*		*Harris*	*48201*		*Pecos*	*48371*
Borden	*48033*		*Harrison*	*48203*		*Polk*	*48373*
Bosque	*48035*		*Hartley*	*48205*		*Potter*	*48375*
Bowie	*48037*		*Haskell*	*48207*		*Presidio*	*48377*
Brazoria	*48039*		*Hays*	*48209*		*Rains*	*48379*
Brazos	*48041*		*Hemphill*	*48211*		*Randall*	*48381*
Brewster	*48043*		*Henderson*	*48213*		*Reagan*	*48383*
Briscoe	*48045*		*Hidalgo*	*48215*		*Real*	*48385*
Brooks	*48047*		*Hill*	*48217*		*Red River*	*48387*

Brown	*48049*		*Hockley*	*48219*		*Reeves*	*48389*
Burleson	*48051*		*Hood*	*48221*		*Refugio*	*48391*
Burnet	*48053*		*Hopkins*	*48223*		*Roberts*	*48393*
Caldwell	*48055*		*Houston*	*48225*		*Robertson*	*48395*
Calhoun	*48057*		*Howard*	*48227*		*Rockwall*	*48397*
Callahan	*48059*		*Hudspeth*	*48229*		*Runnels*	*48399*
Cameron	*48061*		*Hunt*	*48231*		*Rusk*	*48401*
Camp	*48063*		*Hutchinson*	*48233*		*Sabine*	*48403*
Carson	*48065*		*Irion*	*48235*		*San Augustine*	*48405*
Cass	*48067*		*Jack*	*48237*		*San Jacinto*	*48407*
Castro	*48069*		*Jackson*	*48239*		*San Patricio*	*48409*
Chambers	*48071*		*Jasper*	*48241*		*San Saba*	*48411*
Cherokee	*48073*		*Jeff Davis*	*48243*		*Schleicher*	*48413*
Childress	*48075*		*Jefferson*	*48245*		*Scurry*	*48415*
Clay	*48077*		*Jim Hogg*	*48247*		*Shackelford*	*48417*
Cochran	*48079*		*Jim Wells*	*48249*		*Shelby*	*48419*
Coke	*48081*		*Johnson*	*48251*		*Sherman*	*48421*
Coleman	*48083*		*Jones*	*48253*		*Smith*	*48423*
Collin	*48085*		*Karnes*	*48255*		*Somervell*	*48425*
Collingsworth	*48087*		*Kaufman*	*48257*		*Starr*	*48427*
Colorado	*48089*		*Kendall*	*48259*		*Stephens*	*48429*
Comal	*48091*		*Kenedy*	*48261*		*Sterling*	*48431*
Comanche	*48093*		*Kent*	*48263*		*Stonewall*	*48433*
Concho	*48095*		*Kerr*	*48265*		*Sutton*	*48435*
Cooke	*48097*		*Kimble*	*48267*		*Swisher*	*48437*
Coryell	*48099*		*King*	*48269*		*Tarrant*	*48439*
Cottle	*48101*		*Kinney*	*48271*		*Taylor*	*48441*
Crane	*48103*		*Kleberg*	*48273*		*Terrell*	*48443*
Crockett	*48105*		*Knox*	*48275*		*Terry*	*48445*
Crosby	*48107*		*Lamar*	*48277*		*Throckmorton*	*48447*
Culberson	*48109*		*Lamb*	*48279*		*Titus*	*48449*
Dallam	*48111*		*Lampasas*	*48281*		*Tom Green*	*48451*
Dallas	*48113*		*La Salle*	*48283*		*Travis*	*48453*
Dawson	*48115*		*Lavaca*	*48285*		*Trinity*	*48455*
Deaf Smith	*48117*		*Lee*	*48287*		*Tyler*	*48457*
Delta	*48119*		*Leon*	*48289*		*Upshur*	*48459*
Denton	*48121*		*Liberty*	*48291*		*Upton*	*48461*
DeWitt	*48123*		*Limestone*	*48293*		*Uvalde*	*48463*
Dickens	*48125*		*Lipscomb*	*48295*		*Val Verde*	*48465*
Dimmit	*48127*		*Live Oak*	*48297*		*Van Zandt*	*48467*
Donley	*48129*		*Llano*	*48299*		*Victoria*	*48469*
Duval	*48131*		*Loving*	*48301*		*Walker*	*48471*
Eastland	*48133*		*Lubbock*	*48303*		*Waller*	*48473*
Ector	*48135*		*Lynn*	*48305*		*Ward*	*48475*
Edwards	*48137*		*McCulloch*	*48307*		*Washington*	*48477*

El Paso	*48139*		*McLennan*	*48309*		*Webb*	*48479*
Ellis	*48141*		*McMullen*	*48311*		*Wharton*	*48481*
Erath	*48143*		*Madison*	*48313*		*Wheeler*	*48483*
Falls	*48145*		*Marion*	*48315*		*Wichita*	*48485*
Fannin	*48147*		*Martin*	*48317*		*Wilbarger*	*48487*
Fayette	*48149*		*Mason*	*48319*		*Willacy*	*48489*
Fisher	*48151*		*Matagorda*	*48321*		*Williamson*	*48491*
Floyd	*48153*		*Maverick*	*48323*		*Wilson*	*48493*
Foard	*48155*		*Medina*	*48325*		*Winkler*	*48495*
Fort Bend	*48157*		*Menard*	*48327*		*Wise*	*48497*
Franklin	*48159*		*Midland*	*48329*		*Wood*	*48499*
Freestone	*48161*		*Milam*	*48331*		*Yoakum*	*48501*
Frio	*48163*		*Mills*	*48333*		*Young*	*48503*
Gaines	*48165*		*Mitchell*	*48335*		*Zapata*	*48505*
Galveston	*48167*		*Montague*	*48337*		*Zavala*	*48507*
Garza	*48169*		*Montgomery*	*48339*			

