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WASHINGTON UNIVERSITY IN ST. LOUIS

Department of Education

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William F. Tate IV, Chair
Renee M. Cunningham-Williams
Garrett Albert Duncan
Rowhea Elmesky
Mark C. Hogrebe

Four Essays in Education and Epidemiology

by

Brittni D. Jones

A dissertation presented to the
Graduate School of Arts & Sciences
of Washington University in
partial fulfillment of the
requirements for the degree
of Doctor of Philosophy

May 2016
St. Louis, Missouri

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Brittni D. Jones

Washington University in St. Louis

May 2016

ABSTRACT OF THE DISSERTATION

Four Essays in Education and Epidemiology

by

Brittni D. Jones

Doctor of Philosophy in Education

Washington University in St. Louis, 2016

William F. Tate IV, Chair

This dissertation includes four, co-authored essays in which social epidemiological concepts and methods were applied to explore the nexus of race, education, and health in the United States. In the first two essays, colleagues and I employed geospatial mapping and analysis to examine the association between past, racially segregative, housing practices and the geospatial distribution of poor, education, health, and related developmental outcomes across Ferguson, Missouri, and the surrounding St. Louis metropolitan region. We investigated this association during two, respective cross-sections of time. Results revealed the nature and distribution of class and racial disparities across the region. Based on the results, recommendations to improve social, economic, education, and health-related outcomes for all, local citizens were highlighted. The studies in the latter two essays focus on characterizing hookah tobacco use among 18-to-24-year-old, African American college students. Specifically, the relative contribution of individual- and school-level, contextual factors to hookah smoking risk among this population was examined. Findings indicated distinct, individual-level and contextual risk and protective factors for hookah tobacco use among African American college students. Given our findings, recommendations for future research, policy, and college health promotion practice were discussed. Considered together, the studies in this dissertation illuminate how various individual-level and social factors

can interact to shape youth education and health outcomes and how these outcomes, in turn, have life-course and intergenerational implications for human development.

Chapter 1
Introduction

Scholars have demonstrated the need for increased attention to the relationship between education and health in U.S. metropolitan regions (Hogrebe & Tate, 2012; Tate, 2012; Tate et al., 2014; Virginia Commonwealth University [VCU] Center on Society and Health, 2016). The emphasis on this relationship stems partly from increasing evidence of regional, economic disadvantage related to social disparities in education, health, and related developmental outcomes (see, e.g., Purnell, Camberos, & Fields, 2014). This dissertation includes four, co-authored essays in which epidemiological concepts and methods were applied to explore the nexus of race, education, and health. In the first two essays, colleagues and I examine the association between past, racially segregative, housing practices and the geospatial distribution of poor, education and health outcomes across Ferguson, Missouri, and the surrounding St. Louis metropolitan region. The studies in the latter two essays focus on characterizing hookah tobacco use among 18-to-24-year-old, African American[1] college students. Considered together, the four studies in this dissertation illuminate how various social factors can interact to shape youth education and health outcomes and how these outcomes, in turn, have life-course and intergenerational implications for human development.

1.1 Application of Social Epidemiology

Social epidemiology is an emerging epidemiological branch that focuses on the influence of social–structural factors on states of health and well-being (Honjo, 2004). Scholars in the discipline assume that the distribution of health and well-being reflects the distribution of

[1] The essays in this dissertation were submitted to peer-reviewed journals in the education and public health disciplines. Due to varying conventions and preferences, the terms *African American* and *Black* are hereinafter used interchangeably.

advantages and disadvantages in society. In other words, social epidemiology moves beyond the foundational, biological paradigm of traditional epidemiology. The biological paradigm maintains that the population pattern of poor, health outcomes can be attributed to individual risk factors. Social epidemiologists, on the other hand, contend that the interaction of individual and social attributes influences population patterns of health outcomes.

Given this description, it follows that the history and culture of a population shape how and why individuals are exposed to certain risks. This premise is central to the first two essays in this dissertation. The nature and extent of racial, residential segregation and the associated geographic concentration of poverty are important risk and protective factors for health and education outcomes (Purnell et al., 2014). Residential segregation has been linked to broader social–structural characteristics, including discriminatory, housing policies and practices (Gordon, 2008; Rothstein, 2014). Therefore, the studies in the first two dissertation essays broadly illuminate how social epidemiology can be applied to better understand the pattern of population-level, education outcomes.

The premise that social and individual attributes interact to shape health applies to individuals within a population as well (Honjo, 2004). Thus, in the latter two herein contained essays, the relative influence of school-level, contextual factors, such as student population size, and of individual-level attributes on college students' hookah smoking risk is investigated.

It is important to acknowledge the conceptual link between the studies described in essays 1–2 and in essays 3–4. Based on the findings of the first study, colleagues and I sought to examine in the second essay, during another cross-section of time, one pathway by which residential segregation is associated with poor health and education outcomes across the St. Louis metropolitan region. Similarly, findings related to increased hookah use risk among

female, African American, college students and those who use other substances led to the analyses in the final essay.

1.2 Guiding Questions of the Dissertation

In light of the brief review provided in this introduction, the following questions were posed to guide the studies in this dissertation:

1.2.1 Essay 1

1. What is social epidemiology, and how might this discipline inform our understanding of race and related education and developmental outcomes in Ferguson and in neighboring communities in metropolitan St. Louis?

1.2.2 Essay 2

1. How did policies, practices, and folkways help to create the current conditions in Ferguson and the surrounding St. Louis metropolitan region?
2. What is the current state of affairs for Black youth in the region?
3. Why is race such a major impediment to social reform in the region?

1.2.3 Essay 3

1. Which socio-demographic, school contextual, and substance use factors significantly predict the relative odds of hookah tobacco use, either exclusively or concurrently with cigarette smoking, among a national sample of African American college students?
2. How are African American college students' interest in receiving and their actual receipt of tobacco use prevention information from their college or university related to hookah tobacco use?

1.2.4 Essay 4

1. How does experiencing stress and/or stressful or traumatic events affect hookah tobacco use risk among a national sample of female, African American college students?
2. After accounting for the impact of stress and stressful or traumatic experiences, does other substance use still significantly increase hookah tobacco use risk among students in this population?

1.3 Organization of the Dissertation

As organized, this dissertation moves from a population- to individual-level investigation of the nexus of race, education, and health. In the first two essays, "Ferguson and Beyond: A Descriptive Epidemiological Study Using Geospatial Analysis" and "Anonymity No More: Seeing Our Neighbors in Ferguson and the Implications for Social Policy," colleagues and I examine the divisive legacy of the St. Louis metro segregation regime. We use geospatial analysis to visualize the disparate impact of past, segregative housing practices across the region. Based on our findings concerning the nature and distribution of class-based and racial disparities, we offer several, key recommendations to improve conditions for all local citizens.

In the next two dissertation essays, "Hookah and Cigarette Smoking Among African American College Students: Implications for Campus Risk Reduction and Health Promotion Efforts" and "Stress, Stressors, and Substance Use: Differential Risk for Hookah Use Among African American Female College Students," colleagues and I use epidemiological methods to identify individual- and institutional-level, risk and protective factors for hookah smoking among African American college students. Hookah smoking is an increasingly prevalent health-risk behavior among all U.S. college students (Grekin & Ayna, 2012). Compared to their Caucasian American peers, however, African American college students are less likely to smoke hookah

(Grekin & Ayna, 2012; Jarrett, Blosnich, Tworek, & Horn, 2012). Given findings from the initial hookah study in this dissertation and evidence of compounded risks for African American, female college students, the fourth dissertation study centers on the relative contribution of substance use to current hookah use after accounting for the role of stress and traumatic events. My co-authors and I offer recommendations for campus health education and promotion initiatives related to hookah use among African American college students. In the final chapter of this dissertation, I discuss the significance of social epidemiology in education research and recommendations for education policy based on collective findings.

1.4 Acknowledgment of Co-Authorship

It is imperative that I acknowledge the co-authorship of the essays in this dissertation, which reflects the shift in the social sciences toward team science. Through other research endeavors, I have established my own, singular scholarly voice. My collaboration with education and public health scholars inevitably requires my recognizing the multiple voices and perspectives in each of the studies presented hereinafter. In 2010, a working group comprised of, among others, members of the International Committee of Medical Journal Editors developed a 14-role taxonomy as part of the Contributor Roles Taxonomy project (Project CRediT). The Project CRediT taxonomy was created to help researchers describe their individual contributions to published, scholarly work (Consortia Advancing Standards in Research Administration [CASRAI], 2016). The taxonomy, which has been publicly available for use since 2014, consists of the following contributor roles: conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, original draft preparation, review and editing, visualization, supervision, project administration, and funding acquisition. Although this

taxonomy was created by members of the biomedical science community, it was designed to apply to scholarly research broadly.

Using the Project CRediT taxonomy as a guide, I, as follows, spell out my specific contributions to the research and production of each essay in this dissertation. For the first essay, I obtained and curated data from publicly available sources; performed formal, geospatial analysis; and produced some of the graphics. I also drafted major portions of the Results and Discussion section. Similarly, I obtained and curated data from publicly available data sources; performed formal, geospatial analysis; and produced all but one of the graphics in the second essay. I also drafted the Geospatial Distributions section. During initial conceptualization of the third essay, I suggested that the relationship between mental health factors and hookah use among the study sample be examined in a separate, related study. This suggestion led to the development and production of the final essay in this dissertation. In essays three and four, I managed and prepared data for statistical analysis, performed the analysis, and drafted the Methods and Discussion sections. I also prepared the tables in the third essay. For pre-publication drafts of each of the four essays, I provided critical review, revisions, and edits.

Chapter 2
Ferguson and Beyond: A Descriptive Epidemiological Study Using Geospatial Analysis[1]

2.1 Introduction

Ferguson, Missouri, has emerged as a cultural reference for structural inequality in the United States; however, beyond journalistic descriptions of the community, there is very little in the scholarly literature about the interdependence of health, education, and the well-being of members of this community and its surrounding areas. The current study is important because its focus on the interdependence of health, education, and place has largely been lost in discussions of the geography of opportunity in Ferguson and in similar isolated, at-risk municipalities across the United States (Rusk, 2013). Good health positively influences cognition, learning, achievement, and educational attainment. Similarly, a quality education is associated with better health outcomes. A key risk and protective factor in both education and health is the nature and extent of residential segregation and the associated geographic continuum of poverty and affluence (Purnell, Camberos, & Fields, 2014). In this study, the authors will examine the nature and extent of residential segregation and of health and education disparities in Ferguson and the surrounding region.

In *The Truly Disadvantaged*, Wilson (1987) is credited with providing a paradigm-changing explanation of the deterioration of segregated African American neighborhoods in the urban context. He argued that, until the mid-1970s, largely African American communities consisted of both poor and middle-class residents. Wilson documented the decline in industrial-age employment opportunities, including factory work, coupled with the out-migration of

[1] A subsequent version of this chapter was published in the *Journal of Negro Education* as follows:
Jones, B. D., Harris, K. M., & Tate, W. F. (2015). Ferguson and beyond: A descriptive epidemiological study using geospatial analysis. *Journal of Negro Education, 84*, 231–253.

middle-class African Americans to surrounding suburbs in Chicago. Therefore, many African American communities were left with high concentrations of poverty and of social isolation. Wilson argued that these conditions fostered social instability and related negative developmental outcomes.

Some scholars assumed that the conditions in Chicago represented those in most urban communities in the United States. In the essay, "No Two Ghettos Are Alike," sociologist Mario Small (2014) stated, "Poor neighborhoods are difficult places to live, but not all are difficult in the same way" (para. 9). Small argued that Wilson's theory linked a substantial and fine-grained set of hypotheses, including many that were confirmed. However, over the course of the past two decades, Wilson's work has inappropriately dominated the picture of urban poverty because for some thought leaders, the work left little room for important questions about its universal applicability across urban metropolitan regions in the United States. Small challenged researchers not to ignore heterogeneity in their discussions of urban poverty and to avoid the related risk of stereotyping. Some scholars have endeavored to avoid this type of mischaracterization of urban poverty through their research, including relatively recent studies of Detroit, Chicago, and Boston (Galster, 2012a; Sampson, 2012; Tach, 2014). The authors accept this challenge as well and seek to better understand the uniqueness of Ferguson, Missouri, and its neighboring communities.

The purpose of this article is to describe an epidemiological study of Ferguson and its surrounding region using geospatial methodology. The aim is to demonstrate the salience of social epidemiological modeling in efforts to better understand how race matters in educational debates and discourse. The following questions will frame this article: What is social epidemiology, and how might this discipline inform the understanding of race and related

educational and developmental outcomes in Ferguson and neighboring communities? The authors will discuss how research and policy interests involving racial health disparities and education disparities are interdependent. This will be accomplished by providing an evidentiary base using a variety of underutilized information sources from education and health.

2.1.1 Urban Segregation and Opportunity

Over the past 20 years, there has been a renewed focus on the effects of geospatial arrangements and social contexts as opportunity factors in models of child and adolescent development broadly defined (e.g., Hogrebe & Tate, 2012; Spencer et al.,2012; Yeakey, 2012). This renewed focus is especially important because poor, urban youth living in segregated contexts experience a dichotomous regulatory experience that differs from that of more affluent and privileged children. Across demographic groups, youth are not legally authorized to vote, serve in the armed forces, or independently make health decisions. However, Edwards (2010) posited that concerning matters of criminality, poor, urban youth are treated as adults, while their more affluent counterparts are granted the benefit of being children, worthy of developmental supports. In contrast, poor, urban youth are viewed as not needing health care, psychosocial support, and education to make the transition to productive, healthy adulthood. Michelle Alexander extended this argument in a discussion of the prison pipeline in the United States:

> Certainly youth of color, particularly those in ghetto communities, find themselves born into the cage. They are born into a community in which the rules, laws, policies, structures of their lives virtually guarantee that they will remain trapped for life. The cage is the unequal educational opportunities these children are provided at a very early age coupled with the constant police surveillance they're likely to encounter, making it very likely that they're going to serve time and be caught for committing the various types of minor crimes—particularly drug crimes—that occur with roughly equal frequency in middle-class white communities but go largely ignored. So, for many, whether they go to prison or not is far less about the choices they make and far more about what kind of cage they're born into. Middle-class white children,

> children of privilege, are afforded the opportunity to make a lot of mistakes and still go on to college, still dream big dreams. But for kids who are born in the ghetto in the era of mass incarceration, the system is designed in such a way that it traps them, often for life. (Sokolower, 2011–2012, para. 3)

Alexander's cage metaphor refers to racial segregation. In this article, the authors conceptualize racial segregation in urban metropolitan regions as an opportunity structure with geographically varying institutions, systems, and markets that influence intergenerational outcomes related to health, education, and well-being (Galster, 2012b; Johnson, 2012). The opportunity structure includes social networks, housing, politics, tax revenue, criminal justice, municipal services, employment, health care access, social service supports, financial services, and schooling.

2.1.2 St. Louis Metro's Segregation Regime

Stone (1989) conceptualized a regime as a coalition including local government(s) with one or more private groups or classes, which provide strategic support for elected officials. He argued that local governments do not have the capacity to govern without entering into a regime. This conceptualization is consistent with how elected officials and private groups organized to create and to maintain residential segregation in metropolitan St. Louis. Gordon's (2008) historical and geospatial analysis of St. Louis provided arguably the most graphic illustration and description of how federal policy and policymakers; local government officials; and private groups, for example, realtors, churches, banks, and neighborhood associations, worked in concert to deny Black families access to quality housing, remove Black families from areas viewed as more appropriate for White families, and direct Blacks to public housing and housing options approved for Blacks only. While not central in Gordon's analysis, Ferguson, Missouri, is prominent in the history of the region and its segregation regime politics, as the city symbolizes the consequences of systematic barriers to opportunity.

Located 13 miles northwest of downtown St. Louis, Ferguson was incorporated by the state of Missouri in 1894 (Smith, 1976). The first school was built in the city in 1867. In 1877, Ferguson School District was chartered by the state as a rural township district. In 1855, Vernon School for Black students was built. The building was replaced in 1927. During this period, Black secondary students were prohibited from attending school in Ferguson. Instead, they were required to travel to a southern suburb in the region, Webster Groves, to attend high school. Until 1954 in the St. Louis metro region, Black students residing in school districts outside of St. Louis City, Webster Groves, Kirkwood, and Kinloch were forced out of their respective districts to receive their high school education (Missouri Advisory Committee to the U. S. Commission on Civil Rights, 1981). While these cities may not be familiar to many outside of the region, the cities and their respective school districts represented the lone public educational opportunity spaces for Black youth dispersed across the region during this era. The United States Supreme Court's 1954 *Brown v. Board of Education* decision ended *de jure* segregation in metro St. Louis and throughout the country. However, *de facto* segregation remained in place throughout the St. Louis region until the aftermath of the 1972 *Liddell* case, which resulted in the creation of one of the nation's largest inter-district voluntary school desegregation programs. Residents of Ferguson and of other regional municipalities participated in the effort to desegregate public schools.

Blacks' opportunities to purchase residential housing and to enjoy related social amenities, such as schooling and health care in the community, were regulated by the segregation regime. According to the Federal Housing Administration (FHA), 80,000 Blacks in St. Louis had the income and means to live in middle-to-upper-middle-class neighborhoods in the region in 1953 (Rothstein, 2014). These individuals and others who followed during later decades were

denied access to quality housing options in such neighborhoods through a variety of reinforcing private and public policies, including racially explicit zoning, state-enforced restrictive deed covenants, racially exclusive government subsidies supporting suburban expansion, and redlining by banks and realtors. Boundary strategies and municipal incorporation policies were designed to create geopolitical markers that prevented Blacks from residing near White neighborhoods. The current regional political fragmentation represents the "success" of the segregation regime's efforts. St. Louis is the third most politically fragmented region in the United States. Political fragmentation is a reinforcing segregation strategy. First, political fragmentation is an outgrowth of White flight and related efforts to maintain homogeneous communities. Second, once in place, political fragmentation and its myriad of incorporated, relatively small suburban governments and independent cities are usually incapable of adopting broad, integrating strategies (Rusk, 2013).

Barrier to entry policies and practices were only a part of the regime strategy to segregate the region. Other policy instruments were applied to remove Blacks from communities. Annexation was used to acquire unincorporated, mostly Black communities deemed to be too close to White communities (Gordon, 2009; Rothstein, 2014). Once annexed, the newly incorporated community was subjected to the taxation policy of the municipality. This placed new financial burdens on Black residents. Many could not afford the new tax burden and were left with few housing options. The housing choices included neighborhoods subjected to racially explicit zoning regulations or segregated public housing. In the St. Louis region, both of these residential options characterized communities where municipal services were denied, and, consequently, unhealthy conditions were created. Since services, such as trash collection, street

lighting, and emergency response, were unfairly and disparately distributed, conditions that fueled White flight and reinforced racial stereotypes about Black communities proliferated.

The segregation regime also influenced the nature and distribution of health care access for Black families in the St. Louis region. Prior to 1919, Black patients in St. Louis were provided health care in segregated facilities. In 1937, Homer G. Phillips Hospital was established for Blacks in the community. Although unfunded and understaffed, the hospital ranked as one of the ten largest general hospitals in the country. During the mid-1950s, there was a political movement to desegregate all hospitals in the region. Ultimately, all regional hospitals, including Homer G. Phillips, desegregated. Despite opposition, Homer G. Phillips was closed in 1979. NAACP official Ernest Galloway stated, "Giving up the hospital may be the price we have to pay for an integrated community" ("Integration" Threatens to Close St. Louis Hospital, 1961, p. 51).

While a price was paid for the cause of integration, the health care infrastructure in the Black community remains fragile. In a study of the distribution of pediatrician offices in St. Louis City and St. Louis County, Tate (2012) applied the nearest-neighbor index (NNI), a measure of clustering, to determine the distribution pattern. If the NNI is less than 1, the pattern exhibits clustering. The NNI measure was equal to 0.27 with a Z-score of –15.5 ($p < 0.01$) and indicated a statistically significant, high degree of clustering of pediatrician offices in the metro St. Louis region. Two of the largest clusters were located in or near two pediatric hospitals. Unfortunately, nearly all of the clustering was outside of north St. Louis City and north St. Louis County, where regional population density is highest and a majority of residents are Black. The northern sector of metro St. Louis has extremely limited access to pediatricians. In a related study, Carter and Jackson (2008) reported that there were an estimated 25 physicians per 10,000

north St. Louis City residents, 70% fewer physicians per 10,000 residents than in the rest of St. Louis City. In addition, most areas in north St. Louis City have fewer than eight physicians per 10,000 residents, and when community health centers are excluded, the ratio is fewer than five physicians per 10,000 residents. The distribution of primary care physicians is more limited in most areas of north St. Louis City with four primary care physicians, excluding clinic-based practitioners, per 10,000 residents. For residents of these communities, the emergency room is the main source of primary care. In terms of mental health care, Blacks use the emergency room for mental health conditions 121% more frequently than do Whites in St. Louis City and St. Louis County (Purnell, Camberos, & Fields, 2014). Carter and Jackson (2008) reported that many Blacks residing in north St. Louis felt that the only way to secure mental health care was through violent or psychotic acts or through arrests.

Criminalization regime. It is tempting to discuss Ferguson as a single unit of analysis. However, the history of segregation and political fragmentation in the region suggests that Ferguson is linked to the broader region. The economic cost of racial division in the metropolitan region is harmful to economic growth, regional labor productivity, and upward mobility (Organisation for Economic Co-operation and Development, OECD, 2015). Local governments work against each other rather than with each other. Municipalities compete for industry, retail, and related employment opportunities. More affluent areas tend to generate sound tax revenue through property taxes or sales taxes generated by high-end retail markets. Less affluent areas lack the ability to generate sufficient revenue through property taxes and sales taxes. Over time, these municipalities, losers in the regional competition for taxable revenue sources, seek to generate revenue by way of police practices, municipal fines, and court cases. For example, according to the United States Department of Justice (2015), the city of Ferguson

"budgets for sizable increases in municipal fines and fees each year, exhorts police and court staff to deliver those revenue increases, and closely monitors whether those increases are achieved" (p. 2). Disproportionately impacted by Ferguson's law enforcement practices, Blacks account for 85% of vehicle stops, 90% of citations, and 93% of arrests, while comprising nearly two-thirds of the city population. The disparate impact of local police enforcement practices on Blacks is 48% larger when citations are issued on the basis of officers' judgment, rather than by means of radar or laser technology. The Department of Justice concluded that these police enforcement tactics have fostered community distrust and division.

The criminal justice system is not the only institution dispensing punishment in unequal fashion in the St. Louis region. Figure 2.1 indicates that three of the top six school districts with the highest elementary suspension rates nationwide are located in the St. Louis region. All of these metro St. Louis school districts are majority Black districts in terms of student population. During the 2011-2012 academic year, the St. Louis Public Schools District suspended almost 3,500 elementary students at least once (Losen et al., 2015). Nearly 50% of all Black male elementary students were suspended at least once during the academic year. A St. Louis Post-Dispatch (2015) exposé revealed that a quarter of the suspensions were attributable to insubordination or disrespect, a category that relies on a teacher's or an administrator's subjectivity. Out-of-school suspension during the early grades is a mark that follows students through the school system and that negatively influences teachers' expectations and students' opportunities for development.

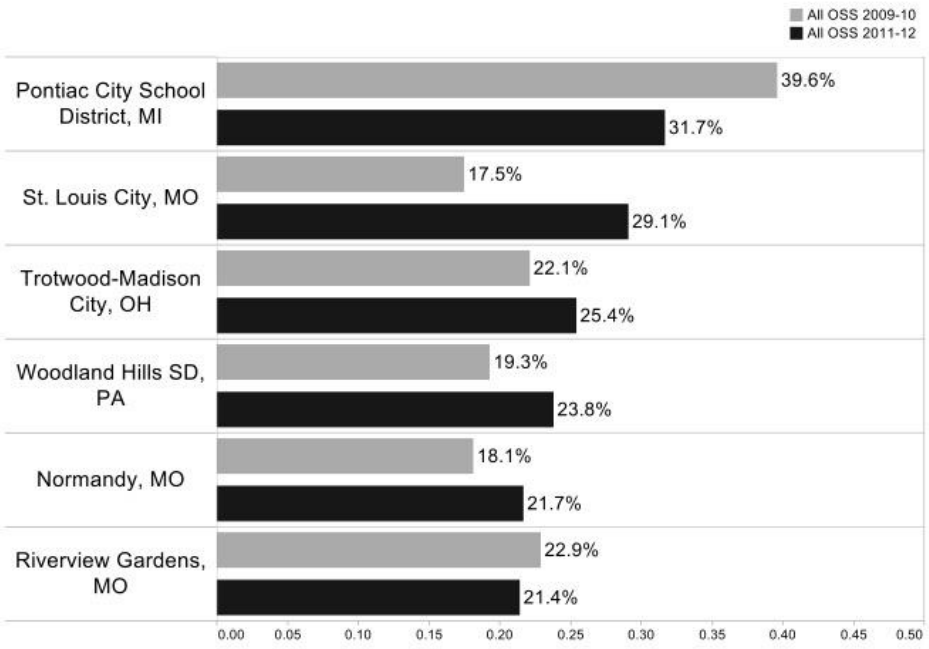

Figure 2.1 Six highest-suspending districts for all elementary school students.
Note. Data obtained from Losen, Hodson, Keith, Morrison, and Belway (2015); OSS=out-of-school suspensions.

Demographic aftermath. Today, the city of Ferguson is a part of one of the most segregated metropolitan regions in the United States. According to Logan and Stults (2011), in 2010, the St. Louis metropolitan area was the ninth most segregated U.S. region, with a Black–White segregation dissimilarity index of 70.6. This index score means that 70.6% of either group must move to a different census tract for the groups to become evenly distributed. However, segregation patterns in St. Louis vary in the region. Demographically speaking, the region consists almost exclusively of Blacks and Whites. This demographic binary simplifies the mapping process, as a map representing the demographic distribution of either demographic group provides insight into both groups. Figure 2.2 provides a map of the distribution of Blacks across the region.

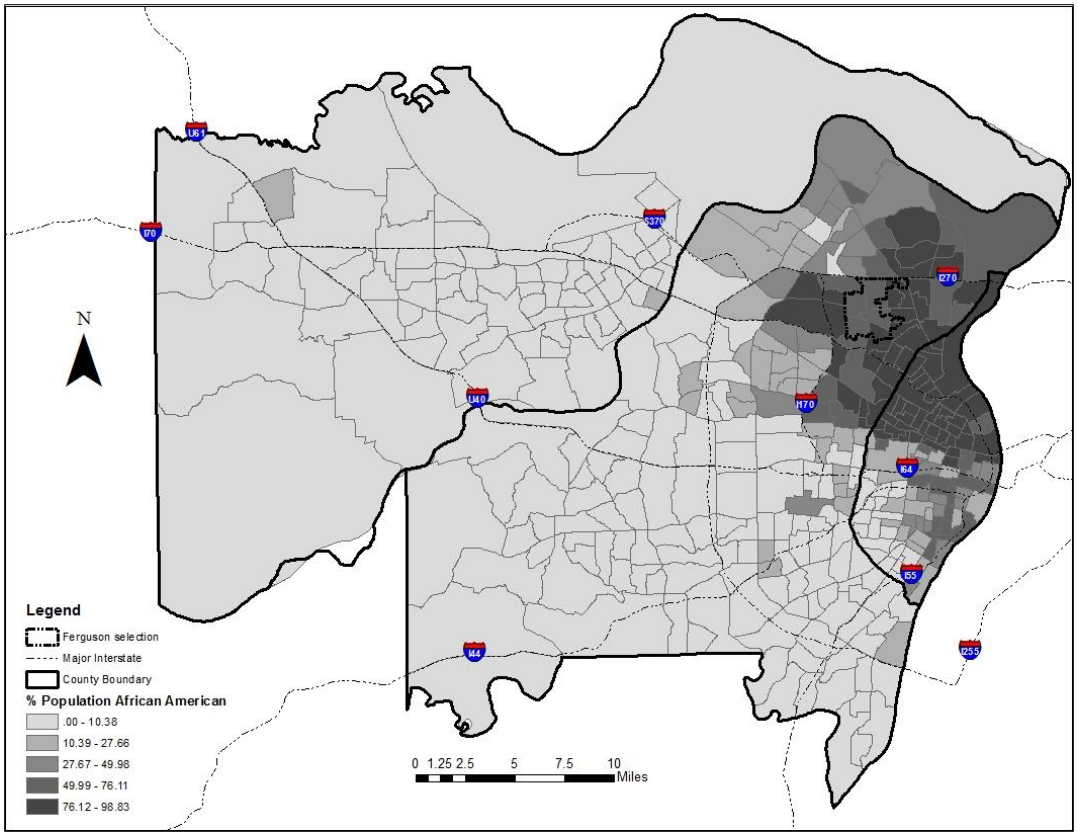

Figure 2.2 Racial residential segregation in St. Louis region, 2010.
Source. United States Census Bureau. (2010). 2010 Missouri tiger census tract shapefile [Raw data]. Retrieved from https://www.census.gov/geo/maps-data/data/tiger-line.html.

According to the United States Census (2015), 67% of Ferguson is Black and 29% is White. Rodden's (2014) analysis of segregation in the St. Louis metro region indicates that Ferguson stands out for its relative heterogeneity and internal desegregation. He argued that the immediate problem in Ferguson is not residential segregation. Instead, the problem is that community racial integration is not reflected in the municipal government and the police force, whose racial compositions reflect the politics of a past era. More information is required to better understand past St. Louis geopolitics and the related segregation regime.

