Social Capital and Health Outcomes in Boston

TECHNICAL REPORT
Center on Human Needs
Virginia Commonwealth University
Richmond, Virginia

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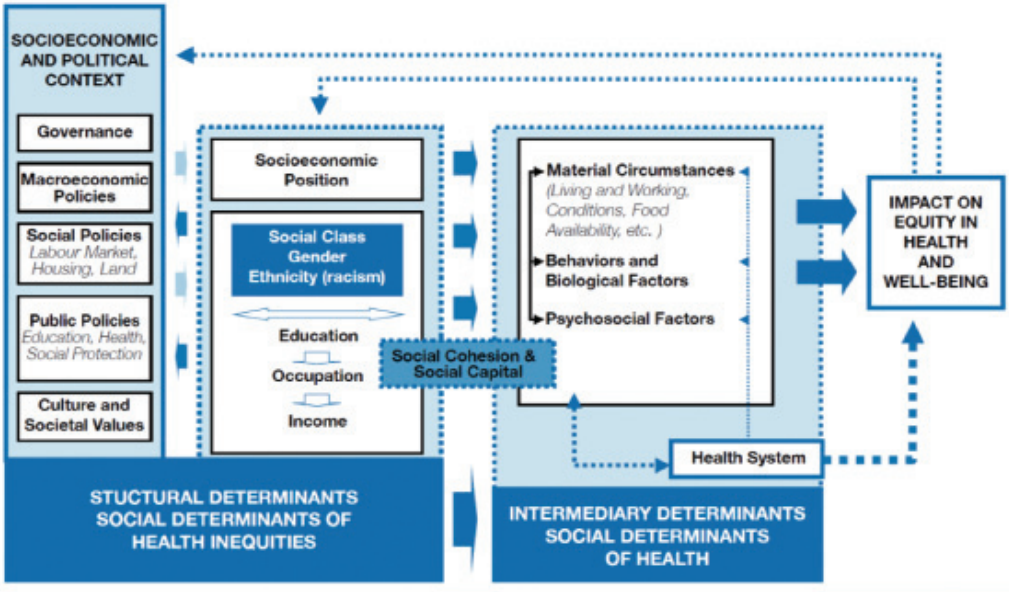
Preface

Health is influenced by more than health care, and the same is true for health disparities.[1] Inequities in health exist for reasons that transcend access to health care or adequate health insurance coverage. Health is also heavily influenced by health behaviors (such as tobacco use), modifiable risk factors (such as obesity), and environmental conditions. These conditions are only partly a matter of personal choice. Adopting a healthier diet requires access to supermarkets or farmers' markets that sell fresh produce. Regular physical activity requires a conducive built environment and access to safe parks, pedestrian routes, and green space for residents to walk, bicycle, or play. Tobacco and alcohol use is influenced by enticing advertising and marketing practices. Exposure to environmental pollutants from unhealthy housing or from nearby factories and smokestacks are not choices made by residents but by society.

Figure 1:
World Health Organization Conceptual Model for Social Determinants of Health



From: *A Conceptual Model for Taking Action on the Social Determinants of Health.* Geneva: World Health Organization, 2010 (reprinted with permission)

In the language of social epidemiology, "downstream" determinants of health—ranging from unhealthy behaviors to living and working conditions—are the byproduct of "upstream" structural determinants (Figure 1) such as socioeconomic position, race-ethnicity, occupation, and social cohesion. These socioeconomic circumstances are themselves the result of upstream policies that create opportunities for education and employment, income and savings, social equality, and environmental stewardship. Macroeconomic policies create commercial incentives for industries to either promote unhealthy products or more healthful alternatives.[2]

Health also varies sharply by geography—across communities and neighborhoods—because unhealthful downstream conditions are often concentrated in disadvantaged areas. Areas populated by the poor or communities of color typically experience greater exposure to unhealthy conditions and material deprivation, a vicious cycle that is itself shaped by upstream factors. These upstream influences include historical antecedents, such as racial or ethnic discrimination and recurring cycles of poverty that inhibit economic growth and social mobility over generations, but also modern-day decisions about where to position highways and supermarkets and how much resource to invest in public transportation, housing, local development, crime prevention, public schools, job training, and social services. The recognition that "place matters" to health and the need to understand how unwise social policies foment health inequity comes at the recommendation of prestigious commissions sponsored by the World Health Organization,[3] MacArthur Foundation,[4] and Robert Wood Johnson Foundation.[5]

About the Place Matters Project

The Place Matters technical reports were produced by the Virginia Commonwealth University (VCU) Center on Human Needs (CHN) in collaboration with the Joint Center for Political and Economic Studies/Health Policy Institute (HPI) and the Virginia Network for Geospatial Health Research (VANGHR). All maps and geospatial analyses were produced by VANGHR.

The production of the Place Matters technical reports was funded by HPI under a subaward from a parent grant from the National Institutes of Health (grant 5RC2MD004795-02). The goal of the project was to prepare and disseminate a series of locally tailored Community Health Equity reports (CHERs) to assess population health inequities and related social and economic conditions for the following eight communities:

- Alameda County, California
- Baltimore, Maryland
- Bernalillo County, New Mexico
- Orleans Parish, Louisiana
- Cook County, Illinois
- San Joaquin Valley, California
- Boston, Massachusetts
- South Delta, Mississippi

The VCU Center on Human Needs and VANGHR were contracted by HPI to develop technical reports on which the eight CHERs were based. What follows is the technical report for Boston, Massachusetts. The focus of the report and the research questions it addresses were guided by extensive input from the Place Matters team in Boston. See the Methods Appendix on the CHN website for more details on analytic methods.

The project was approved by the VCU Institutional Review Board.

For more information about the Place Matters technical reports or collaborating organizations visit the websites listed below:

Center on Human Needs: www.humanneeds.vcu.edu
Health Policy Institute: www.jointcenter.org/institutes/health-policy
Place Matters Initiative: www.jointcenter.org/hpi/pages/place-matters
Virginia Network for Geospatial Health Research: vnghr.org/

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Introduction

The health of Boston residents is related to many factors. Across the country, disease rates vary dramatically by age, gender, race, and ethnicity as well as with the prevalence of risky health-related behaviors.[3,6-11] Place matters in health because characteristics of the areas in which people live affect health choices, behaviors, environmental risks, and access to medical care.[12-17] Local conditions that may affect health include levels of stress and environmental toxins, the social and economic characteristics of individuals and families (such as education and income), and the characteristics of the communities in which people live. This report will focus on social capital and the demographic and socioeconomic characteristics of Boston and its communities that may affect the health outcomes of residents. Health outcomes that will be explored include life expectancy, premature mortality, elevated blood lead levels in children, and violent crime.

Citywide statistics oversimplify important geographic differences that exist between different neighborhoods and communities within Boston and that contribute to large differences in the health of residents. Geographic disparities in health status within Boston reflect, in part, geographic patterns in the population and living conditions. The health challenges faced by individuals and households are influenced by the neighborhood.[18, 19] Regardless of one's education, income, or motivation to make healthy choices, risks may be introduced by crime, air pollution, poor schools, the absence of places to exercise, lack of access to nutritious food, a scarcity of good jobs, and stress related to these community challenges.[20-28] In addition, historical patterns contribute to long-term trends of placing vulnerable populations in stressed areas. This in turn reinforces cycles of hardship that entrench patterns of socioeconomic disadvantage.[29-33]

This report specifically focuses on the geographic distribution of social capital in Boston, its social determinants, and its relationship to health outcomes. In his 1993 book, *Making Democracy Work*, Robert Putnam described social capital as the "features of social organizations such as trust, norms, and networks that can improve the efficiency of society by facilitating coordinated actions." [34] Studies have shown consistent relationships between social capital and self-reported health status as well as some measures of mortality.[35-39] Social capital is dependent upon community members forming relationships and networks with their neighbors. Characteristics of communities that foster distrust among neighbors such as unmaintained properties and criminal activity can affect both the cohesiveness of neighbors as well as the frequency of poor health outcomes.

Part I of this report provides background information about Boston, including population data, socioeconomic conditions, community characteristics, and health outcomes. Part II examines the relationship between the social capital of neighborhood residents and health outcomes. Part III presents conclusions about community-level factors related to social capital and health outcomes in Boston. Appendix A on the CHN website presents detail about the data and methods that were used in preparing this report.

I. Background: Population, Community Characteristics, and Health in Boston

Population

The city of Boston, located on the eastern coast of Massachusetts, had a population of 645,187 in 2009.[40,41] It is one of the densest metropolitan areas in the United States, with an overall population density of 12,765.5 people per square mile in 2009—a value less than the density of New York City, NY and San Francisco, CA but close to the density of Chicago, IL.[37] Population density ranges from a low of 1,197.8 in coastal East Boston to a high of 112,290 in eastern Fenway (Map 1).[41] Boston is characterized by a dense urban environment near the coast that becomes progressively less populated toward the south-west.

