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Ferguson and Beyond: A Descriptive Epidemiological Study Using Geospatial Analysis

Brittni D. Jones  Washington University in St. Louis
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Ferguson, like many at-risk suburbs, has largely been lost in discussions of the geography of opportunity. The authors conducted a descriptive epidemiological case study of Ferguson and its surrounding region with a focus on health and education indicators. Drawing from a variety of community data sources, they used geospatial methods to investigate the interdependence of place, education, and health across the metropolitan region. Results revealed the nature and distribution of class and racial disparities across the region. The legacy of the regional segregation regime indicates that substantive reform is required. Recommendations to improve education and health outcomes include eliminating political fragmentation with a unification strategy for the region and health insurance for families without coverage.

Keywords: segregation, Ferguson, opportunity, education and health, geospatial disparities

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 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.

**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, as Edwards (2010) posited, poor, urban youth are treated as adults concerning matters of criminality, 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. In an interview, 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.

**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 (2009) 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 in several ways. 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. This ratio translates to 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 in several ways, including economically. 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, exerts police and court staff to deliver those revenue increases, and closely monitors whether those increases are achieved” (p. 2). Ferguson’s law enforcement practices disproportionately impact Blacks, who account for nearly two-thirds of the city’s population. Yet, Blacks account for 85% of vehicle stops, 90% of citations, and 93% of arrests. 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 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 exposé (Crouch, 2015) 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.

![Graph](image1.png)

**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. Figure 2 provides a map of the distribution of Blacks across the region. The regional racial binary simplifies the mapping process, as a map illustrating the distribution of either demographic group provides insight into the distribution of both groups.

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 metropolitan St. Louis, regions with greater upward income mobility tend to have less segregation, better schools, greater social capital, and less income inequality.

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 3 provides one pathway through which racial segregation develops and influences life-course developmental outcomes related to health and education. The pathway model suggests causality and, therefore, is temporal in nature. In this study, the authors do not intend 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.
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 metropolitan St. Louis, regions with greater upward income mobility tend to have less segregation, better schools, greater social capital, and less income inequality.

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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 3 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 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 1

**Data Sources**

<table>
<thead>
<tr>
<th>Construct</th>
<th>Data Source(s)</th>
<th>Significance for Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home values</td>
<td>US Census Bureau, 2010; ACS 2008–2012</td>
<td>Important indicator of neighborhood wealth and resources; provides the tax base that is linked to education funding (Kenyon, 2007)</td>
</tr>
<tr>
<td>Underbanked households</td>
<td>Social Compact CityDNA, 2009; St. Louis Neighborhood Market Drilldown, 2012</td>
<td>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; Social Compact, 2012).</td>
</tr>
<tr>
<td>Major companies</td>
<td>St. Louis Regional Chamber, 2012</td>
<td>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, &amp; Fernandez, 2013; Stoll, 2005).</td>
</tr>
<tr>
<td>Per pupil funding</td>
<td>Missouri Department of Elementary and Secondary Education (DESE), 2014</td>
<td>Reflects, in part, neighborhood economic resources and ability to invest in educational resources for local students (Kenyon, 2007)</td>
</tr>
<tr>
<td>Poverty</td>
<td>ACS, 2008–2012</td>
<td>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).</td>
</tr>
<tr>
<td>Preterm births</td>
<td>Missouri Information for Community Assessment (MICA), 2015; US Census, 2010</td>
<td>Reflects maternal educational attainment and predicts children’s future educational opportunity and outcomes (Williams et al., 2013)</td>
</tr>
</tbody>
</table>


Table 1 continued

<table>
<thead>
<tr>
<th>Construct</th>
<th>Data Source(s)</th>
<th>Related to economic opportunity and outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asthma</td>
<td>MICA, 2015; US Census, 2010</td>
<td>Most prevalent chronic childhood disease, which disproportionately impacts urban poor and minority youth (Claudio, Stingone, &amp; Godbold, 2006; Eggleston et al., 1998); also the primary reason for school absence among youth in the US (Basch, 2011a, 2011b)</td>
</tr>
<tr>
<td>Childhood mental health disorders</td>
<td>MICA, 2015; US Census, 2010</td>
<td>Linked to school discipline and suspensions (Purnell, Camberos, &amp; Fields, 2014)</td>
</tr>
<tr>
<td>Infant mortality rates</td>
<td>DESE, 2014</td>
<td>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, &amp; Belway, 2015).</td>
</tr>
<tr>
<td>Third-grade literacy attainment</td>
<td>DESE, 2014</td>
<td>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, &amp; Gwynne, 2010).</td>
</tr>
<tr>
<td>Dropout rates</td>
<td>DESE, 2014</td>
<td>Related to economic opportunity, future labor market success, poverty, crime, and health outcomes (Purnell, Camberos, &amp; Fields, 2014; Sum, Khatiwada, McLaughlin, &amp; Palma, 2009)</td>
</tr>
</tbody>
</table>

Note: All maps were created with ArcGIS utilizing data from these sources.