In the St. Louis region, the segregation regime and the related racial division have been costly. Racial division and segregation are associated with income inequality (Rusk, 2013). In

terms of upward income mobility, the St. Louis metro region is ranked in the bottom ten of the 50 largest regions in terms of upward income mobility (Chetty et al., 2014). In contrast to St. Louis metro, regions with greater upward income mobility tend to have less segregation, better schools, greater social capital, and less income inequality.

2.2 Data Sources and Methodology

In this study, the authors employ a social epidemiological approach. Social epidemiology is an epidemiological branch that focuses specifically on the influences of social–structural factors on states of health and well-being (Honjo, 2004). Scholars in the discipline assume that the distribution of advantages and disadvantages in society is reflected in the distribution of health and well-being. One of the key assumptions of some branches of epidemiology is that empirical inquiry should begin at the biological level. Social epidemiology has moved outside of this biological model and is unique in its approach to studying the distribution, determinants, and control of health and well-being. Social factors are viewed as important influences on health outcomes. This is important because race and segregation are associated with broader social factors. This study provides a unique example of how social epidemiology has the potential to inform our understanding of education and related developmental outcomes.

Figure 2.3 provides one pathway through which racial segregation develops and influences life-course developmental outcomes, including health and education. The pathway model suggests causality and, therefore, is temporal in nature. In this study, there is no intent to demonstrate causality, but to use the model to describe the current state of affairs in metropolitan St. Louis. In the pathway, the first phase focuses on policies that led to White flight and racial housing discrimination. This phase of the segregation pathway varies by region in the United

States. Therefore, the phase represents an opportunity to describe the unique history of segregation in Ferguson, Missouri, and more broadly in the surrounding metropolitan region.

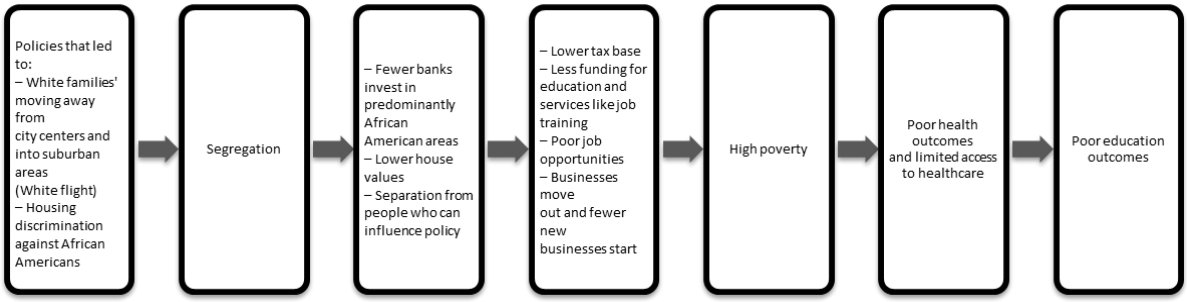

Figure 2.3 Process by which racial residential segregation leads to poor education outcomes.
Note. Adapted from Anderson, E., & Jones, J. (2002). The geography of race in the United States. Retrieved from http://www.umich.edu/~lawrace/. ©2002 Creative Commons Attribution=Shareable 4.0.

This descriptive, epidemiological case study is a paradigmatic example of moving from journalistic inquiry to more analytical approaches to the study of race, education, and place, where the interdependence of health and learning are prominent. Flyvbjerg (2006) defined the purpose of a paradigmatic case study as "to develop metaphor or establish a school for the domain that the case concerns" (p. 230). In this study, the pathway model in Figure 2 guides variable selection. The authors use Geographic Information Systems (GIS) mapping as an analytical strategy to interpret multiple data sources, including the U.S. Census Bureau's American Community Survey, Missouri Department of Elementary and Secondary Education, Missouri Information Community Assessment, Missouri Spatial Data Information Service, and the St. Louis Regional Chamber. Table 2.1 summarizes constructs and community data sources as well as the developmental relevance and significance of each construct used in the study. GIS mapping serves as an analytical lens for investigating the ecological environment of the case

through an understanding of community data sources. One limitation of this approach is that the analysis is descriptive. Although the pathway model infers causality, causal inferences are not feasible, since the authors focus on one cross-section of time.

Table 2.1 Data Sources

Construct	Data Source(s)	Significance for Study
Home values	US Census Bureau, 2010; ACS 2008–2012	Important indicator of neighborhood wealth and resources; provides the tax base that is linked to education funding (Kenyon, 2007)
Under-banked households	Social Compact CityDNA, 2009; St. Louis Neighborhood Market Drilldown, 2012	The ability to access credit and financial capital is an indicator of residents' economic opportunity and of the financial industry's willingness to invest in neighborhoods (Dunham, 2015; St. Louis Neighborhood Market Drilldown, 2012).
Major companies	St. Louis Regional Chamber, 2012	Proximity and geographic access to employment is another indicator of residents' economic opportunity and demonstrates the spatial mismatch that exists in many urban areas (Li, Campbell, & Fernandez, 2013; Stoll, 2005).
Per pupil funding	Missouri Department of Elementary and Secondary Education (DESE), 2014	Reflects, in part, neighborhood economic resources and ability to invest in educational resources for local students (Kenyon, 2007)
Poverty	ACS, 2008–2012	High poverty is related to the uneven distribution of economic resources. Studies have indicated that high poverty is correlated also with poor health and educational outcomes (D. Berliner, 2006; D. C. Berliner, 2009).
Preterm births	Missouri Information for Community Assessment (MICA), 2015; US Census, 2010	Reflects past educational attainment and predicts future educational opportunity and outcomes (Williams et al., 2013)
Low birth weight	MICA, 2015; US Census, 2010	Reflects past educational attainment and predicts future educational opportunity and outcomes (Hernandez & Napierala, 2014; Reichman, 2005)
Otitis media (OM)	MICA, 2015; US Census, 2010	Most common childhood diagnosis in the US and frequently occurs during the early years, a critical period for language development and early learning; hearing loss related to OM may impact these outcomes as well as early academic achievement (Casby, 2001; Racanello, 2010; Roberts, 2004; Winskel, 2007)
Asthma	MICA, 2015; US Census, 2010	Most prevalent chronic childhood disease, which disproportionately impacts urban poor and minority youth (Claudio, Stingone, & Godbold, 2006; Eggleston et al., 1998); also the primary reason for school absence among youth in the US (Basch, 2011a, 2011b)

Mental health disorders	MICA, 2015; US Census, 2010	Highly correlated with school discipline and suspensions (Purnell, Camberos, & Fields, 2014)
Suspension rates	DESE, 2014	Three (two bordering Ferguson) of the six school districts with the highest elementary school suspension rates in the US are located in the St. Louis region. All three districts are predominantly Black in student body population and have high rates of students living in poverty (Losen, Hodson, Keith, Morrison, & Belway, 2015).
Third-grade literacy attainment	DESE, 2014	Literacy attainment, specifically by the end of third grade, predicts future academic performance, high school completion, college readiness, and later labor market success (Fiester, 2010; Lesnick, Goerge, Smithgall, & Gwynne, 2010).
Dropout rates	DESE, 2014	Related to economic opportunity, future labor market success, poverty, crime, and health outcomes (Purnell, Camberos, & Fields, 2014; Sum, Khatiwada, McLaughlin, & Palma, 2009)
Educational attainment	US Census, 2010; ACS, 2008–2012	Key factor in the cyclical relationship between education and health and a predictor of intergenerational well-being (Purnell, Camberos, & Fields, 2014)

2.3 Results and Discussion

2.3.1 Distribution of Economic Resources

The four maps in Figures 2.4–2.7 demonstrate the distribution of economic resources throughout the region. Figure 2.4 reveals the geospatial concentration of the "underbanked" population, or households that have established little-to-no credit record. In contrast to the "unbanked" population, those who do not use banks or financial institutions, the underbanked may have an account with a bank or credit union, but rely considerably on alternative financial institutions. These institutions include check cashing businesses and short-term, high-cost loan facilities, such as payday loan and title loan businesses. Figure 2.4 indicates that between one-quarter and one-third of the residents in Ferguson were underbanked in 2012. Nearly 50% or more of the households in zip codes along the central corridor of St. Louis City were underbanked. In two zip codes along this central corridor, two-thirds to three-fourths of the population had little-to-no credit record.

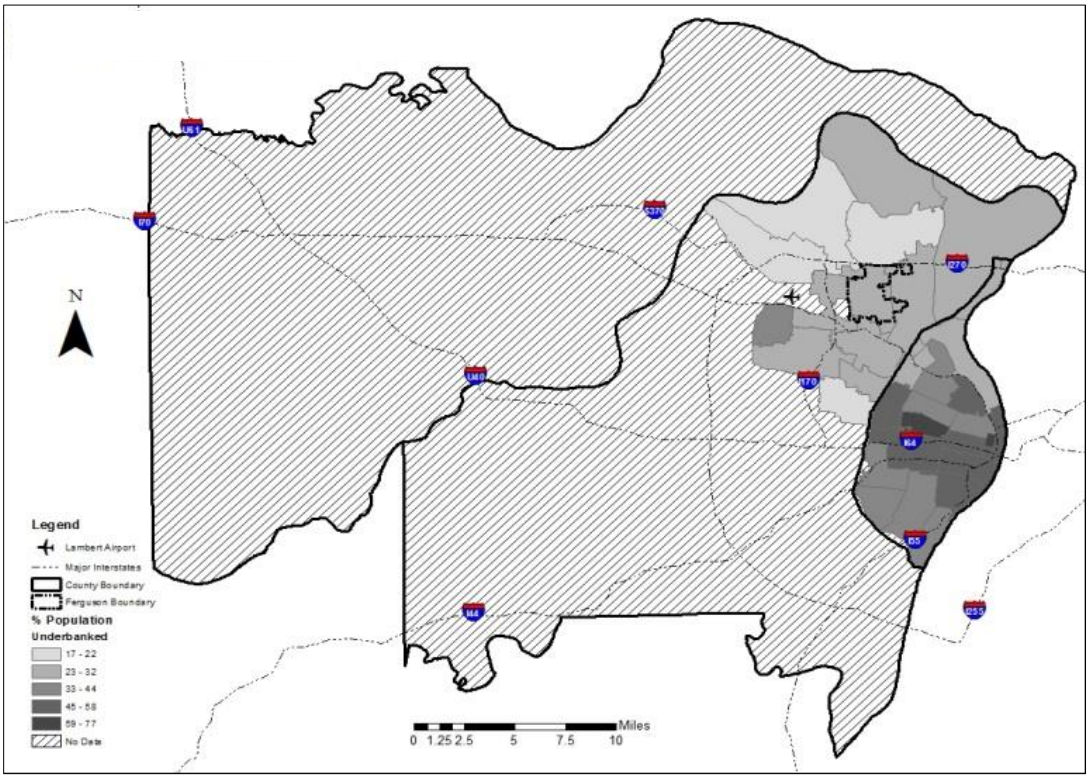

Figure 2.4 Percentage of population underbanked in St. Louis area, 2012.
Source. Social Compact. (2012). *St. Louis Neighborhood Market DrillDown* [Raw data]. Retrieved from http://drilldownstl.org/wordpress/wpcontent/uploads/2012/09/FinalDrillDownReport.pdf.

The St. Louis Neighborhood Market Drilldown (2012) revealed that 47% of the residential population in these areas live nearer to and rely most heavily on alternative financial services. These alternative financial service providers charge underbanked residents from 2.5%–5% of their monthly or annual income for check cashing and other financial services (Beard, 2010). Furthermore, when large proportions of the population are underbanked, substantial economic disinvestment in communities usually follows. Minimal bank investment in predominantly Black communities limits economic opportunities for local residents. Opportunities to rent or purchase housing and transportation are limited, and in many cases employment opportunities may also be impacted. While respective zip-code level data for a substantial portion of St. Louis County were unavailable, Table 2.2 indicates how the data for the

St. Louis region compared with broader regional, state, and national unbanked and underbanked figures in 2009. St. Louis City had nearly three times the percentage of unbanked households and high unbanked census tracts than did St. Louis County and nearly double that of the region and nation. When these figures are examined in conjunction with regional segregation patterns, it is evident that low-income and minority communities are disproportionately affected.

Table 2.2 Unbanked/underbanked population, metro St. Louis

	St. Louis City	St. Louis County	St. Louis Metro Area*	Missouri	United States
% Unbanked Households	13.7%	5.5%	7.5%	8.2%	7.7%
# Unbanked Households	19,597	22,203	82,518	190,423	9,085,000
% High Unbanked Census Tracts	77.8%	28.9%	34%	34.3%	41.9%
% Underbanked Households	22.3%	16.1%	22.4%	19.3%	17.9%
# Underbanked Households	31,899	64,995	246,455	488,191	21,276,000

Note. *Metro Area includes St. Louis City, St. Louis County, and 15 additional surrounding counties on both the Missouri and Illinois sides.Sources: Corporation for Enterprise Development, Bank On. (n.d.). *Unbanked profile* [Raw data]. Retrieved from http://webtools.joinbankon.org/community/search; Federal Deposit Insurance Corporation. (2009). *National survey of unbanked and underbanked households* [Raw data]. Washington, DC: Author. Retrieved from https://www.fdic.gov/householdsurvey/2013report.pdf

Home values are an important indicator of neighborhood wealth, resources, and property tax base (Kenyon, 2007). As illustrated in Figure 2.5, the percentage of owner-occupied homes valued at $150,000 or greater varied widely across the St. Louis region in 2012. In a cluster of zip codes in northern St. Louis City and St. Louis County, no more than one-quarter of homes had a value of at least $150,000. This cluster of zip codes included Ferguson. In contrast, 75%–100% of owner-occupied homes were valued at $150,000 or greater in a cluster of zip codes in western St. Louis County and St. Charles County. These findings reflect the historical legacy of the St. Louis region's segregation regime and related disparities in the community, as the

northern areas of St. Louis City and St. Louis County are majority Black communities, while the population in western St. Louis County and St. Charles County is largely White.

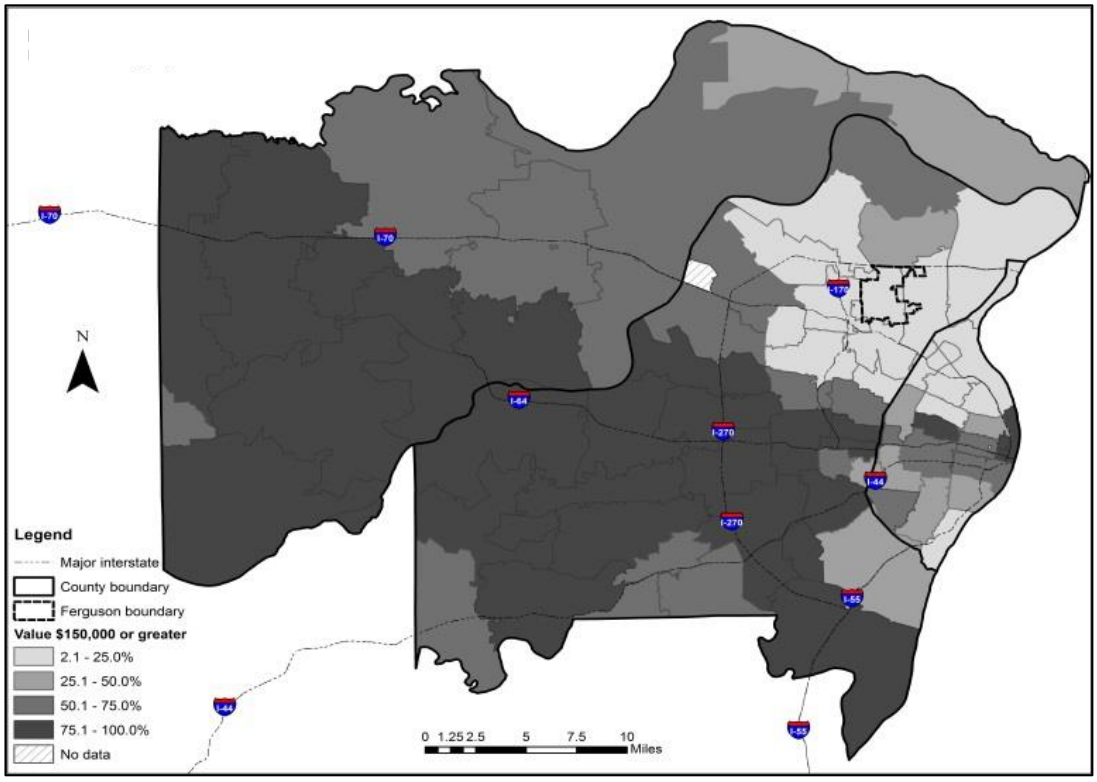

Figure 2.5 Home values by zip code in St. Louis area, 2008–2012.
Source. United States Census Bureau. (2012). *American Community Survey, 2008–2012 5-year estimates* [Raw data]. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

Figure 2.6 depicts the distribution of school district per pupil expenditures, another indicator of neighborhood economic resources and ability to invest in educational resources for local youth (Kenyon, 2007). Per pupil spending ranged from $7,559 in the Bayless School District in southern St. Louis County to $18,372 in the Clayton School District located west of St. Louis City. The majority of regional school districts spent less than $12,500 per student. In a few school districts where the majority of homes were valued at $150,000 or higher, per pupil

spending was less than $10,000. In St. Louis Public Schools (SLPS), per pupil expenditures totaled $15,658. Per pupil spending was also greater than $15,000 in the Brentwood and Maplewood-Richmond Heights districts located west of St. Louis City. In Ferguson-Florissant and other school districts serving young people residing in Ferguson, per pupil spending was less than $12,500 in 2012. It is important to note that the per pupil spending of the SLPS District includes funding to support special education services, whereas school districts located in St. Louis County use a consortium strategy to provide special education services. The Special School District of St. Louis County provides the county districts with a unique service at an economy of scale.

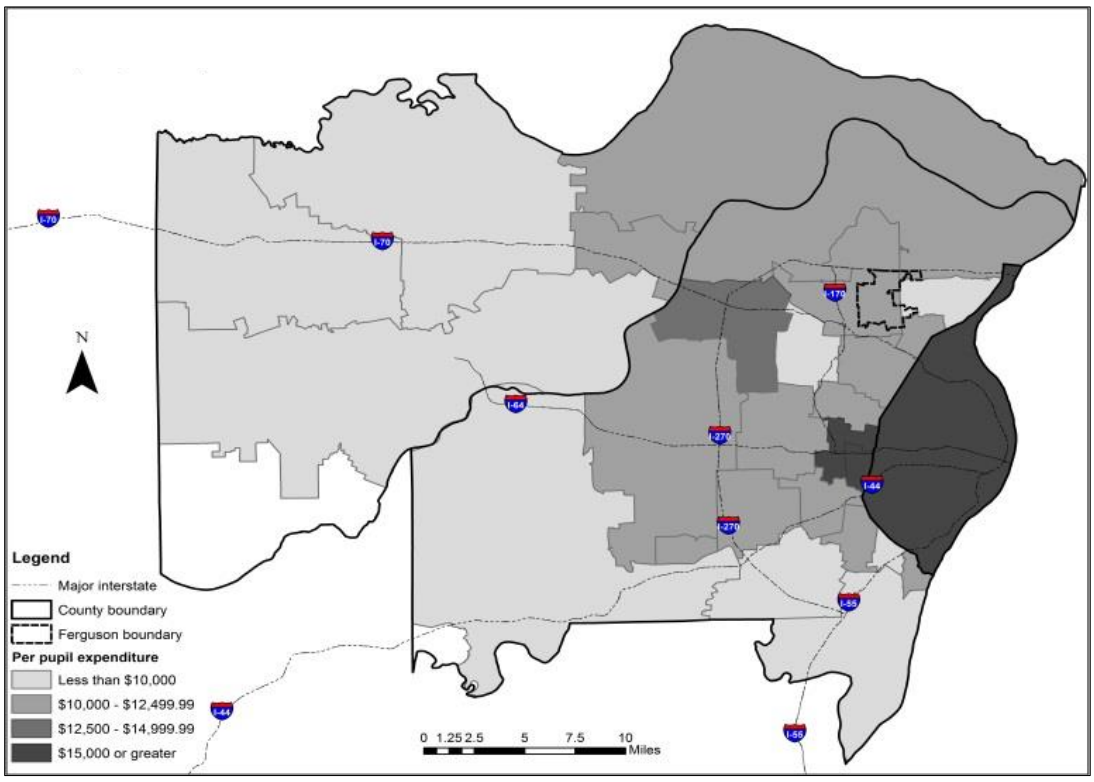

Figure 2.6 Per pupil expenditure by school district in St. Louis area, 2012.
Source. Missouri Department of Elementary & Secondary Education. (2014d). *School finance data and statistics summary* [Raw data]. Retrieved from http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx.

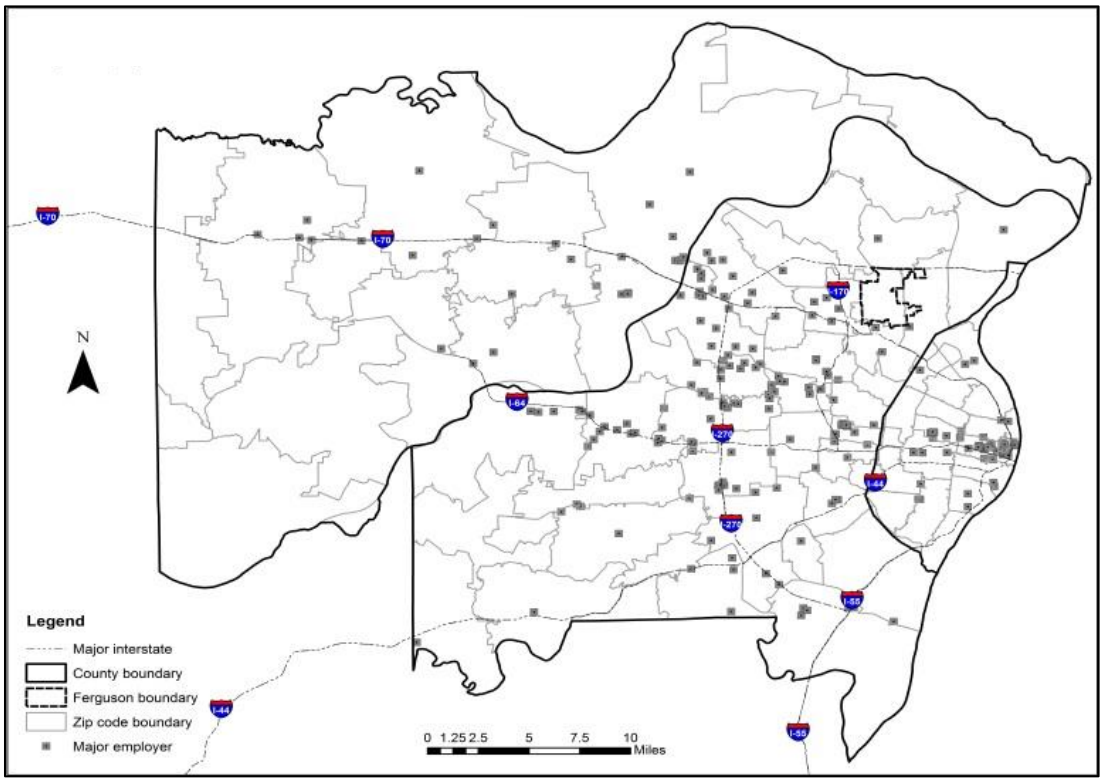

Figure 2.7 Largest employers in St. Louis area, 2012.
Source. St. Louis Regional Chamber. (2012). *Largest employers in greater St. Louis* [Raw data]. Retrieved from http://www.stlregionalchamber.com/regional-data/companies.

Figure 2.7 illustrates the distribution of 247 of the largest employers in the metropolitan region in 2012. Generally, the companies were located near major interstates in St. Louis City and St. Louis County. Although several were located near neighboring Interstate 70, no major companies were located in the city of Ferguson. The average NNI tool in the Spatial Analyst Extension of ArcGIS 10.2.2 (Environmental Systems Research Institute, ESRI, 2014) was used to determine if the 247 companies exhibited statistically significant clustering or dispersal across the region. Recall that if the NNI is less than 1, the pattern exhibits clustering. Results of the analysis revealed that the companies exhibited a statistically significant level of clustering across the region (NNI = 0.59; *Z*-score = –12.36, $p < 0.001$). The relatively large *Z*-score and its

associated *p*-value support rejection of the hypothesis that large companies are randomly located in the region. Again, the segregation regime's legacy continues, as the largest employers are located outside of Ferguson and in mostly White communities.

2.3.2 Distribution of Poverty

As reported in the model in Figure 2.3, the uneven distribution of economic resources throughout the region has led to higher concentrations of poverty in specific geographic areas. Figure 2.8 represents the distribution of poverty throughout the region, with a large number of census tracts within St. Louis City and near northern suburbs in St. Louis County demonstrating higher percentages of poverty.

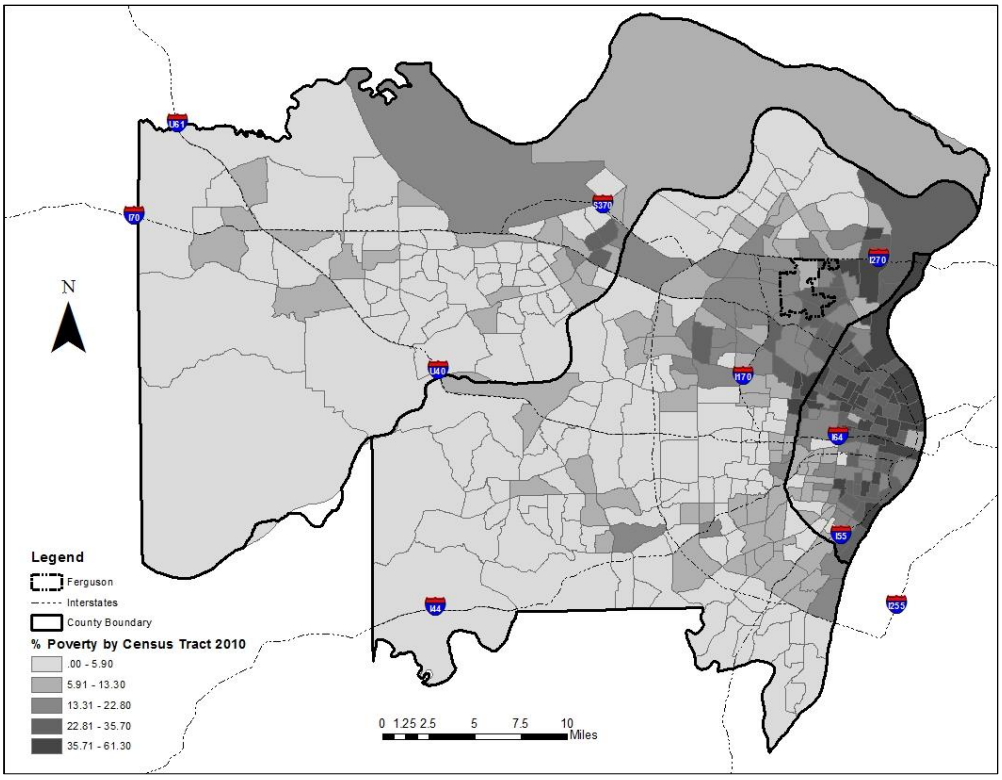

Figure 2.8 Distribution of poverty in St. Louis region, 2010.
Source. United States Census Bureau. (2010). 2010 Missouri tiger census tract shapefile [Raw data]. Retrieved from https://www.census.gov/geo/maps-data/data/tiger-line.html.

This graphic is strikingly similar to Figure 2.2, which illustrated segregation in the region and is consistent with the higher percentages of underbanked households and lower home values in these same areas. Several of the census tracts along the river, the eastern St. Louis City border, and extending west throughout the city had poverty rates higher than 35% and approaching 60%–65%. In contrast, in many of the census tracts in central and southern St. Louis County, considerably lower percentages of the population were living in poverty.

St. Louis City had the largest impoverished population. In addition, compared to St. Louis County and St. Charles County, the city has experienced the highest poverty concentration, with the smallest change in its poverty rates and largest decreases in its overall population over the past 50 years. Table 2.3 provides the compound decade growth rates in the region and allows us to examine the average rate at which both poverty and population numbers have changed during each decade over the past 50 years. The compound decade growth rate yields more nuanced results than does the average rate of change over the single 50-year time period. St. Louis City has seen a poverty growth rate of 1.9% per decade and population loss rate of 16.0% per decade. In contrast, St. Charles County has experienced the largest increases in its population with a per decade growth rate of 47.0% and a 15.2% rate of decline in poverty per decade from 1960–2010. Poverty and population rates in St. Louis County have increased more consistently with an average increase of 8.9% in poverty and an average growth rate of 7.0% in population per decade. During the 1960s and 1970s, the suburban expansion could be attributed to government subsidies that were largely racially exclusive. Then and now, employment opportunities in western St. Louis County and in St. Charles County, relative to those in St. Louis City, are greater. Residents followed these job opportunities over time. Again, this

pattern of opportunity has a geospatial distribution that aligns with the racial composition of the metropolitan region.