APPENDIX B

ACCESS DATABASE FORMAT

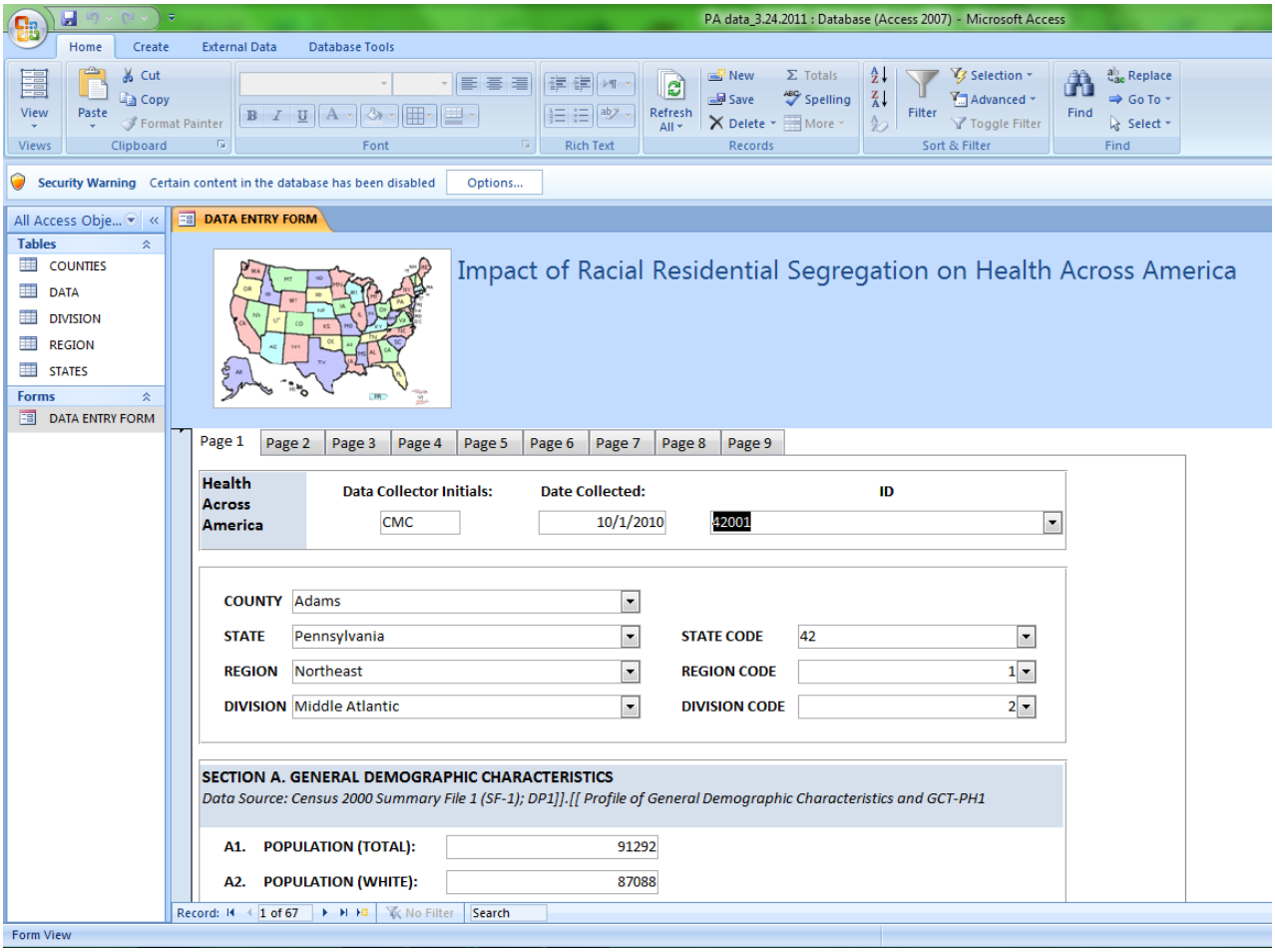

Figure B-1. Access Database Format

APPENDIX C

DATA DICTIONARY

Table C-1. Data Dictionary

VARIABLE (SPSS)	VARIABLE (ACCESS)	DEFINITION	VARIABLE TYPE	CODING CATEGORIES / POSSIBLE VALUES
id	ID	County ID (FIPS format)	Text	*separate list
initials	COLLECTOR_INITIALS	Data collector initials	Text	
Date	DATE_COLLECTED	Date data collection form completed	Date/Time	
county	COUNTY	County name	Text	
state	STATE	State name	Text	
stcode	STATE_CODE	State code (FIPS format)	Text	01=Alabama 05=Arkansas 09=Connecticut 10=Delaware 11=District of Columbia 12=Florida 13=Georgia 21=Kentucky 22=Louisiana 23=Maine 24=Maryland 25=Massachusetts 28=Mississippi 33=New Hampshire 34=New Jersey 36=New York 37=North