Map 1:
Population Density by Census Tract, Boston, 2009

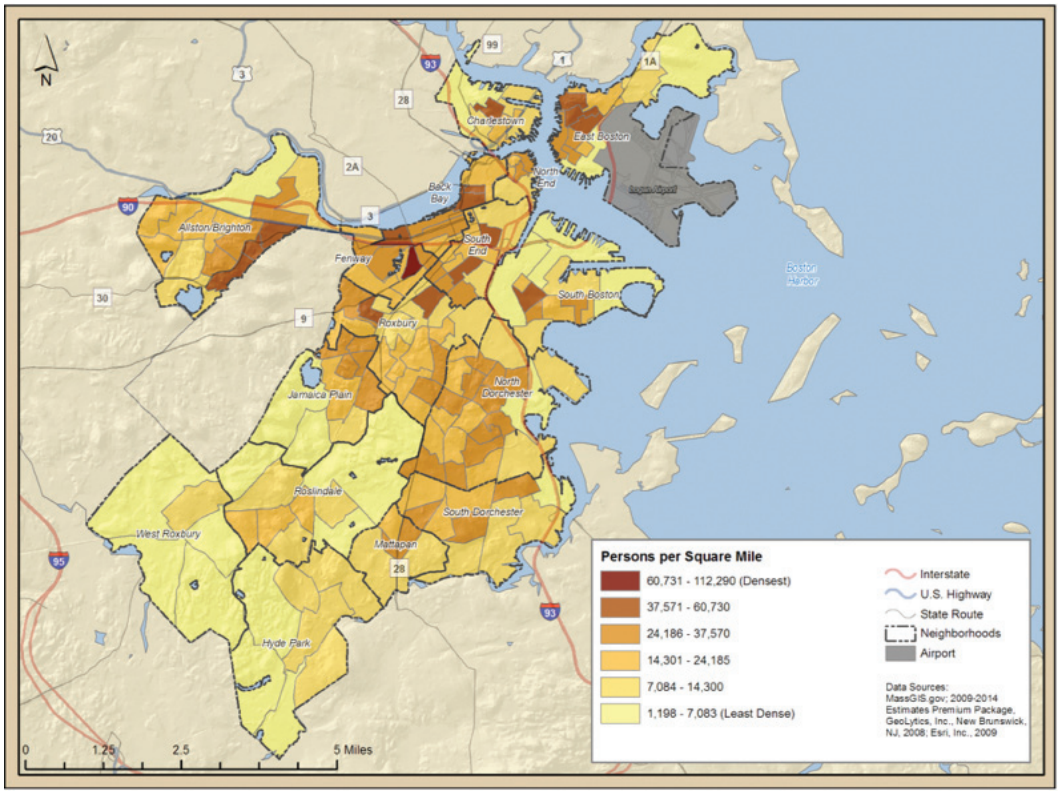


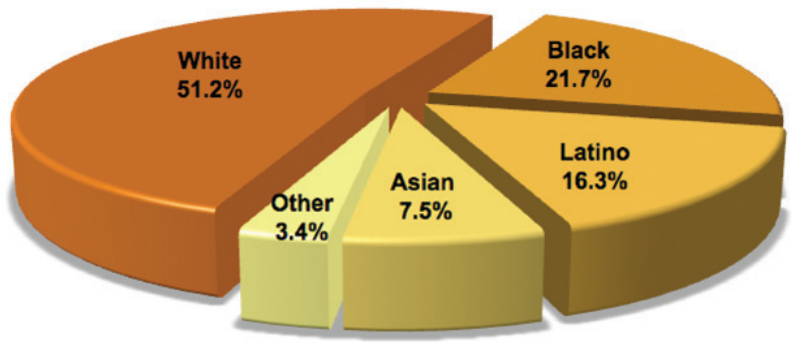
Table 1: Demographic Characteristics of Boston, Massachusetts, and the United States

	Boston	Massachusetts	United States
Population (2009)[(a)]	645,187	6,593,587	307,006,556
Population density (2009)[(b)]	12,765.5	824.0	86.7
Race/Ethnicity (2009)[(a)]			
Non-Latino White	51.2%	78.2%	64.9%
Non-Latino Black	21.7%	5.8%	12.1%
Latino	16.3%	8.8%	15.8%
Non-Latino Asian	7.5%	4.9%	4.4%
Non-Latino two or more races	1.7%	1.5%	1.8%
Non-Latino American Indian/ Alaska Native	0.2%	0.1%	0.6%
Non-Latino Native Hawaiian/ Other Pacific Islander	0.03%	0.02%	0.1%
Non-Latino some other race	1.5%	0.6%	0.2%
Foreign-born (2009)[(a)]	25.1%	14.3%	12.5%

(a) Source: U.S. Census Bureau, 2009 American Community Survey.
(b) Source: 2009 Geolytics Projection.
Note: Latino can include any racial group.

The population of Boston has a higher percentage of non-Latino Blacks compared to the rest of the nation (21.7% versus 12.1%) and a lower percentage of non-Latino Whites (51.2% versus 64.9%).[40] There is also a larger Asian population (7.5% versus 4.4%). Latinos represent 16.3% of Boston residents (Figure 2).[40] According to the U.S. Census Bureau, a quarter (25.1%) of Bostonians were born outside of the United States, approximately twice the percentage of the United States as a whole (12.5%) (Table 1).[32,40]

Figure 2: Race and Ethnicity in Boston



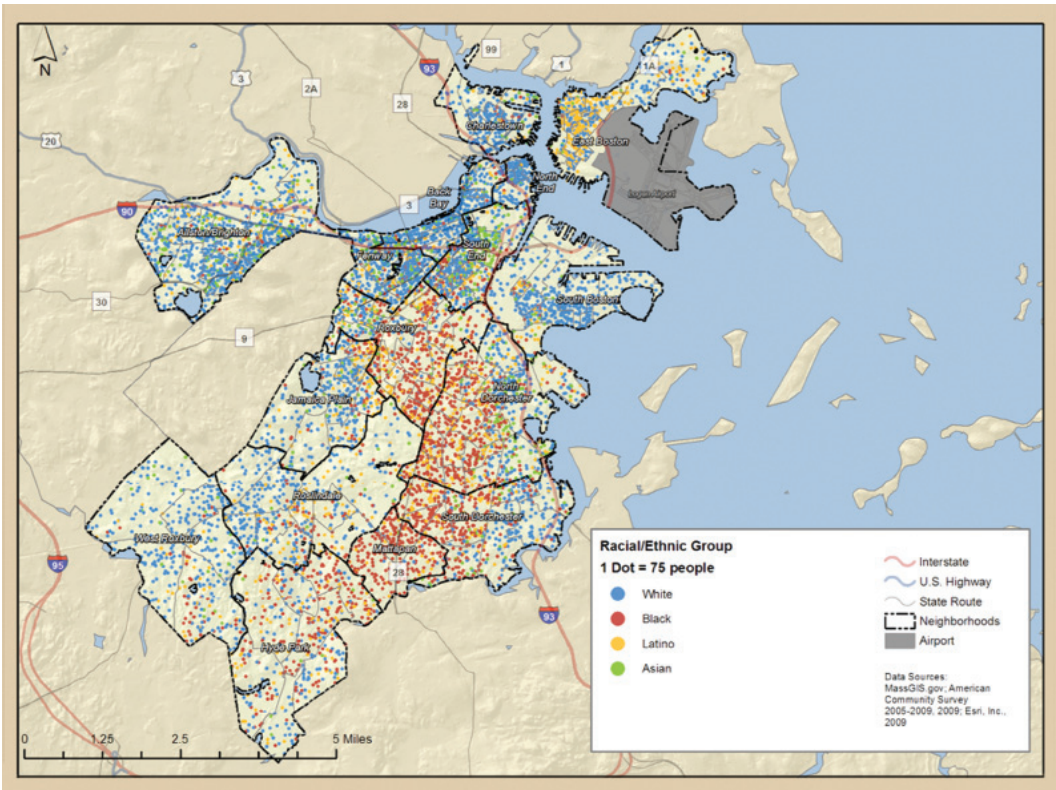
Source: U.S. Census Bureau, 2009 American Community Survey.
Note: "Other" includes American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, and those who identified themselves as some other race or two or more races. Racial groups include the non-Latino population only; Latino can include any racial group.

In part because of racial segregation, racial and ethnic groups are concentrated differently across Boston.[17, 42,43] The Index of Dissimilarity[44] is a measure of residential segregation that identifies the percentage of the population that would have to relocate to completely integrate the community. The higher the value, the more segregated the area. Generally, larger areas such as states have lower values than those of smaller areas. More than 80% of the population in Boston is either White or Black, so a comparison between these two groups is most relevant. Between 2005 and 2009, Boston's Index of Dissimilarity between White and Black populations was 66.7%, compared with 63.9% in Massachusetts.[45] Boston ranked 19th in Black-White segregation among the top 100 largest metropolitan areas according to 2005–2009 American Community Survey data. Milwaukee, Detroit, the New York metropolitan area, Chicago, and Cleveland held the top 5 spots.[45]

The diversity index is used to compare racial segregation at smaller geographic levels, such as the census tract. It is a measure of the likelihood that two people randomly chosen from an area will be of a different race or ethnicity. The higher the value, the less segregated the area. Although the diversity index for Boston as a whole is 65.2%, the value ranges from 1.7% in the Pleasure Bay area of South Boston (east of O and N Street) to 84.8% in East Boston (west of Border, Meridian, and Havre Streets).

The spatial distribution of racial groups throughout the city is illustrated in Map 2. The least diverse section of Boston, according to the diversity index, is in South Boston (east of K, H, and E Streets). This area is majority White. The area where the population is most segregated (diversity index = 23.3%) and majority Black is in Mattapan (between Norfolk and Harvard Streets). North Dorchester and South End display the most diversity (76.1 and 72.6%, respectively).

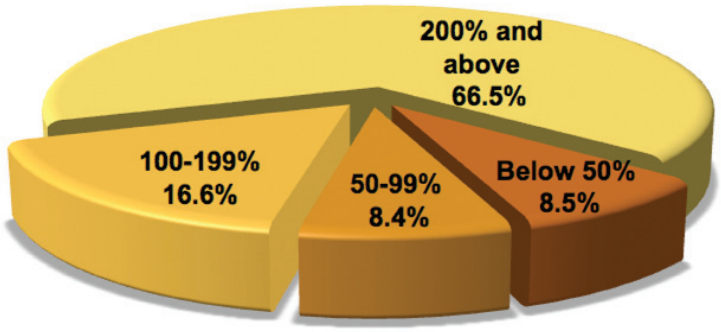
Map 2:
Racial and Ethnic Distribution, Boston, 2005-2009



Socioeconomic Characteristics

As is true of other communities, socioeconomic conditions in Boston exert an important, and often unrecognized, influence on health status. Nationally, families living below the federal poverty level (FPL) are 3.6 times more likely to report fair or poor health than are those with incomes of at least twice the poverty level.[46]

Figure 3: Income-to-Poverty Ratio in Boston



Source: U.S. Census Bureau, 2009 American Community Survey.
Note: Income-to-poverty ratio (IPR) refers to a family's, or unrelated individual's, income divided by their federal poverty threshold. For example, a family with an IPR of 50% has income that is half the poverty threshold.

In 2009, about one-sixth (16.9%) of households in Boston had incomes below the FPL, compared with 10.3% of Massachusetts households and 14.3% nationally.[40] The income-to-poverty ratio expresses household income as a percentage of the FPL. As shown in Figure 3, 8.5% of households in Boston had incomes below half the FPL (an income-to-poverty ratio of less than 50%), and more than one third of households (33.5%) had incomes less than twice the FPL (Table 2).[40] For a family of four in 2009, this would be an income below $44,100 a year.