Table 2.3 Poverty and population rates by county, metro St. Louis, 1960–2010

County	**Poverty Rate 1960**	**Poverty Rate 1970**	**Poverty Rate 1980**	**Poverty Rate 1990**	**Poverty Rate 2000**	**Poverty Rate 2010**	**Compound Decade Growth Rate of Poverty (%)**
St. Charles County	12.4	5.8	4.4	4.7	4.0	5.4	**-15.2**
St. Louis County	6.9	4.9	4.9	5.6	6.9	10.5	**8.9**
St. Louis City	24.6	20.3	21.8	24.6	24.6	27.0	**1.9**
County	**Population 1960**	**Population 1970**	**Population 1980**	**Population 1990**	**Population 2000**	**Population 2010**	**Compound Decade Growth Rate of Population (%)**
St. Charles County	51,786	92,000	142,789	210,448	279,670	355,354	**47.0**
St. Louis County	619,567	940,891	960,475	975,567	997,284	979,653	**7.0**
St. Louis City	733,072	610,808	444,308	386,630	339,323	308,767	**-16.0**

Note: Compound Decade Growth Rate (CDGR) calculated is the average per decade change across 5 decades, [calculated as CDGR=(((T5/T1)^1/# of time periods))-1)*100, where T5 = value at last time period and T1 = value at first time period]Source: U.S. Census Bureau. (n.d.). *Poverty data* [Raw data]. Retrieved from https://www.census.gov/hhes/www/poverty/data/

2.3.3 Health Outcomes and Access to Health Care

As the segregation conceptual model in Figure 2.3 demonstrates, preterm birth and low-birth weight (LBW) rates are two indicators that reflect past and predict future educational and related developmental opportunity (Hernandez & Napierala, 2014; Reichman, 2005; Williams et al., 2013). Low maternal educational attainment is associated with poor health, which increases the risk for preterm births and LBW. Preterm birth and LBW, in turn, may increase children's risk of impaired cognitive development, learning ability, and academic achievement. Figure 2.9 indicates that the percentage of preterm births, or those in which gestation lasted fewer than 37 completed weeks, ranged from 3.5%–25.4% across the region.

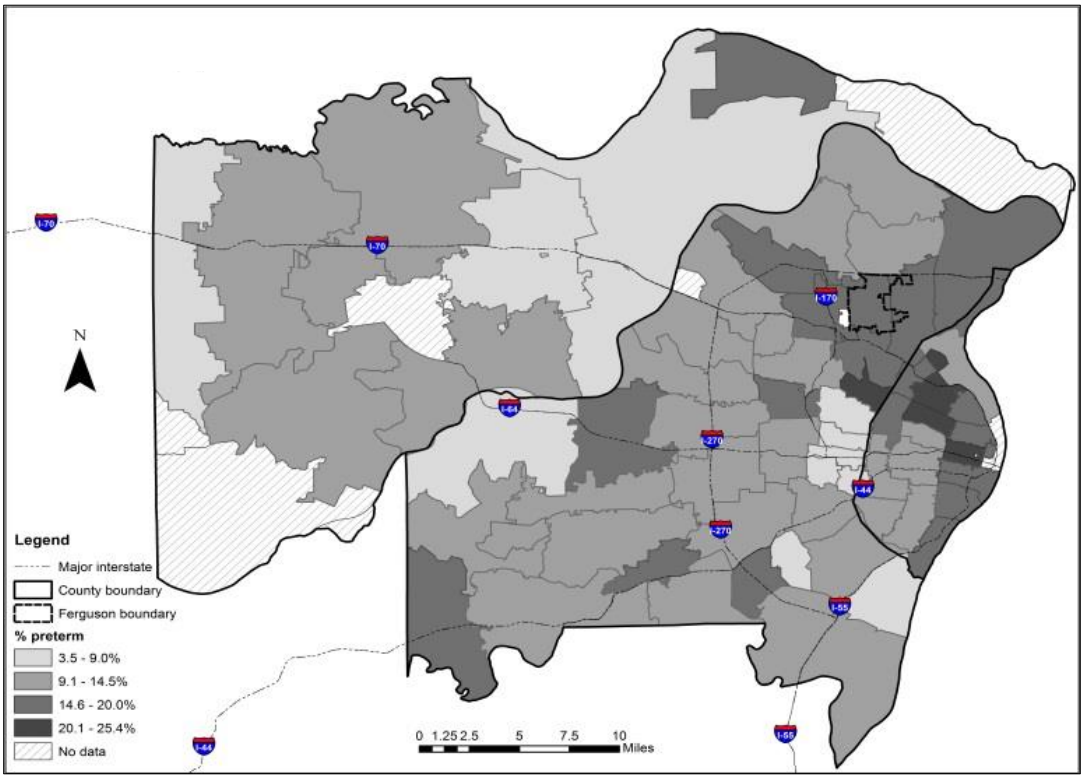

Figure 2.9 Preterm birth rate by zip code in St. Louis area, 2012.
Source. Missouri Department of Health & Senior Services. (2015a). Birth MICA [Raw data]. Retrieved from http://health.mo.gov/data/mica/BirthMICA/.

The highest rates of preterm births were reported mostly in zip codes in northern and eastern St. Louis City and northern St. Louis County. A few dispersed zip codes in western St. Louis County also had relatively high preterm birth rates. In the city of Ferguson, the preterm birth rate was approximately 15% in 2012. Similar to that of preterm births, the percentage of LBW (see Figure 2.10) varied considerably across the area. Rates were the highest in St. Louis City and in suburban neighborhoods directly to the North and Northwest. In St. Louis City, the percentage of LBW was as high as 21.1% in at least one zip code. The lowest rates were reported mostly in zip codes in southern and western St. Louis County and throughout St. Charles County. In Ferguson, the LBW rate was similar to that of preterm births.

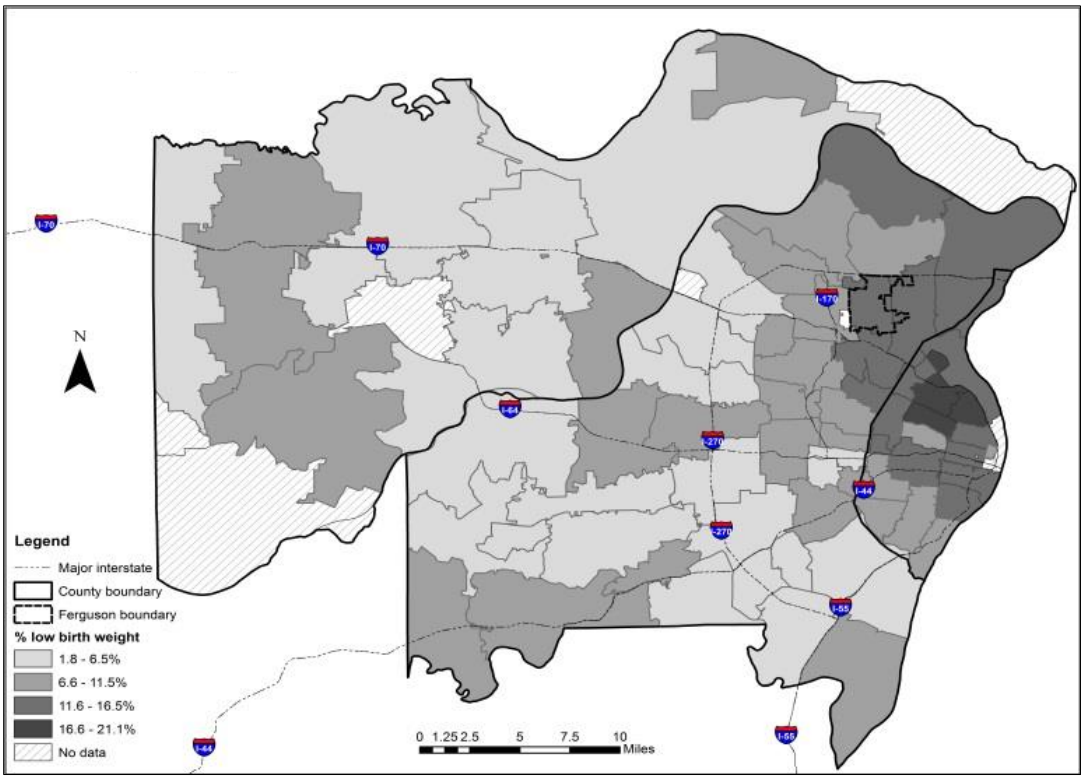

Figure 2.10 Low birth weight rate by zip code in St. Louis area, 2012.
Source. Missouri Department of Health & Senior Services. (2015a). Birth MICA [Raw data]. Retrieved from http://health.mo.gov/data/mica/BirthMICA/.

Additional childhood health outcomes that predict future educational opportunity and attainment include otitis media (OM), or infections of the middle ear, and asthma. Otitis media is the most common diagnosed childhood illness (Roberts, 1995, 2004) and while OM may be common among young children nationally, Figure 2.11 indicates that distribution of OM emergency room visits within the region varied by location. Emergency room visit rates for OM demonstrate that identification and treatment is not evenly, geographically distributed.

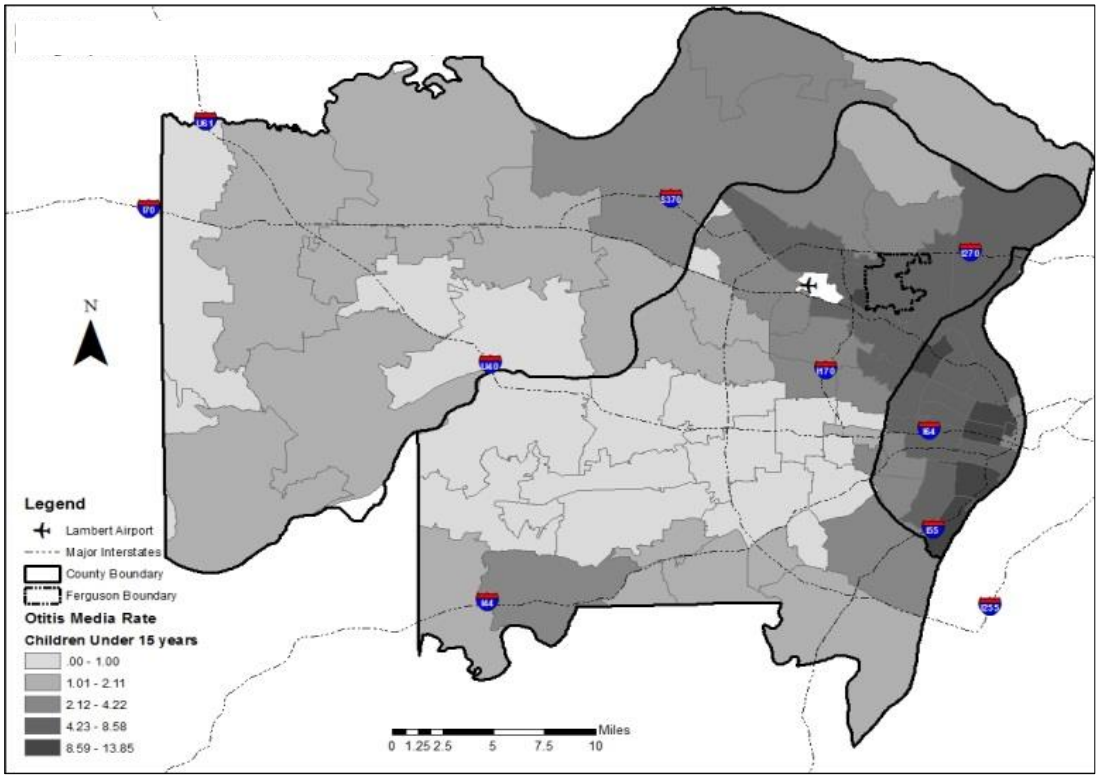

Figure 2.11 Emergency room visits for otitis media by zip code in St. Louis area, 2012. *Source*. Missouri Department of Health & Senior Services. (2015b). Emergency room MICA [Raw data]. Retrieved from http://health.mo.gov/data/mica/EmergencyRoomMICA/.

OM is most common during the early years of development, and this period is also a critical stage for language development and early learning skills. When left untreated, OM commonly causes a mild to moderate conductive hearing loss. While this loss is typically resolved with treatment, OM, without immediate attention, may directly affect children's opportunities for language development and early learning during this critical time (Casby, 2001; Racanello & McCabe, 2010; Winskel, 2007). In turn, academic achievement during the early elementary years could be adversely affected. OM rates were highest in St. Louis City and northern St. Louis County and lowest along central and western St. Louis County. Earlier geospatial representations indicated that these areas with comparably low rates had higher home values, lower poverty, and lower proportions of minority residents.

Figure 2.12 suggests that, similar to OM, childhood asthma is common among youth and locally more common within St. Louis City and northern St. Louis County. Asthma is the most common chronic childhood disease and is the primary reason for absence among school-age children (Basch, 2011a, 2011b). Asthma disproportionately impacts minority children in urban areas and children in poverty (Claudio, Stingone, & Godbold, 2006; Eggleston et al., 1999) and, therefore, differentially shapes their opportunities to learn through missed school days and reductions in school connectedness. Locally, asthma rates for young children in the city of St. Louis are five to seven times those of young children in central and western St. Louis County. In Ferguson, specifically, asthma rates among youth are three to five times those of central and western St. Louis County.

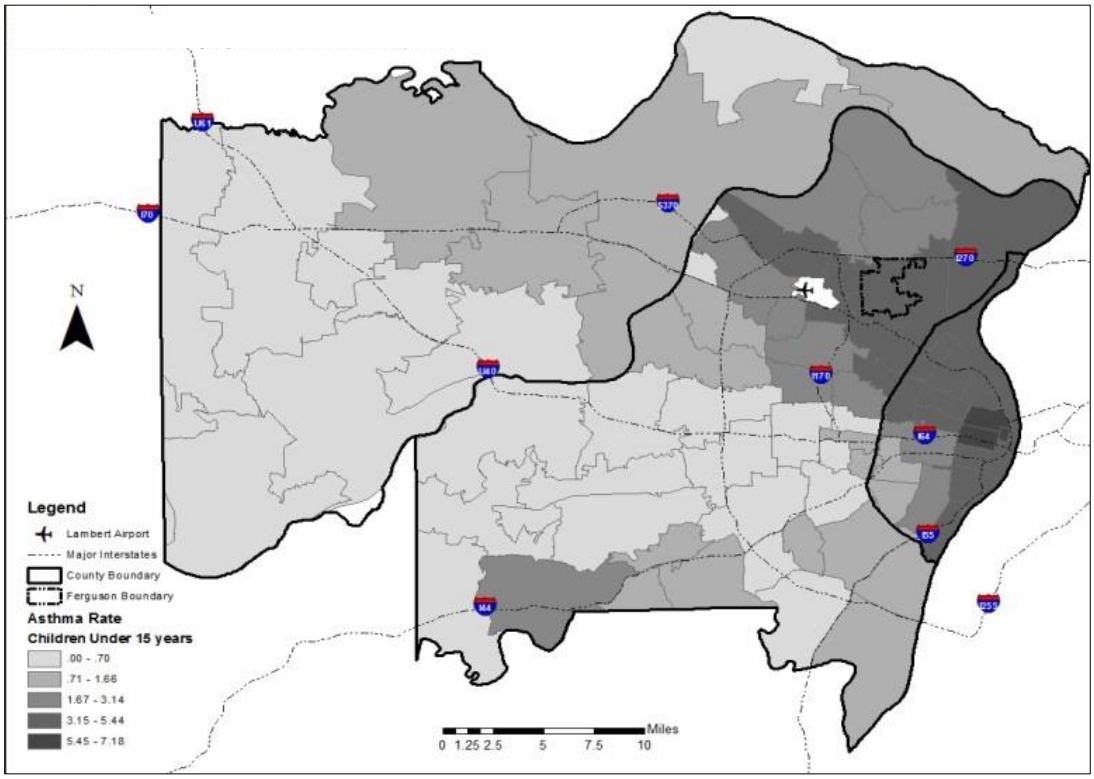

Figure 2.12 Emergency room visits for asthma by zip code in St. Louis area, 2012. *Source*. Missouri Department of Health & Senior Services. (2015b). Emergency room MICA [Raw data]. Retrieved from http://health.mo.gov/data/mica/EmergencyRoomMICA/.

Figure 2.13 indicates that variation exists in the geographic distribution of diagnosed mental health disorders within the region. Zip codes with the highest rates of diagnosed mental illness can be found in St. Louis City, northern St. Louis County, and one zip code in southern St. Louis County. In these zip codes, rates of diagnosed mental health disorders were five times those of the zip codes with the lowest rates of diagnosed mental illness. Rates of mental illness in Ferguson were three times those of areas with the lowest rates. Within the Ferguson boundaries, the prevalence of diagnosed mental health disorders was highest in the northeastern and southeastern areas, the same areas where there were a larger percentage of minority residents and residents in poverty.

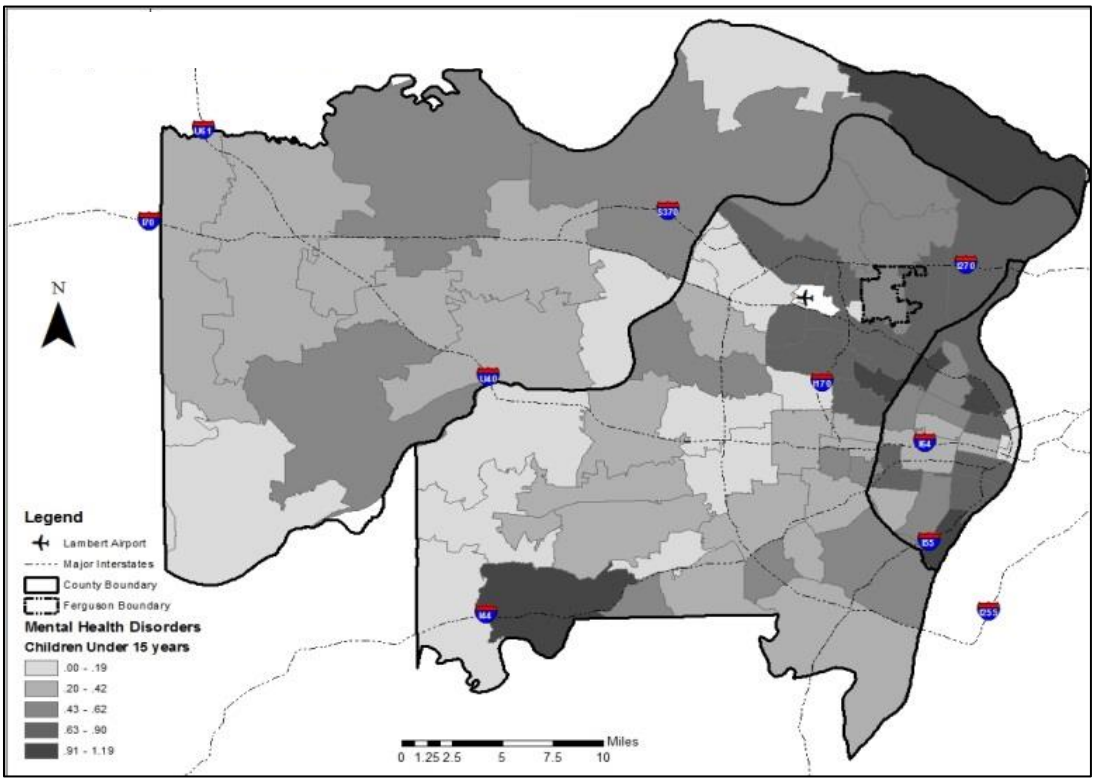

Figure 2.13 Emergency room visits for mental health disorders
by zip code in St. Louis area, 2012.
Source. Missouri Department of Health & Senior Services. (2015b). Emergency room
MICA [Raw data]. Retrieved from

Health care access for children under 18 years varied substantially as well throughout the region. As Figure 2.14 indicates, the largest percentages of youth with health insurance coverage were in central and western St. Louis County, while northern St. Louis County and areas in central and southern St. Louis City had the smallest percentages of youth with health insurance coverage.

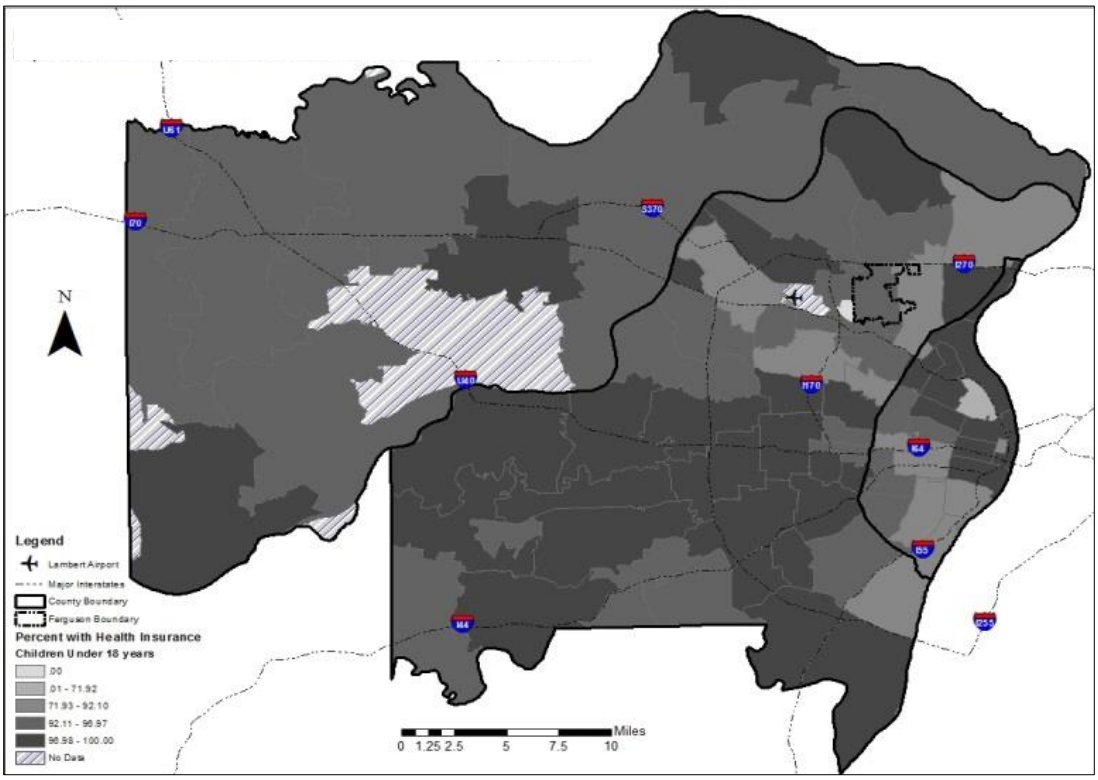

Figure 2.14 Population under 18 years with health insurance
by zip code in St. Louis area, 2008–2012.
Source. United States Census Bureau. (2012). American Community Survey, 2008–2012
5-year estimates [Raw data]. Retrieved from
http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

2.3.4 Education Outcomes

Substantial evidence indicates that literacy attainment by the end of third grade predicts several important education outcomes, such as high school performance and completion and college readiness (Fiester, 2010; Lesnick et al., 2010). Each year in Missouri, students enrolled in grades 3 to 8 in public schools complete respective grade-level English Language Arts (ELA) Missouri Assessment Program (MAP) assessments (Missouri Department of Elementary and Secondary Education, MO DESE, 2014). Results from the 2012 ELA MAP test are presented to provide a snapshot of third-grade students' literacy attainment. Figure 2.15 depicts third-grade students' Proficient or Advanced status on the ELA MAP by school district. In 2012, school

district attainment on this combined accountability metric ranged from approximately 13%–74% in 2012. The proportion of students achieving proficiency or Advanced status was highest in several school districts in western St. Louis County and in St. Charles County. In SLPS and in several neighboring districts serving Ferguson residents, no more than 45% of students attained Proficient or Advanced status.

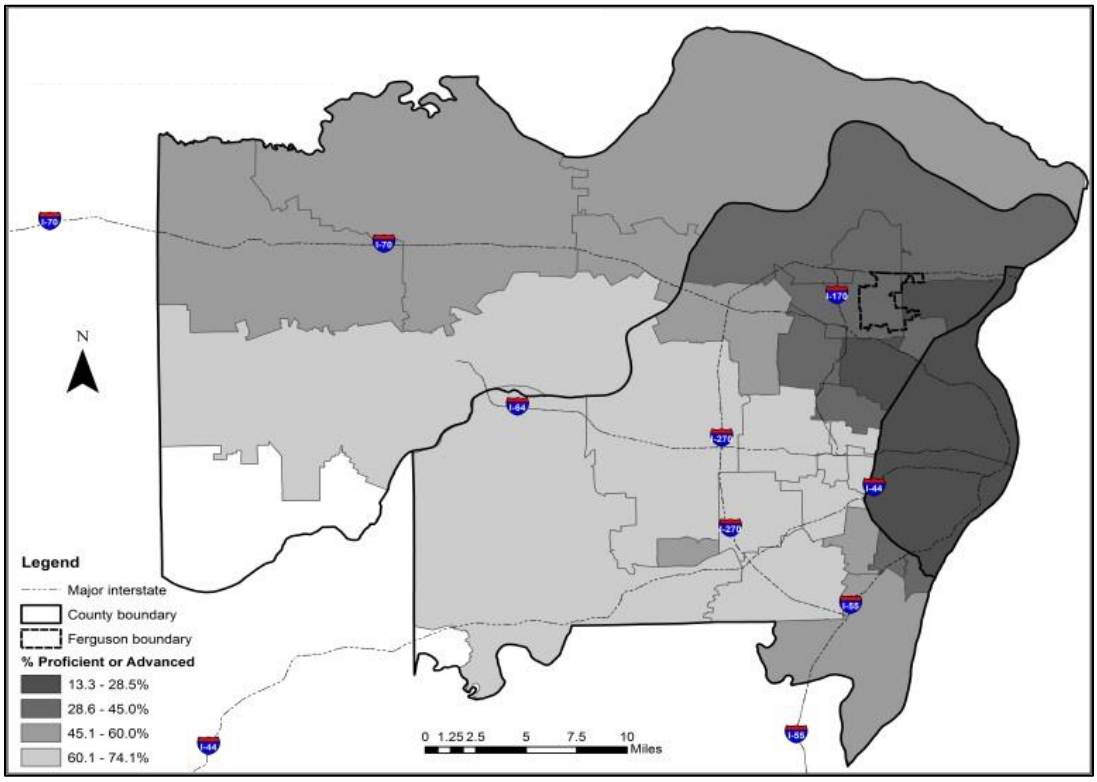

Figure 2.15 Third-grade English language arts attainment by school district in St. Louis area, 2012.
Source. Missouri Department of Elementary & Secondary Education. (2014c). MAP district final [Raw data]. Retrieved from http://mcds.dese.mo.gov/quickfacts/Pages/State-Assessment.aspx.

Researchers have linked dropping out of high school to fewer opportunities for stable employment and related negative outcomes, including poverty, criminal activity and delinquency, and poor health (Purnell, Camberos, & Fields, 2014; Sum et al., 2009). Figure 2.16 indicates that less than 5% of students dropped out of high school in most St. Louis-area school districts during the 2012 school year. In contrast, approximately 8% of students dropped out of high school in the Riverview Gardens district, which served part of southeast Ferguson. In SLPS and in adjoining Normandy and University City districts, at least 10% of students dropped out in 2012. This figure was roughly 22% for the Normandy district. Riverview Gardens, Normandy, University City, and St. Louis City are majority Black school districts. This aligns with the trend of racial disparities in the region.

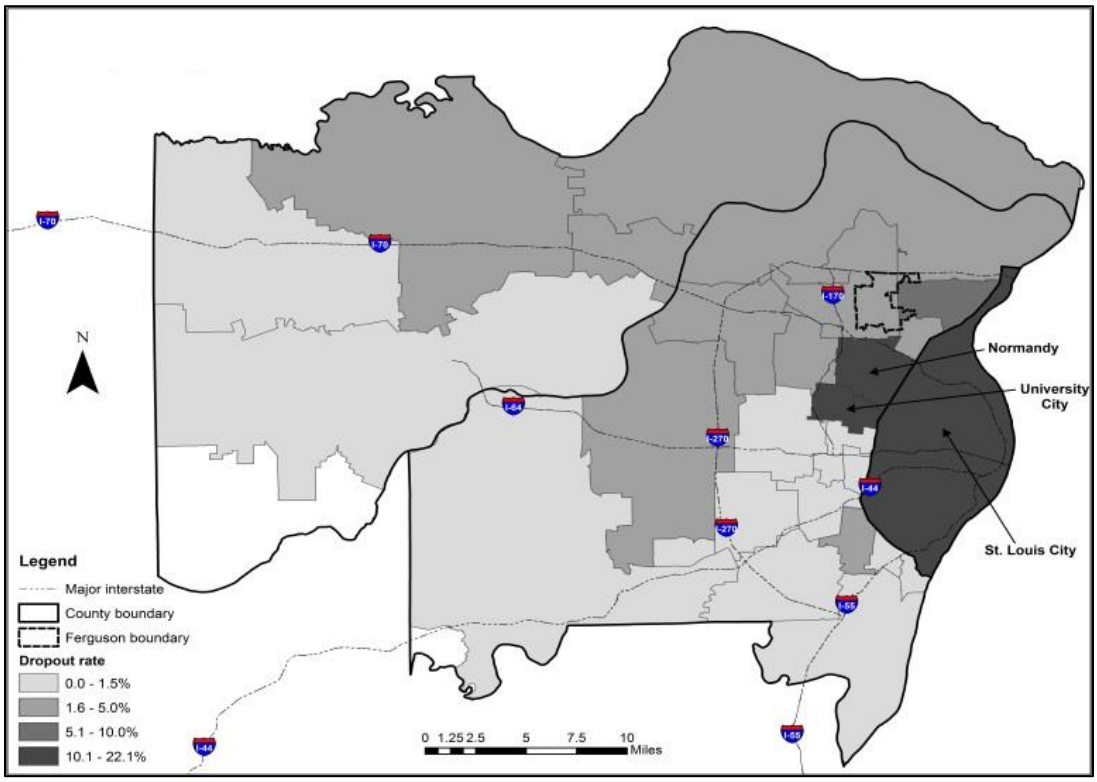

Figure 2.16 Annual dropout rate by school district in St. Louis area, 2012.
Source. Missouri Department of Elementary & Secondary Education. (2014a). District annual dropout rate [Raw data]. Retrieved from http://mcds.dese.mo.gov/quickfacts/Pages/District-and-School-Information.aspx.