				Carolina 40=Oklahoma 42=Pennsylvania 44=Rhode Island 45=South Carolina 47=Tennessee 48=Texas 50=Vermont 51=Virginia 54=West Virginia
region	REGION	Region name	Text	
regcode	REGION_CODE	Region code	Number	1=Northeast 2=Midwest 3=South 4=West
division	DIVISION	Division name	Text	
divcode	DIVISION_CODE	Division code	Number	1=New England 2=Middle Atlantic 3=East North Central 4=West North Central 5=South Atlantic 6=East South Central 7=West South Central 8=Mountain 9=Pacific
poptot	POPULATION_TOTAL	Total population, 2000 (raw)	Number	
popw	POPULATION_WHITE	White population, 2000 (raw)	Number	
popb	POPULATION_BLACK	Black population, 2000 (raw)	Number	
popden	POPULATION_DENSITY	Population density, 2000 (total population per mile^2)	Number	
popurb	POPULATION_URBAN	Population in urban area, 2000 (raw)	Number	
poprur	POPULATION_RURAL	Population in rural area, 2000 (raw)	Number	

housing	HOUSING_UNITS	Housing units, 2000 (raw)	Number	
land	LAND_AREA	Land area, 2000 (miles^2)	Number	
water	WATER_AREA	Water area, 2000 (miles^2)	Number	
hden	HOUSING_DENSITY	Housing density, 2000 (housing units per mile^2)	Number	
vacant	VACANT_HOUSING_UNITS	Vacant housing units, 2000 (% of total housing units)	Number	
entryint	ENTRY_INITIALS	Initials of person completing data entry	Number	
entrydt	ENTRY_DATE	Date data entry completed	Number	
occtot	OCCUPIED_HOUSING_TOTAL	Total occupied housing units, 2000 (raw)	Number	
occown	OCCUPIED_HOUSING_OWNER	Total owner occupied housing units, 2000 (raw)	Number	
occownw	OCCUPIED_HOUSING_OWNER_ WHITE	White owned occupied housing units, 2000 (raw)	Number	
occownb	OCCUPIED_HOUSING_OWNER_B LACK	Black owned occupied housing units, 2000 (raw)	Number	
occrent	OCCUPIED_HOUSING_RENTER	Total renter occupied housing units, 2000 (raw)	Number	
occrentw	OCCUPIED_HOUSING_RENTER_ WHITE	White renter occupied housing units, 2000 (raw)	Number	
occrentb	OCCUPIED_HOUSING_RENTER_ BLACK	Black renter occupied housing units, 2000 (raw)	Number	
teltot	TELEPHONE_TOTAL	Total occupied housing units without telephone service, 2000 (raw)	Number	
plumbtot	PLUMBING_TOTAL	Total occupied	Number	

		housing units lacking complete plumbing facilities, 2000 (raw)		
kittot	KITCHEN_TOTAL	Total occupied housing units lacking complete kitchen facilities, 2000 (raw)	Number	
telw	TELEPHONE_WHITE	White occupied housing units without telephone service, 2000 (raw)	Number	
plumbw	PLUMBING_WHITE	White occupied housing units lacking complete plumbing facilities, 2000 (raw)	Number	
kitw	KITCHEN_WHITE	White occupied housing units lacking complete kitchen facilities, 2000 (raw)	Number	
telb	TELEPHONE_BLACK	Black occupied housing units without telephone service, 2000 (raw)	Number	
plumbb	PLUMBING_BLACK	Black occupied housing units lacking complete plumbing facilities, 2000 (raw)	Number	
kitb	KITCHEN_BLACK	Black occupied housing units lacking	Number	

		complete kitchen facilities, 2000 (raw)		
renttot	GROSS_RENT_TOTAL	Total median gross rent as a % of household income, 1999 (%)	Number	
rentw	GROSS_RENT_WHITE	White median gross rent as a % of household income, 1999 (%)	Number	
rentb	GROSS_RENT_BLACK	Black median gross rent as a % of household income, 1999 (%)	Number	
valuetot	HOME_VALUE_TOTAL	Median value of total owned homes, 2000 ($)	Number	
valuew	HOME_VALUE_WHITE	Median value of all white-owner occupied homes, 2000 ($)	Number	
valueb	HOME_VALUE_BLACK	Median value of all black-owner occupied homes, 2000 ($)	Number	
costtot	OWNER_COSTS_TOTAL	Median owner costs of all owner-occupied housing units as a % of household income, 1999 (%)	Number	
costw	OWNER_COSTS_WHITE	Median owner costs of all white-owner occupied housing units as a % of household income, 1999	Number	

		(%)		
costb	OWNER_COSTS_BLACK	Median owner costs of all black-owner occupied housing units as a % of household income, 1999 (%)	Number	
unempltot	UNEMPLOYMENT_TOTAL	Total unemployment rate, 2000 (%)	Number	
unemplw	UNEMPLOYMENT_WHITE	White unemployment rate, 2000 (%)	Number	
unemplb	UNEMPLOYMENT_BLACK	Black unemployment rate, 2000 (%)	Number	
incometot	HOUSEHOLD_INCOME_TOTAL	Median household income, all householders, 1999 ($)	Number	
incomew	HOUSEHOLD_INCOME_WHITE	Median household income, white householders, 1999 ($)	Number	
incomeb	HOUSEHOLD_INCOME_BLACK	Median household income, black householders, 1999 ($)	Number	
percaptot	INCOME_PERCAPITA_TOTAL	Per capita income, total population, 1999 ($)	Number	
percapw	INCOME_PERCAPITA_WHITE	Per capita income, white population, 1999 ($)	Number	
percapb	INCOME_PERCAPITA_BLACK	Per capita income, black population, 1999 ($)	Number	
povpoptot	POVERTY_POPULATION_TOTAL	Total population for which poverty status is determined, 2000 (raw)	Number	
povtot	POVERTY_BELOW_TOTAL	Total population below poverty	Number	