Table 2: Socioeconomic Characteristics of Boston, Massachusetts, and the United States in 2009

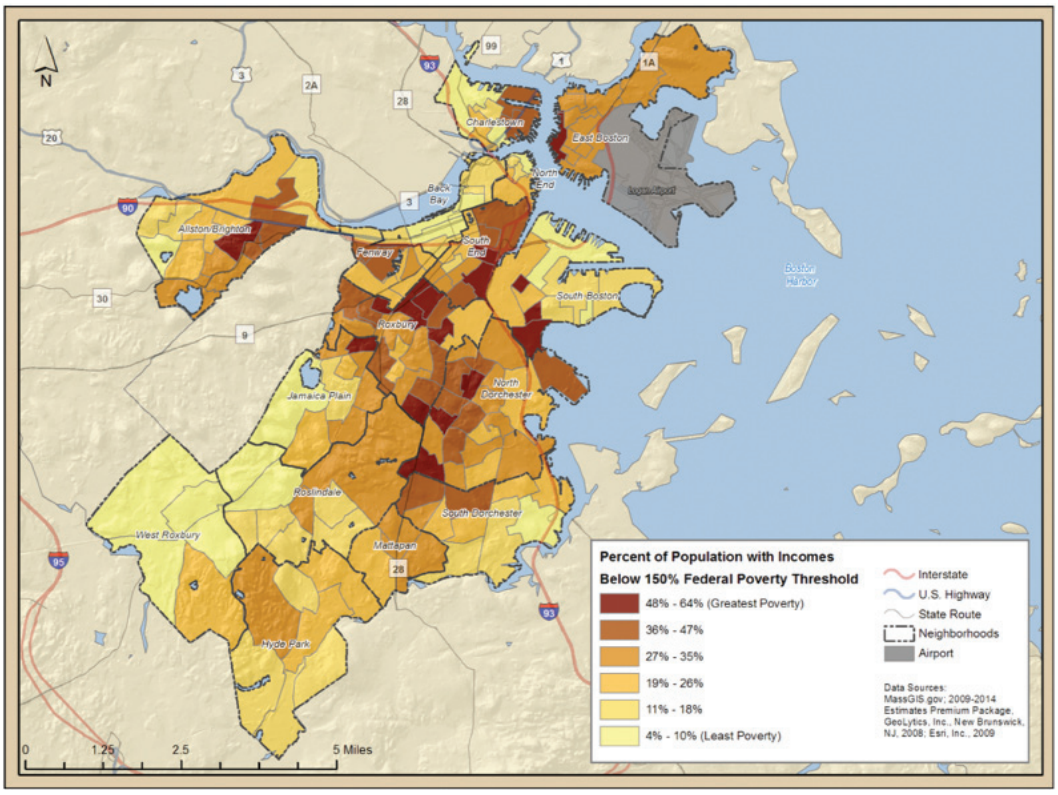
	Boston	Massachusetts	United States
Educational attainment			
Less than high school	14.5%	11.0%	14.7%
High school only	22.4%	26.3%	28.5%
Some college	18.4%	24.4%	28.9%
Bachelor's degree or higher	44.7%	38.2%	27.9%
Poverty rate			
Below 50% of poverty rate	8.5%	4.5%	6.3%
50–99% of poverty rate	8.4%	5.8%	8.1%
100–199% of poverty rate	16.6%	12.7%	18.4%
200% and above of poverty rate	66.5%	77.0%	67.3%

Source: U.S. Census Bureau, 2009 American Community Survey.

The U.S. Census Bureau estimates that 23.6% of U.S. households had incomes below 150% FPL in 2009.[40] In Boston, 25.4% of the population had incomes less than 150% of the FPL, yet 52.9% of Boston census tracts—representing 83 tracts—met or exceeded this level of poverty.[41] As shown in Map 3, the percentage of the population below 150% of the FPL was highest in parts of

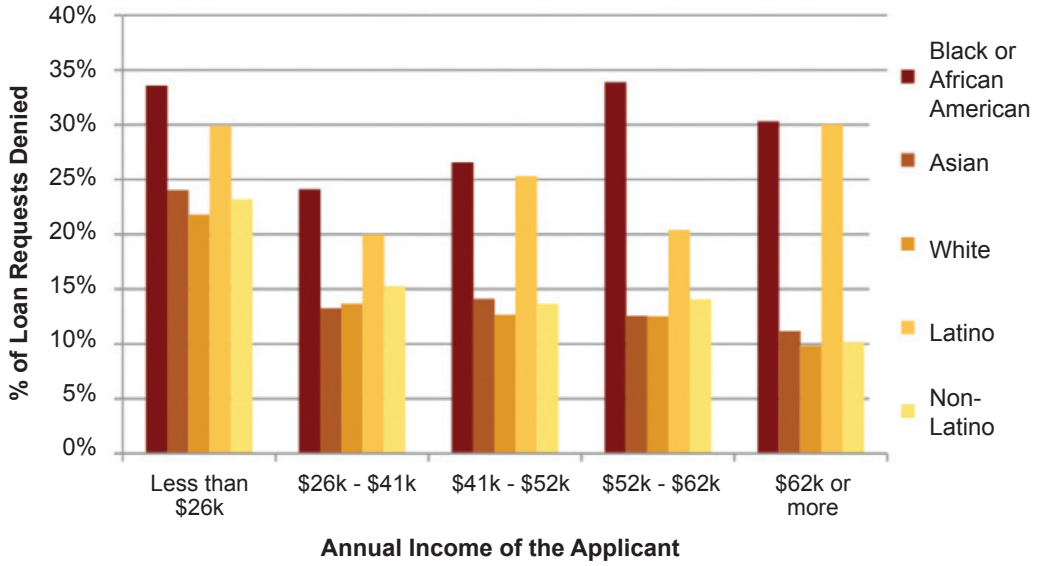
- South Boston (near Old Colony Avenue, B Street, and Columbia Road, and Old Colony Avenue and Dorchester Street)
- East Boston (near Meridian Street and Decatur Street)
- South End (near Berkeley Street and Albany Street)
- Jamaica Plain (near Centre Street and Walden Street)
- Roxbury (near Tremont, Whittier, and Saint Alphonsus Streets, near Washington and Lenox Streets, near Harrison Avenue and Warren Streets, and near Blue Hill Avenue and Route 28)
- North Dorchester (near Tremont Street and Talbot Avenue and near Columbia Road, Washington Street, and Dudley Street), and
- Allston/Brighton (near Cambridge and Washington Streets).

Map 3: Households below 150% of the Federal Poverty Threshold, by Census Tract, Boston, 2009



Race is a strong predictor of poverty and wealth—both nationally and in Boston. In 2009, White residents of Boston had significantly higher median income ($67,956) than did Black ($37,242) and Latino ($32,265) residents.[40] Even at similar income levels, minority groups in Boston have a more difficult time accumulating wealth as compared with White residents. In 2009, Blacks and Latinos in Boston experienced more difficulty securing home loans as compared with Whites at similar income levels (Figure 4).

Figure 4:
Loan Denials by Race and Income, Boston, 2009



Source: Federal Financial Institutions Examination Council, Home Mortgage Disclosure Act 2009.

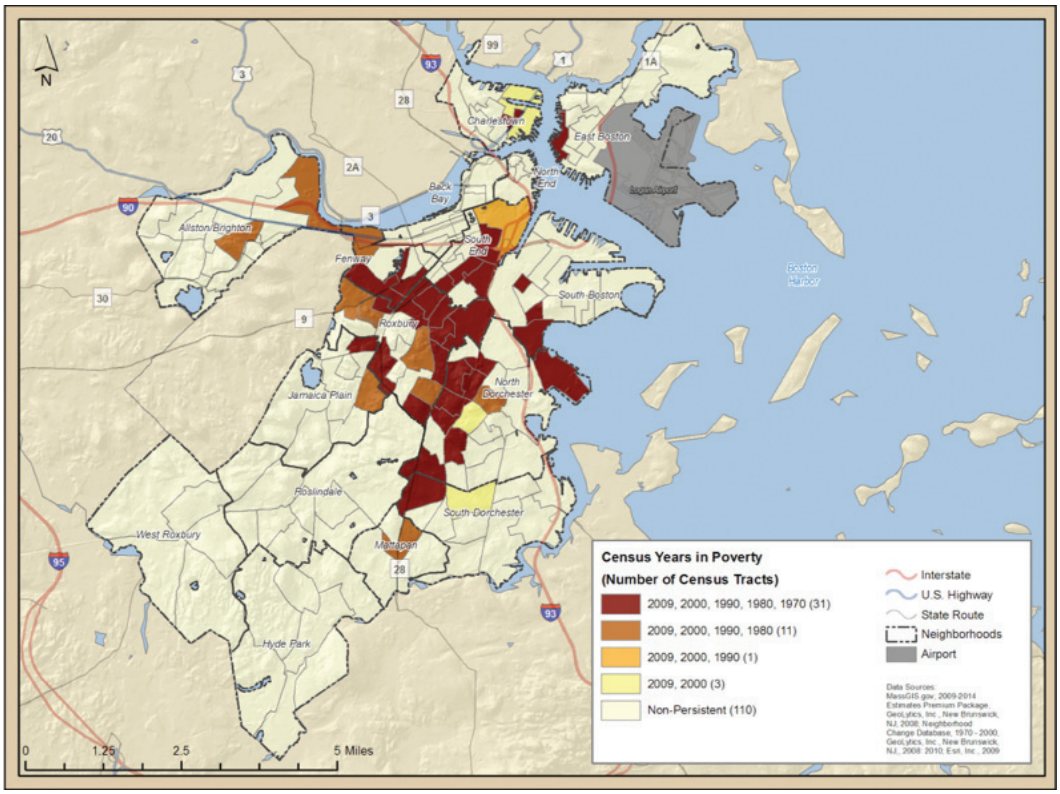
Persistence of concentrated poverty across several decades may have additional health and social consequences, particularly for the children living in those areas. A persistent lack of economic resources during childhood has consequences on cognitive, emotional, behavioral, and physical development.[47, 48] It may also diminish the likelihood of high school completion, thus perpetuating disadvantage and the multigenerational cycle of living in conditions that adversely affect health.[47, 48] Persistent poverty, which occurs when at least 20% of the population has incomes below 100% of the FPL for at least two consecutive decades (as measured by decennial censuses), has been a pervasive influence in several areas of Boston:

- Fenway (near Brookline Avenue and Longwood Avenue and near Route 9 and Parker Street) and Charlestown (near Route 1 and Vine Street)
- East Boston (near Meridan and Decatur Streets)
- South Boston (near Old Colony Avenue, Columbia Road, and B and Dorchester Street)
- South End (near Washington, Berkeley, and Waltham Streets; near Marginal Road and Tremont Street; near Massachusetts Avenue and Tremont Street; and near Albany and Union Park Street)
- Roxbury (near Massachusetts Avenue and Tremont Street; near Dudley and Hampden Street; near Melnea Cass Boulevard, Harrison Avenue, and Tremont Street; near Tremont, Ruggles, and Saint Alphonsus Streets; near Warrant and Quincy Streets; and near Route 28 and Blue Hill Avenue)
- Jamaica Plain (near Centre Street and Bickford Street)

- North Dorchester (near Columbia Road, Geneva Avenue, and Quincy Street; near Magnolia and Quincy Streets; near William J. Day Boulevard and Mount Vernon Street; near Columbia and Stoughton Streets; near Ceylon and Quincy Street; near Washington and Harvard Streets; and near Route 28 and Harvard Street), and
- South Dorchester (near Route 28 and Woodrow Avenue).