RESULTS AND DISCUSSION

Distribution of Economic Resources

The four maps in Figure 4 demonstrate the distribution of economic resources throughout the region. Figure 4a 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 4a 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.
The St. Louis Neighborhood Market Drilldown (Social Compact, 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 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 becomes evident that low-income and minority communities are disproportionately affected.
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strategy to provide special education services. The Special School District of St. Louis County
spending was also greater than $15,000 in the Brentwood and Maplewood-Richmond Heights
where the majority of homes were valued at $150,000 or higher, per pupil spending was less than
majority of regional school districts spent less than $12,500 per student. In a few school districts
St. Louis County to $18,372 in the Clayton School District located west of St. Louis City. The
occupied homes were valued at $150,000 or greater in a cluster of zip codes in western St. Louis
75% –100% of owner-
Home values are an important indicator of neighborhood wealth, resources, and property tax
base (Kenyon, 2007). As illustrated in Figure 4b, 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 4c 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 4d 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

### Table 2

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

*Metro Area includes St. Louis City, St. Louis County, and 15 additional surrounding counties on both the Missouri and Illinois sides.

### Note.

Recall that if the NNI is less than 1, the pattern exhibits clustering. Results of the analysis revealed

### Sources.

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.

**Distribution of Poverty**

As presented in the model in Figure 3, the uneven distribution of economic resources throughout the region has led to higher concentrations of poverty in specific geographic areas. Figure 5 depicts the distribution of poverty throughout the region. A large number of census tracts within St. Louis City and near northern suburbs in St. Louis County had higher percentages of poverty. This graphic is strikingly similar to Figure 2, which illustrated racial segregation in the region and is consistent with the higher percentages of underbanked households and lower home values in these same areas (see Figure 4). 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.

![Figure 5. Poverty in St. Louis region, 2010.](https://www.census.gov/geo/maps-data/data/tiger-line.html)


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
and in mostly White communities. The rejection of the hypothesis that large companies are randomly located in the region. Again, the lower percentages of the population were living in poverty. In contrast, in many of the census tracts in central and southern St. Louis County, considerably extending west throughout the city had poverty rates higher than 35% and approaching 60%–65%. With the higher percentages of underbanked households and lower home values in these same areas is strikingly similar to Figure 2, which illustrated racial segregation in the region and is consistent with the distribution of poverty throughout the region. A large number of census tracts within St. Louis County and near northern suburbs in St. Louis 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 24 decades.

Table 3

<table>
<thead>
<tr>
<th>County</th>
<th>Poverty Rate 1960</th>
<th>Poverty Rate 1970</th>
<th>Poverty Rate 1980</th>
<th>Poverty Rate 1990</th>
<th>Poverty Rate 2000</th>
<th>Poverty Rate 2010</th>
<th>Compound Decade Growth Rate of Poverty (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Charles County</td>
<td>12.4</td>
<td>5.8</td>
<td>4.4</td>
<td>4.7</td>
<td>4.0</td>
<td>5.4</td>
<td>-15.2</td>
</tr>
<tr>
<td>St. Louis County</td>
<td>6.9</td>
<td>4.9</td>
<td>4.9</td>
<td>5.6</td>
<td>6.9</td>
<td>10.5</td>
<td>8.9</td>
</tr>
<tr>
<td>St. Louis City</td>
<td>24.6</td>
<td>20.3</td>
<td>21.8</td>
<td>24.6</td>
<td>24.6</td>
<td>27.0</td>
<td>1.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>St. Charles County</td>
<td>51,786</td>
<td>92,000</td>
<td>142,789</td>
<td>210,448</td>
<td>279,670</td>
<td>355,354</td>
<td>47.0</td>
</tr>
<tr>
<td>St. Louis County</td>
<td>619,567</td>
<td>940,891</td>
<td>960,475</td>
<td>975,567</td>
<td>997,284</td>
<td>979,653</td>
<td>7.0</td>
</tr>
<tr>
<td>St. Louis City</td>
<td>733,072</td>
<td>610,808</td>
<td>444,308</td>
<td>386,630</td>
<td>339,323</td>
<td>308,767</td>
<td>-16.0</td>
</tr>
</tbody>
</table>

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]

50 years. Table 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.

**Health Outcomes and Access to Health Care**

As the segregation conceptual model in Figure 3 demonstrates, preterm birth and low-birth weight (LBW) rates are two indicators that reflect maternal educational attainment and that predict education and related developmental outcomes for future generations (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 6a 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. 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.

![Figure 6](image)

Similiar to that of preterm births, the percentage of LBW (see Figure 6b) 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.
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 7a 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. OM is most common during the early developmental period, which is 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. In 2012, 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 7b 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 7c 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.

Health care access for children under 18 years varied substantially as well throughout the region. As Figure 7d 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.

**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 & Secondary Education, MO DESE, 2014b). Results from the 2012 ELA MAP test are presented to provide a snapshot of third-grade students’ literacy attainment. Figure 8a 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 8 (a–c).](image)

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 8b 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. The comparatively high dropout rate in these school districts aligns with the trend of racial disparities in the region.

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 8c 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.

**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, the authors 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 et al., 2014; OECD, 2015; Purnell, Camberos, & Fields, 2014).

**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.
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.

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.

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