		level, 2000 (raw)		
povpopw	POVERTY_POPULATION_WHITE	White population for which poverty status is determined, 2000 (raw)	Number	
povw	POVERTY_BELOW_WHITE	White population below poverty level, 2000 (raw)	Number	
povpopb	POVERTY_POPULATION_BLACK	Black population for which poverty status is determined, 2000 (raw)	Number	
povb	POVERTY_BELOW_BLACK	Black population below poverty level, 2000 (raw)	Number	
gini	GINI	Gini coefficient, 2000 (measure of income inequality; 0=total equality, 1=total inequality)	Number	
tot5	TOTAL_ 5TH	Total population aged 25+ with less than a 5th grade education, 2000 (raw)	Number	
tot8	TOTAL_ 8TH	Total population aged 25+ with 5th-8th grade education, 2000 (raw)	Number	
tot12	TOTAL_ 12TH	Total population aged 25+ with 9th-12th grade education, 2000 (raw)	Number	
toths	TOTAL_ HS	Total population aged 25+ with	Number	

		high school diploma or equivalent, 2000 (raw)		
totcoll1	TOTAL_COLLEGE_1YR	Total population aged 25+ who have completed less than 1 year of college, 2000 (raw)	Number	
totsomecoll	TOTAL_COLLEGE	Total population aged 25+ who have completed some college (no degree), 2000 (raw)	Number	
totass	TOTAL_ ASSOCIATES	Total population aged 25+ with Associate's degrees, 2000 (raw)	Number	
totbach	TOTAL_ BACHELORS	Total population aged 25+ with Bachelor's degrees, 2000 (raw)	Number	
totmas	TOTAL_MASTERS	Total population aged 25+ with a Master's degree, 2000 (raw)	Number	
totprof	TOTAL_PROFESSIONAL	Total population aged 25+ with a professional degree (MD, JD, etc.), 2000 (raw)	Number	
Totphd	TOTAL_DOCTORATE	Total population aged 25+ with a doctorate, 2000 (raw)	Number	
Toted	TOTAL _EDUCATION	Total population aged 25+, 2000 (raw)	Number	
wm9	WHITE_MALE_9TH	White male	Number	

		population aged 25+ with less than a 9th grade education, 2000 (raw)		
wm12	WHITE_MALE_12TH	White male population aged 25+ with 9-12th grade education, 2000 (raw)	Number	
Wmhs	WHITE_MALE_HS	White male population aged 25+ with high school diploma or equivalent, 2000 (raw)	Number	
wmcoll	WHITE_MALE_COLLEGE	White male population aged 25+ who have completed some college, 2000 (raw)	Number	
wmass	WHITE_MALE_ASSOCIATES	White male population aged 25+ with Associate's degrees, 2000 (raw)	Number	
wmbach	WHITE_MALE_BACHELORS	White male population aged 25+ with Bachelor's degrees, 2000 (raw)	Number	
wmgrad	WHITE_MALE_GRAD	White male population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree, 2000 (raw)	Number	
wmed	WHITE_MALE_EDUCATION	White male population aged 25+, 2000 (raw)	Number	
wf9	WHITE_FEMALE_9TH	White female population aged 25+ with less than a 9th	Number	

		grade education, 2000 (raw)		
wf12	WHITE_FEMALE_12TH	White female population aged 25+ with 9-12th grade education, 2000 (raw)	Number	
wfhs	WHITE_FEMALE_HS	White female population aged 25+ with high school diploma or equivalent, 2000 (raw)	Number	
wfcoll	WHITE_FEMALE_COLLEGE	White female population aged 25+ who have completed some college, 2000 (raw)	Number	
wfass	WHITE_FEMALE_ASSOCIATES	White female population aged 25+ with Associate's degrees, 2000 (raw)	Number	
wfbach	WHITE_FEMALE_BACHELORS	White female population aged 25+ with Bachelor's degrees, 2000 (raw)	Number	
wfgrad	WHITE_FEMALE_GRAD	White female population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree, 2000 (raw)	Number	
wfed	WHITE_FEMALE_EDUCATION	White female population aged 25+, 2000 (raw)	Number	
bm9	BLACK_MALE_9TH	Black male population aged 25+ with less than a 9th grade education, 2000 (raw)	Number	

bm12	BLACK_MALE_12TH	Black male population aged 25+ with 9-12th grade education, 2000 (raw)	Number	
bmhs	BLACK_MALE_HS	Black male population aged 25+ with high school diploma or equivalent, 2000 (raw)	Number	
bmcoll	BLACK_MALE_COLLEGE	Black male population aged 25+ who have completed some college, 2000 (raw)	Number	
bmass	BLACK_MALE_ASSOCIATES	Black male population aged 25+ with Associate's degrees, 2000 (raw)	Number	
bmbach	BLACK_MALE_BACHELORS	Black male population aged 25+ with Bachelor's degrees, 2000 (raw)	Number	
bmgrad	BLACK_MALE_GRAD	Black male population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree, 2000 (raw)	Number	
bmed	BLACK_MALE_EDUCATION	Black male population aged 25+, 2000 (raw)	Number	
bf9	BLACK_FEMALE_9TH	Black female population aged 25+ with less than a 9th grade education, 2000 (raw)	Number	
bf12	BLACK_FEMALE_12TH	Black female population aged 25+ with	Number	