Examining the geospatial distribution of high school dropout rates illuminates only part of the regional context. In 2012, over 2,000 African American ninth- through twelfth-grade students dropped out of high school in metropolitan St. Louis (Purnell, Camberos, & Fields, 2014). This figure equates to approximately one in ten African American high school students who dropped out during the academic year in the metropolitan region. In addition, this rate presents a challenge, both for educators and for health care professionals, as school dropout is linked to poor health outcomes. It has been estimated that each young person who drops out of high school will earn about $7,000 less per year than their counterparts who graduate (Purnell, Camberos, & Fields, 2014). Their lifetime earnings loss (between $347,000 to $739,410) reduces purchasing power to local businesses; lowers tax receipts; and adds to the costs of health care, social services, and unemployment assistance. Use of lost earnings, a conservative estimation approach, suggests that the 2012 regional cohort of dropouts will lose between $700 million to $1.5 billion in earnings over the course of their lifetime. Thinking about high school dropout as an annual process with related potential lifetime earnings loss puts the problem into broader perspective.

It is not only the academic achievement and high school dropout rates of students currently attending school that are important for understanding health outcomes and well-being. So, too, is the level and proportion of postsecondary educated individuals in a region. Figure 2.17 depicts the distribution of educational attainment in the region. Educational attainment in the St. Louis region was lowest in the northern areas of St. Louis County. Less than one-quarter (10.1%–22.9%) of residents in these areas had received bachelor's degrees or higher, whereas nearly three-fourths (61.4%–74.1%) of residents in central St. Louis County had received bachelor's degrees or higher. St. Louis City also had lower rates of educational attainment, with

up to only one-third (23.0%–35.7%) of its residents receiving bachelor's degrees or higher. When examined alongside the location of employers throughout the region, these data demonstrate that youth in St. Louis City are unprepared for potential jobs in the recently established biotech cluster along the central corridor.

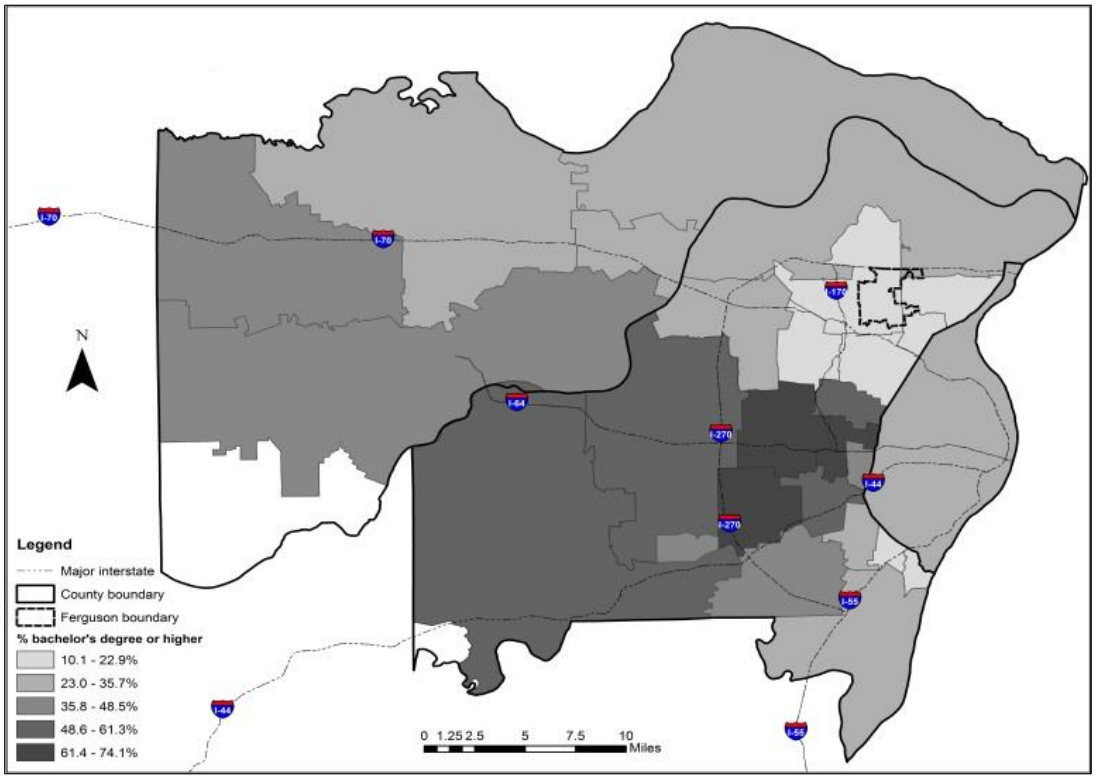

Figure 2.17 Educational attainment by school district in St. Louis area, 2012.
Source. United States Census Bureau. (2012). American Community Survey, 2008–2012 5-year estimates [Raw data]. Retrieved from http://factfinder.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t#.

2.4 Political and Health Reform Are Education Reform

The intention of the geospatial mapping and analysis was to provide visual insights into Ferguson and the surrounding St. Louis region. Focusing on economic resources, poverty, and health and education indicators, it is illustrated that the geospatial distribution of negative outcomes is consistently concentrated in the northern areas of St. Louis City and St. Louis County. The legacy of the segregation regime is that many communities located in the north St.

Louis City and north St. Louis County regions are underdeveloped and underserved. Poor communities are associated with lower levels of cognitive development and poorer health for its residents. Cognitive development and health are foundational to learning and education. Better promoting the cognitive development and health of youth in the underserved areas of the St. Louis region is vital to education reform. The inability to provide necessary supports to underserved communities is linked to the region's competitive disadvantages, which include segregation and political fragmentation. The evidence presented in this article suggests that building a healthy St. Louis region will require reversing the legacy of segregation and the related political fragmentation. Political fragmentation has helped to create underdeveloped neighborhoods and lost opportunities to foster an economically competitive region.

The authors offer two policy options that are designed to improve the education, health, and well-being of metro St. Louis residents and that are informed by the visuals in this regional case study. The most glaring regional challenge is the historical legacy of segregation. In the St. Louis region, the costs of racial segregation have accrued in the form of fiscal, social, and developmental disadvantage to individuals, families, and communities. The costs have been intergenerational, and the literature on urban segregation and opportunity indicates that the negative trajectory for the most underserved in the St. Louis metro region will not change without comprehensive and sustained interventions (Orfield, 2002; Rusk, 2013; Soja, 2010). The costs are not limited to the underserved, as the region as a whole is less prosperous and less healthy due in part to racial segregation and the related political fragmentation (Chetty, Hendren, Kline, & Sauz, 2014; OECD, 2015; Purnell, Camberos, & Fields, 2014).

2.4.1 Political Unification

If the region were united, St. Louis would move from the 58th largest city to the eighth, just ahead of Dallas. This unification would provide a foundation for improved economic viability, regional competitiveness, and health/wellness outcomes. Spatial polarization and income polarization augment each other and impede the upward mobility of residents in a region. The St. Louis metropolitan region requires a shift from its current political fragmentation to a more unified political configuration. Eradicating the socially constructed political boundaries created as a part of the segregation regime would be a major step toward creating the fiscal foundation required to improve income mobility and toward reducing regional social and income disparities (OECD, 2015; Rusk, 2013). There are no technical barriers to modifying the boundaries in the region. Every decade in the United States and in the St. Louis region, our political officials modify boundaries for congressional districts, aldermanic boards, and state legislative districts because of residential mobility and census trends. Population shifts dictate how one forms political units.

A state constitutional amendment that calls for dissolving the county functions of the city of St. Louis with the city existing as a municipality in St. Louis County would be a start. Why institute this change as a state constitutional amendment? The local political will to resolve a city and county split that has existed since 1876 is lacking. In 1962, voters rejected a consolidation plan for the city and county. More than five decades later, the political will to consolidate remains weak, despite evidence suggesting that the region would benefit from fewer municipalities. Attempts at smaller municipality mergers have failed, in part, because of government employees' concerns about unification of services and potential loss of jobs (Stokes, 2007). Some residents fear that municipal mergers would lead to school district mergers (Taylor,

2007), and others have reported that merging smaller municipalities would not generate a sufficient economy of scale required to produce savings (Stokes, 2007; Taylor, 2007). Final challenges to consolidation are related to the public finance structure. Substantial concerns exist regarding the ability to protect the county from the debts and liabilities of the city. Furthermore, a city–county merger would require new municipal organizations in the areas of public health, parks and recreations, and police and fire services (e.g., Better Together, 2015). Merging these organizations would require more than the technical expertise to reconcile budgets. Any plan concerning consolidation of municipal services would require deliberate political decisions.

The city–county merger holds the greatest promise for improving residents' health and education outcomes and for promoting regional growth. Students could choose to attend schools across city boundaries within the newly consolidated county government. Currently, state law allows students to transfer from unaccredited to neighboring accredited school districts (Tate et al., 2014). However, in their efforts to transfer out of unaccredited school districts, students face numerous hurdles. A city–county merger would create a government with the power to implement and oversee a metropolitan school choice plan.

2.4.2 Insurance Coverage

Imagine learning to read or completing a math assignment with ear pain or asthma. Picture taking a big test while experiencing a state of depression. Many students miss school, experience increased severity of illness, and remain untreated because they cannot afford a health care provider. Similar to families, educators are on the front lines of child and adolescent health. Too many students do not have health care coverage. The U.S. Census Bureau estimated that 7.6 million, or 9.7% of children under the age of 19, lacked health insurance (Todd & Sommers, 2012). St. Louis City and St. Louis County contribute more than 13,000 youth to this national

problem. Insured children perform better in school. Cohodes and colleagues (2014) reported that the expansion of public health care in the form of Medicaid reduced high school dropout rates, increased college attendance, and improved the rate of college degrees earned. Under national health care reform, the state of Missouri has an opportunity to expand Medicaid to provide health insurance to single parents who earn up to 138% of the federal poverty level, or about $25,000 for a family of three. Although the evidence suggests that Medicaid expansion should remain an important policy target for health and education reformers, attempts to expand Medicaid coverage have failed in Missouri.

2.5 Coda

Ferguson, Missouri, and the surrounding region are not doomed to a negative fate, nor are the many U.S. metropolitan regions experiencing similar conditions destined for underdevelopment. There is a need for universities, politicians, and community organizations to organize visual political literacy projects that use maps to support collective cognition related to the local challenges and opportunities for improvement (Tate & Hogrebe, 2011). Too often, addressing challenges and improving conditions for all citizens in a region come down to poor collective cognition and a lack of civic capacity and will. Policy choices and collective action have the potential to change the course of a region. Political unification and broader health insurance coverage are policy options that could potentially address the legacy of the St. Louis region's divisive regime politics. Rather than accept the current course charted by a powerful segregation regime, it is time to change course to foster a more vibrant and healthy community.

Chapter 3
Anonymity No More: Seeing Our Neighbors in Ferguson and the Implications for Social Policy[1]

3.1 Introduction

On a warm, summer day in August 2014, a police officer killed Michael Brown in Ferguson, Missouri. The media captured the ensuing civil unrest and shared it across the globe. Prior to this tragedy, Ferguson was an anonymous community, operating like many of the other communities in the St. Louis region. There was no CNN, MSNBC, Fox News, or other media coverage. In addition, unlike metropolitan Boston, Chicago, New York, San Francisco, Detroit, and Atlanta, there have been relatively few pressing reasons to engage the metro region of St. Louis as the object of study in the social sciences. These other cities and their regions hold or have held important standing as thriving metropolises. Understanding their social, political, and economic dynamics has generated a great deal of scholarly activity (Galster, 2012a; Orfield, 2002; Sampson, 2012; Tach, 2014). However, the failure to attend to regions such as St. Louis in the scholarly literature is a mistake. In 1961, the late Jane Jacobs (1992), a renowned urbanist, stated:

> [T]he qualities, necessities, advantages and behavior of great cities have been utterly confused with the qualities, necessities, advantages and behavior of other and more inert settlements. There is nothing economically or socially inevitable about either the decay of old cities or the fresh-minted decadence of the new unurban urbanization. On the

[1] A version of this chapter was submitted for publication to the journal *Educational Researcher* as follows: Tate, W. F., & Jones, B. D. (under review). *Anonymity no more: Seeing our neighbors in Ferguson and the implications for social policy.*

contrary, no other aspect of our economy and society has been more purposefully manipulated for a full quarter century to achieve precisely what we are getting. (pp. 6–7)

Jacobs makes two important points. First, she notes that cities are not the same. Second, Jacobs reminds us that urban living conditions are designed and developed, and even manipulated. Ferguson and the greater St. Louis metropolitan region are not an accident of random chance; rather, the region is a product of intentional design conceived in the form of policies, practices, and folkways. Yet, beyond journalistic depictions of the city and its surrounding region, there is little in the way of scholarship about the political economy of the region and how that has influenced the education, health, and well-being of Black youth in the community (e.g., Portz, Stein, & Jones, 1999; Stone, Henig, Jones, & Pierannunzi, 2001; Wells & Crain, 1997). This article is a response to this void.

Several questions guided this investigation and reporting. How did policies, practices, and folkways help to create the conditions in Ferguson and the surrounding St. Louis metropolitan region? The first section of this article provides a brief contextualization of the St. Louis segregation regime as a frame to interpret the current state of affairs. Ferguson is viewed as an archetype of structural inequality and segregation. What is the current state of affairs for Black youth in the region? This question is examined in the second section using social epidemiology and geospatial analysis. The aim is to see our neighbors in Ferguson and its surrounding areas with a specific focus on factors contributing to regional decay. For too long this community and others like it have been anonymous. Visualizing the conditions in a region is not sufficient. Why is it difficult to have empathy for these communities and its young people? The third section is a brief review of science and social science studies that offer insight into the challenges of seeing our neighbors as humans and worthy of empathy. These insights

are required if social change is to occur. The final section offers several recommendations for durable, intergenerational social policy and practice.

3.1.1 Regional Context

To fully understand St. Louis, it is important to remember that it has many positive attributes and risks. On many metrics, the St. Louis region ranks among the best metropolitan areas in the United States. It boasts one of the lowest costs of living among urban metropolitan regions (St. Louis Regional Chamber, 2015). The city has more museums and libraries per capita than does New York City or Washington, D.C. (Maasen, 2012). The non-profit arts industry spending and volunteers for the arts in markets with populations over one million is top ranked. *Fortune* ranked the area at the top of its list for fastest-growing cities for technology jobs (Fisher, 2013). Biotechnology is a regional strength with the Cortex Innovation Community serving as home to a technology district integrated into an historic neighborhood, surrounded by nationally ranked biological, biomedical, and public health academic departments and medical centers. A Brookings Institution report characterized Cortex as part of a new geography of innovation in America:

> Innovation districts represent a radical departure from traditional economic development. Unlike customary urban revitalization efforts that have emphasized the commercial aspects of development (e.g., housing, retail, sports stadiums), innovation districts help their city and metropolis move up the value chain of global competitiveness by growing the firms, networks, and traded sectors that drive broad-based prosperity. Instead of building isolated science parks, innovation districts focus extensively on creating a dynamic physical realm that strengthens proximity and knowledge spillovers. Rather than focus on discrete industries, innovation districts represent an intentional effort to create

> new products, technologies and market solutions through the convergence of disparate sectors and specializations (e.g., information technology and bioscience, energy, or education). (pp. 1–2)

Cortex represents the new St. Louis, an urban design built on a promising vision of geography and science. The innovation regime, however, is inseparable from the segregation regime's legacy of disinvestment in the Black community. Stone (1989) conceptualized a regime as a coalition of local governments and one or more private groups or classes, which provide strategic guidance and resources for elected officials. He theorized that local governments lacked the capacity to govern without entering into a regime. This framing is aligned with how the innovation district developed recently and how over decades elected officials and private groups operated to create and to maintain residential segregation in metropolitan St. Louis. Cummings (2004) argued that the regional disparities in economic development have created a geospatial mismatch between St. Louis residents and suburban industrial clusters where job opportunities are being created. This claim remains accurate for the most part, yet should be amended. Cortex is located in St. Louis City in an area transformed by the segregation regime's strategy of urban renewal (Gordon, 2008). Cortex is where the new vision meets the old segregation regime.

The St. Louis segregation regime's practices and the related disparate impact on residential housing have been chronicled. For example, Gordon's (2008) geospatial history project focused on St. Louis. It documented how federal policy and policymakers; local government officials; and private sector organizations, such as realtors, churches, banks, and neighborhood associations, worked collaboratively to manipulate Black families' access to quality housing. Black families were removed from communities viewed as more appropriate

for White families. Many of these families were directed to segregated public housing and segregated neighborhoods. Blacks' opportunities to secure residential housing and to benefit from the related services, such as education and health care in the region, were regulated by the segregation regime.

Annexation was used to secure unincorporated, predominately Black communities regarded as too close to White communities (Rothstein, 2014). Annexed properties were subject to the taxing authority of the new municipality. Exposed to new financial burdens created by higher taxes, many Black residents were placed in financial distress and with alternatives limited to segregated neighborhoods. Alternatives included neighborhoods designed based on racially explicit zoning regulations or segregated public housing. Throughout the St. Louis region, predominately Black and segregated communities experienced denial or limited delivery of municipal services, such as trash collection, street lighting, and emergency response. Unfair and disparately distributed, these unhealthy conditions reinforced racial stereotypes about Black neighborhoods and fueled White flight.

White flight and the depopulation of St. Louis City accelerated after 1970. The population decreased by almost 170,000 by the 1980 census and by more than 100,000 by 2000 (Gordon, 2008). With each new census, the city's population decreased from a post-World War II peak in 1950 at just over 850,000 to an estimated 317,000 in 2014 (United States Census Bureau, 2015). Fleeing the city and the inner-ring suburbs as well, White residents moved further west and created a new color line that stretched west of the city to encompass large portions of near northeast St. Louis County, including Ferguson. This created a large void in the tax base of Ferguson and of other small, at-risk suburban communities experiencing depopulation.

The city of Ferguson is located 10 miles northwest of the Cortex Innovation District. However, Ferguson is not a magnet for technology innovation. Instead, Ferguson generates revenue by increasing municipal fines and fees annually and encouraging police and court officials to secure these revenue increases and to monitor whether the gains are attained (United States Department of Justice, 2015). In Ferguson, two-thirds of the population is Black, yet Blacks account for 85% of automobile stops, 90% of tickets and citations, and 93% of arrests. The U.S. Department of Justice found that disparate impact of policing and related revenue-generating enforcement practices on Blacks increased by 48% when based on officers' judgment, rather than technology, including radar or laser. The Department of Justice concluded that this artifact of the segregation regime fostered a community divide and a lack of confidence in local public officials.

Rodden (2014) espoused a different argument about the challenges in Ferguson. He contended that a central problem in Ferguson and in many of the other north suburban St. Louis municipalities is not the historical legacy of residential segregation. Rodden argued that many of these communities are relatively heterogeneous in terms of residential housing. He stated that Ferguson served as a point of entry for Blacks living in segregated north St. Louis City and seeking single-family homes, better schools, and safety from crime. In addition, Rodden indicated that while isolated poverty and Section 8 housing dominate the media coverage, there is a resilient Black middle class in the city. He acknowledged the out-migration of a large number of Whites to homogeneous St. Charles County to the west over the past four decades, yet he concluded that many White families have remained. He theorized that the foundational challenge is asymmetrical representation on the police force, in local government, and on school boards—a problem he attributes to the status quo of the 1980s and low Black voter turnout in

mid-term elections. There are no shortage of theories about the challenges facing Ferguson and the St. Louis region. What is clear is that the history of the segregation regime and its legacy require visible steps of change if improvement is to be realized. A step toward change is to see the community in clearer terms.

3.2 Data Sources and Methodology

It has been argued that epidemiology and education research have for too long operated in a disjointed and disconnected fashion (Tate, Hamilton, Jones et al., 2014). The findings presented in this article are part of a larger social epidemiological case study of the St. Louis metropolitan region (Tate, 2012; Tate, Hamilton, Jones et al., 2014; Tate, Hamilton, Robertson et al., 2014). Social epidemiology focuses particularly on the influences of social-structural factors on states of health and well-being (Honjo, 2004). While many branches of epidemiology begin analysis at the biological level, social epidemiology assumes that the distribution of advantages and disadvantages in society is reflected in the distribution of health, development, and well-being. Sound evidence supports this assumption in the distribution of education-related outcomes (Duncan & Murnane, 2011; Tierney, 2015). An important risk factor in education and health is residential segregation and the associated geographic concentration of poverty (Kramer & Hogue, 2009; Williams & Collins, 2001). Residential segregation is influential in determining the social distribution of education, health, and developmental outcomes.

Figure 3.1 illustrates a sequence through which racial segregation develops and influences life-course factors, including education and health. A sequence model implies causality and, therefore, is time-based in character. In this article, the intent is neither to confirm, nor disaffirm causality; rather, the aim is to depict how processes operate with one another and to provide a very general sense of order. The processes in this model are consistent

with other conceptual frames of urban segregation patterns (e.g., Galster, 2012; Johnson, 2012; Massey & Denton, 1993). A second aim of this study is to use the model as a conceptual and organizational frame for the geospatial analysis of of residential segregation, education, and health in metropolitan St. Louis.

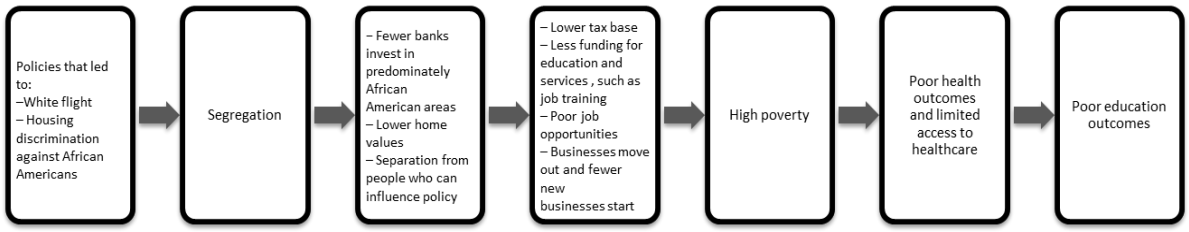

Figure 3.1 Pathway by which racial residential segregation leads to poor education outcomes.
Note. Adapted from Anderson, E., & Jones, J. (2002). The geography of race in the United States. Retrieved from http://www.umich.edu/~lawrace.

In this social epidemiological case study, the sequence model in Figure 3.1 guides variable selection. Geographic Information Systems (GIS) mapping is used as an analytical strategy to interpret information from multiple data sources, including the U.S. Census Bureau American Community Survey and ZIP Code Business Patterns, Missouri Department of Elementary & Secondary Education Missouri Comprehensive Data System (MCDS), and the Missouri Department of Health & Senior Services Missouri Information Community Assessment (MICA). Table 3.1 provides a summary of constructs and a brief description of the relevance of each construct to this social epidemiological case study.

Table 3.1 Data Sources

Construct	Data Source(s)	Significance for Study
Percentage Black residents	U.S. Census Bureau, 2009–2013 5-Year American Community Survey (ACS), 2014	Points to the racial segregation associated with discriminatory housing policies and practices in St. Louis and in other U.S. metropolitan regions (Galster, 2012; Gordon, 2008; Johnson, 2012)
Home values	U.S. Census Bureau, 2009–2013 5-Year ACS, 2014	Reflect neighborhood wealth, resources, and ability to support local primary and secondary education (Kent & Sowards, 2009; Kenyon, 2007)
Per pupil funding	Missouri Department of Elementary and Secondary Education (DESE), 2014	Reflects, in part, neighborhood wealth, resources, and ability to support local primary and secondary education (Kent & Sowards, 2009; Kenyon, 2007)
Number of business establishments	U.S. Census Bureau, 2013 ZIP Code Business Patterns, 2015	Indicates employment and, more broadly, economic opportunity for local residents; spatially mismatched with urban populations in major metropolitan regions (Li, Campbell, & Fernandez, 2013; Stoll, 2005)
Annual business payroll	U.S. Census Bureau, 2013 ZIP Code Business Patterns, 2015	Indicates degree of developmental disparities in a metropolitan region; pertaining specifically to black-owned businesses, inversely related to negative youth outcomes (Cummings, 2004; Parker, 2015)
Poverty	U.S. Census Bureau, 2009–2013 5-Year ACS, 2014	Strongly associated with various health and education outcomes (Berliner, 2006; Berliner, 2009)
Preterm births	Missouri Information for Community Assessment (MICA), 2015	Associated with maternal educational attainment and children's future cognitive ability and education outcomes (Berliner, 2009; Williams et al., 2013)
Low birth weight	MICA, 2015	Associated with maternal educational attainment and children's future cognitive ability and education outcomes (Berliner, 2009; Hernandez & Napierala, 2014; Reichman, 2005)
Childhood otitis media (OM)	MICA, 2015	Among U.S. children, most commonly diagnosed illness, which frequently occurs during the critical early years; related to hearing loss, which may affect language development and early learning and academic performance (Casby, 2001; Racanello & McCabe, 2010; Roberts et al., 2004; Winskel, 2007)
Childhood asthma	MICA, 2015	Among U.S. children, most prevalent chronic disease, which disproportionately affects youth in poor, urban communities (Basch 2011a, 2011b); the primary contributor to school absences in the U.S. (Claudio, Stingone, & Godbold, 2006; Eggleston et al., 1998)
Childhood mental health disorders	MICA, 2015	Associated with various education outcomes, such as academic performance and school suspension rates (Berliner, 2009; Purnell, Camberos, & Fields, 2014)
Health insurance coverage	U.S. Census Bureau, 2009–2013 5-Year ACS, 2014	Demonstrated to improve education outcomes (Berliner, 2009; Cohodes, Grossman, Kleiner, & Lovenheim, 2014; Levine & Schanzenbach, 2009)
Third-grade literacy attainment	DESE, 2014	Strongly predicts future developmental outcomes, such as academic performance, high school completion, and labor market success (Fiester, 2010; Lesnick, Goerge, Smithgall, & Gwynne, 2010)
Dropout rates	DESE, 2014	Associated with future developmental outcomes, including employment opportunities, poverty, crime, and health (Purnell, Camberos, & Fields, 2014; Sum, Khatiwada, McLaughlin, & Palma, 2009)
Educational attainment	U.S. Census Bureau, 2009–2013 5-Year ACS, 2014	Strongly predicts future developmental outcomes, such as employment and economic opportunities and health, across familial generations (Purnell, Camberos, & Fields, 2014)

A limitation of our approach is that the analysis is descriptive and focuses on a cross-section of time. GIS mapping is used to investigate the ecological environment of the case through an understanding of community data sources as geospatial distributions.

3.3 Geospatial Distributions

3.3.1 Black Residents

The city of St. Louis is classified as a county equivalent jurisdiction. It is one of 106 counties in the United States where the population identified as Black alone-or-in-combination comprised 50 percent or more of the county population (Rastogi, Johnson, Hoeffel, and Drewery, 2011)[2]. The city of St. Louis was the exception in this group of counties, in that all others were located in the South. From 2009–2013, the proportion of Black residents in communities across the St. Louis metropolitan region differed substantially (see Figure 3.2). As in previous years, Black residents were concentrated predominately in census tracts in northern St. Louis City and northern St. Louis County (Gordon, 2008). Black individuals composed 74–100% of the population in the majority of northern St. Louis City and southern Ferguson census tracts. In contrast, less than 8% of the population was Black in most communities in southern and western St. Louis County and in neighboring St. Charles County.

[2] The Black alone-or-in-combination population reflects the maximum number of people reporting Black on the U.S. Census, as it combines respondents reporting Black alone and those who reported Black in combination with other races. In the remainder of the article, if we use the term *Black* in a geospatial analysis, it reflects Black alone.