In these tracts, at least 20% of the population has experienced poverty for the past four decennial census periods as well as in 2009 (1970–2009) (Map 4).[41, 49]

Map 4:
Persistent Poverty by Census Tract, Boston, 1970–2009

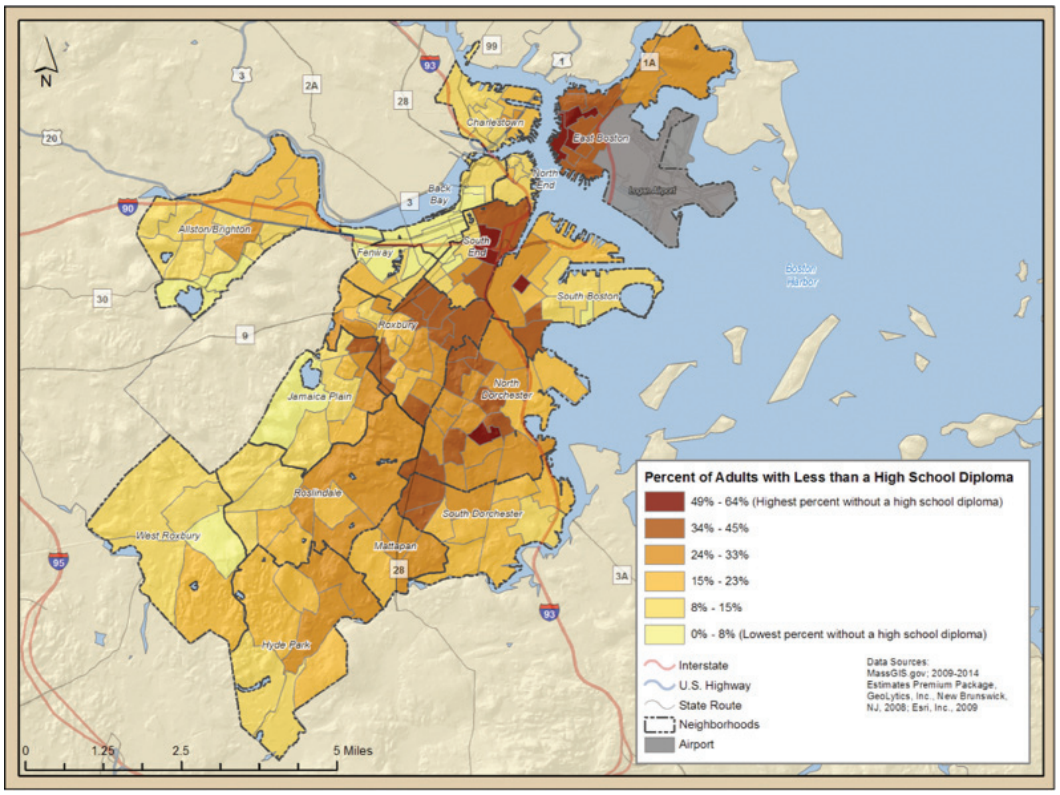


A physical environment lacking in proper maintenance serves as a signal to others that behaviors that are usually prohibited may be tolerated.[25] Furthermore, lower percentages of community-level owner-occupied housing are associated with crime rates and inadequate education.[50-53] Because of a lack of access to financial capital, impoverished families are more likely to rent rather than own property and to live in less desirable areas. In 2009, only 30.6% of housing units in Boston were owner occupied, compared with 57.7% in Massachusetts and 60.7% nationally.[41]

Education is a pathway to higher income and net worth and also has strong influences on health status and access to health care. In 2009, American adults with less than a high school diploma as their highest educational attainment had less than half the earnings ($18,432 versus $47,510)[40] and were three times more likely to die before age 65 as compared with adults with at least a Bachelor's degree.[54] They were also more likely to engage in unhealthy behaviors such as cigarette smoking.[55]

The percentage of the adult population with less than a high school education is higher in Boston than in the Commonwealth (14.5% vs. 11.0%, respectively) but is comparable with the rate for the nation as a whole (14.7%) (Table 2).[40] Educational attainments statistics are also influenced by the large concentration of colleges and universities in Boston. High school completion rates, however, vary greatly by neighborhood (Map 5).[41] The tracts exhibiting the highest level of educational distress—with more than half of adults lacking a completed high school education—are in South Boston (near Broadway and B Street), South End (near Route 28 and Marginal Road, Berkeley Street, and Harrison Avenue), East Boston (near Meridian, Decatur, Gove, and Princeton Street), and North Dorchester (near Geneva Avenue and Bowdoin Streets).

Map 5:
Adults with Less than a High School Education, Boston, 2009



Besides educational attainment, measures of educational proficiency also vary by place. The National Assessment of Educational Progress (NAEP) evaluates samples of students in the 4th, 8th, and 12th grades to gauge their proficiency in various subjects. Whereas Massachusetts students scored better than the national average in most subjects in 2009, Boston 4th and 8th graders scored lower in reading and mathematics than did students in the Commonwealth or nation (Table 3).[56] Boston students in these grades were more likely to score below basic proficiency in these subjects than were students nationwide.[56]

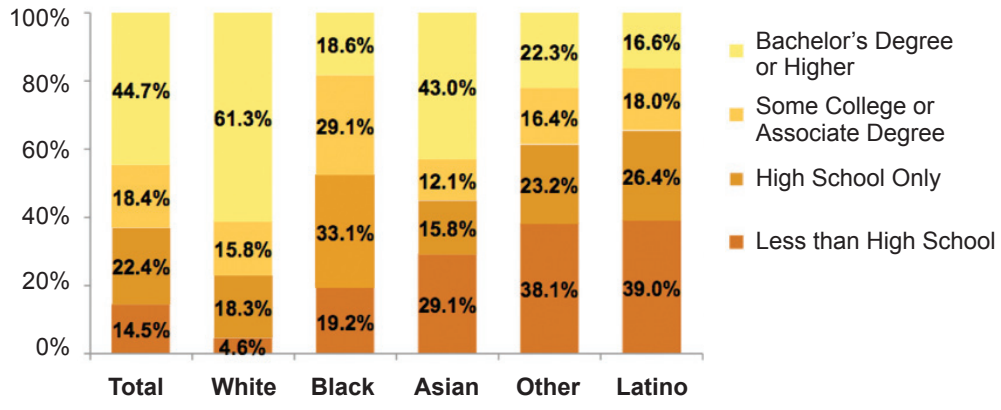
Table 3:
National Assessment of Educational Progress Proficiency Scores for Boston, Massachusetts, and the United States in 2009

	Boston	Massachusetts	United States
4th grade, reading			
Average scale score	215	234	221
Percent below basic proficiency	39%	20%	33%
4th grade, mathematics			
Average scale score	236	252	240
Percent below basic proficiency	19%	8.0%	18.0%
8th grade, reading			
Average scale score	257	274	264
Percent below basic proficiency	32%	17%	25%
8th grade, mathematics			
Average scale score	279	299	283
Percent below basic proficiency	33%	15%	27%

Source: United States Department of Education, National Assessment of Educational Progress Data Explorer.

Race and ethnicity are strongly associated with educational attainment. Compared with non-Latino Whites in the same time period, Black adults (non-Latino or Latino) in Boston were more than four times as likely to lack a high school education (Figure 5).[40] Latino residents fare even worse, with almost two of every five adults lacking a high school education. The Asian (non-Latino or Latino) population of Boston is nearly twice as likely to lack a high school education as is the Asian population of the United States (29.1% and 14.7%, respectively).[40] Gross comparisons such as these, however, overlook within-group differences. The Asian population of Metropolitan Boston is made up of 15 different ethnic subgroups.[57] Approximately two thirds of Boston's Asian population are of Chinese, Indian, or Vietnamese descent, but there are also significant populations of Cambodians, Koreans, Japanese, Filipinos, Laotians, Thai, Pakistani, and Hmong, among others.[57] Those of Chinese and Indian ancestry in Boston are much more likely to have completed high school than are those of Vietnamese or Cambodian ancestry.[57]

Figure 5:
Educational Attainment in Boston



Source: U.S Census Bureau, 2009 American Community Survey.
Note: "Other" includes American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, and those who identified themselves as some other race or two or more races. White includes the non-Latino population only; all other racial categories include both Latino and non-Latino; Latino can include any racial group.

Health Outcomes

Disparities in health outcomes based on demographic factors are well established. In 2007, life expectancy at birth in the United States was 77.9 years: it was 73.6 years for Blacks, compared with 78.4 years for Whites.[58] In 2007, Black Boston residents had a rate ratio of 1.8 premature deaths for every White premature death, a ratio larger than that of the nation or of Massachusetts.[59] (Table 4).

Table 4:
Health Characteristics of Boston, Massachusetts, and the United States

	Boston	Massachusetts	United States
Life expectancy at birth	**79.9[a]**	**79.3[b]**	**77.9[c]**
Premature mortality (per 100,000)	**213.3[d]**	**181.4[e]**	**238.4[e]**
White	**159.7[d]**	**179.4[e]**	**221.5[e]**
Black	**286.9[d]**	**289.0[e]**	**384.7[e]**

(a) Calculations performed by the VCU Center on Human Needs from 2003–2007 mortality data provided by Boston Resident Deaths, Massachusetts Department of Public Health, available from Boston Public Health Commission Research and Evaluation Office.
(b) Calculations performed by VCU Center on Human Needs from NVSS death tables by state and Geolytics population estimates.
(c) Health, United States 2010: With Special Features on Death and Dying; the Centers for Disease Control and Prevention: 2007.
(d) Calculations performed by the VCU Center on Human Needs from 2007 mortality data provided by Boston Resident Deaths, Massachusetts Department of Public Health, available from Boston Public Health Commission Research and Evaluation Office and 2007 Geolytics Premium Estimates.
(e) Centers for Disease Control and Prevention CDC WONDER Tool 2007
Note: All racial categories are non-Latino only.