		9-12th grade education, 2000 (raw)		
bfhs	BLACK_FEMALE_HS	Black female population aged 25+ with high school diploma or equivalent, 2000 (raw)	Number	
bfcoll	BLACK_FEMALE_COLLEGE	Black female population aged 25+ who have completed some college, 2000 (raw)	Number	
bfass	BLACK_FEMALE_ASSOCIATES	Black female population aged 25+ with Associate's degrees, 2000 (raw)	Number	
bfbach	BLACK_FEMALE_BACHELORS	Black female population aged 25+ with Bachelor's degrees, 2000 (raw)	Number	
bfgrad	BLACK_FEMALE_GRAD	Black female population aged 25+ with a graduate (MA, PhD) or professional (MD, JD) degree, 2000 (raw)	Number	
bfed	BLACK_FEMALE_EDUCATION	Black female population aged 25+, 2000 (raw)	Number	
pupil	PUPIL_TEACHER_RATIO	Pupil to teacher ratio, 2001-2002 (raw)	Number	
cartot	CAR_TOTAL	Total workers aged 16+ traveling by car to work, 2000 (raw)	Number	
pubtranstot	PUBLICTRANS_TOTAL	Total workers aged 16+ traveling by public transit	Number	

		to work, 2000 (raw)		
motortot	MOTORCYCLE_TOTAL	Total workers aged 16+ traveling by motorcycle to work, 2000 (raw)	Number	
biketot	BICYCLE_TOTAL	Total workers aged 16+ traveling by bicycle to work, 2000 (raw)	Number	
walktot	WALK_TOTAL	Total workers aged 16+ walking to work, 2000 (raw)	Number	
othertranstot	OTHER_TRANS_TOTAL	Total workers aged 16+ utilizing other methods of travel to work, 2000 (raw)	Number	
hometot	WORK_HOME_TOTAL	Total workers aged 16+ working from home, 2000 (raw)	Number	
transtot	TRANS_TOTAL_TOTAL	Total workers aged 16+, 2000 (raw)	Number	
carw	CAR_WHITE	White workers aged 16+ traveling by car to work, 2000 (raw)	Number	
pubtransw	PUBLICTRANS_WHITE	White workers aged 16+ traveling by public transit to work, 2000 (raw)	Number	
motorw	MOTORCYCLE_WHITE	White workers aged 16+ traveling by motorcycle to work, 2000 (raw)	Number	
bikew	BICYCLE_WHITE	White workers aged 16+ traveling by bicycle to work, 2000	Number	

		(raw)		
walkw	WALK_WHITE	White workers aged 16+ walking to work, 2000 (raw)	Number	
othertransw	OTHER_TRANS_WHITE	White workers aged 16+ utilizing other methods of travel to work, 2000 (raw)	Number	
homew	WORK_HOME_WHITE	White workers aged 16+ working from home, 2000 (raw)	Number	
transw	TRANS_TOTAL_WHITE	White workers aged 16+, 2000 (raw)	Number	
carb	CAR_BLACK	Black workers aged 16+ traveling by car to work, 2000 (raw)	Number	
pubtransb	PUBLICTRANS_BLACK	Black workers aged 16+ traveling by public transit to work, 2000 (raw)	Number	
motorb	MOTORCYCLE_BLACK	Black workers aged 16+ traveling by motorcycle to work, 2000 (raw)	Number	
bikeb	BICYCLE_BLACK	Black workers aged 16+ traveling by bicycle to work, 2000 (raw)	Number	
walkb	WALK_BLACK	Black workers aged 16+ walking to work, 2000 (raw)	Number	
othertransb	OTHER_TRANS_BLACK	Black workers aged 16+ utilizing other methods of travel to work, 2000 (raw)	Number	
homeb	WORK_HOME_BLACK	Black workers	Number	

		aged 16+ working from home, 2000 (raw)		
transb	TRANS_TOTAL_BLACK	Black workers aged 16+, 2000 (raw)	Number	
vehicletot	NO_VEHICLE_TOTAL	Total occupied housing units without a vehicle, 2000 (raw)	Number	
vehiclew	NO_VEHICLE_WHITE	White occupied housing units without a vehicle, 2000 (raw)	Number	
vehicleb	NO_VEHICLE_BLACK	Black occupied housing units without a vehicle, 2000 (raw)	Number	
food	FOOD	Food and beverage stores, 2002 (raw) (code 445)	Number	
grocery	GROCERY	Grocery stores, 2002 (raw) (code 4451)	Number	
specialty	SPECIALTY	Specialty food stores, 2002 (raw) (code 4452)	Number	
supermarket	SUPERMARKETS	Supermarkets and other grocery stores, 2002 (raw) (code 44511)	Number	
conven	CONVENIENCE	Convenience stores, 2002 (raw) (code 44512)	Number	
liquor	LIQUOR	Beer, wine and liquor stores, 2002 (raw) (code 44531)	Number	
pharm	PHARMACY	Pharmacies / drug stores, 2002 (raw) (code 44611)	Number	
gas	GAS_CONVENIENCE	Gas stations with	Number	

		convenience stores, 2002 (raw) (code 44711)		
foodsvc	FOOD_SVC	Food services and drinking, 2002 (raw) (code 722)	Number	
restfull	RESTAURANTS_FULL	Full-service restaurants, 2002 (raw) (code 7221)	Number	
restlimit	RESTAURANTS_LIMITED	Limited service restaurants (e.g., fast food), 2002 (raw) (code 7222)	Number	
phys	PHYSICIAN_OFFICES	Physician offices, 2002 (raw) (code 621111)	Number	
physment	PHYSICIAN_OFFICES_MENTAL	Mental health specialist physician offices, 2002 (raw) (code 621112)	Number	
famplan	FAMILY_PLANNING	Family planning centers, 2002 (raw) (code 62141)	Number	
subabuse	SUBSTANCE_ABUSE	Outpatient mental health and substance abuse centers, 2002 (raw) (code 62142)	Number	
ambu	AMBULATORY	Ambulatory health care services, 2002 (raw) (code 621)	Number	
ambuer	AMBULATORY_ER	Ambulatory surgical and emergency centers, 2002 (raw) (code 621493)	Number	
hospital	HOSPITALS	Hospitals, 2002 (raw) (code 622)	Number	
hospgen	HOSPITALS_GENERAL	General	Number	