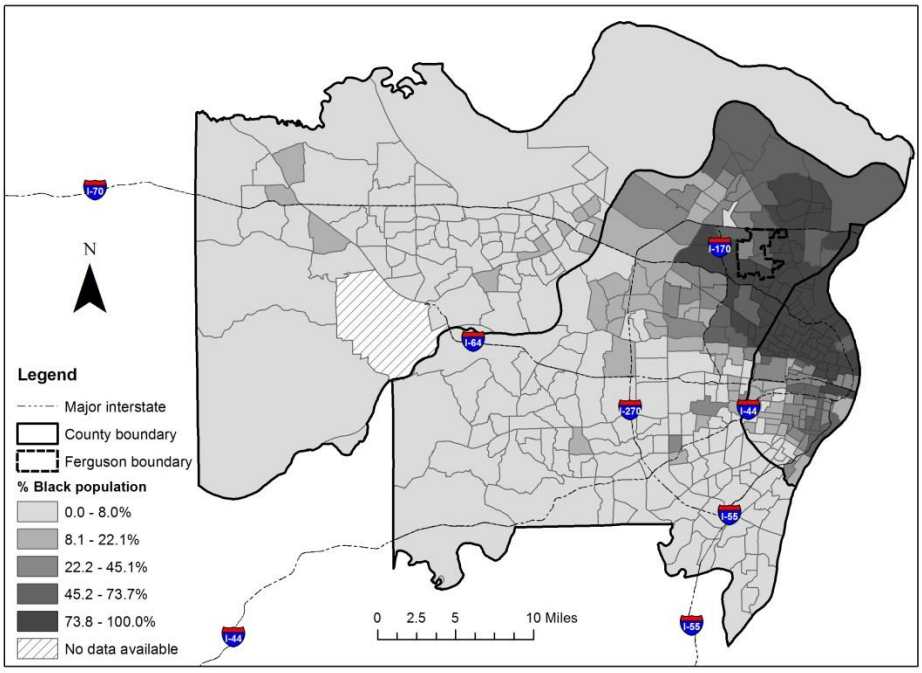

Figure 3.2 Distribution of Black residents across the St. Louis region, 2009–2013.
Note. Data were retrieved from http://factfinder.census.gov/.

3.3.2 Economic Resources

The four maps in Figures 3.3–3.6 depict the distribution of economic resources throughout the St. Louis metropolitan region. Home values are an important indicator of neighborhood wealth, resources, and ability to support local primary and secondary education (Kent & Sowards, 2009; Kenyon, 2007). As illustrated in Figure 3.3, the percentage of owner-occupied homes valued at $150,000 or greater varied considerably across the St. Louis area from 2009–2013.

In zip codes in north St. Louis City and in near north suburbs, including Ferguson, less than one-fifth of homes were valued at $150,000 or greater. In contrast, approximately 80–100% of homes in zip codes in western St. Louis County and St. Charles County had a value of at least $150,000. When examined in light of Black residents' concentration in north St. Louis City and

north St. Louis County, this pattern suggests a racial disparity in wealth accrued through homeownership. Further, the pattern reflects the regional history of discriminatory policies and practices targeting Black residents.

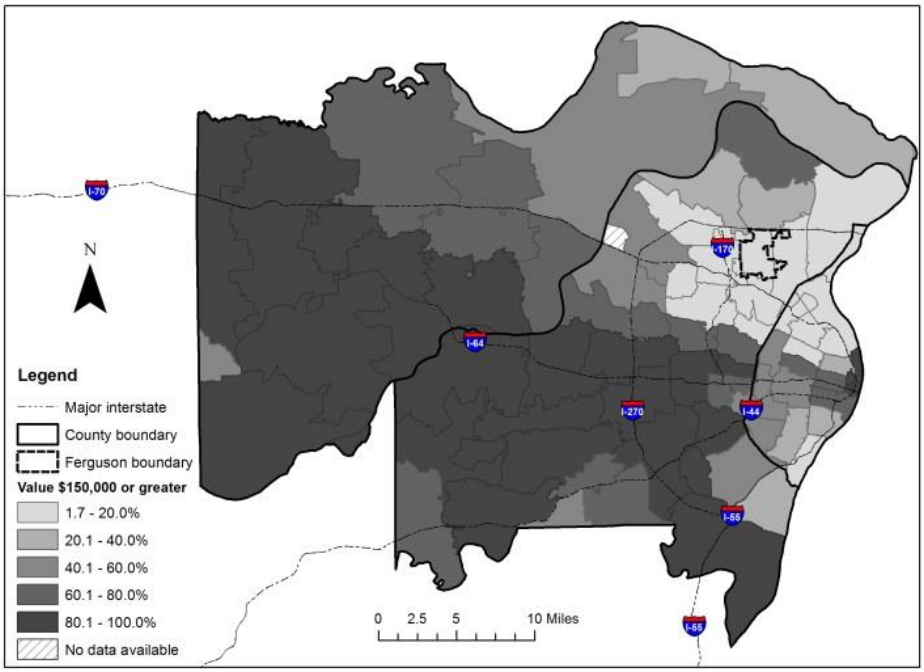

Figure 3.3 Home values by zip code in the St. Louis region, 2009–2013.
Note. Data were retrieved from http://factfinder.census.gov/.

Figure 3.4 reflects the distribution of school district per pupil expenditures, another indicator of neighborhood economic resources and ability to invest in educational resources for local youth (Kent & Sowards, 2009; Kenyon, 2007). Per pupil spending ranged from $7,920 in the Bayless School District in southern St. Louis County to $17,722 in the Clayton School District located immediately west of St. Louis City. Most regional school districts, including some in which a majority of homes had a value of $150,000, spent less than $12,500 per student

in 2013. In the St. Louis Public Schools (SLPS) District, per pupil expenditures totaled $14,376. It is noteworthy that this total includes expenses associated with district special education services. School districts in St. Louis County participate in the Special School District of St. Louis County, a consortium that provides special education services at an economy of scale.

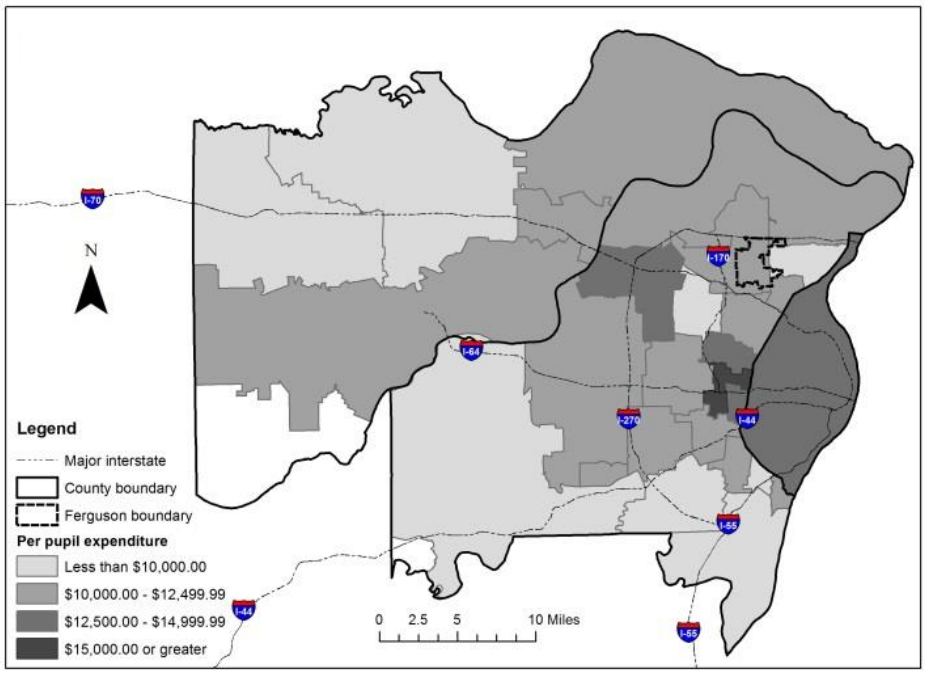

Figure 3.4 Per pupil funding by school district in the St. Louis region, 2013.
Note. Data were retrieved from http://mcds.dese.mo.gov/Pages/default.aspx.

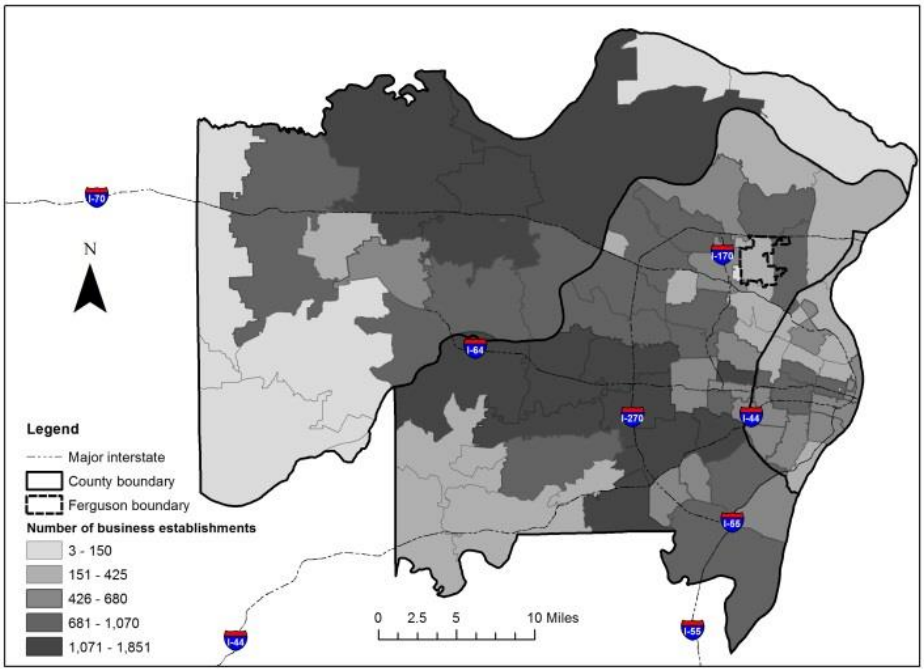

Figure 3.5 Number of business establishments by zip code in the St. Louis region, 2013.
Note. Data were retrieved http://factfinder.census.gov/.

Figure 3.5 illustrates the distribution of business establishments across the metropolitan region in 2013. The number of businesses per zip code ranged widely from 3–1,851. Zip codes with the greatest number of business establishments were located primarily in northern St. Charles County and along Interstate 64 in western St. Louis County. It is important to recall the relatively low percentage of Black residents in these areas. Comparatively few businesses were located in zip codes in Ferguson, north St. Louis City and the sparsely populated westernmost and easternmost parts of St. Charles County. The average nearest neighbor tool in the Spatial Analyst Extension of ArcMap 10.2.2 (Environmental Systems Research Institute [ESRI], 2014) was used to determine if the total number of business establishments exhibited statistically significant clustering or dispersal across the region. The tool was used to estimate the nearest

neighbor index (NNI), a measure of clustering, to determine the distribution of the regional businesses. If the NNI is less than 1, the pattern exhibits clustering; if the NNI is greater than 1, the pattern exhibits dispersal. Results of the analysis revealed that the businesses exhibited a statistically significant level of dispersal across the region (NNI = 1.22; Z-score = 4.10, $p < 0.001$). The Z-score and its associated *p*-value support rejection of the hypothesis that this dispersed pattern could be attributed to random chance.

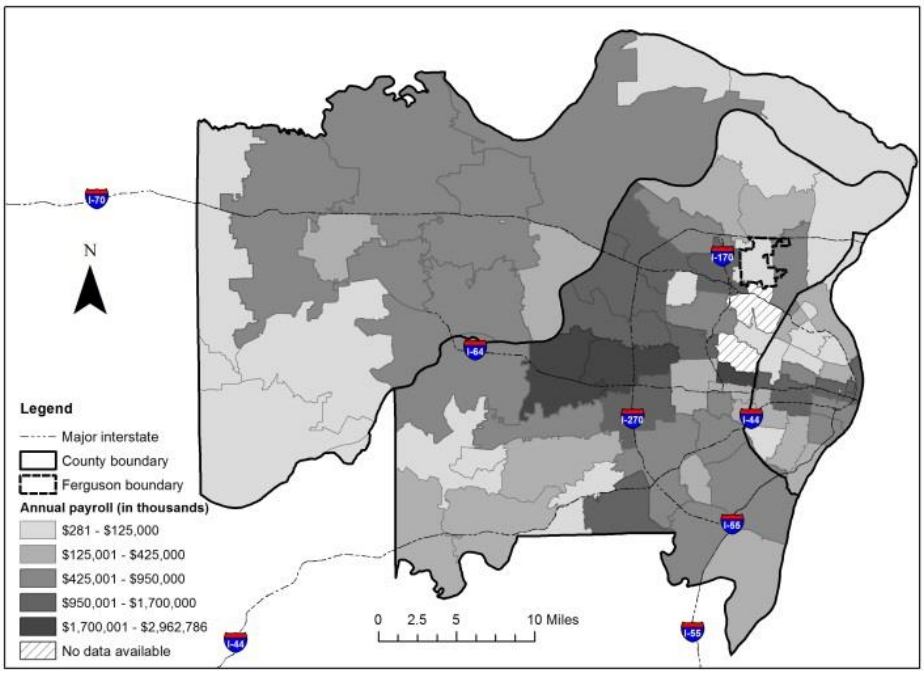

Figure 3.6 Annual business payroll by zip code in the St. Louis region, 2013.
Note. Data were retrieved http://factfinder.census.gov/.

Although the NNI indicated that businesses were dispersed across the region, Figure 3.6 suggests a geographic disparity related to ability to invest in the local community. Similar to the number of businesses, annual business payroll by zip code differed extensively and ranged from $280,000 to $3 billion across the St. Louis metropolitan region. Annual business payroll was highest in several zip codes in western St. Louis County and along the central corridor of St. Louis City. In contrast, businesses with the lowest annual payroll totals were located in zip codes in Ferguson, northern St. Louis City, and St. Charles County. Black residents comprised a sizable proportion of the population of these areas, excluding western and eastern St. Charles County.

3.3.3 Poverty

As the segregation–education model in Figure 3.1 suggests, economic disinvestment and limited economic opportunities for local citizens may contribute to high community poverty levels. The map in Figure 3.7 illustrates the geospatial distribution of the population living in poverty by census tract across the St. Louis area. From 2009–2013, a cluster of census tracts in northern St. Louis City and near northern suburbs had some of the highest poverty rates. Recall that in most of these areas, the Black population was comparatively high, while home values, number of businesses, and annual business payroll were relatively low. Several census tracts along the Missouri–Illinois line in eastern St. Louis City had poverty rates between 40.7–63.2%. In contrast, the majority of census tracts in St. Charles County and in southern and western St. Louis County had poverty concentrations below 14.8%.

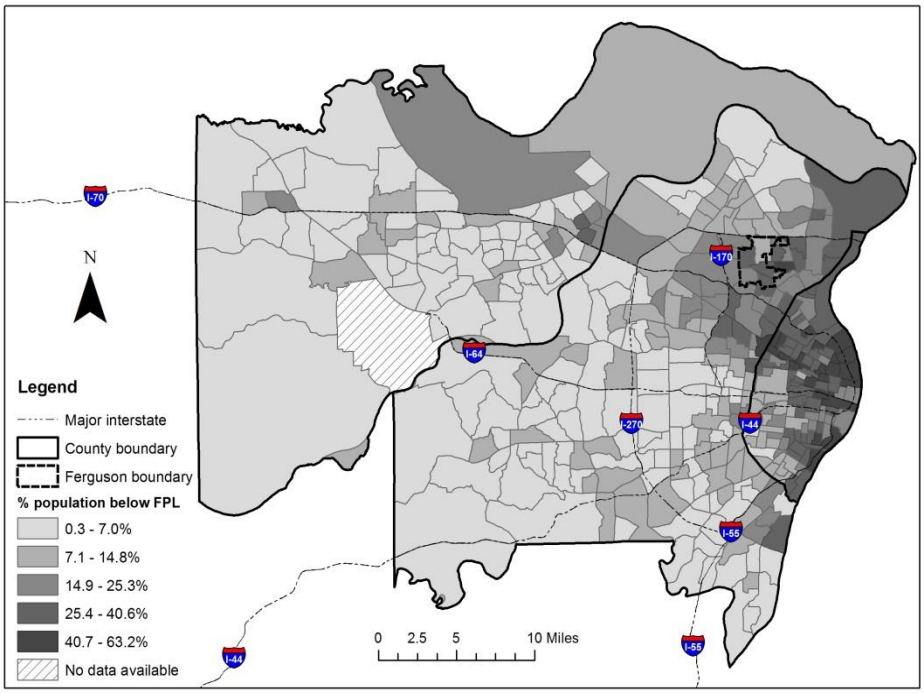

Figure 3.7 Distribution of impoverished population across the St. Louis region, 2009–2013.
Note. Data were retrieved http://factfinder.census.gov/.

3.3.4 Health and Developmental Outcomes

Preterm birth and low birth weight (LBW) rates are two important indicators of maternal educational attainment and of children's future cognitive ability and education outcomes (Berliner, 2009; Hernandez & Napierala, 2014; Williams et al., 2013). Low maternal educational attainment is associated with poor health, and women with poor health have an increased risk of delivering preterm and LBW babies. Preterm birth and LBW, in turn, may increase children's risk of impaired cognitive development, learning ability, and future academic achievement.

Across the St. Louis metropolitan region, the preterm birth rate ranged from 0–34.5% in 2013 (see Figure 3.8). Several zip codes in northern St. Louis City and in nearby northern

suburbs, including Ferguson, had relatively high preterm birth rates. Preterm birth rates were lowest in St. Charles County and in southern and western St. Louis County. As Figure 3.9 indicates, LBW rates were also highest in zip codes throughout St. Louis City and in several near northern suburbs. In one of these zip codes, the LBW rate was approximately 20%. In the city of Ferguson, the rate was 15.5% in 2013. Similar to the proportion of preterm births, that of LBW was relatively low throughout St. Charles County and the majority of St. Louis County.

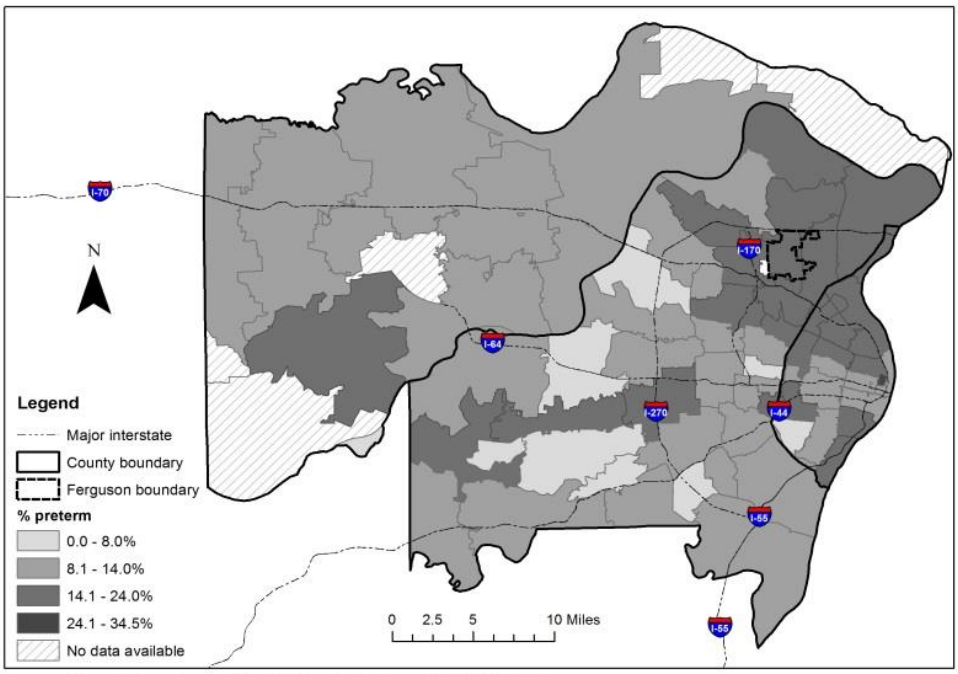

Figure 3.8 Preterm birth rate by zip code across the St. Louis region, 2013.
Note. Data were retrieved http://health.mo.gov/data/mica/BirthMICA/.

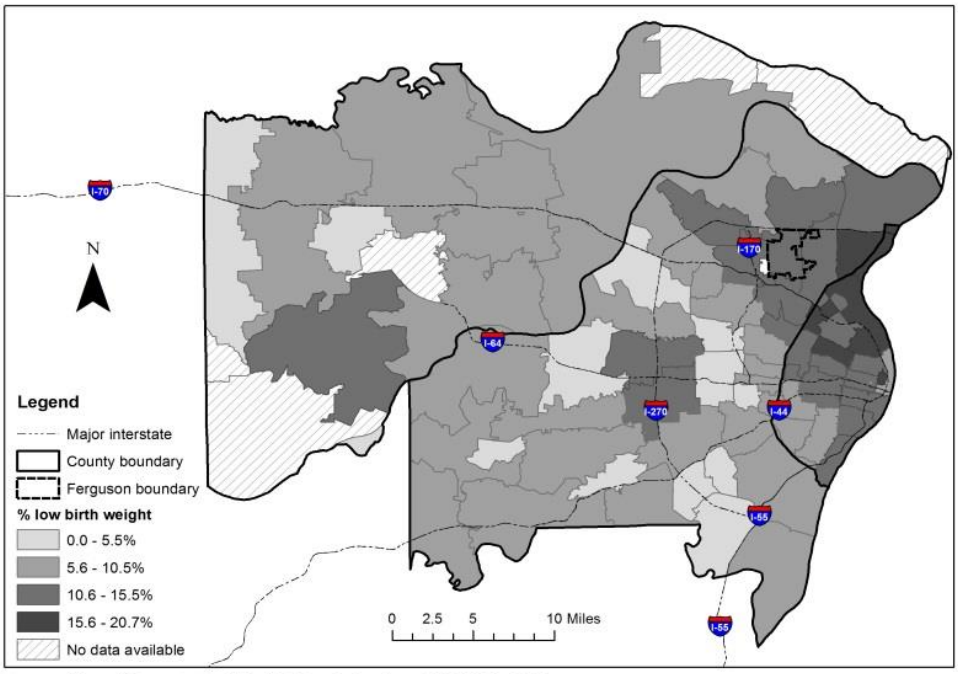

Figure 3.9 Low birth weight rate by zip code across the St. Louis region, 2013.
Note. Data were retrieved http://health.mo.gov/data/mica/BirthMICA/.

Frequently occurring during the critical early years, otitis media (OM), or infection of the middle ear, is the most commonly diagnosed illness among U.S. children (Roberts et al., 2004). Without immediate treatment, OM may contribute to mild to moderate conductive hearing loss and, thus, adversely affect children's language development and early learning ability (Casby, 2001; Racanello & McCabe, 2010; Winskel, 2007). As Figure 3.10 illustrates, the percentage of emergency room (ER) visits attributable to OM among St. Louis children was highest in zip codes located primarily throughout St. Louis City and northern St. Louis County. Two sparsely populated zip codes in St. Charles County also had relatively high proportions of OM-related ER visits among children. This proportion was lowest in communities in western St. Louis County and in adjoining St. Charles County.

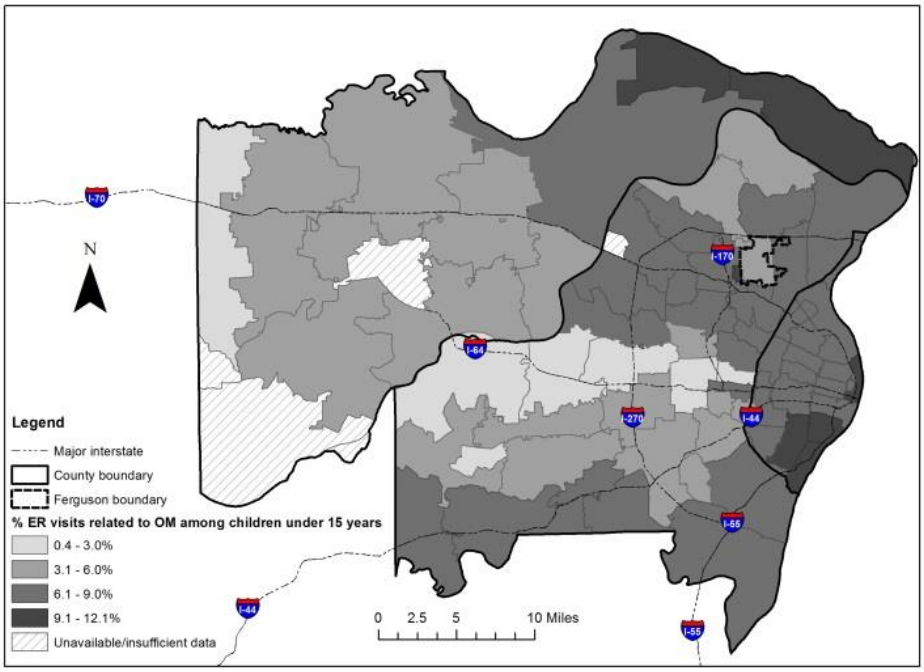

Figure 3.10 Child emergency room visit rates related to otitis media
by zip code across the St. Louis region, 2013.
Note. Data were retrieved from http://health.mo.gov/data/mica/EmergencyRoomMICA/.

Similar to the percentage of ER visits related to OM, the proportion attributable to asthma among children distinctly differed across the St. Louis metropolitan region (see Figure 3.11). Excluding a low-population outlier in northeastern St. Charles County, the majority of zip codes with the highest percentages of asthma-related, child ER visits was located in northernmost St. Louis City and St. Louis County. This group included zip codes in Ferguson. A cluster of zip codes along Interstate 64 in western St. Louis County and in central St. Charles County had the lowest proportions of asthma-related ER visits among children. Among all children in the U.S., asthma is the most commonly diagnosed chronic disease and the main reason for absences among school-aged children (Basch, 2011a, 2011b). In addition, the disease disproportionately affects children of color in poor, urban areas (Claudio, Stingone, & Godbold, 2006; Eggleston et

al., 1999). The high proportions of asthma-attributable ER visits among children in predominately Black and poor St. Louis communities align with this evidence.

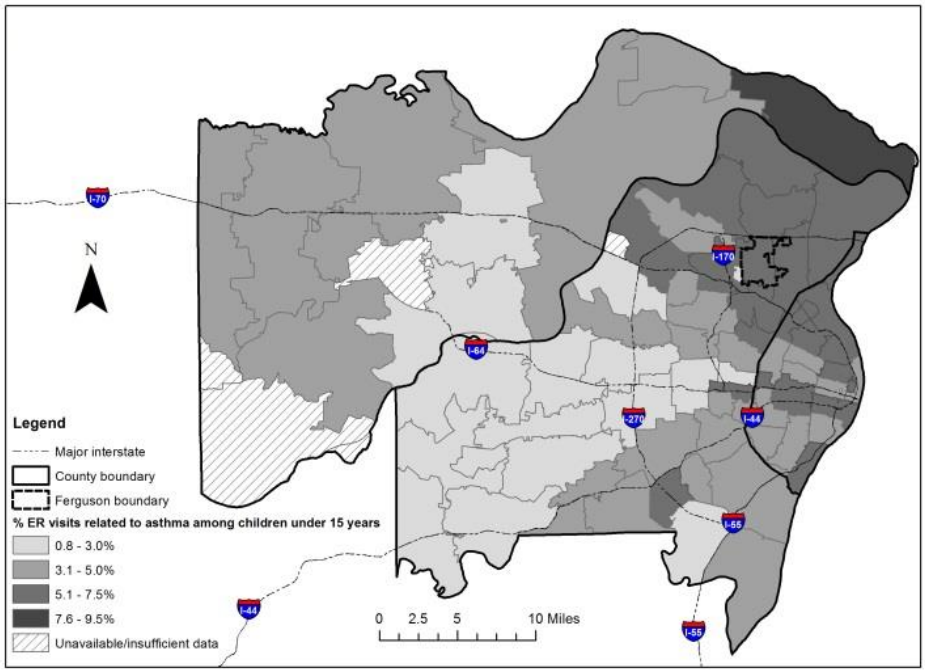

Figure 3.11 Child emergency room visit rates related to asthma by zip code across the St. Louis region, 2013.
Note. Data were retrieved from http://health.mo.gov/data/mica/EmergencyRoomMICA/.

As depicted in Figure 3.12, the percentage of child ER visits related to mental health disorders was less than 2% in most zip codes in the St. Louis area. Several zip codes in northern St. Louis County had the lowest proportions (0–1%) of mental health ER visits. Conversely, the highest proportions were in one zip code in St. Charles County and in a few dispersed throughout central and southern St. Louis County. In at least one of these zip codes, the percentage of mental health ER visits was as high as 4.3%.