Nationally, Blacks had the highest age-adjusted mortality rate in 2007 among racial or ethnic groups, a rate 28% higher than that of the White population.[59] Blacks also had the highest age-adjusted mortality rate from circulatory diseases, which include conditions such as ischemic heart disease and stroke.[59]

In Boston, Black residents have an all-cause mortality rate that is 39% higher than that of White residents—a disparity higher than that of the United States and of Massachusetts. Circulatory disease mortality among Blacks is 31% higher than among Whites in Boston, compared to 10% higher in Massachusetts and 38% higher nationally (Table 5).[59]

Table 5:
All Cause and Disease-Specific Mortality Rates in Boston, Massachusetts, and the United States

	Boston[a]	Massachusetts[b]	United States[b]
All-cause mortality (per 100,000)	**762.5**	**709.1**	**776.3**
White	**727.9**	**712.5**	**763.3**
Black or African American	**1010.3**	**822.7**	**978.6**
Circulatory diseases (per 100,000)	**211.3**	**219.8**	**256.0**
White	**207.8**	**220.7**	**249.4**
Black or African American	**272.3**	**243.3**	**343.6**

(a) Calculations performed by Boston Public Health Commission Research and Evaluation Office from 2007 death data provided by Boston Resident Deaths, Massachusetts Department of Public Health.
(b) 2007 Centers for Disease Control and Prevention CDC Wonder Tool indirectly standardized to the 2000 U.S. Census Population.
Note: All racial categories are non-Latino only.

Race is also a strong predictor of birth outcomes. The infant mortality rate in the United States for 2006 was 6.7 deaths per 1,000 live births, but outcomes differed significantly by race[58]: The infant mortality rate was 5.6 per 1,000 for White mothers and 12.9 per 1,000 for Black mothers. Infant mortality is more than 24 times greater for infants with a birth weight of less than 2,500 grams than it is for infants at or above this weight.[58] In the United States, Black mothers are 89% more likely to deliver a child with a low birth weight than are White mothers (13.4% to 7.1% respectively). Black mothers in Boston and Massachusetts are also at an increased risk of low birth weights (Table 6).

Table 6:
Low Birth Weight Rates in Boston, Massachusetts, and the United States

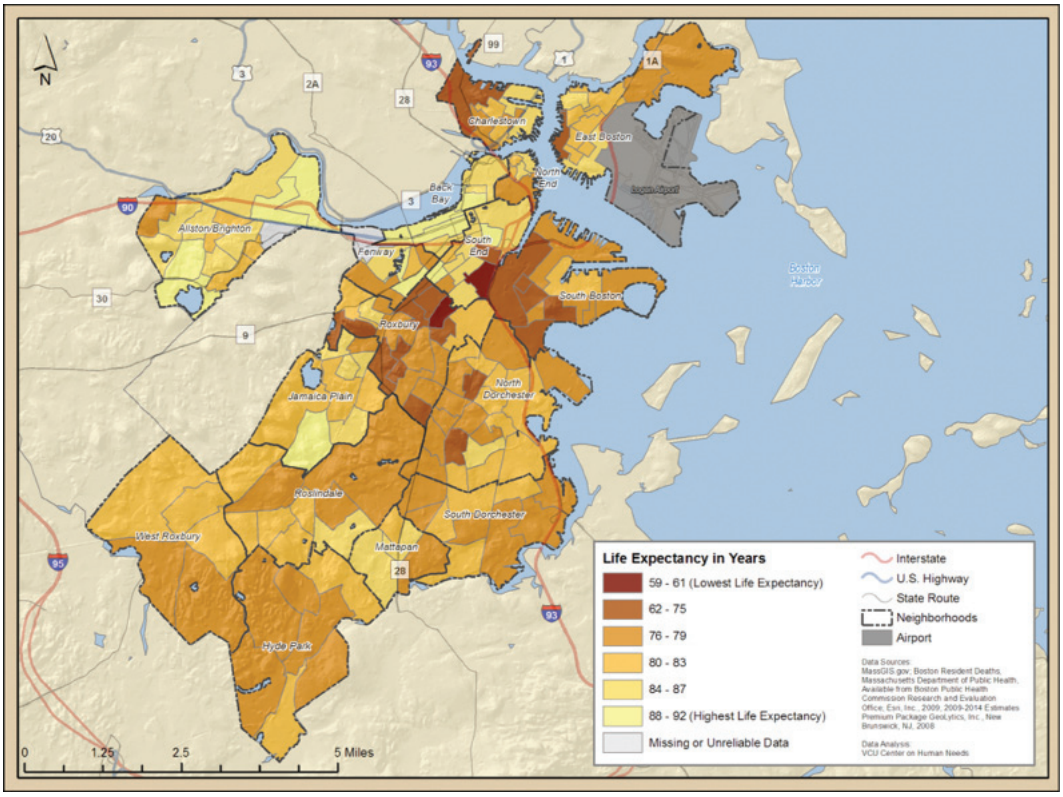
	Boston[a]	Massachusetts[b]	United States[b]
Low birth weight	**9.6%**	**7.7%**	**8.2%**
White	**8.4%**	**7.3%**	**7.1%**
Black	**12.7%**	**10.1%**	**13.4%**

(a) Calculations performed by Boston Public Health Commission Research and Evaluation Office from 2007 data provided by Boston Resident Births, Massachusetts Department of Public Health.
(b) Source: Centers for Disease Control and Prevention National Vital Statistics System 2007.
Note: All racial categories are non-Latino only.

Given the geographic variation in socioeconomic and environmental factors that affect health in Boston, it follows that health outcomes—including life expectancy—vary sharply by neighborhood as well (Map 6). Life expectancy varies by as much as 33 years between census tracts in Boston. The tract with the longest life expectancy (91.9 years) is in the Charles River Basin (between Massachusetts Avenue and Arlington Street, north of Commonwealth Avenue). The tract with the shortest life expectancy (58.9 years) is in the Roxbury neighborhood (between Massachusetts Avenue and Dudley Street and Shawmut Avenue and Albany Street). The life expectancy in this census tract is less than the life expectancy of countries such as Cambodia, Gambia, and Iraq.[60] Residents of the census tract bordering this tract, just across Massachusetts Avenue, have a dramatically higher

life expectancy (84.2 years), a difference of more than two and a half decades. Racial and economic characteristics also differ greatly between the two tracts. The tract on the southwest side of Massachusetts Avenue (where life expectancy is 58.9 years) is 45.7% Black and has a median income of $35,458. The tract on the northeast side is only 15.9% Black and has a median income of $42,627.

Map 6:
Life Expectancy by Census Tract, Boston, 2003–2007

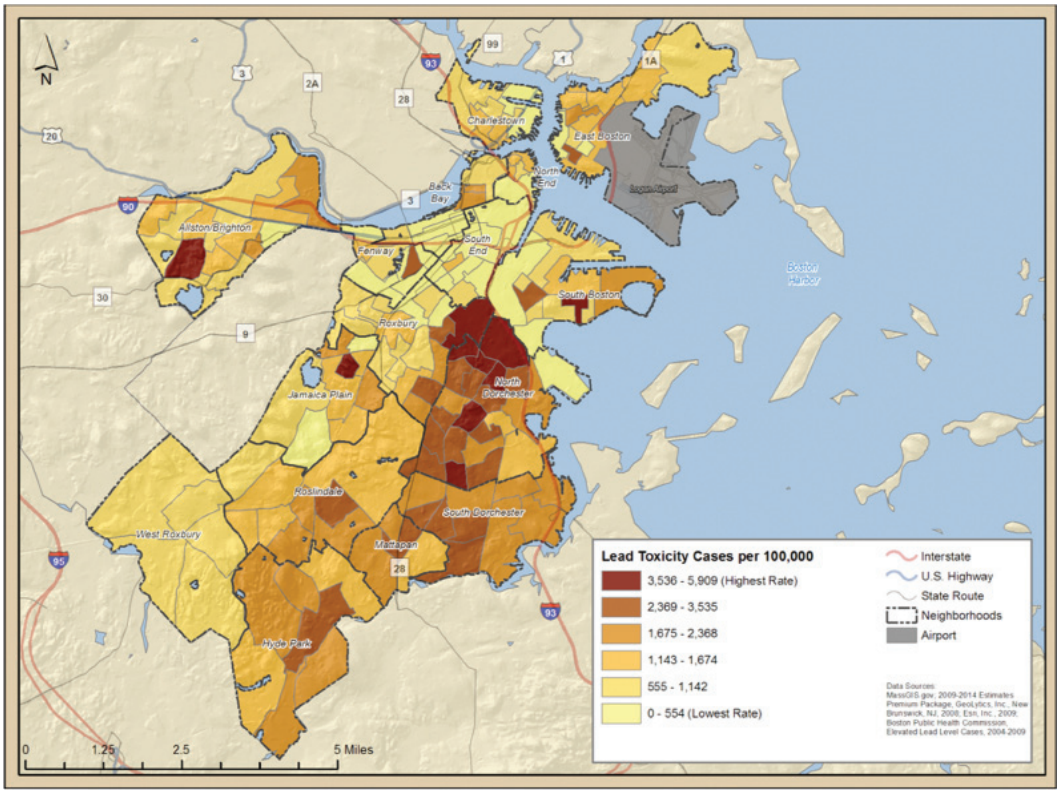


Other health outcomes—including premature mortality and elevated blood lead levels in children—vary sharply by census tract as well. Elevated blood lead levels among children in Boston are related in large part to the older age of much of the city's housing stock: most homes were built before the lead paint ban in 1978, and over half of the housing stock was built before 1940. Nonetheless, there was a steep decline in elevated blood lead in children from 1995 to 2007. During that time period, the citywide rate of elevated blood lead fell from 13.5% to 1.6%. This reduction notwithstanding, the rate of elevated blood lead levels varies dramatically by neighborhood, with North Dorchester and South Dorchester accounting for 42% of all cases in 2007.[61] The distribution of the rate of elevated blood lead levels[a] in the population under age 6 in the years 2004 to 2008 is shown in Map 7.

The areas with the highest rates of lead toxicity are in North and South Dorchester. More than half of the census tracts that make up these neighborhoods have lead toxicity rates that are greater than 1,000 cases per 100,000 persons. Both of these neighborhoods have higher concentrations of Black residents (North Dorchester, 44.2% Black; South Dorchester, 46.4% Black) then the rest of Boston (21.7% Black).

[a] Defined as greater than or equal to 10 µg/dl.