		medical and surgical hospitals, 2002 (raw) (code 6221)		
hosppsych	HOSPITALS_PSYCH	Psychiatric and substance abuse hospitals, 2002 (raw) (code 6222)	Number	
pcp	PCP	Primary care physicians, 2005 (per 100,000 population)	Number	
waste	WASTE	Waste management and remediation services, 2002 (raw) (code 562)	Number	
wastetx	WASTETX	Waste treatment and disposal, 2002, (raw) (code 5622)	Number	
hazard	HAZARDOUS_WASTE	Hazardous waste treatment and disposal centers, 2002 (raw) (code 562211)	Number	
landfill	LANDFILL	Solid waste landfills, 2002 (raw) (code 562212)	Number	
incin	INCINERATORS	Solid waste combustors and incinerators, 2002 (raw) (code 562213)	Number	
coal	COAL	Petroleum and coal products manufacturing, 2002 (raw) (code 324)	Number	
chem	CHEMICAL	Chemical manufacturing, 2002 (raw) (code 325)	Number	
cancerrisk	CANCER_RISK	Cancer risk,	Number	

		2002 (per million)		
neurorisk	NEURO_RISK	Neurological risk, 2002 (per million)	Number	
resprisk	RESPIRATORY_RISK	Respiratory risk, 2002 (per million)	Number	
segtract	SEGREGATION_TRACT	Tract-level white-black index of dissimilarity, 2000	Number	
segbgroup	SEGREGATION_BLOCK_GROUP	Block-group level white-black index of dissimilarity, 2000	Number	
segblock	SEGREGATION_BLOCK	Block-level white-black index of dissimilarity, 2000	Number	
uninsured	UNINSURED_ALL	Uninsured, all ages, 2000 (%)	Number	
uninsured18	UNINSURED_UNDER18	Uninsured, under age 18, 2000 (%)	Number	
canmorttot	CANCER_MORTALITY_TOTAL	Total cancer mortality, all cancer sites, 2005-2009	Number	
canmortw	CANCER_MORTALITY_WHITE	White cancer mortality, all cancer sites, 2005-2009	Number	
canmortb	CANCER_MORTALITY_BLACK	Black cancer mortality, all cancer sites, 2005-2009	Number	
caninctot	CANCER_INCIDENCE_TOTAL	Total cancer incidence, all cancer sites, 2005-2009	Number	
canincw	CANCER_INCIDENCE_WHITE	White cancer incidence, all cancer sites, 2005-2009	Number	
canincb	CANCER_INCIDENCE_BLACK	Black cancer incidence, all cancer sites, 2005-2009	Number	

VARIABLE (SPSS)	VARIABLE (ACCESS)	DEFINITION	EQUATION	CODING CATEGORIES / POSSIBLE VALUES
wpopp	--	White population as a percentage of total population	=(popw / poptot)*100	
bpopp	--	Black population as a percentage of total population	=(popb / poptot)*100	
occp	--	Total occupied housing units as a percentage of total housing units	=(occtot / housing)*100	
owntotp	--	Total owned occupied housing units as a percentage of total occupied housing units	=(occown / occtot)*100	
renttotp	--	Total rented occupied housing units as a percentage of total occupied housing units	=(occrent / occtot)*100	
occw	--	Occupied housing units owned or rented by white head of household (raw)	=occownw + occrentw	
occb	--	Occupied housing units owned or rented by black head of household (raw)	=occownb + occrentb	
ownwp	--	White-owned occupied housing units as a percentage of all white-occupied housing units	=(occownw / occw)*100	
ownbp	--	Black-owned occupied housing units as a percentage of all black-owned housing units	=(occownb / occb)*100	
ownratio	--	Ratio of % of black owners to white owners	=ownbp / ownwp	
rentwp	--	White-rented occupied housing units as a percentage of all white-occupied housing units	=(occrentw / occw)*100	
rentbp	--	Black-rented occupied housing units as a percentage of all black-occupied housing units	=(occrentb / occb)*100	
rentratio	--	Ratio of % of black renters to white renters	=rentbp / rentwp	
teltotp	--	Occupied housing units without telephone service as a percentage of total occupied housing units	=(teltot / occtot)*100	
plumbtotp	--	Occupied housing units lacking complete	=(plumbtot / occtot) * 100	

		plumbing facilities as a percentage of total occupied housing units		
kittotp	--	Occupied housing units lacking complete kitchen facilities as a percentage of total occupied housing units	=(kittot / occtot)*100	
telwp	--	White-occupied housing units lacking telephone service as a percentage of white-occupied housing units	=(telw/occw)*100	
plumbwp	--	White-occupied housing units lacking complete plumbing facilities as a percentage of white-occupied housing units	=(plumbw / occw)*100	
kitwp	--	White-occupied housing units lacking complete kitchen facilities as a percentage of white-occupied housing units	=(kitw/occw)*100	
telbp	--	Black-occupied housing units lacking telephone service as a percentage of black-occupied housing units	=(telb/occb)*100	
plumbbp	--	Black-occupied housing units lacking complete plumbing facilities as a percentage of black-occupied housing units	=(plumbb / occb)*100	
kitbp	--	Black-occupied housing units lacking complete kitchen facilities as a percentage of black-occupied housing units	=(kitb/occb)*100	
telratio	--	Ratio of black-occupied housing units without telephone service to white-occupied housing units without telephone service	=telbp/telwp	
plumbratio	--	Ratio of black-occupied housing units lacking complete plumbing facilities to white-occupied housing units lacking complete plumbing facilities	=plumbbp / plumbwp	
kitratio	--	Ratio of black-occupied housing units lacking complete kitchen facilities to white-	=kitbp/kitwp	