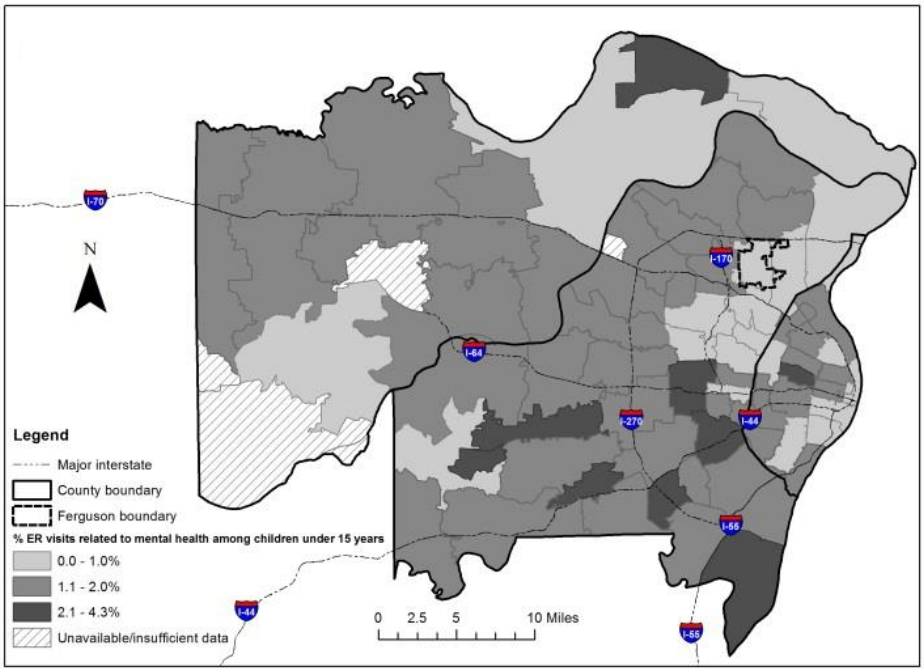

Figure 3.12 Child emergency room visit rates related to mental health disorders by zip code across the St. Louis region, 2013.
Note. Data were retrieved from http://health.mo.gov/data/mica/EmergencyRoomMICA/.

Research suggests that health insurance coverage may improve various education outcomes (Berliner, 2009; Cohodes, Grossman, Kleiner, & Lovenheim, 2014; Levine & Schanzenbach, 2009). Figure 3.13 demonstrates that health insurance coverage varied considerably across the St. Louis metropolitan area. From 2009–2013, zip codes in central and western St. Louis County had the lowest percentages of children without health insurance. In contrast, several zip codes throughout St. Louis City and in northern St. Louis County had comparatively high percentages of uninsured children.

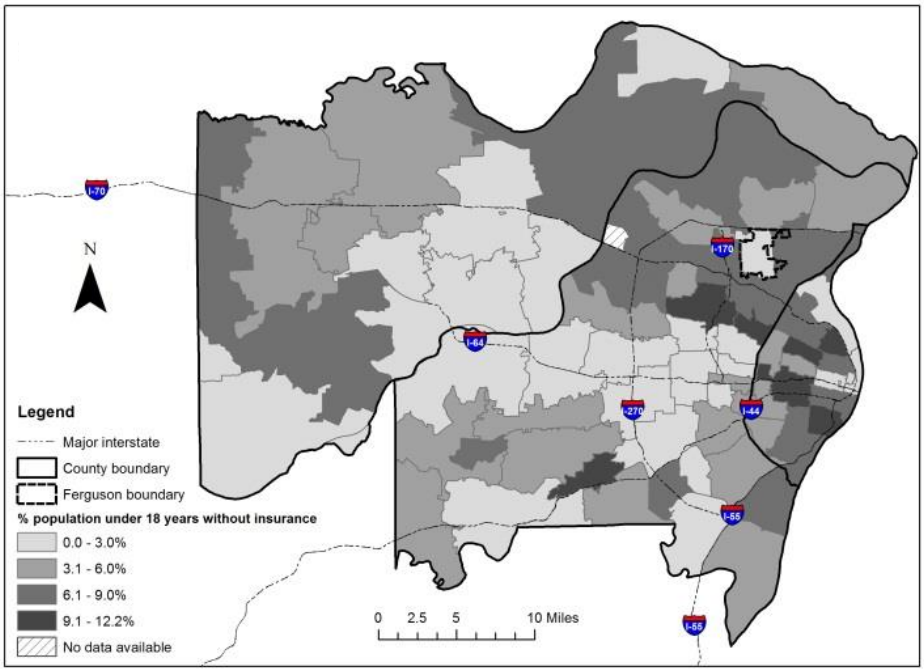

Figure 3.13 Child health insurance coverage by zip code
across the St. Louis region, 2009–2013.
Note. Data were retrieved from http://factfinder.census.gov/.

3.3.5 Education Outcomes

Each year in Missouri public schools, students enrolled in grades 3 to 8 complete respective grade-level English Language Arts (ELA) Missouri Assessment Program (MAP) assessments (Missouri Department of Elementary & Secondary Education, MO DESE, 2014). The map in Figure 3.14 indicates a stark, geospatial variation in third-grade students' literacy attainment in 2013. Across regional school districts, the percentage of students attaining Proficient or Advanced status on the ELA MAP test varied from 14.4–73.6%. Districts with the highest proportions of students achieving proficiency were mostly located in southern and western St. Louis County and in adjoining St. Charles County. No greater than 45% of students in SLPS and in several near northern districts achieved proficiency or Advanced status. In the

Ferguson-Florissant district, to which the majority of school-aged Ferguson residents are assigned, only 35% of third-grade students were considered proficient or advanced in ELA attainment. Moreover, the geospatial location of districts with relatively low third-grade literacy attainment overlaps that of majority-Black, high-poverty communities in the St. Louis metropolitan region. These results are disturbing, as third-grade literacy attainment strongly predicts future education outcomes, including academic performance in secondary school and high school completion (Fiester, 2010; Lesnick, Goerge, Smithgall, & Gwynne, 2010).

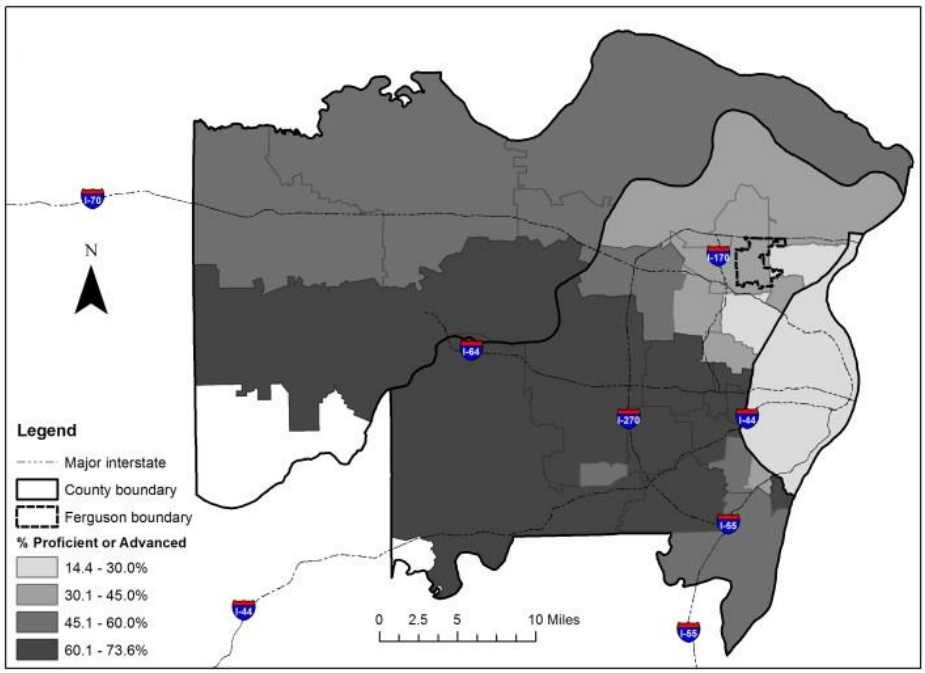

Figure 3.14 Third-grade literacy attainment by school district across the St. Louis region, 2013.
Note. Data were retrieved from http://mcds.dese.mo.gov/Pages/default.aspx.

As Figure 3.15 demonstrates, three regional school districts led the nation in elementary school suspension rates. During the 2011–2012 school year, suspensions in the St. Louis City, Normandy, and Riverview Gardens districts combined accounted for 72% of all elementary school suspensions nationwide (Losen, Hodson, Keith, Morrison, & Belway, 2015). Nearly 30% of all nationwide elementary school suspensions occurred in the St. Louis City district alone. Black students comprise the majority of the student population in each of the three districts.

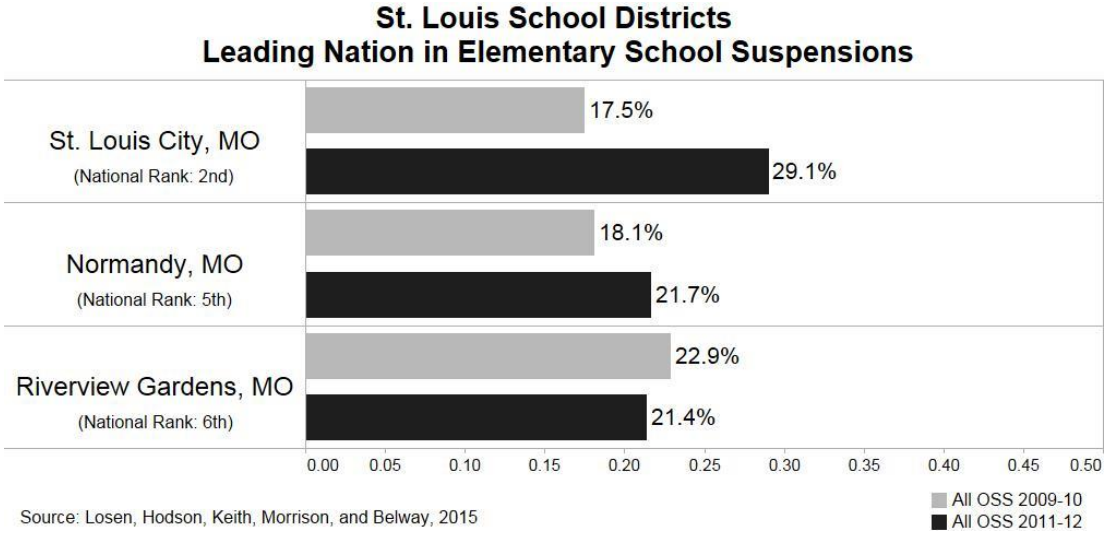

Figure 3.15 St. Louis area school districts with highest elementary school suspension rates.
Note. OSS = out-of-school suspensions.

Failure to complete a high school education is associated with economic distress, poor health outcomes, and premature death in adulthood (Purnell, Camberos, & Fields, 2014). Each year in the region, thousands of Black ninth-through-twelfth grade students drop out during the academic year. In most area school districts, less than 4% of students dropped out of high school during the 2013 academic year (see Figure 3.16). In the Ferguson-Florissant district, the dropout rate was 5%. Nearly 10% of students dropped out of high school in the St. Louis City school

district. As in previous years, the dropout rate in neighboring Normandy school district was greater than 20%. Each of these school districts serves majority-Black communities in the St. Louis area. Thus, the pattern of comparatively high dropout rates in these districts aligns with the trend of regional racial disparities.

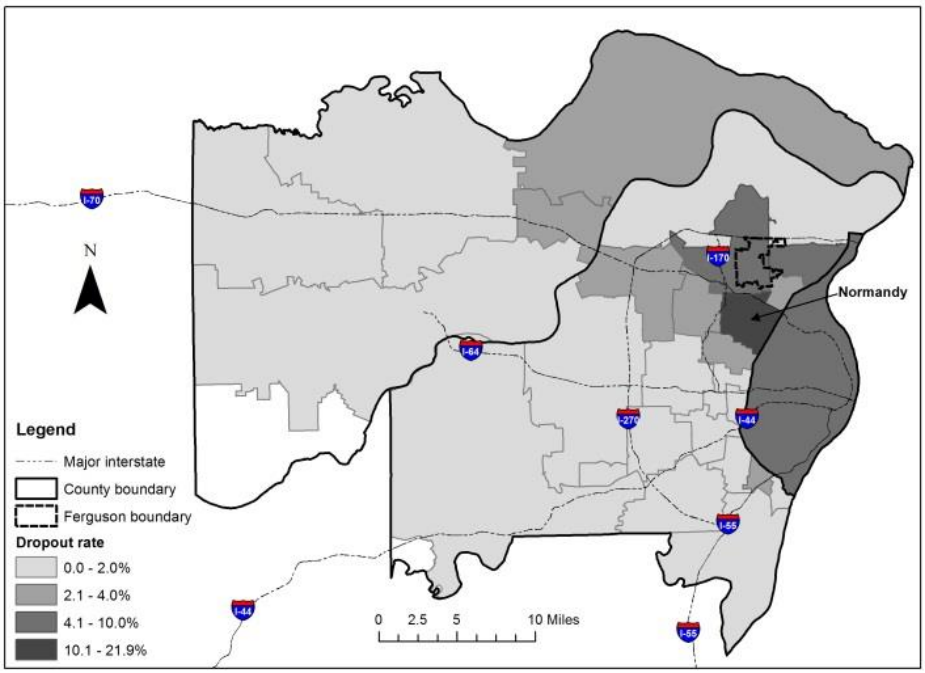

Figure 3.16 Annual dropout rate by school district across the St. Louis region, 2013. *Note.* Data were retrieved from http://mcds.dese.mo.gov/Pages/default.aspx.

As Figure 3.17 indicates, the geospatial distribution of high educational attainment across the St. Louis area reflects that of previously examined indicators. From 2009–2013, less than approximately 25% of adults had obtained a bachelor's or higher degree in most zip codes in northern St. Louis City and in most near north suburbs, including Ferguson. In one of these zip codes, only 1.8% of the adult population had obtained a bachelor's or higher degree. In stark

contrast, 57.4–77.3% of adults in zip codes in central and western St. Louis County had obtained at least a bachelor's degree.

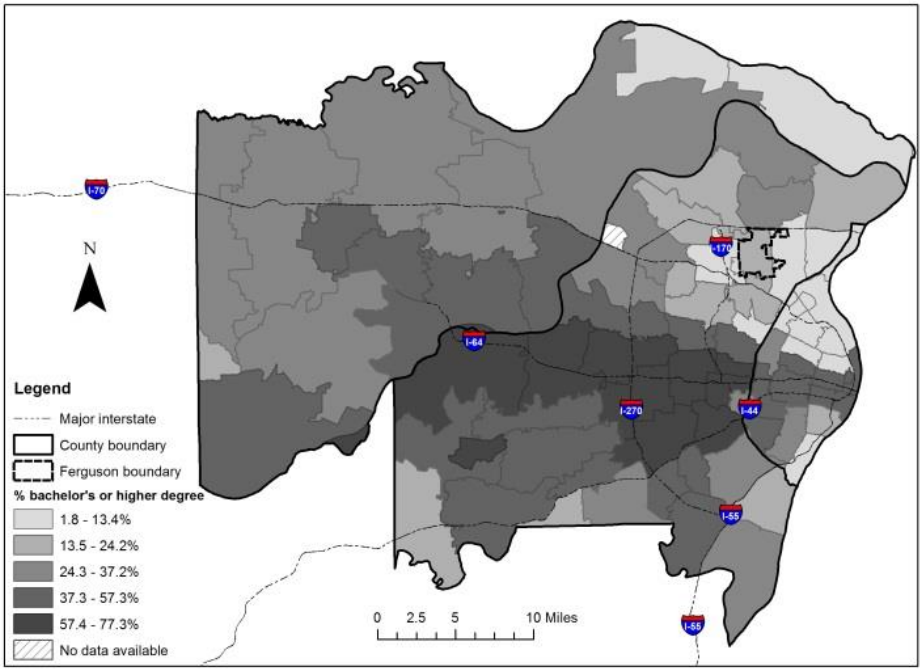

Figure 3.17 Educational attainment by zip code
across the St. Louis region, 2009–2013.
Note. Data were retrieved from http://factfinder.census.gov/.

Summary. The residential housing segregation in the St. Louis region is stark. With respect to the distribution of economic resources, there is great similarity with housing patterns. The majority White western corridor of the metro region is relatively well-resourced compared to the majority Black northern sectors. One positive finding included the significant dispersal of businesses across the region. However, the indicator, business payroll by zip code, being concentrated outside of historically segregated communities, tempered this good news. Thus, it is not surprising that these communities experienced higher poverty, poorer health outcomes, and lower educational attainment.

3.4 I See You. Just Don't Feel You.

One of the major impediments to social reform in Ferguson and the greater metropolitan region of St. Louis is race. What is the role of race in policymaking, and why is it important to discussions of the region? One perspective on this question is found in the science and social sciences literature focused on the development of race as an idea. A preponderance of scientific evidence focused on human variation indicates that biological races do not exist among human beings (Sussman, 2014). Despite this robust evidentiary base, there is a persistent fallacy that race and perceived racial characteristics have biological origins. This fallacy is part of a worldview that has historically characterized Blacks as non-human. This worldview is aligned with a policy logic that minimizes support for causes perceived as Black issues. A brief review of findings from biology, psychology, and political science provide further insight.

Neuroscientists have examined the relationship between empathy and how White and Black individuals exhibit empathic brain responses when observing painful stimuli administered to in-group and out-group models (Avenanti, Sirigu, & Aglioti, 2010). Typically, when people see or envision the pain of another person, they map the others' pain onto the neural network activated during personal experiences of pain as if they were living out the observed pain. Avenanti and colleagues sought to determine whether neurophysiological and autonomic indicators of reactivity to others' pain are modulated by racial membership and racial bias. Their results indicated that humans have neurological responses that reflect empathically to the pain of strangers. However, group-specific lack of empathic reactivity was higher in the onlookers who demonstrated stronger implicit racial bias. Similarly, Xu, Zuo, Wang, and Han (2009) found that racial group membership modulates empathic neural responses when observing pain models as stimuli. Their study suggested that neural mechanisms of empathic bias toward racial in-groups

members were present. They argued that their findings have implications for understanding real-life social behaviors and decision-making.

Psychologists have examined the relationship between intergroup relations and conceptions of racial group membership as biologically determined. Williams and Eberhardt (2008) hypothesized that biologically rooted conceptions of race influence to whom people attend and with whom they associate. Their studies found that participants who equated race as being biological in origin tended to see racial inequities as natural and unlikely to change. This perspective could not be explained by any racial prejudice. In addition, Williams and Eberhardt reported that an experimentally manipulated perspective of race as biological influenced participants to respond to racial inequities with less emotional engagement. In follow-up experiments, they reported that at an interpersonal level, participants with a biological conception of race held less racially diverse friendship networks and were less interested in sustaining contact with a person of another race than were those with a view of race as a social conception. They concluded that a biological conception of race, beyond racial prejudice, heightens associational preferences along racial lines. Further, they argued that support for public policies created to ameliorate racial disparities might attain support that is inversely related to the extent the biological view of race is held by civic participants.

In a related series of six studies, Goff, Eberhardt, Williams, and Jackson (2008) affirmed a bi-directional association between Blacks and apes that operates beneath conscious awareness, while influencing participants' visual perception, attention, and judgments. Part of a centuries old history of dehumanizing representations of African people, the Negro-Ape metaphor moved from a theological to biological rationale for racial hierarchy. Its presence in our thinking is relevant because: "Dehumanization is a method which individuals and social groups are targeted

for cruelty, social degradation, and state-sanctioned violence" (Goff, Eberhart, Williams, and Jackson, 2008, p. 305).

Robert Putnam (2007), a political scientist, revisited social psychologist Gordon Allport's contact theory, the positive hypothesis that if individuals have increased contact with other ethnic and racial groups, collective trust improves. Putnam acknowledged the appeal of contact theory, but argued that conflict theory, which posits diversity fosters out-group distrust and in-group solidarity, had a stronger empirical base. He argued that disagreements about the balance of empirical evidence aside, advocates for contact and conflict theories share a common assumption—specifically that in-group and out-group trust are negatively correlated. Putnam rejected this assumption. He offered evidence from the Social Capital Community Benchmark Survey that suggests residents living in ethnically diverse neighborhoods reported lower trust levels, including with in-group members; altruism and community cooperation rarer; and friends fewer. Putnam referred to this phenomenon as hunkering down, and its effect on community cohesion is a challenge to civic engagement and collective action.

The notion that living in closer proximity to individuals from different racial backgrounds might be a humanizing intervention is in question. This is unfortunate in light of the evidence from neuroscience and psychology that suggests a need for intervention on what King (1991) described as uncritical habits of mind and impaired consciousness about race—habits of mind that are more likely to accept culturally sanctioned views, myths, and folkways that justify out-group disparities and in-group advantages. The literature from neuroscience, psychology, and political science suggest that generating the type of collective cognition required for civic capacity building aimed to improve the conditions for the marginalized and disadvantaged in the St. Louis metro is not trivial. Lack of empathy, biologically rooted conceptions of race, and the

effects of hunkering down represent formidable obstacles to social reform, including that related to education. Despite these challenges, social reform is required.

3.5 Recommendations for Social Reform

The evidence presented in this article suggests that building an opportunity-rich St. Louis region will require building on recent hubs of technology-related growth and reversing the effects of segregation while understanding the biological and psycho-social challenges of individual thinking and collective responses related to in-groups and out-groups. There has been no shortage of policy recommendations focused on improving the life course of Black families and youth in the region. In 2014, Governor Jay Nixon of Missouri commissioned a group of community leaders to study the social and economic conditions that impede opportunity, safety, and equality in the St. Louis region. The Ferguson Commission (2015) report offers scores of recommendations for improving the region. In brief detail, a few recommendations that have implications for social scientists and leaders in the fields of education and child development are described.

3.5.1 Racial Bias and School Discipline Policy

The Ferguson Commission expressed concern about the racial disparities in out-of-school suspension rates. The school discipline regime in the region has resulted in nationally ranked student suspension outcomes. Commission members posited that unconscious racial bias is a root problem. To address the school discipline problem, the Ferguson Commission endorsed the CDC recommendation calling for collaborative approaches to learning and health. More specifically, the Commission advocated establishing school-based health centers with access to mental health and case management across the region (e.g., Lewallen, Hunt, Potts-Datema, Zaza, & Giles, 2015). Moreover, the Commission called for the creation of trauma-informed schools

and districts to ensure that the implementation of evidence-based training and support is offered to families, school leaders, and teachers (Massachusetts Advocates for Children, 2005).

3.5.2 Minority Business Development

Framed as an economic imperative, the Ferguson Commission indicated the need for greater minority business participation. The action item called for the establishment of a statewide Minority/Women's Business Enterprise with outcome measures that incorporate capacity building and education in the area of state and local procurement systems. The recommendation focuses on developing a stronger minority entrepreneurial presence in the region. In light of the developments in the Cortex Innovation District, unique opportunities exist in the region to aggressively support minority business participation. However, the reason for doing so transcends economic opportunity, given the relationship between the number of African American businesses in a community and youth outcomes. Parker (2015) found that the presence of African American businesses contributed to the decline in Black youth violence in the 1990s, while the rate of paid employees in Black firms was unrelated to Black youth violence. She argued that beyond increasing Blacks on the payroll, Black firms provided role models, value changes, and social buffers. Cortex Innovation District and other areas with a high density of biotechnology activity represent important places to incubate greater diversity on the leadership front. Academic institutions in the region have a responsibility to recruit the next generation of leaders capable of responding to this recommendation. Existing student science and leadership incubators, such as Ideas Lab, represent the future of science and entrepreneurship (see http://idealabsincubator.org/). Ideas Lab is a student-run biotechnology incubator that supports, trains, and mentors teams of students (medical, engineering, business, etc.) as they seek innovative solutions to clinical problems. The organizational costs are low,

while the payoff in terms of preparation for leading innovation is significant. Long-term, this type of leadership pathway has the potential to greatly impact regional youth development.

3.5.3 Monitor Child Well-Being

The Ferguson Commission recognized the need to develop a school-based early warning system to improve collective cognition related to child well-being in the St. Louis region. The system would track and respond to all students' successes and challenges. The Commission called for the development of scalable models for collecting data, particularly related to subjective well-being. The recommendation included creating an annual reporting process capable of accounting for how regional services are delivered and how the investments are spent to meet the needs of children and youth.

3.6 Coda

Elsewhere, we argued that universities and colleges play an important role in supporting the development of leaders of innovation and regional monitoring of child well-being (Author-d). Moreover, we demonstrated that geospatial tools support monitoring and mobilization of community resources related to education, health, and child development. A coalition of universities, school districts, and social services agencies is needed to build the research and development capacity for regional monitoring. Visualizing problems and opportunities is a critical step in moving from anonymity, the state of being unnoticed, to collective understanding and problem solving. St. Louis and many other communities suffering from the vestiges of segregation and rife with racial disparities cannot afford to remain anonymous. The catalyst for change should not be another lost life or civil unrest. Proactive solutions exist.

Chapter 4
Hookah and Cigarette Smoking Among African American College Students: Implications for Campus Risk Reduction and Health Promotion Efforts[1]

4.1 Introduction

As a result of the effective use of comprehensive tobacco control policies and programs, the United States has witnessed a 25% decline in adult smoking rates since the publication of the Surgeon General's 1964 report, *Smoking and Health* (U.S. Department of Health, Education, and Welfare, 1964). Despite this significant progress over the last 50 years, tobacco use remains the chief preventable cause of morbidity and mortality among Americans (U.S. Department of Health and Human Services [U.S. DHHS], 2014). Cigarette smoking has contributed to the premature death of more than 20 million Americans, at a rate of about 438,000 annually (Centers for Disease Control and Prevention [CDC], 2005; National Center for Health Statistics, 2005), and is causally linked to a host of cancers, cardiovascular and respiratory diseases, and fetal harm and death. Most recently, smoking has been linked to several other conditions, such as diabetes (U.S. DHHS, 2014). As such, the societal cost of tobacco use is estimated to be approximately $300 billion annually. Adult smokers start smoking quite young, with 90% reporting initiation of smoking by the age of 18 and nearly 100% by the age of 26 (Campaign for Tobacco-Free Kids, 2009; CDC, 2016). Hence, young adult tobacco use rates are among the highest in the U.S. (CDC, 2015).

[1] A version of this chapter was accepted for publication in the *Journal of American College Health* as follows: Jones, B. D., & Cunningham-Williams, R. M. (in press, April 2016). Hookah and cigarette smoking among African American college students: Implications for campus risk reduction and health promotion efforts. *Journal of American College Health*.

4.1.1 Hookah (Water-Pipe) Smoking

In its trend report, the American Lung Association (2007) deemed hookah (water-pipe) smoking as the "first new tobacco trend of the 21st century." Dating back centuries, hookah use originated in Middle Eastern countries (Blachman-Braun, Del Mazo-Rodríguez, López-Sámano, & Buendía-Roldán, 2014; World Health Organization [WHO], 2005) and has begun to spread to Western countries, including the U.S., and is now considered a global public health threat (Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010; WHO, 2005). The nature of hookah use is social; a hookah is typically used in a group context among friends, with a single hookah pipe that is passed around after inhalation or with multiple hoses.

Among college students, the rates of hookah smoking appear to be relatively high and associated with several socio-demographic and substance use correlates. Using a large, web-based survey with a random sample of nearly 4,000 college students enrolled at eight North Carolina institutions, Sutfin and colleagues (2011) reported that 40% of the sample used hookah during their lifetimes, with 17% using in the past 30 days. In addition, the researchers reported significant correlations of hookah use with selected demographics; substance use; misperceptions about relative harm from hookah, compared to cigarettes; and residential proximity to a commercial hookah venue. While informative, however, that study was limited in its ability to add to the literature on hookah use among racial/ethnic minority college students, particularly African American college students, due to the lack of racial/ethnic heterogeneity in the sample (80% Caucasian) and underrepresentation of African Americans (less than 10%).

Analyzing Spring 2008–Fall 2009 National College Health Assessment data, Jarrett and colleagues (2012) found 23% lifetime hookah use in this predominately Caucasian and female sample (n=82,155). With respect to African American students specifically, the researchers

reported a protective effect on cigarette and hookah smoking. Nonetheless, African Americans were at higher odds of being a hookah-only and a dual hookah and cigarette user when they did smoke. Jarrett and colleagues concluded, in part, that more within racial/ethnic minority group analyses are needed with a focus on other types of smoking, beyond cigarette smoking.

Some young people perceive that hookah smoking is a less harmful alternative to cigarette smoking, perhaps because of the use of water as filtration in the hookah pipes and/or the use of candy or spice-flavored tobacco products (Aljarrah, Ababneh, & Al-Delaimy, 2009; Kandela, 2000; Kiter, Ucan, Ceylan, & Kilinc, 2000). This perception may, therefore, potentially contribute to its rise in popularity among youth and the concomitant decline in cigarette smoking rates (Berg et al., 2015; Caldeira et al., 2012). In a recent review of published, clinical case studies, case reports, and systematic reviews collected from three, major bibliographic databases, El-Zaatari and colleagues (2015) concluded that despite misperceptions about the health effects of hookah smoking, evidence substantiates a variety of acute and chronic harmful effects, including several cancers and cardiovascular conditions.

In light of this evidence, the emergence of hookah bars and cafés near college/university campuses has increased concerns for college students' susceptibility to hookah use (Sutfin et al., 2011). Accordingly, colleges/universities represent potentially important sites of hookah-smoking risk reduction and education efforts. Reviewing the literature concerning individual- and institutional-level tobacco use interventions, Murphy-Hoefer and colleagues (2005) acknowledged a dearth of rigorous, comprehensive evaluations of interventions on college/university campuses. These authors noted also that none of the reviewed studies focused on interventions specific to culturally, racially, and ethnically diverse subpopulations of students.