Map 7:
Rate of Elevated Blood Lead Levels in Children by Census Tract, Boston, 2004–2008



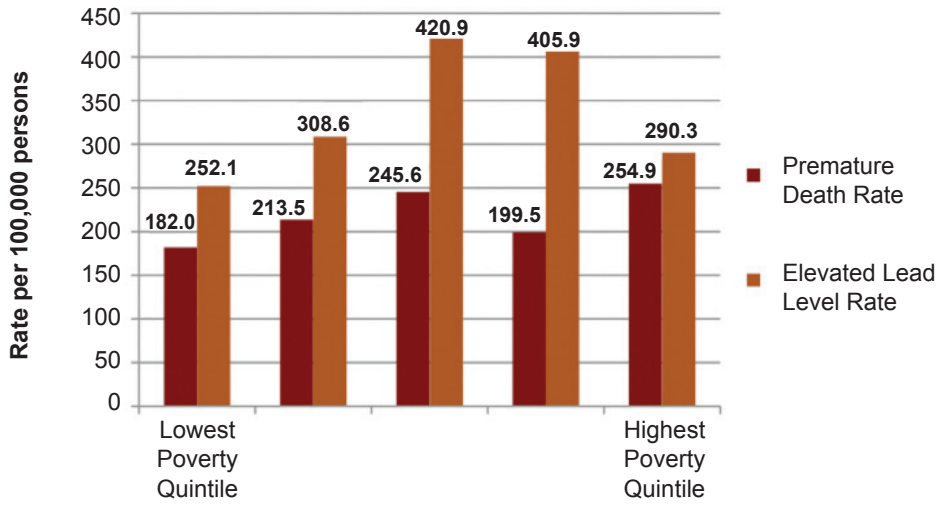
Socioeconomic Factors and Health

Socioeconomic factors affect the way people live and may affect the risk of illness and premature death.[38] In 2007, members of families living in poverty nationwide were nearly twice as likely to have diabetes, 5.3 times more likely to report serious psychological distress, and 1.6 times as likely to have been hospitalized during the previous year as compared with families with incomes of at least 200% of the FPL.[62]

The relationship between the poverty rate and health outcomes at the census-tract level in Boston is illustrated in Figure 6. We split tracts into quintiles (5 equally sized groups) according to the percentage of the population under 150% of the FPL.

Census tracts in the first quintile had the lowest rate of premature deaths and lead toxicity. Premature death rates were progressively higher in all but the fourth quintile. The highest rate of premature death was in quintile 5, which had the highest prevalence of poverty. Lead toxicity followed a similar progression up to quintile 4, followed by a large drop in quintile 5. Lead toxicity is highly contingent on housing quality. Areas in extreme poverty may include more public housing, which may paradoxically have less lead if built more recently.

Figure 6:
Health Outcomes by Poverty Quintile in Boston



Source: Calculations performed by VCU Center on Human Needs; Geolytics 2009 Premium Estimates: Boston Resident Deaths, Massachusetts Department of Public Health, Available from Boston Public Health Commission Research and Evaluation Office; Boston Public Health Commission Office of Environmental Health.

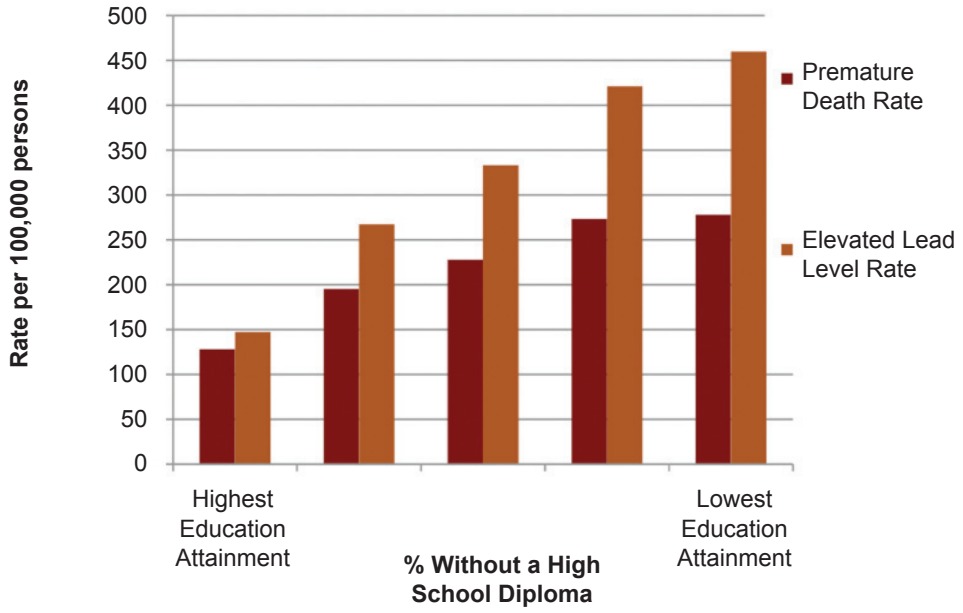
Quintile 1: Less than 14% of the population in poverty
Quintile 2: Between 14% and 22.1% of the population in poverty
Quintile 3: Between 22.2% and 29.6% of the population in poverty
Quintile 4: Between 29.7% and 40% of the population in poverty
Quintile 5: More than 40% of the population in poverty

Education is a strong predictor of health outcomes. For example, in a 37-state reporting area in 2005 the Centers for Disease Control and Prevention found that the infant mortality rate among babies born to mothers with less than 12 years of education was more than twice the rate for mothers with 16 or more years of education.[63] In 2007, among adults age 25 and older, those with less than a high school diploma were 4.5 times more likely to report fair or poor health status, had more than twice the prevalence of diabetes, and were more than 5 times as likely to report serious psychological distress.[62]

Based on our analysis, educational attainment (percent of the Boston population with less than a high school education) is significantly correlated with the census tracts' premature death rate (correlation coefficient (r) = 0.38, $P < 0.0001$), elevated blood lead levels (r = 0.31, $P < 0.0001$), and life expectancy (r = –0.37, $P < 0.0001$). The relationship between educational attainment and premature death and lead toxicity is illustrated in Figure 7. Again, we split the tracts into quintiles according to the percentage of the population over the age of 25 that had not graduated high school.

On average, census tracts with the lowest percentage of high school graduates (the lowest 20% for educational attainment) had twice the premature mortality rate and more than 3 times the elevated blood lead level rate as did tracts with the highest educational attainment (top 20%). Life expectancy was also 4.5 years shorter in the tracts with the lowest educational attainment as compared with the highest.

Figure 7:
Health Outcomes by Educational Attainment Quintile in Boston

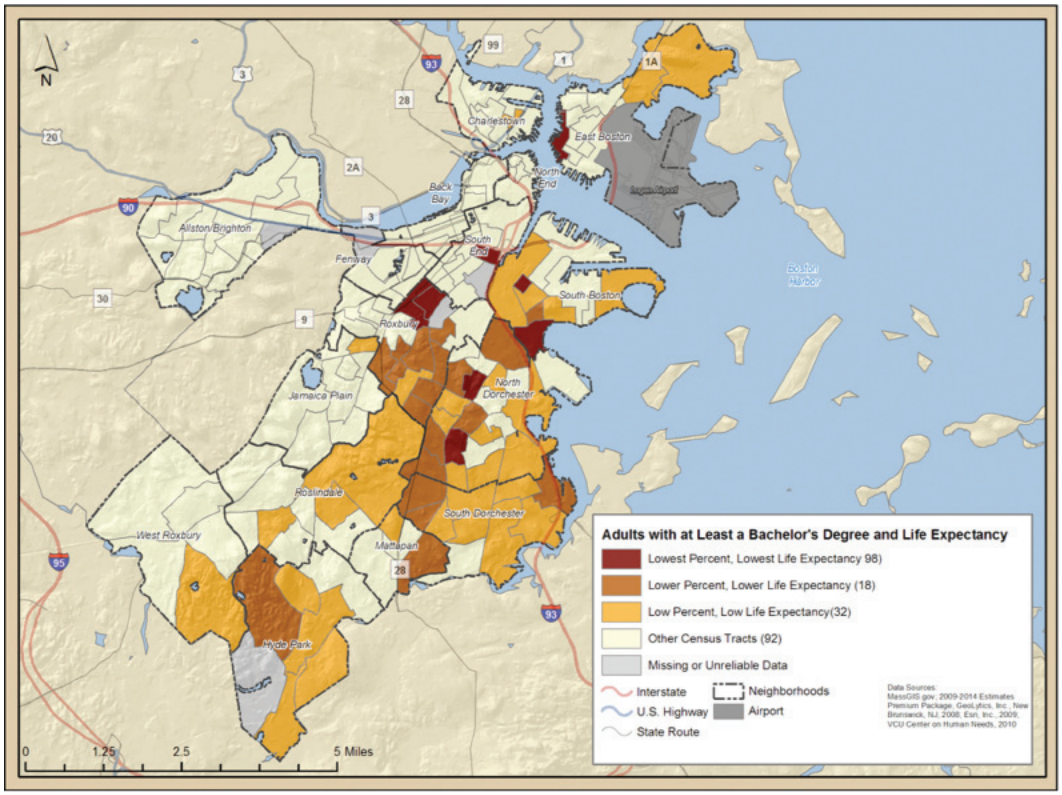


Source: Calcuations performed by the VCU Center on Human Needs2009 Geolytics Premium Estimates, 2003–2007 Boston Resident Death, Massachusetts Departmetn of Public Health; 2004–2008 Boston Public Health Commission Office of Environmental Health.

Quintile 1: Less than 10.3% of the adult population without a high school dipoma
Quintile 2: Between 10.3% and 16.2% of the adult population without a high school diploma
Quintile 3: Between 16.3% and 24.6% of the adult population without a high school diploma
Quintile 4: Between 24.7% and 35.7% of the adult population without a high school diploma
Quintile 5: More than 35.7% of the adult population without a high school diploma

The spatial relationship between educational attainment (percent of the population with at least a Bachelor's degree) and life expectancy is illustrated in Map 8. These two variables have a moderately strong, positive relationship ($r = 0.55$, $P < 0.0001$), indicating that census tracts with lower educational attainment tend to have a shorter life expectancy. The areas in dark red are census tracts that, compared with the rest of the tracts in Boston, have the lowest percentage of the population with at least a Bachelor's degree (no more than 14.7%) and the shortest life expectancy (no more than 74.9 years). These areas include East Boston (near William F. McClellan Highway and Meridian Street), South Boston (near Old Colony Avenue, B Street, and William J. Day Boulevard), South End (near Berkeley and Albany Streets), Roxbury (near Melnea Cass Boulevard and Tremont Street), and North Dorchester (near Columbia Road and Quincy Street and near Washington and Bowdoin Streets).

Map 8:
Co-occurrence of Low Educational Attainment and Low Life Expectancy, Boston



Note: *Lowest* percent with at least a Bachelor's degree, 3.3% to 14.7%; *lower* percent, 3.3% to 23.1%; *low* percent, 3.3% to 32.7%. *Lowest* life expectancy, 71.0 to 74.8 years; *lower*, 71.0 to 77.6 years; *low*, 71.0 to 80.3 years.

Part I of this report presented data on various community characteristics that may be related to poor health outcomes, such as segregation, poverty, and low educational attainment. We have also examined racial and geographic disparities in the distribution of health outcomes in Boston. There is strong evidence of the relationship between poverty, income, and educational attainment at the census-tract level in Boston as well as a relationship between all three variables and health outcomes. Areas in Boston in which poverty, low educational attainment, and low life expectancy co-occur include the neighborhoods of East and South Boston, South End, Roxbury, and North Dorchester. In the next section, we will examine the social and environmental factors associated with poor health outcomes.