		occupied housing units lacking complete kitchen facilities		
rentratio2	--	Ratio of black median gross rent as a % of household income to white median gross rent as a % of household income	=rentb / rentw	
valueratio	--	Ratio of median value of all black-owner occupied homes to median value of all white-owner occupied homes	=valueb / valuew	
costratio	--	Ratio of median owner costs of all black-occupied housing units as a % of household income to median owner costs of all white-occupied housing units as a % of household income	=costb / costw	
unemplratio	--	Ratio of black unemployment rate to white unemployment rate	=unemplb / unemplw	
incomeratio	--	Ratio of median household income of black householders to median household income of white householders	=incomeb / incomew	
percapratio	--	Ratio of black per capita income to white per capita income	=percapb / percapw	
povtotp	--	Total population living in poverty (%)	=(povtot / povpoptot) * 100	
povwp	--	White population living in poverty (%)	=(povw / povpopw) * 100	
povbp	--	Black population living in poverty (%)	=(povb / povpopb) * 100	
povratio	--	Ratio of black population living in poverty to white population living in poverty	=povbp / povwp	
tot9	--	Total population aged 25+ with less than 9th grade education (raw)	=tot5+tot8	
totcoll	--	Total population aged 25+ with some college, but no degree (raw)	=totcoll1 + totsomecoll	
totgrad	--	Total population aged 25+ with a graduate degree (Master's, Professional, Doctorate) (Raw)	=totmas + totprof + totphd	

totnohs	--	Total population aged 25+ with less than high school education (no diploma) (raw)	=tot9+tot12	
tothsplus	--	Total population aged 25+ with high school degree or higher (raw)	=toths + totcoll + totass + totbach + totgrad	
totcollplus	--	Total population aged 25+ with a college degree or higher	=totass + totbach + totgrad	
totnohsp	--	Total population aged 25+ with less than high school education (no diploma) as a percentage of total population aged 25+	=(totnohs / toted) * 100	
tothsplusp	--	Total population aged 25+ with high school degree or higher as a percentage of total population aged 25+	=(tothsplus / toted) * 100	
totcollplusp	--	Total population aged 25+ with a college degree or higher as a percentage of total population aged 25+	=(totcollplus / toted) * 100	
w9	--	White population aged 25+ with less than 9th grade education (raw)	=wm9+wf9	
w12	--	White population aged 25+ with 9th-12th grade education (no diploma) (raw)	=wm12 + wf12	
whs	--	White population aged 25+ with high school degree (diploma or GED) (raw)	=wmhs+wfhs	
wcoll	--	White population aged 25+ with some college (no degree) (raw)	=wmcoll + wfcoll	
wass	--	White population aged 25+ with an Associate's degree (raw)	=wmass + wfass	
wbach	--	White population aged 25+ with a Bachelor's degree (raw)	=wmbach + wfbach	
wgrad	--	White population aged 25+ with a graduate degree (Master's, Professional, Doctorate)	=wmgrad + wfgrad	
wed	--	White population aged 25+ (raw)	=wmed + wfed	
wnohs	--	White population aged 25+ with less than high school degree (raw)	=w9+w12	

whsplus	--	White population aged 25+ with high school degree or higher (raw)	=whs + wcoll + wass + wbach + wgrad	
wcollplus	--	White population aged 25+ with college degree or higher	=wass + wbach + wgrad	
wnohsp	--	White population aged 25+ with less than high school degree as a percentage of white population aged 25+	=(wnohs/wed) *100	
whsplusp	--	White population aged 25+ with high school degree or higher as a percentage of white population aged 25+	=(whsplus / wed) *100	
wcollplusp	--	White population aged 25+ with a college degree or higher as a percentage of white population aged 25+	=(wcollplus / wed) *100	
b9	--	Black population aged 25+ with less than 9th grade education (raw)	=bm9+bf9	
b12	--	Black population aged 25+ with 9th-12th grade education (no diploma) (raw)	=bm12+bf12	
bhs	--	Black population aged 25+ with high school degree (diploma or GED) (raw)	=bmhs+bfhs	
bcoll	--	Black population aged 25+ with some college (no degree) (raw)	=bmcoll + bfcoll	
bass	--	Black population aged 25+ with an Associate's degree (raw)	=bmass + bfass	
bbach	--	Black population aged 25+ with a Bachelor's degree (raw)	=bmbach + bfbach	
bgrad	--	Black population aged 25+ with a graduate degree (Master's, Professional, Doctorate)	=bmgrad + bfgrad	
bed	--	Black population aged 25+ (raw)	=bmed+bfed	
bnohs	--	Black population aged 25+ with less than high school degree (raw)	=b9+b12	
bhsplus	--	Black population aged 25+ with high school degree or higher (raw)	=bhs + bcoll + bass + bbach + bgrad	
bcollplus	--	Black population aged 25+ with college degree	=bass + bbach + bgrad	