The current study represents the first effort to characterize current hookah and cigarette smoking among a national sample of African American college students. We aimed to add to the emerging body of research on hookah and cigarette smoking by describing the socio-demographic characteristics, institutional context, and substance use correlates of current hookah and cigarette smoking among a national sample of 18-to-24-year-old African American college students. To inform campus wellness initiatives, we also examined if students' interest in receiving tobacco use prevention information from the college/university, as well as their actual receipt of such information, was significantly associated with their current hookah and cigarette smoking.

4.2 Methods

An interdisciplinary team of college health professionals from the American College Health Association (ACHA) developed the National College Health Assessment (NCHA). Administered bi-annually since Spring 2000 to students at more than 700 colleges/universities across the U.S., the NCHA survey asks questions related to the following areas: alcohol, tobacco, and other drug use; sexual health; weight, nutrition, and exercise; mental health; and personal safety and violence. The NCHA was revised for the Fall 2008 data collection to include, among others, a question regarding students' lifetime and last 30-day hookah use. This revised version (ACHA–NCHA II) has been administered at self-selecting colleges/universities in the U.S. each semester since Fall 2008. The national ACHA–NCHA II datasets include only those schools that randomly selected students or that surveyed students in randomly selected classrooms (American College Health Association, n.d.). At participating institutions, a paper survey is administered to students in randomly selected classrooms and a web-based form to randomly selected students. In this study, we analyzed the ACHA–NCHA II data collected during Fall 2012, the most recent

available at the time of analysis. The Washington University Human Research Protection Office reviewed this secondary analysis project and rendered it exempt from further Institutional Review Board oversight.

4.2.1 Measures

The outcome variable, cigarette and hookah use, was derived from two survey items that asked respondents whether they had used cigarettes and/or tobacco from a water pipe (hookah) during the last 30 days. The final outcome variable consisted of the following four mutually exclusive categories: cigarette-only use, hookah-only use, dual use, and non-use. The dual use category included respondents who reported using hookah in conjunction with cigarettes within the last 30 days.

To generate a profile of African American college students who used cigarettes only, hookah only, both concurrently, or neither in the last 30 days, we examined socio-demographic, co-occurring substance use, institutional, and prevention receptivity characteristics as correlates. Socio-demographic characteristics included age, year in school, gender identity (male, female, transgender), sexual orientation (heterosexual, gay/lesbian, bisexual, unsure), employment status (employed, unemployed), current residence, fraternity or sorority membership, and internationality. Based on findings from previous studies, we included last 30-day alcohol, marijuana, and other drug use as potential correlates of current cigarette and hookah smoking. Given the potential influence of college/university contextual factors, we also examined region of the country and size of the city in which respondents' college/university was located, classification of the institution as public or private, and size of the student population. Moreover, we were interested in assessing the relationship between students' hookah and cigarette smoking and institutional tobacco use prevention efforts. To this end, we relied on two survey items that

respectively asked if respondents had received information on tobacco use and/or were interested in receiving such information from their college/university.

4.2.2 Data Analysis

The analytic sample consisted of college students who self-identified as being Black (African American) and being 18–24 years old (n=1,402). We used SPSS 22.0 to conduct all statistical analyses. First, we examined frequencies for all categorical predictors and descriptive statistics for age. Then, we employed cross tabulation and chi-square tests and a one-way ANOVA of age to examine differences in cigarette and hookah smoking behavior by each predictor and to determine which predictors to include in the multivariable models. Finally, to assess differences by last 30-day smoking status, we generated two multinomial logistic (MNL) regression models that included all statistically significant predictors at the bivariate level ($p<0.05$).

Per standard epidemiological practice, we also included gender identity, although not significant at the bivariate level, in both multivariable models. Using MNL regression analyses with nonuse as the reference category, we identified the relative odds of hookah use, exclusively and concurrently with cigarettes, as well as the odds of cigarette-only use. Similarly, the second model of smokers only (i.e., cigarette-only users as the reference) determined increased risk for exclusive and dual hookah use. We examined associations in these models by assessing the relative influence of socio-demographics, last 30-day substance use, institutional context, and interest in and receipt of tobacco use prevention information from colleges/universities. We examined the adjusted odds ratios (aORs) and 95% confidence intervals (CIs) for each predictor in both models. To determine the goodness-of-fit of the final models, we examined the Pearson and deviance chi-square statistics. Moreover, we performed regression diagnostics, including

testing for linearity of the logit for age, the only continuous predictor, and observing VIF and associated statistics for multicollinearity of predictors.

4.3 Results

4.3.1 Participant Description and Bivariable Associations with Last 30-Day Smoking Status

The average age of this African American sample was 19.8 (SD=1.7) years (see Table 4.1), with the majority being female (74.2%), U.S. citizen (90.4%), and heterosexual (88.2%). Nearly one-third of the sample was in their first year of undergraduate education. The least represented were those in graduate/professional school (3.2%). About half of the sample was employed (55.6%) and living on campus or in Greek-affiliated housing (58.6%), with nearly 10% being affiliated with a Greek organization as either a fraternity or sorority member.

Age and sexual orientation were each significantly associated with smoking status at the bivariate level ($p<0.05$). Specifically, older students (average age=20.6 years), compared to younger students, were most represented among cigarette-only users. While both males and females were most represented among the nonsmokers at rates higher than their representation in the sample, males were more often cigarette-only users and females were more often hookah-only users within the smoking categories. Those who self-identified as transgendered were fairly evenly split among nonsmokers and dual users. Given their small sample size (n=7), this response category was excluded from further analysis. Compared to respondents identifying as heterosexual, those who self-identified as gay/lesbian/bisexual/unsure of their sexual orientation reported significantly higher current cigarette-only use, hookah-only use, or dual use.

Table 4.1 Characteristics of African American nonsmokers, cigarette-only users, hookah-only users, and dual users from the American College Health Association–National College Health Assessment II, Fall 2012

	Total n (%)	Nonsmokers, n (%)[a]	Cigarette-only users, n (%)[a]	Hookah-only users, n (%)[a]	Dual users, n (%)[a]
Total	1,402	1,200 (86.6)	70 (5.1)	82 (5.9)	33 (2.4)
SOCIO-DEMOGRAPHICS					
Age (Mean, SD**)***	19.8 (1.7)	19.8 (1.7)	20.6 (1.9)	19.4 (1.5)	19.4 (1.5)
Gender identity					
Male[b]	353 (25.3)	307 (25.8)	19 (27.9)	12 (14.8)	10 (33.3)
Female	1,035 (74.2)	885 (74.2)	49 (72.1)	69 (85.2)	20 (66.7)
Transgender[c]	7 (0.5)	3 (0.3)	0 (0.0)	1 (1.2)	3 (9.1)
International student					
No	1,248 (90.4)	1,071 (90.8)	64 (91.4)	74 (91.4)	26 (78.8)
Yes	132 (9.6)	109 (9.2)	6 (8.6)	7 (8.6)	7 (21.2)
Sexual orientation*					
Heterosexual	1,223 (88.2)	1,072 (90.5)	52 (74.3)	67 (81.7)	20 (60.6)
Gay/lesbian/bisexual/ unsure	164 (11.8)	113 (9.5)	18 (25.7)	15 (18.3)	13 (39.4)
Year in school					
1st year undergraduate	431 (31.3)	369 (31.3)	13 (18.8)	31 (38.8)	15 (45.5)
2nd year undergraduate	342 (24.8)	298 (25.3)	17 (24.6)	15 (18.8)	6 (18.2)
3rd year undergraduate	299 (21.7)	254 (21.5)	18 (26.1)	18 (22.5)	6 (18.2)
4th or more year undergraduate	261 (19.0)	220 (18.6)	19 (27.5)	15 (18.8)	5 (15.2)
Graduate/professional	44 (3.2)	39 (3.3)	2 (2.9)	1 (1.3)	1 (3.0)
Employment status					
Unemployed	618 (44.4)	534 (44.9)	24 (34.3)	39 (47.6)	15 (45.5)
Employed	773 (55.6)	655 (55.1)	46 (65.7)	43 (52.4)	18 (54.5)
Current residence					
On campus or in sorority/fraternity house	803 (58.6)	686 (58.3)	38 (57.6)	55 (68.8)	20 (62.5)
Off campus	568 (41.4)	491 (41.7)	28 (42.4)	25 (31.3)	12 (37.5)
Fraternity/sorority member					
No	1,259 (90.7)	1,076 (90.6)	66 (94.3)	74 (90.2)	28 (84.8)
Yes	129 (9.3)	111 (9.4)	4 (5.7)	8 (9.8)	5 (15.2)
SUBSTANCE USE					
Last 30-day alcohol use*					
No	720 (51.8)	689 (57.6)	9 (12.9)	16 (19.8)	1 (3.0)
Yes	671 (48.2)	508 (42.4)	61 (87.1)	65 (80.2)	32 (97.0)
Last 30-day marijuana use*					
No	1,173 (84.4)	1,070 (89.4)	40 (58.0)	48 (59.3)	9 (27.3)
Yes	217 (15.6)	127 (10.6)	29 (42.0)	33 (40.7)	24 (72.7)
Last 30-day other drug use*					
No	1,297 (96.2)	1,142 (98.4)	58 (85.3)	71 (91.0)	18 (54.5)
Yes	51 (3.8)	19 (1.6)	10 (14.7)	7 (9.0)	15 (45.5)

INSTITUTIONAL CHARACTERISTICS					
Type of institution*					
Public	875 (62.4)	743 (61.9)	42 (60.0)	62 (75.6)	14 (42.4)
Private	527 (37.6)	457 (38.1)	28 (40.0)	20 (24.4)	19 (57.6)
Institutional regional locale*					
Northeast	618 (44.1)	537 (44.8)	29 (41.4)	31 (37.8)	11 (33.3)
Midwest	220 (15.7)	181 (15.1)	14 (20.0)	19 (23.2)	3 (9.1)
South	431 (30.7)	376 (31.3)	17 (24.3)	25 (30.5)	10 (30.3)
West	133 (9.5)	106 (8.8)	10 (14.3)	7 (8.5)	9 (27.3)
Size of institution locale					
>=500,000	421 (30.0)	360 (30.0)	16 (22.9)	25 (30.5)	16 (48.5)
250,000–499,999	256 (18.3)	216 (18.0)	15 (21.4)	11 (13.4)	8 (24.2)
50,000–249,999	461 (32.9)	396 (33.0)	21 (30.0)	32 (39.0)	7 (21.2)
<50,000	264 (18.8)	228 (19.0)	18 (25.7)	14 (17.1)	2 (6.1)
Size of student population*					
>=20,000	485 (34.6)	420 (35.0)	17 (24.3)	34 (41.5)	9 (27.3)
10,000–19,999	388 (27.7)	327 (27.3)	20 (28.6)	29 (35.4)	5 (15.2)
5,000–9,999	206 (14.7)	176 (14.7)	11 (15.7)	5 (6.1)	10 (30.3)
<5,000	323 (23.0)	277 (23.1)	22 (31.4)	14 (17.1)	9 (27.3)
PREVENTION RECEPTIVITY					
Received tobacco use information					
No	778 (56.1)	672 (56.5)	32 (46.4)	48 (59.3)	18 (54.5)
Yes	610 (43.9)	518 (43.5)	37 (53.6)	33 (40.7)	15 (45.5)
Interested in tobacco use information*					
No	981 (72.5)	861 (74.0)	41 (60.3)	55 (71.4)	18 (56.3)
Yes	373 (27.5)	302 (26.0)	27 (39.7)	22 (28.6)	14 (43.8)

[a]Column percentage
[b]The first category is always the referent.
[c]Due to small sample size (n=7), we excluded transgender respondents from further analyses.
*Significant bivariable association with smoking status at $p<0.05$

Table 4.1 also provides the overall rates of substance use and the rates by smoking status in our sample. Nearly half of the sample (48.2%) used alcohol, 15.6% used marijuana, and 3.8% used some other drug in the last 30 days. There was a statistically significant co-occurrence of each of these substances with smoking cigarettes, hookah, or both substances. Specifically, respondents who used alcohol, marijuana, or other drugs in the last 30 days had a significantly higher prevalence of cigarette-only, hookah-only, or dual use than did non-substance users.

The majority of the sample (62.4%) attended a public college/university and an institution with an enrollment of at least 10,000 students (62.3%). The schools were primarily

located in the Northeast (44.1%) or South (30.7%), with a regional population size between 50,000 and 249,999 (32.9%) or greater than 500,000 (30%).

With the exception of college/university locale size, all institutional characteristics were significantly related to smoking status at the bivariate level ($p<.05$). Specifically, students attending colleges in the Midwest and West had proportionally higher rates of cigarette and hookah smoking compared to those attending colleges/universities in other U.S. regions. Students who currently attended public colleges/universities had comparable rates of cigarette smoking, but higher hookah use and lower dual use rates than did those attending private colleges/universities. Those attending colleges/universities with fairly small student populations (5,000–9,999 students) had the highest rates of both cigarette smoking and dual use. Students attending schools with fewer than 5,000 students had hookah use rates that were comparable to the schools with populations of 10,000 students or more.

Less than half of the sample (43.9%) had ever received tobacco use information from the college/university, and only 27.5% indicated that they were interested in receiving such information. While having received tobacco use information from the college/university was not significantly related to smoking status, interest in receiving such information was associated with smoking status ($p<.05$). Those who were interested in receiving tobacco use information had higher hookah-only use prevalence (3.8%) than did those who were not interested in such information (1.8%). A similar finding of higher cigarette-only use (7.4%) was evident among those interested in receiving tobacco use information compared with those who were not interested in this information (4.2%).

4.3.2 Multivariable Associations with Last 30-Day Smoking Status—Model I: Cigarette-Only, Hookah-Only, and Dual Users versus Nonsmokers

In the multivariable model with nonsmokers as the referent, age, gender identity, and sexual orientation significantly predicted smoking status (see Table 4.2). Older age and self-identifying as gay/lesbian/bisexual/unsure increased the relative odds of smoking cigarettes only, while being female increased the odds of exclusive hookah use. Last 30-day alcohol and marijuana use both increased the odds of being in any of the three smoking categories. However, using drugs other than alcohol or marijuana during the last 30 days increased the likelihood of cigarette-only and dual use, but not hookah-only use. Although type of institution, regional location, and student population size were all significantly associated with smoking status bivariately, none of these institutional contextual variables were statistically significant contributors in the multivariable model. Finally, interest in tobacco use information increased the relative odds of cigarette-only and of dual use, yet interest in receiving such information was statistically unrelated to hookah-only use in this model.

4.3.3 Multivariable Associations with Last 30-Day Smoking Status—Model II: Hookah-Only and Dual Users versus Cigarette-Only Users

In a second model excluding nonsmokers, older age was a protective factor for hookah use, either exclusively or combined with cigarette smoking (see Table 4.3). Attending a college/university with fewer than 10,000 students (aOR=0.06; 95% CI=0.01, 0.64) or one with fewer than 5,000 students (aOR=0.14; 95% CI=0.02, 0.83) was a protective factor for hookah-only use. No other variables examined further distinguished cigarette and/or hookah smokers in this sample. In fact, other than age, no additional variables emerged as significant risk or protective factors for dual cigarette and hookah smoking.

Table 4.2 Adjusted odds ratios comparing African American cigarette-only, hookah-only, and dual users to nonsmokers from the American College Health Association–National College Health Assessment II, Fall 2012, N=1,402

	Cigarette-only users vs. nonsmokers, aOR (95% CI)[a]	**Hookah-only users vs. nonsmokers, aOR (95% CI)**	**Dual users[b] vs. nonsmokers, aOR (95% CI)**
Age	1.22 (1.04, 1.43)*	0.81 (0.68, 0.96)*	0.88 (0.66, 1.16)
Gender identity			
Male[c]	----	----	----
Female	0.98 (0.52, 1.83)	2.05 (1.01, 4.17)*	0.90 (0.34, 2.38)
Sexual orientation			
Heterosexual[c]	----	----	----
Gay/lesbian/bisexual/unsure	2.06 (1.07, 3.97)*	1.41 (0.69, 2.88)	2.40 (0.90, 6.38)
Last 30-day alcohol use	4.63 (2.14, 10.04)*	4.87 (2.52, 9.42)*	15.45 (1.91, 125.10)*
Last 30-day marijuana use	3.07 (1.66, 5.67)*	2.41 (1.35, 4.30)*	5.43 (2.09, 14.14)*
Last 30-day other drug use	4.05 (1.57,10.46)*	2.00 (0.65, 6.14)	10.94 (3.80, 31.52)*
Institutional regional locale			
Northeast[c]	----	----	----
Midwest	0.98 (0.44, 2.20)	1.30 (0.64, 2.66)	0.49 (0.09, 2.62)
South	0.91 (0.44, 1.90)	1.00 (0.53, 1.90)	1.72 (0.54, 5.52)
West	1.43 (0.56, 3.69)	1.39 (0.49, 3.98)	1.82 (0.50, 6.66)
Type of institution			
Public[c]	----	----	----
Private	0.87 (0.38, 2.02)	1.02 (0.41, 2.56)	2.14 (0.56, 8.09)
Size of student population			
>=20,000[c]	----	----	----
10,000–19,999	1.18 (0.55, 2.53)	0.78 (0.42, 1.47)	0.80 (0.20, 3.13)
5,000–9,999	1.53 (0.46, 5.13)	0.27 (0.06, 1.12)	1.16 (0.19, 7.03)
<5,000	2.39 (0.82, 7.00)	0.62 (0.20, 1.89)	1.14 (0.21, 6.34)
Interested in tobacco use information	1.79 (1.01, 3.15)*	1.25 (0.71, 2.20)	2.90 (1.16, 7.24)*

[a]aOR=adjusted odds ratio; CI=confidence interval
[b]Dual users included respondents who reported using cigarettes and hookah within the last 30 days.
[c]Denotes reference category
* Significant at $p<0.05$

Table 4.3 Adjusted odds ratios comparing African American hookah-only and dual users to cigarette-only users from the American College Health Association–National College Health Assessment II, Fall 2012, N=1,402

	Hookah-only users vs. cigarette-only users, aOR (95% CI)[a]	**Dual users[b] vs. cigarette-only users, aOR (95% CI)**
Age	0.67 (0.53, 0.86)*	0.72 (0.53, 0.98)*
Gender identity		
Male[c]	----	----
Female	1.97 (0.71, 5.48)	0.71 (0.20, 2.47)
Sexual orientation		
Heterosexual[c]	----	----
Gay/lesbian/bisexual/unsure	0.68 (0.25, 1.87)	1.54 (0.47, 5.06)
Last 30-day alcohol use	1.36 (0.45, 4.06)	3.54 (0.36, 34.94)
Last 30-day marijuana use	0.60 (0.26, 1.42)	1.79 (0.58, 5.53)
Last 30-day other drug use	0.47 (0.12, 1.86)	2.56 (0.73, 8.96)
Region of country		
Northeast[c]	----	----
Midwest	1.88 (0.61, 5.76)	0.45 (0.07, 2.95)
South	1.14 (0.42, 3.14)	1.60 (0.40, 6.45)
West	1.74 (0.34, 8.91)	1.77 (0.29, 10.73)
Type of institution		
Public[c]	----	----
Private	1.97 (0.43, 8.90)	3.40 (0.62, 18.62)
Size of student population		
>=20,000[c]	----	----
10,000–19,999	0.50 (0.18, 1.44)	0.55 (0.11, 2.74)
5,000–9,999	0.06 (0.01, 0.64)*	0.41 (0.03, 5.46)
<5,000	0.14 (0.02, 0.83)*	0.30 (0.04, 2.40)
Interested in tobacco use information	0.68 (0.30, 1.58)	1.16 (0.40, 3.40)

[a]aOR=adjusted odds ratio; CI=confidence interval
[b]Dual users included respondents who reported using cigarettes and hookah within the last 30 days.
[c]Denotes reference category
* Significant at $p<0.05$

4.4 Discussion

Recent research indicates an increasing prevalence of hookah use, either alone or in conjunction with cigarettes and other tobacco products, among U.S. college students (Enofe, Berg, & Nehl, 2014; Grekin & Ayna, 2012; Jarrett et al., 2012; Sutfin et al., 2011). African American college students are less likely than their White peers to smoke cigarettes or hookah. Existing evidence, however, demonstrates higher risks for negative health effects, such as increased susceptibility to nicotine dependence, among African American smokers (Halperin, Smith, Heiligenstein, Brown, & Fleming, 2010; Luo et al., 2008). Given this evidence, we sought to identify the relative contribution of potential individual and institutional risks and protections for current hookah and cigarette smoking among a national sample of 18-to-24-year-old, African American college students.

While cigarette and hookah smoking base rates were comparatively low in our sample, the increased relative odds based on current alcohol, marijuana, and other substance use are particularly noteworthy. In bivariate analysis and in a multivariable logistic regression model with non-use as the referent, substance use had a significant differential risk for cigarette and hookah smoking in our sample. Compared to socio-demographic, institutional, and tobacco prevention receptivity characteristics, current substance use predicted the relative odds of a respondent's hookah and/or cigarette smoking to the greatest degree.

Not surprising, students who reported current use of alcohol, marijuana, and other illicit drugs were more likely to smoke cigarettes than were non-users of these substances. Results from other studies of college student tobacco smoking corroborate our findings concerning the co-occurrence of tobacco and alcohol, marijuana, and other substance use (Jarrett et al., 2012; Mohler-Kuo, Lee, & Wechsler, 2003; Nichter, Nichter, Carkoglu, & Lloyd-Richardson, 2010;

Rigotti, Lee, & Wechsler, 2000; Sutfin et al., 2011). In our study, specifically, the adjusted odds ratios were the highest for respondents who reported dual, or both cigarette and hookah, use within the last 30 days. Current alcohol, marijuana, and other illicit drug use were, respectively, statistically significant correlates of cigarette-only and dual use. Whereas current alcohol and marijuana use significantly predicted the relative odds of hookah-only use, illicit drug use did not. One possible explanation for this finding might be that hookah use, similar to alcohol and marijuana use, is becoming an increasingly popular, strictly social activity among U.S. college students (Mohler-Kuo et al., 2003; Nichter et al., 2010).

Respondents' age significantly, yet differentially, predicted the relative odds of cigarette and hookah use within the last 30 days. In both the non-use and the cigarette-only use referent multivariable models, older age decreased the risk of hookah-only use. Older age decreased also the risk of dual cigarette and hookah use compared to cigarette-only use. These results confirm findings from the dearth of available studies of large, racially/ethnically heterogeneous college student samples (Jarrett et al., 2012; Sutfin et al., 2011). Moreover, the findings indicate a decreased risk for hookah use among older, African American college students. In a recent study, Doran and colleagues (2015) found that past-month hookah use predicted cigarette smoking progression over a 6-month period among an ethnically diverse, college student sample. Thus, our finding regarding younger students' being more likely to use hookah is particularly concerning.

In previous studies of racially/ethnically diverse, college student samples, males were at higher risk for hookah use (Enofe et al., 2014; Grekin & Ayna, 2012; Sutfin et al., 2011). Among our African American college student sample, however, being female increased the odds of exclusive hookah use, compared to nonsmoking. This result suggests the need for additional

research that examines gender-specific hookah use patterns among African American college students.

Respondents who reported an interest in receiving tobacco use prevention information from their college/university had increased odds of cigarette-only use and of dual use, compared to non-use. The odds of cigarette-only smoking were approximately 79% higher among students who were interested in receiving tobacco use prevention information from their college/university. Among respondents in this same group, the odds of dual cigarette and hookah use in the last 30 days were nearly three times the odds of non-use. Interestingly, reporting an interest in receiving tobacco use information did not significantly predict the risk of a respondent's hookah-only use in either of the multivariable models. This result might likely reflect decades of targeted messages and prevention and cessation efforts related to the deleterious effects of cigarette smoking (U.S. Department of Health, Education, and Welfare, 1964; U.S. DHHS, 2014). Furthermore, in previous studies, researchers have reported that college students generally misperceive hookah smoking as less harmful to their health than cigarette smoking (Berg et al., 2015; Grekin & Ayna, 2012). Based on this evidence, the African American college students in our sample might have been more receptive to information about the harmful health effects of cigarette smoking, but not necessarily hookah smoking. This finding suggests that further investigation concerning the nuances of African American college students' hookah use, both exclusively and dually with cigarettes, is warranted.

Results from the second multivariable model with cigarette-only use as the referent revealed also that attending relatively smaller colleges/universities was a protective factor for hookah-only use. One possible explanation for this finding might be the decreased opportunities to form multiple and broader peer networks that are associated with peer influences to use

hookah at smaller colleges/universities (Berg et al., 2015; Braun, Glassman, Wohlwend, Whewell, & Reindl, 2012). Furthermore, the result points to the need for future studies that will address the potential influence of social context and norms on African American college students' hookah smoking behavior.

4.4.1 Limitations

We present these findings in the context of several caveats. First, the ACHA–NCHA II is a cross-sectional survey and, as such, cannot be used to generate causal inferences. Second, colleges/universities opt to participate in the survey and are not sampled based on probability. Therefore, our age-restricted analytic sub-sample of African Americans might not be representative of all African American U.S. college students and of all U.S. colleges/universities. Third, students completing the ACHA–NCHA II were able to self-identify with more than one racial-ethnic category, including Hispanic or Latino/a ethnicity, as well as bi-/multi-racial and "Other" options. Thus, the composition of our sample of college students who self-identified as African American included some students who selected other racial/ethnic categories in addition to survey option (2), "Black." Hence, our findings may have masked significant disparities in hookah and cigarette smoking among Black, non-Hispanic and Hispanic young adults, for instance (U.S. DHHS, 2012). Finally, the ACHA–NCHA II was not specifically designed to examine cigarette and hookah smoking behaviors among an age-restricted and race/ethnicity-restricted sample of U.S. college/university students. As a result, this analysis was limited by the questions asked and by respondents' interpretations of and responses to them. For example, the two respective questions regarding whether students had received and/or were interested in receiving tobacco use information from their college/university did not refer to *prevention*

directly, but to tobacco use more generally. Therefore, some students may have potentially misinterpreted the meaning of these questions.

4.4.2 Conclusions

In the U.S., the prevalent use and the evidence regarding negative health consequences of hookah smoking among young adults are increasing. To our knowledge, this study represents the first effort to examine individual and institutional factors related to hookah use, either alone or in conjunction with cigarette smoking, among a national, entirely African American college student sample. Furthermore, this study is novel also in its focus on the potential impact of respondents' interest in and actual receipt of tobacco use information from the college/university. Based upon the results of this study, future studies are needed to investigate the nuances of African American college students' smoking hookah only compared to smoking hookah dually with cigarettes. Such further research might inform the development of specific policies and campus prevention and health promotion initiatives related to hookah use among African American college students. Our findings also suggest the need to assess the impact of availability on hookah use within this population. Moreover, these findings might also be useful in policy discussions concerning regulations on hookah bars and cafés, which generally locate near college/university campuses and attract younger students. Finally, campus health promotion campaigns may need to include targeted messages to African American students, particularly those who use substances, to underscore the health-related risks of both hookah and cigarette smoking.

Chapter 5
Stress, Stressors, and Substance Use: Differential Risk for Hookah Use Among African American, Female College Students[1]

5.1 Introduction

Globally, tobacco use contributes to nearly 6 million deaths per year (World Health Organization [WHO], 2011). In the U.S., women's mortality risk attributable to smoking has risen to equal that of men. This increase is, in part, due to direct marketing by the tobacco industry to women, with more than 200,000 U.S. women dying from smoking and tobacco use annually (Centers for Disease Control and Prevention [CDC], 2014). The societal cost attributable to smoking in the U.S. is more than $300 billion annually in medical care and lost productivity (CDC, 2014; Xu, Kennedy, Simpson, & Pechacek, 2014). While cigarette smoking rates have declined over the last five decades (CDC, 2014), there remains concern about the increased use of alternative tobacco products (CDC, 2011), such as hookah (water-pipe) use, among adolescents and college students (Cobb, Ward, Maziak, Shihadeh, & Eissenberg, 2010). In its recent policy statement, the American Academy of Pediatrics (Groner et al., 2015) has deemed tobacco use, including that of alternative products, as a serious threat to society and offered several recommendations for its control, especially among youth. Despite early origins dating back centuries and growing popularity of hookah, evidence is mounting about its carcinogenic (Maziak, Ward, & Soweid, 2004) and other chronic disease consequences (Shaikh, Vijayaraghavan, & Sulaiman, 2008) for both active and passive smokers (Blachman-Braun, Del Mazo-Rodríguez, López-Sámano, & Buendía-Roldán, 2014).

[1] A subsequent version of this chapter will be submitted to the *American Journal of Public Health*.

Data from a nationally representative sample of more than 24,658 middle and high school students support the early onset of not only cigarette use, but also poly tobacco use at 14.7% (Lee, Hebert, Nonnemaker, & Kim, 2015). In fact, hookah use particularly may be a gateway to other substance use (Jensen, Cortes, Engholm, Kremers, & Gislum, 2010; Soneji, Sargent, & Tanski, 2014). Given the lack of stringent prohibitions against hookah smoking, its social acceptability, increased popularity, and availability near college campuses (Barnett, Curbow, Soule, Tomar, & Thombs, 2011), coupled with peer support of hookah smoking (Heinz et al., 2013) and misperceptions concerning the safety of hookah relative to that of cigarette smoking (Rahman, Chang, Hadgu, Salinas-Miranfa, & Corvin, 2014), public health concern is warranted.