Part II. Social Capital, Health Outcomes, and Community Violence

Social Capital

A central idea behind Putnam's definition of social capital is the notion that community problems such as crime, poor schools, and blighted properties are more easily overcome by collective rather than individual action.[34] Interventions such as neighborhood watch programs, which show strong evidence of an associated decrease in criminal activity,[64] require collaboration among a network of people. Areas where strong social networks and social capital exist have an advantage in facilitating action.[34] The potential mechanism through which social capital is associated with health is unclear, but hypothesized pathways include an increase in knowledge about health promotion and available health care services, peer pressure toward maintaining healthy behaviors such as dietary habits or tobacco avoidance, and/or improved psychological outlook and health.[65]

Social capital is an abstract concept that cannot be measured directly. It is generally thought to exist when residents have multiple strong contacts within the community and participate in events and programs that foster knowledge and cooperation. Putnam suggests that social capital in a community can be assessed by measuring levels of participation in community activities, interpersonal trust between residents, and perceptions of mutual aid among community members.[66, 67]

Social Capital Nationwide

The Social Capital Benchmark Survey (SCBS), conducted in 2000, was a national survey that gathered baseline measurements on social capital by using various observed indicators. On the basis of the survey responses, 11 elements of social capital were identified: social trust, interracial trust, conventional politics, protest politics, civic leadership, associational involvement, informal socializing, diversity of friendships, giving and volunteering, faith-based engagement, and social capital equity.[68]

SCBS findings revealed differences in social capital by race, age, and socioeconomic status. In response to the question, "How much can you trust people in your neighborhood?" people who responded "a lot" were significantly more likely to be older, White, and more highly educated. Similarly, respondents who were more highly educated and White were more likely to rate their communities as "excellent" places to live.[69] A similar pattern was observed for other indicators of social capital, including voting in the 1996 presidential election, attending political rallies, and signing petitions.

One indicator of social capital that did not follow these trends was participation in religious events, which was less common for Whites. Religious participation was associated with education and age, and Black respondents were slightly more likely than were Whites to report being church/synagogue members (64% to 59%, respectively), attend religious services every week (42% and 40%, respectively), and participate in church activities other than attending services (52% and 46%, respectively).[69]

Like the SCBS, the General Social Survey (GSS) and the World Values Survey (a survey of industrialized countries with similar content as the GSS) found educational attainment to be one of the strongest predictors of social capital.[70] The number of years of education has been found to be correlated with membership in organizations, church attendance, working to solve local problems, and social trust.[70] Furthermore, this relationship appears to be consistent in most countries.[70]

Social Capital in Boston

SCBS findings were used to calculate social trust quotients for 40 different communities in the United States (ranging from cities to entire states).[b] A quotient was defined as a community's performance on a particular dimension of social capital, relative to what was predicted given its urbanicity, ethnicity, levels of education, and age distribution.[68] A score below 100 indicates that a community shows less of this type of social capital than its demographics would predict.[68] Boston had a score of 81 for social trust—the lowest quotient of all communities.[71] Boston also scored below 100 in civic leadership, associational involvement, informal socializing, giving and volunteering, and faith-based engagement. [68,71] Scores for political participation, however, were above average.[71]

The information from national surveys like the SCBS and the GSS indicate that patterns of social, economic, and demographic factors are robust predictors of access to and stocks of social capital. In the next section, we focus on the relationship between these factors in Boston and its neighborhoods. One unique characteristic of the City of Boston is the high concentration of colleges/universities and college students. In 2008, 15.8% of the Boston population above age 3 was a registered college student: This value ranged from a low of 2.7% in North Dorchester between Dudley Street and Quincy Street west of Columbia Road to 94.1% in Back Bay between Deerfield and University Road, where the Boston University campus is located along with students of other universities.[72] The large student population has an effect on findings related to socioeconomic status and social capital. Census tracts with a high concentration of college students tend to have

[b]Included areas were metropolitan Atlanta (GA), Baton Rouge (LA), metropolitan Birmingham (AL), Bismarck (ND), Boulder County (CO), Central OR, Charlotte Region/14 counties (NC), metropolitan Chicago (IL), metropolitan Cincinnati (OH), Delaware, Denver (city/county) (CO), metropolitan Detroit (MI), East Tennessee, Freemont/Newaygo County (MI), Grand Rapids (MI), Greensboro/Guilford County (NC), Houston/Harris City (TX), Indiana, Kalamazoo County (MI), Kanawha Valley (WV), Lewiston-Auburn (ME), Los Angeles County (CA), Minneapolis (MN), Montana, New Hampshire, North Minneapolis (MN), Peninsula/Silicon Valley (CA), Phoenix/Maricopa City (AZ), metropolitan Rochester (NY), San Diego County (CA), San Francisco (CA), Rural South Dakota, Seattle (WA), Saint Paul (MN), Syracuse/Onodaga County (NY), Winton-Salem/Forsyth County (NC), Yakima (WA), and York (PA).

high average education levels (usually associated with greater social capital) but a young adult demographic (otherwise associated with lower social capital). Furthermore, college students are largely a transient population, which may limit attachment to the community.

Measuring Social Capital at the Neighborhood Level

We used three sources of data to measure social capital at the neighborhood and census-tract levels in Boston: the Boston Neighborhood Survey (BNS), conducted in 2008 by the Harvard Youth Violence Prevention Center; voter participation data from the Boston Election Department; and the number of houses of worship and community centers located in each census tract.

The BNS provided neighborhood-level data on social trust indicators. We used responses to nine questions from the BNS as indicators of the levels of social trust in each neighborhood (the social trust index). The index score represents the average number of affirmative responses residents provided to the following nine questions:

1. Have you attended any neighborhood social activities?
2. Do you own or rent your home?
3. Do you like the neighborhood you live in?
4. Can the people in your neighborhood be trusted?
5. Do you have friends that live in your neighborhood?
6. Are the people in your neighborhood willing to help their neighbors?
7. Are there adults in your neighborhood whom children can look up to?
8. Can adults in your neighborhood be counted on to watch out that children and teens are safe?
9. Are your neighbors likely to do something about a fight?

Responses were weighted by gender, race, age, income, and education. A more detailed description of the methodology and the questions used can be found in Appendix A.

For Boston as a whole, the social trust index measured 6.5 out of 9. The social trust score at the individual level did not show statistically significant differences by respondents' race, ethnicity, education, or income. We calculated the social trust score at the neighborhood level[c], resulting in 16 different values, ranging from 4.0 in Mattapan to 8.0 in North End. Here again, the differences were not statistically significant. It is difficult to distinguish whether this lack of statistical differences was a result of no relationship between social trust and the social/economic/demographic characteristics tested in Boston or whether the limitations of the survey data made it impossible to detect relationships that do, in fact, exist.

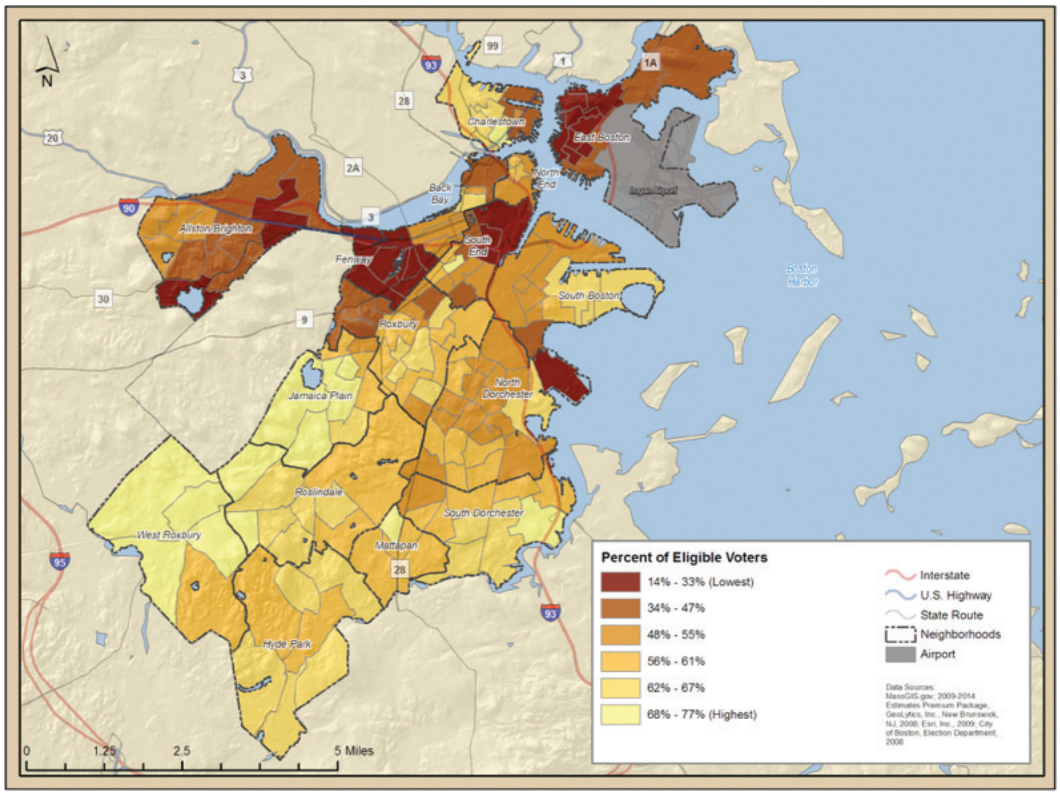
[c]Neighborhoods are a larger geographic unit than census tracts. Due to data restrictions, some of the analysis of this report is based on 16 neighborhoods and some is based on 157 census tracts.

To measure electoral participation, we used data on voter participation in the 2008 presidential election. In that year, 61.5% of eligible voters registered and 49.9% of all eligible voters in Boston ultimately cast a vote (see Appendix A for a description of how these findings were calculated). West Roxbury had the highest voter participation rate. Fenway had the lowest rate, with only one of four residents over age 18 actually casting a vote.