		or higher		
bnohsp	--	Black population aged 25+ with less than high school degree as a percentage of black population aged 25+	=(bnohs/bed)*100	
bhsplusp	--	Black population aged 25+ with high school degree or higher as a percentage of black population aged 25+	=(bhsplus / bed)*100	
bcollplusp	--	Black population aged 25+ with a college degree or higher as a percentage of black population aged 25+	=(bcollplus / bed)*100	
nohsratio	--	Ratio of black population aged 25+ with less than high school degree to white population aged 25+ with less than high school degree	=bnohsp / wnohsp	
hsplusratio	--	Ratio of black population aged 25+ with high school degree or higher to white population aged 25+ with high school degree or higher	=bhsplusp / whsplusp	
collplusratio	--	Ratio of black population aged 25+ with college degree or higher to white population aged 25+ with college degree or higher	=bcollplusp / wcollplusp	
cartotp	--	Total workers aged 16+ using a car to commute to work as a percentage of total workers aged 16+	=(cartot / transtot)*100	
pubtranstotp	--	Total workers aged 16+ using public transportation to commute to work as a percentage of total workers aged 16+	=(pubtranstot / transtot) *100	
motortotp	--	Total workers aged 16+ using motorcycles to commute to work as a percentage of total workers aged 16+	=(motortot / transtot) *100	
biketotp	--	Total workers aged 16+ using bicycles to commute to work as a percentage of total workers aged 16+	=(biketot / transtot) *100	
walktotp	--	Total workers aged 16+ who walk to work as a	=(walktot / transtot) *100	

		percentage of total workers aged 16+		
othertranstotp	--	Total workers aged 16+ who utilize other methods of transport to commute to work as a percentage of total workers aged 16+	=(othertranstot / transtot) *100	
hometotp	--	Total workers aged 16+ working from home as a percentage of total workers aged 16+	=(hometot / transtot) *100	
carwp	--	White workers aged 16+ using a car to commute to work as a percentage of white workers aged 16+	=(carw / transw) *100	
pubtranswp	--	White workers aged 16+ using public transportation to commute to work as a percentage of white workers aged 16+	=(pubtransw / transw) *100	
motorwp	--	White workers aged 16+ using motorcycles to commute to work as a percentage of white workers aged 16+	=(motorw / transw) *100	
bikewp	--	White workers aged 16+ using bicycles to commute to work as a percentage of white workers aged 16+	=(bikew / transw) *100	
walkwp	--	White workers aged 16+ who walk to work as a percentage of white workers aged 16+	=(walkw / transw) *100	
othertranswp	--	White workers aged 16+ who utilize other methods of transport to commute to work as a percentage of white workers aged 16+	=(othertransw / transw) *100	
homewp	--	White workers aged 16+ working from home as a percentage of white workers aged 16+	=(homew / transw) * 100	
carbp	--	Black workers aged 16+ using a car to commute to work as a percentage of black workers aged 16+	=(carb / transb)*100	
pubtransbp	--	Black workers aged 16+ using public transportation to commute to work as a percentage of black workers aged 16+	=(pubtransb / transb) * 100	

motorbp	--	Black workers aged 16+ using motorcycles to commute to work as a percentage of black workers aged 16+	=(motorb / transb) * 100	
bikebp	--	Black workers aged 16+ using bicycles to commute to work as a percentage of black workers aged 16+	=(bikeb / transb) *100	
walkbp	--	Black workers aged 16+ who walk to work as a percentage of black workers aged 16+	=(walkb / transb) * 100	
othertransbp	--	Black workers aged 16+ who utilize other methods of transport to commute to work as a percentage of black workers aged 16+	=(othertransb / transb) * 100	
homebp	--	Black workers aged 16+ working from home as a percentage of black workers aged 16+	=(homeb / transb) * 100	
carratio	--	Ratio of black workers aged 16+ using a car to commute to work to white workers aged 16+ using a car to commute to work	=carbp/carwp	
pubtransratio	--	Ratio of black workers aged 16+ using public transportation to commute to work to white workers aged 16+ using public transportation to commute to work	=pubtransbp / pubtranswp	
motorratio	--	Ratio of black workers aged 16+ using motorcycle to commute to work to white workers aged 16+ using a motorcycle to commute to work	=motorbp / motorwp	
bikeratio	--	Ratio of black workers aged 16+ using a bicycle to commute to work to white workers aged 16+ using a bicycle to commute to work	=bikebp / bikewp	
walkratio	--	Ratio of black workers aged 16+ who walk to work to white workers aged 16+ who walk to to	=walkbp / walkwp	

		work		
othertransratio	--	Ratio of black workers aged 16+ utilizing other forms of transportation to commute to work to white workers aged 16+ utilizing other forms of transportation to commute to work	=othertransbp / othertranswp	
homeratio	--	Ratio of black workers aged 16+ working from home to white workers aged 16+ working from home	=homebp / homewp	
vehicletotp	--	Total occupied housing units without a vehicle as a percentage of total occupied housing units	=(vehicletot / occtot) * 100	
vehiclewp	--	White-occupied housing units without a vehicle as a percentage of white-occupied housing units	=(vehiclew / occw) * 100	
vehiclebp	--	Black-occupied housing units without a vehicle as a percentage of black-occupied housing units	=(vehicleb / occb) * 100	
vehicleratio	--	Ratio of black-occupied housing units without a vehicle to white-occupied housing units without a vehicle	=vehiclebp / vehiclewp	
imrratio	--	Ratio of black infant mortality to white infant mortality	=imrb/imrw	
canmortratio	--	Ratio of black cancer mortality to white cancer mortality	=canmortb / canmortw	
canincratio	--	Ratio of black cancer incidence to white cancer incidence	=canincb / canincw	
popurbp	--	Urban population as a percentage of total population	=(popurb / poptot)*100	
poprurp	--	Rural population as a percentage of total population	=(poprur / poptot)*100	

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