Rates of hookah use have risen near comparability to those of cigarette use among college students (Primack, Sidani, Shadel, Donny, & Eissenberg, 2008). In fact, among college-age women, non-Hispanic, African American women had the highest rates of current use of multiple tobacco products than did women of any other race/ethnicity (CDC, 2014). In a follow-up study of female, first-year, college students at a large, private university in upstate New York, Fielder (2012) found that hookah smoking was highest during the first two months after arriving on the college campus, with lifetime use rates increasing from 29% to 45% one year later. These findings raised concerns about increased risk, particularly for younger college students.

Young people transitioning to college life are doing so during a period when brain maturation has not yet completed and both risk-taking (Arnett, 2005; Fromme, 2008) and perceived stress may be highest, especially as effective coping and social support may be variable (Chao, 2012). As is attributable to their racial status (Smedley, Myers, & Harrell, 1993) or perceptions and experiences of racism (Clark, Andersen, Clark, & Williams, 1999), African American college students may experience stressors in addition to those common to emerging

adulthood and college life. In a recent study of a diverse sample of 143 students at an urban university, nearly half of the sample reported lifetime hookah smoking, with about 1 in 5 having done so in the past 30 days (Heinz et al., 2013). While there were no differences in depression, anxiety, and impulsivity in that study, hookah users, compared to nonusers, reported using alcohol as a coping mechanism and had a higher risk for other substance use. Earlier studies examining both alcohol and cannabis use as stress-reducers/coping strategies among college students (Beck et al., 2009; Park & Levenson, 2002) support this result. In addition, college students appear to even substitute substances to cope with stressful events in their lives (O'Hara, Armeli, & Tennen, 2016). In a recent analysis of 1,402 African American college students participating in the Fall 2012 National College Health Assessment (Jones & Cunningham-Williams, in press), the researchers found, among other risks (e.g. last 30-day alcohol and marijuana use), that being female increased the odds of exclusive hookah use, while being an older student served as a protective factor. Though not reported specifically for African American females, results of Grinberg's (2015) nationally representative study of 18-to-30-year-olds corroborates the association of high levels of stress and sadness and lower overall well-being among hookah users relative to nonusers. In this study, we aim to add to the limited, available literature examining hookah use risk, particularly as it relates to the role of stress and substance use, among African American, female college students.

5.2 Methods

We analyzed data from the Fall 2012 American College Health Association–National College Health Assessment (ACHA–NCHA) II. Since 2000, the survey has assessed the health-related behaviors, habits, and perceptions of students at more than 700 self-selecting, U.S. colleges/universities. Questions cover the following specific topics: alcohol, tobacco, and other

drug use; sexual health; weight, nutrition, and exercise; mental health; and personal safety and violence. For the Fall 2008 data collection, the ACHA–NCHA was revised to include, among others, a question regarding students' lifetime and last 30-day hookah use. The revised version (ACHA–NCHA II) has been administered each semester since Fall 2008. The national ACHA–NCHA II datasets include only those schools that randomly selected students or that surveyed students in randomly selected classrooms (ACHA, 2015). At participating institutions, randomly selected students complete a web-based form and those in randomly selected classrooms complete a paper survey. The Washington University Human Research Protection Office reviewed this secondary analysis study and rendered it exempt from further Institutional Review Board oversight.

5.2.1 Measures

We derived the outcome variable, last 30-day hookah use, from a survey item that asked respondents if they had used tobacco from a water pipe (hookah) within the last 30 days. To assess the relative impact of other substance use on current hookah use after accounting for the contribution of stress and stressful or traumatic events, we analyzed socio-demographic, institutional, other substance use, and stress-related characteristics as potential correlates. Individual-level, socio-demographic variables included age, sexual orientation (heterosexual, gay/lesbian, bisexual, unsure), internationality, year in school, employment status (employed/unemployed), current residence, and sorority membership. Based on previous evidence of the influence of college/university contextual factors, we also examined the following institutional-level characteristics: type of college/university (public/private), classification as minority-serving, region and size of the locale, and size of student population. Substance use predictors included lifetime and last 30-day alcohol, marijuana, other tobacco

(cigarette, cigar/little cigar/clove cigarette, smokeless tobacco), and illicit substance use. In addition to self-rated, overall level of stress (no/less than average, average, more than average/tremendous stress) within the last 12 months, the number of stressful/traumatic events experienced during this same time period was tested as a potential predictor of current hookah use. We aggregated this variable from a multiple-response survey question inquiring if any of the following were traumatic or very difficult to handle within the last 12 months: academics, career-related issue, death and/or health problem of a family member/friend, family problems, intimate and/or other social relationships, finances, personal appearance and/or health issue, sleep difficulties, and/or other experiences.

5.2.2 Statistical Analysis

Self-identified Black (African American), female undergraduates aged 18–24 years comprised our analytic sample (n=982). Initially, we surveyed frequencies for all categorical predictors and descriptive statistics for age and number of last-year stressful/traumatic events. Then, we employed cross tabulations with chi-square tests and independent-samples t-tests to observe differences in hookah use by each predictor. Based on statistical significance at the bivariate level, we ascertained which variables to include in the multivariable models.

We constructed the following three binary logistic regression models: 1) relative influence of lifetime substance use model, 2) relative influence of current substance use model, and 3) relative influence of specific types of stressors model. Lifetime alcohol, marijuana, other tobacco, and illicit substance use were included in the first model, whereas last 30-day alcohol, marijuana, other tobacco, and illicit substance use were analyzed in the second model. The final, multivariable model focused on the relative contribution of specific, last-year stressful/traumatic events to current hookah use risk. In this model, we included the stressful/traumatic events

predictors that were significantly associated with last 30-day hookah use at the bivariate level. As they were significantly related to hookah use at the bivariate level, age and sexual orientation were the only socio-demographic predictors included in each multivariable model. Moreover, we included self-rated, overall stress level in each of the three models to analyze the relative effect of other substance use on hookah use risk after accounting for the role of stress. The first two models included also the number of last-year, stressful/traumatic events covariate.

For predictors in each of the logistic regression models, we examined adjusted odds ratios (aORs) and associated 95% confidence intervals. To determine the goodness-of-fit of the final models, we relied on the Hosmer and Lemeshow test. We performed all statistical analyses in SPSS 22.0 and considered a two-sided p-value < 0.05 to be statistically significant.

5.3 Results

5.3.1 Sample Description

One out of four African American (AA), female college students in this sample reported using hookah in their lifetimes, with 36% (n=87; 8.9%) of them having done so within the last 30 days. Table 5.1 provides sample characteristics stratified by hookah use status within the last 30 days. The mean age of the sample was 19.6 years, with hookah users being significantly younger on average than nonusers (mean=19.2, SD=1.3). Nearly 12% reported being either gay, lesbian, bisexual, or unsure of their sexual orientation in the total sample, with nearly twice as many being represented among current hookah users (24.1%) compared to nonusers (10.2%). Less than 8% of the sample reported being an international student. One-third of students in this undergraduate sample were freshman, with the remainder being fairly evenly distributed among the 2^{nd}–4^{th} years of undergraduate education. More than half of the sample were currently employed. Approximately 60% lived on campus or in a sorority house, with 8.4% being a

sorority member. Other than age and sexual orientation, these demographic characteristics (i.e., international student status, year in school, employment status, current residence, and Greek sorority membership) did not significantly distinguish current hookah users from nonusers.

Table 5.1 Characteristics of African American, female, undergraduate hookah nonusers and users from the American College Health Association–National College Health Assessment II, Fall 2012

	Total n (%)	**Hookah nonusers in last 30 days, n (%)[a]**	**Hookah users in last 30 days, n (%)[a]**
TOTAL	982	895(81.1)	87(8.9)
Hookah use, lifetime			
No[b]	738 (75.2)	738 (82.5)	0 (0)
Yes	244 (24.8)	157 (17.5)	87 (100)
SOCIO-DEMOGRAPHICS			
Age (Mean, SD)******	19.6 (1.56)	19.7 (1.6)	19.2 (1.3)
Sexual orientation***			
Heterosexual	865 (88.4)	794 (89.8)	66 (75.6)
Gay/lesbian/bisexual/unsure	113 (11.6)	90 (10.2)	21 (24.1)
International student			
No	891 (91.3)	807 (91.5)	80 (92.0)
Yes	85 (7.6)	75 (8.5)	7 (8.0)
Year in school			
1st year undergraduate	322 (32.6)	284 (31.7)	36 (41.4)
2nd year undergraduate	241 (24.4)	222 (24.8)	17 (19.5)
3rd year undergraduate	225 (22.8)	202 (22.6)	22 (25.3)
4th or more year undergraduate	201 (20.3)	187 (20.9)	12 (13.8)
Employment status			
Unemployed	423 (43.1)	380 (42.8)	41 (47.1)
Employed	558 (56.4)	507 (57.2)	46 (52.9)
Current residence			
On campus or in sorority/fraternity house	592 (61.2)	529 (60.5)	59 (68.6)
Off campus	375 (38.8)	345 (39.5)	27 (31.4)
Sorority member			
No	897 (91.6)	810 (91.5)	80 (92.0)
Yes	82 (8.4)	75 (8.5%)	7 (8.0)
INSTITUTIONAL CHARACTERISTICS			
Type of institution			
Public	618 (62.5)	553 (61.8)	61 (70.1)
Private	371 (37.5)	342 (38.2)	26 (29.9)
Minority serving institution			
No	872 (88.2)	787 (87.9)	79 (90.8)
Yes	117 (11.8)	108 (12.1)	8 (9.2)
Institution regional locale			
Northeast	443 (44.8)	409 (45.7)	30 (34.5)
Midwest	143 (14.5)	125 (14.0)	17 (19.5)
South	318 (32.2)	289 (32.3)	28 (32.2)
West	85 (8.6)	72 (8.0)	12 (13.8)
Size of institution locale			
>=500,000	282 (28.5)	251 (28.0)	30 (34.5)
250,000–499,999	185 (18.7)	169 (18.9)	13 (14.9)
50,000–249,999	332 (33.6)	298 (33.3)	32 (36.8)
<50,000	190 (19.2)	177 (19.8)	12 (13.8)

Size of student population			
>=20,000	343 (34.7)	307 (34.3)	33 (37.9)
10,000–19,999	280 (28.3)	250 (27.9)	29 (33.3)
5,000–9,999	142 (14.4)	131 (14.6)	9 (10.3)
<5,000	224 (22.6)	207 (23.1)	16 (18.4)

[a]Column percentage; [b]The first category is always the referent. Significant bivariable association with hookah use status at: *p<0.05, **p<.01, *** p<.001.

Approximately 60% of participants attended a public college or university and one that was not a designated minority-serving institution (88.2%). Institutions in which respondents were enrolled were located mostly in the Northeast (45%) or the South (32%). Nearly half of the sample attended a college/university located in a locale that was between 50,000–249,999 population size (33.6%) or greater (19.2%) and with a student population size of 10,000 or more students (63%). None of these institutional characteristics were significantly associated with current hookah use status in this sample.

5.3.2 Substance Use Correlates

The lifetime prevalence of licit substance (i.e., alcohol, marijuana, and other tobacco) use was 68.1% in this sample, with 73.9% (n=496) of them having used in the last 30 days (see Table 5.2). Specifically, AA, female college students in this sample had a high rate of alcohol use (66.1%), followed by marijuana use (30%), and a lower rate of other tobacco use (20.5%). With respect to use within the last 30 days, nearly half of students (47.5%) drank alcohol, 15.1% used marijuana, and 10.1% used other tobacco products. Each of these substances, used during the lifetime and in the last 30 days, were significantly associated with current hookah use status. Specifically, twice as many hookah users (82.6%) versus nonusers (44.1%) drank alcohol, with differences by hookah use status being most striking for marijuana use (45% of hookah users versus 12% of hookah nonusers) and use of other tobacco products (32.6% hookah users versus 7.2% hookah nonusers). The rate of lifetime illicit drug use was 8%, with 86.8% of them using

in the last 30 days. Similar to licit substance use, illicit drug use was significantly associated with current hookah use status, in that 18.4% of hookah users, relative to 5.4% of nonusers, used illicit drugs in the last 30 days.

Nearly half of our sample (46.6%) reported experiencing more than average or tremendous stress within the last 12 months (see Table 5.3). The number of stressful/traumatic events experienced by these students during the same period ranged from 0–11 events, with an average of 3.5 events. This variable was significantly associated with hookah use status (t=–3.045, df=92.209; p=.003). While stress level was not significantly associated with current hookah use status, experiences of stressful/traumatic events that were difficult for these college women to handle were significantly associated. Specifically, during the last 12 months, the experiences of having difficulty handling family problems (41.8%), other (non-familial) relationships (27.7%), health problems of family members/partner (20.2%), personal appearance (29.1%), and sleep difficulties (29.6%) were each significantly associated with current hookah use status. A higher proportion of hookah users, relative to nonusers, experienced difficulty handling each of these stressful/traumatic events.

Table 5.2 Substance use among African American, female, undergraduate hookah nonusers and users from the American College Health Association–National College Health Assessment II, Fall 2012, N=982

	Total n (%)	**Hookah nonusers in last 30 days n (%)[a]**	**Hookah users in last 30 days, n (%)[a]**
TOTAL	982	895 (91.1)	87 (8.9)
SUBSTANCE USE			
Licit substance use (lifetime)***			
No[b]	314 (31.9)	310 (34.6)	4 (4.6)
Yes	671 (68.1)	585 (65.4)	83 (95.4)
Licit substance use (last 30 days)***			
No	483 (49.3)	474 (53.3)	8 (9.2)
Yes	496 (50.7)	415(46.7)	79 (90.8)
Alcohol use (lifetime)***			
No	333 (33.9)	325 (36.4)	7 (8.1)
Yes	649 (66.1)	568 (63.6)	79 (91.9)
Alcohol use (last 30 days)***			
No	516 (52.5)	499 (55.9)	15 (17.4)
Yes	466 (47.5)	394 (44.1)	71 (82.6)
Marijuana use (lifetime)***			
No	687 (70.0)	656 (73.5)	31 (36.0)
Yes	295 (30.0)	237 (26.5)	55 (64.0)
Marijuana use (last 30 days)***			
No	834 (84.9)	785 (87.9)	48 (55.8)
Yes	148 (15.1)	108 (12.1)	38 (44.2)
Other tobacco use (lifetime)***			
No	776 (79.5)	730 (82.3)	44 (51.2)
Yes	200 (20.5)	157 (17.7)	42 (48.8)
Other tobacco use (last 30 days)***			
No	881 (89.9)	821 (92.8)	58 (67.4)
Yes	99 (10.1)	64 (7.2)	28 (32.6)
Illicit drug use (lifetime)***			
No	878 (92.0)	811 (93.5)	65 (76.5)
Yes	76 (8.0)	56 (6.5)	20 (23.5)
Illicit drug use (last 30 days)***			
No	920 (93.3)	847 (94.6)	71 (81.6)
Yes	66 (6.7)	48 (5.4)	16 (18.4)

[a]Column percentage; [b]The first category is always the referent; significant bivariable association with hookah use status at: *p<0.05, ** p<.01 ***p <.001.

Table 5.3 Stressful/traumatic events among African American, female, undergraduate hookah nonusers and users from the American College Health Association–National College Health Assessment II, Fall 2012, N=982

	Total n (%)	Hookah nonusers in last 30 days n (%)[a]	Hookah users in last 30 days, n (%)[a]
Total	982	895 (91.1)	87 (8.9)
Level of stress, last 12 months			
No/less than average[b]	130 (13.2)	117 (13.1)	12 (13.8)
Average stress	397 (40.3)	361 (40.5)	31 (35.6)
More than average/tremendous stress	459 (46.6)	414(46.4)	44 (50.6)
Stressful/traumatic events, 12 months ***Had difficulty handling …***			
Academics			
No	494 (50.4)	474 (51.1)	38 (42.7)
Yes	486 (49.6)	453 (48.9)	51 (57.3)
Career-related issue			
No	770 (78.7)	732 (79.1)	66 (73.3)
Yes	209 (21.3)	193 (20.9)	24 (26.7)
Death of family member/friend *			
No	796 (81.3)	756 (81.8)	66 (73.3)
Yes	183 (18.7)	168 (18.2)	24 (26.7)
Family problems**			
No	570 (58.2)	555 (60.0)	41 (45.6)
Yes	409 (41.8)	370 (40.0)	49 (54.4)
Intimate relationships			
No	604 (62.1)	579 (63.1)	49 (55.1)
Yes	368 (37.9)	339 (36.9)	40 (44.9)
Other (non-familial) relationships**			
No	704 (72.3)	649 (73.7)	50 (58.1)
Yes	270 (27.7)	232 (26.3)	36 (41.9)
Finances			
No	485 (49.7)	442 (50.1)	38 (44.2)
Yes	490 (50.3)	440 (49.9)	48 (55.8)
Health problem of family/partner*			
No	779 (79.8)	710 (80.5)	62 (71.3)
Yes	197 (20.2)	172 (19.5)	25 (28.7)
Personal appearance***			
No	779 (79.8)	638 (72.3)	48 (55.2)
Yes	197 (19.9)	245 (27.7)	39 (44.8)
Personal health issue			
No	692 (70.9)	681 (77.4)	64 (73.6)
Yes	284 (29.1)	199 (22.6)	23 (26.4)
Sleep difficulties**			
No	687 (70.4)	630 (71.4)	50 (57.5)

Yes	289 (29.6)	252 (28.6)	37 (42.5)
(Any) other issues			
No	861 (89.2)	777 (89.1)	77 (89.5)
Yes	104 (10.8)	95 (10.9)	9 (10.5)
Number of stressful /traumatic events, last 12 months (**Mean, SD)	3.5 (2.9)	3.4 (2.9)	4.5 (3.3)

[a]Column percentage; [b]The first category is always the referent; significant bivariable association with hookah use status at: *p<0.05, ** p<.01 ***p <.001.

5.3.3 Multivariate Modeling of the Relationship Between Substance Use and Hookah Use

Table 5.4 presents the results of three, separate models of the differential impact of lifetime and last 30-day substance use on current hookah use in the presence of stress (level and number–Models I and II, respectively) and type of stressful/traumatic events (Model III). In each of the three models, older age had a protective effect on last 30-day hookah use. Additionally, none of the models found significant associations between illicit drug use, either lifetime or current, and hookah use. Model I, however, revealed that the number of stressful/traumatic events had a unique impact on hookah use in the presence of age, unique risks associated with self-identification as gay/lesbian/bisexual or unsure sexual orientation, and significant lifetime alcohol use and other tobacco use (χ^2=6.462, df=8; p=0.596). Lifetime marijuana use and illicit drug use, as well as level of stress, were not significant in this model.

When we explored the association of last 30-day substance use with hookah use in Model II, we similarly found that stress level was not significantly associated with hookah use, but the number of stressful/traumatic events were with the exact same likelihood and similar, but slightly better, overall model fit compared to Model I (χ^2=6.308, df=8; p=0.613). In this model, last 30-day alcohol use, other tobacco use, and marijuana use were unique risk factors for hookah use.

Table 5.4 Relative risk for current hookah use among African American, female undergraduates, American College Health Association–National College Health Assessment II, Fall 2012, N=982

	Model I, aOR (95% CI)[a]	**Model II, aOR (95% CI)**[a]	**Model III, aOR (95% CI)**[a]
Age	0.74 (0.62, 0.89)***	0.75 (0.62, 0.90)**	0.75 (0.63,0.90)***
Sexual orientation			
Heterosexual[b]	----	----	----
Gay/lesbian/bisexual/unsure	1.96 (1.05, 3.67)*	1.57 (0.80,3.08)	1.39 (0.71,2.72)
Substance use			
Alcohol use, lifetime	4.86 (1.81, 13.08)**	----	----
Marijuana use, lifetime	1.72 (0.95, 3.14)	----	----
Illicit drug use, lifetime	1.38 (0.68, 2.77)	----	----
Other tobacco use, lifetime	2.54 (1.40, 4.60)**	----	----
Alcohol use, last 30 days	----	4.89 (2.47,9.67)***	4.11 (2.14,7.89)***
Marijuana use, last 30 days	----	1.90 (1.05, 3.44)*	2.35 (1.31,4.21)**
Illicit drug use, last 30 days	----	1.82 (0.82,4.01)	1.98 (0.90,4.33)
Other tobacco use, last 30 days	----	3.03 (1.58, 5.81)***	2.62 (1.39, 4.94)**
Level of stress, last 12 months			
No/less than average stress[b]	----	----	----
Average stress	0.52 (0.23, 1.22)	0.45 (0.19,1.06)	0.45 (0.20, 1.03)
More than average/tremendous stress	0.48 (0.20, 1.14)	0.44 (0.18, 1.06)	0.44 (0.19, 1.00)*
Number of stressful/traumatic events, last 12 months	1.12 (1.02, 1.23)*	1.12 (1.02,1.23)*	----
Stressful/traumatic events, last 12 months *Difficulty handling . . .*			
Death of family member/friend	----	----	2.01 (1.11, 3.65)*
Family problems	----	----	1.26 (0.72, 2.21)
Intimate relationships	----	----	1.21 (0.66, 2.23)
Health problem of family/partner	----	----	0.82 (0.44, 1.55)
Personal appearance	----	----	1.38 (0.77, 2.48)
Sleep difficulties	----	----	1.42 (0.78, 2.58)
Model fit statistics–Hosmer & Lemeshow test	χ^2=6.462, df=8; p=0.596	χ^2=6.308, df=8; p=0.613	χ^2=9.441, df=8; p=0.306

[a]aOR=adjusted odds ratio; CI=confidence interval; [b]Denotes reference category;*p<0.05; **p<0.01; ***p<0.001.

Finally, in Model III, we removed the number of stressful/traumatic events variable to understand the unique contributions of the type of stressful/traumatic events to the relationship of substance use and hookah use. The same substances used in the last 30 days were risk factors for hookah use, with marijuana use being an even stronger risk factor for hookah use in this model. Model III is also the only model in which having a more than average/tremendous stress level

was protective of hookah use (aOR=0.44; 95% CI=0.19, 1.00). Regarding the influence of type of stressors variables in this model, respondents who reported having difficulty handling the death of a family member or friend during the last 12 months experienced higher odds of hookah use (aOR=2.01; 95% CI=1.11, 3.65). No other stressful/traumatic event was a significant risk factor for hookah use. Compared to Models I and II, Model III did not fit the data as well (χ^2=9.441, df=8; p=0.306). Nevertheless, it remained a strong model with distinct risk factors not found in the previous two models.

5.4 Discussion

In a previous study of an African American, college student sample, we found that being female, rather than male, increased the risk of current hookah use. In her study of a nationally representative sample of 1,147 18-to-30-year-old adults, Grinberg (2015) found that hookah users were more likely than were non-users to report higher levels of stress and sadness. Among one sample of U.S. college students specifically, higher perceived stress levels increased the risk of hookah use (Berg, Schauer, Asfour, Thomas, & Ahluwalia, 2011). Given this and other research indicating the consistent, strong relationship between hookah and other substance use among college students, we, after controlling for the unique contributions of stress and stressful or traumatic experiences, explored the other substance–hookah use relationship among a national sample of 18-to-24-year-old, African American, female undergraduates.

Results from each logistic regression model revealed that older age was a protective factor associated with current hookah use among our sample of African American, female, undergraduate students. This finding corroborates that from existing studies of current hookah use among college student samples (see, e.g., Barnett et al., 2013; Jarrett, Blosnich, Tworek, & Horn, 2012; Jones & Cunningham-Williams, in press). In this study, older age decreased the

relative odds of last 30-day hookah use by approximately 25%. Based on evidence of hookah smoking progression during the freshman year (Fielder, 2012), this result is particularly concerning.

In the lifetime of substance use model (Model I), gay/lesbian/bisexual/unsure sexual orientation and lifetime alcohol and other tobacco use significantly increased the relative risk of hookah use. Lifetime alcohol use increased the relative risk of last 30-day hookah use by nearly five times. While lifetime marijuana use did not significantly predict current hookah use risk, last 30-day marijuana use, in addition to last 30-day alcohol and other tobacco use, did. This result is unsurprising, as existing evidence points to an association between current hookah and alcohol, marijuana, and other tobacco use (Goodwin et al., 2014; Jarrett et al., 2012; Jones & Cunningham-Williams, in press; Sutfin, 2011). Among a mostly female, ACHA–NCHA II sample of 111,245 students from 158 schools, Primack and colleagues (2012) conducted a cluster analysis to generate distinctive substance use profiles. Results of the analysis indicated that last 30-day binge alcohol drinking, poly-tobacco use, and marijuana use generally clustered together. Among the substance use predictors in our second regression model, current alcohol use most strongly increased the relative odds of hookah smoking. Moreover, it is certainly important to note that neither lifetime, nor current, illicit substance use was significantly linked to hookah use within the last 30 days. One likely hypothesis for these collective findings is that hookah use, similar to alcohol and marijuana use, is an increasingly popular, social activity among college students (Barnett et al., 2013; Mohler-Kuo, Lee, & Wechsler, 2003; Nichter, Nichter, Carkoglu, & Lloyd-Richardson, 2010).

In Model III only, experiencing more than average or tremendous stress unexpectedly reduced the relative risk of hookah smoking. This result contradicts findings from previous

studies of the association between college student stress and hookah use. Since this finding was significant at p=0.05, we interpret it cautiously. As results from the first two regression models indicated, experiencing a greater number of stressful and/or traumatic events within the last 12 months increased the risk of last 30-day hookah use. This finding suggests a potential, negative, cumulative effect of stressful/traumatic life events on hookah smoking risk among African American, female undergraduates. In the final model, in which we explored the contributions of specific types of stressful/traumatic events, dealing with the death of a family member or friend within the last year significantly increased the relative odds of current hookah use. Within our sample, students who were coping with a family member's or friend's death had approximately twice the relative odds of hookah use than were students who had not experienced a loved one's death.

5.4.1 Limitations

Our findings should be considered in the context of the following caveats. First, the ACHA–NCHA II, from which we drew our analytic sample, is a cross-sectional survey. Thus, we cannot generate causal inferences from our findings. Second, colleges/universities voluntarily opt to participate in the survey and are not sampled based on probability. As a result, the African American, female undergraduates in our sample might not be representative of their counterparts at colleges/universities throughout the U.S. It is important to mention, however, that the ACHA–NCHA II was compared in formal, reliability and validity evaluations to three, major, nationally representative surveys of college student health (ACHA, 2014). The survey demonstrated comparably strong reliability and validity and, as such, appears to offer sufficient empirical value. A third, potential limitation of this study includes survey participants' ability to self-identify with multiple racial–ethnic categories. For instance, participants who self-identify

as Hispanic or Latino/a and African American could select both of the respective survey options. Hence, we may have been unable to detect key differences in hookah use risk among Black, non-Hispanic and Hispanic, female college students (U.S. Department of Health & Human Services, 2012). Finally, our stress-related variable selection was limited by the questions asked on the ACHA–NCHA II survey and by respondents' interpretations of and responses to them.

5.4.2 Conclusions

The findings of this study contribute to the dearth of literature concerning differential, hookah use risk among African American, female college students. In light of key findings, future studies are needed to determine if and how stressful/traumatic experiences interact with substance use to impact the risk of current hookah use. Such research could contribute to novel, highly targeted, hookah use prevention and intervention strategies for a particularly vulnerable population. Considered together, the results of this examination illuminate the need for ongoing monitoring of hookah use patterns among younger, African American, female college students and among those experiencing cumulative stress and currently using other substances. Finally, our results might be especially useful in policy discussions concerning the availability of hookah to African American, female college students.

Chapter 6
Coda

Taken together, the first set of studies in this dissertation provides important insights concerning social epidemiological factors associated with the interdependence of place and education, health, and related developmental outcomes across the St. Louis metropolitan region. The geospatial mapping and analysis in the studies offer a relatively dim portrait of local, African American residents' opportunities for positive development, success, and well-being. Nevertheless, these studies do offer the possibility of our findings being applied to improve social, economic, education, and health-related outcomes for African American citizens in metropolitan St. Louis. Given this possibility, I recommend that similar studies for urban areas across the U.S. be conducted.

Collective findings from the second set of dissertation essays indicated distinct, risk and protective factors for hookah tobacco use among African American college students. One key finding was that individual- and school-level, contextual factors significantly predict the risk of hookah use among this population. In light of this takeaway, additional analyses considering the interaction of individual and contextual attributes on hookah smoking risk are warranted. For example, how do attributes of the college or university environment buffer the influence of other substance use on hookah use? Responding to this and related empirical questions provides an opportunity to positively intervene in the lives of African American college students.

Broadly, both sets of studies in this dissertation highlight the influence of contextual factors on individuals' development and well-being. It follows that interventions to promote positive, developmental opportunities for young people must target not only individual behavior, but also macro-level, social–structural factors. In metropolitan regions across the U.S., various

policies and programs, such as the randomized, housing mobility experiment Moving to Opportunity (MTO), have been implemented to address such factors (see, e.g., Briggs, Popkin, & Goering, 2010). The mixed results from MTO evaluations, for example, point to a noteworthy limitation of the models discussed in this dissertation. Albeit defensibly so given existing and herein presented evidence, the models emphasize the role of larger, social–structural influences on individuals' education, health, and related developmental outcomes without considering the interaction between these and individual characteristics. Better understanding this interaction is vital to developing appropriate, targeted interventions to improve the quality of life for all individuals. Improving the quality of life and life chances for all individuals, in turn, is vital to promoting the economic and social vitality of U.S. metropolitan regions as a whole.

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