The percentage of eligible voters who cast a ballot by census tract is displayed in Map 9. The lowest rates were found mostly in

- Northwestern Boston near the university campuses
- North Dorchester (near Blue Hill Avenue and Cottage Street; near Columbia Road, Dudley Street, and Stoughton Street; near Columbia Road and Quincy Street; and near Washington Street and Talbot Avenue)
- Roxbury (near Massachusetts Avenue and Melnea Cass Boulevard),
- Jamaica Plain (near Centre Street and Forbes Street)
- Allston/Brighton (near Washington Street and Chestnut Hill Avenue)
- South Boston (near Broadway and H Street)

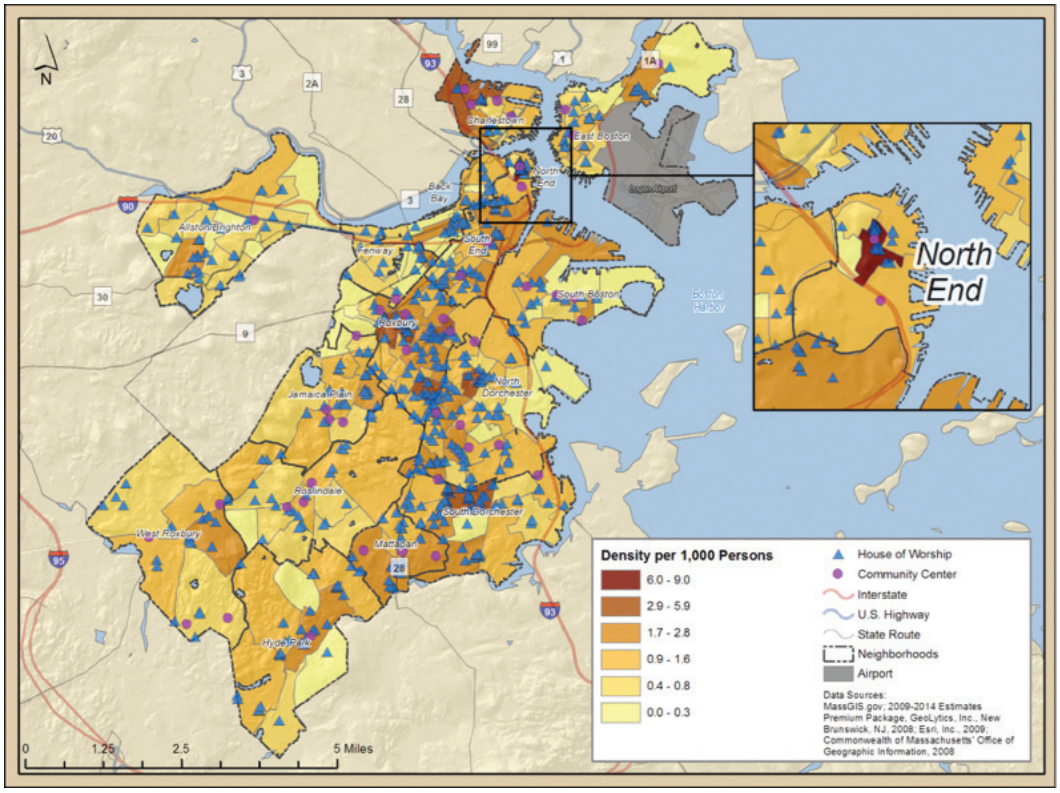
Map 9:
Percentage of Eligible Voters Who Cast a Ballot by Census Tract, Boston, 2008



Another aspect of social capital is group membership and participation in group activities. Going to church or participating in community activities provide opportunities for networking and may increase access to resources. Access to these opportunities may depend in part on the number of groups or institutions located within a community, which varies greatly by neighborhood. As shown in Map 10, in 2008 the North End (between

Commercial and Salem Streets) had the highest concentration of houses of worship and community centers, whereas Fenway had the lowest.

Map 10:
Community Centers and Houses of Worship per 10,000 People, by Census Tract, Boston, 2008



We conducted an analysis of the correlation between voter participation and other measures of social capital. As reported in Appendix A, we found a positive correlation with both social trust and houses of worship/community centers. Next, we examined the socioeconomic and demographic predictors of social capital in Boston and its connections to health outcomes.

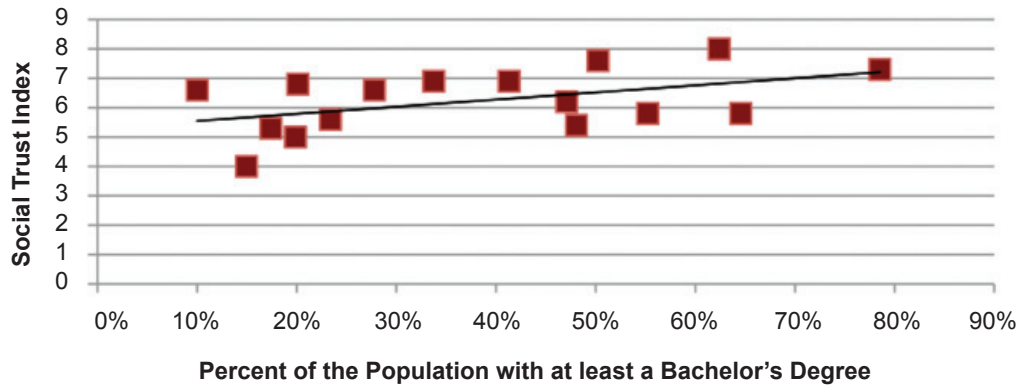
Social Capital, Neighborhood Characteristics, and Health

The relationship between community socioeconomic characteristics and health is well known, and the same relationship can be found in Boston.[3,8,10,73] National analyses have also found significant relationships between the socioeconomic and demographic characteristics of individuals and social capital.[71,74,75–76] In addition, studies have linked multiple aspects of social capital to health outcomes such as self-reported health status and mortality.[35-39, 77] Socioeconomic status, social capital, and health outcomes therefore exhibit strong interconnections.

Neighborhood-level data for Boston underscore sociodemographic influences on social capital. Boston Neighborhood Survey data for 2008 demonstrate that the social trust index was significantly related to educational attainment (percent of adults with a Bach-

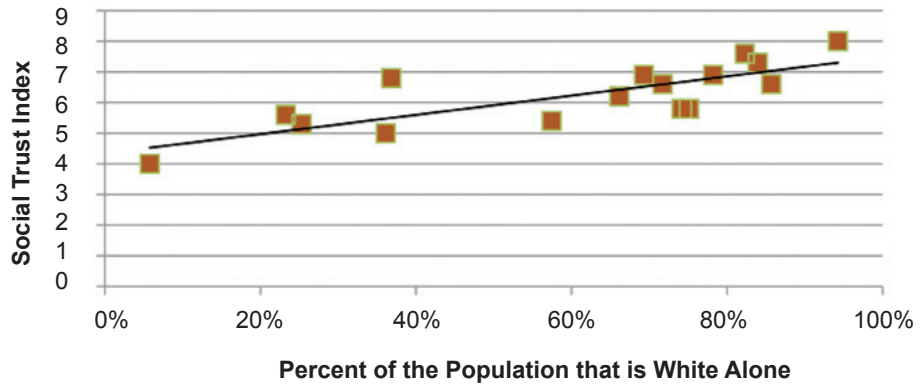
elor's degree or higher) ($r = 0.44$, $P < 0.0001$) (Figure 8), age (percent of population age 65 or older) ($r = 0.26$, $P < 0.0008$), and race (percent of population who identify themselves as White) ($r = 0.58$, $P < 0.0001$) at the census-tract level (Figure 9). Voter participation (percent of eligible population that voted in 2008) was significantly correlated with age ($r = 0.18$, $P < 0.0271$), educational attainment (percent of adults with less than a high school education) ($r = –0.21$, $P < 0.0090$), and poverty (percent of households with income below 150% of the FPL) ($r = –0.41$, $P < 0.0001$) (Figure 10). Lastly, the density of houses of worship/community centers was significantly correlated with representation of Blacks in the census tract ($r = 0.26$, $P < 0.0009$).

Figure 8:
Boston Neighborhoods with More College Graduates Tend to Have Higher Social Trust



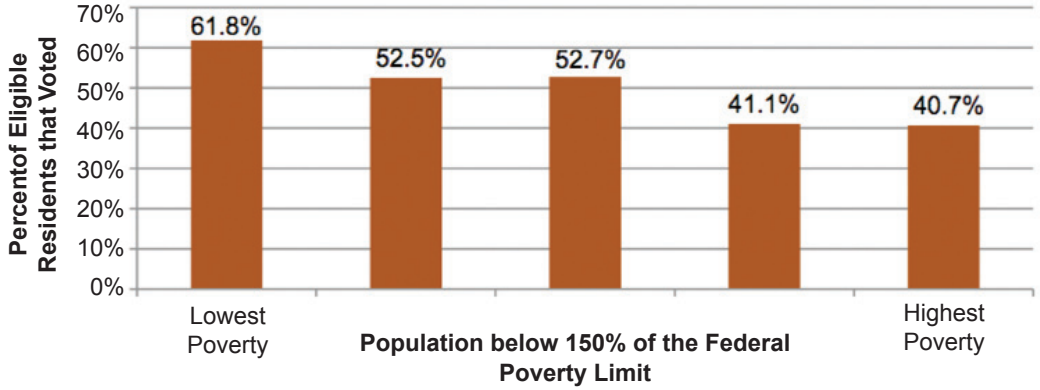
Sources: 2009 Geolytics Premium Estimates; Boston Neighborhood Survey, 2008; Harvard Youth Prevention Center through a cooperative agreement with the Centers for Disease Control and Prevention.

Figure 9:
White Neighborhoods Tend to Have Higher Social Trust Scores in Boston



Sources: 2009 Geolytics Premium Estimates; Boston Neighborhood Survey, 2008; Harvard Youth Prevention Center through a cooperative agreement with the Centers for Disease Control and Prevention

Figure 10:
Voter Participation is Lowest in Boston's Higher Poverty Neighborhoods



Source: 2008 Boston Electoral Department and 2009 Geolytics Premium Projections.

Figures 8 through 10 demonstrate that constructs of social capital have a robust relationship with social, economic, and demographic characteristics at the census-tract level of Boston. These bivariate findings point to the uneven distribution of social capital based on age, race, and socioeconomic status, which is also reflected in the geographic distribution of social capital and favorable health outcomes. In order to determine whether these measures of social capital have a relationship to health outcomes beyond the health effects of demographic and socioeconomic characteristics, we conducted a series of multivariate analyses, which are summarized below.

Social Capital and Premature Mortality/ Life Expectancy

Bivariate analysis of the neighborhood and census-tract level data in Boston indicates that the premature mortality rate and life expectancy are significantly correlated with social capital (voter participation), as well as with a variety of socioeconomic (educational attainment, median income, poverty rate, and unemployment) and demographic characteristics (percent White, Black, Latino, or Asian). In order to determine the independent effects of voter participation controlling for socioeconomic and demographic characteristics, we conducted a multivariate linear regression predicting premature mortality and life expectancy.

In predicting premature mortality (adjusted $r^2 = 0.555$), we found that voter participation was significantly related to premature mortality after controlling for race and income.[d] In neighborhoods with low voter participation and fewer college students, premature mortality is higher ($P < .047$) even after adjustment for race and income. Lastly, although premature mortality tends to be higher in Black neighborhoods, it is lower than expected

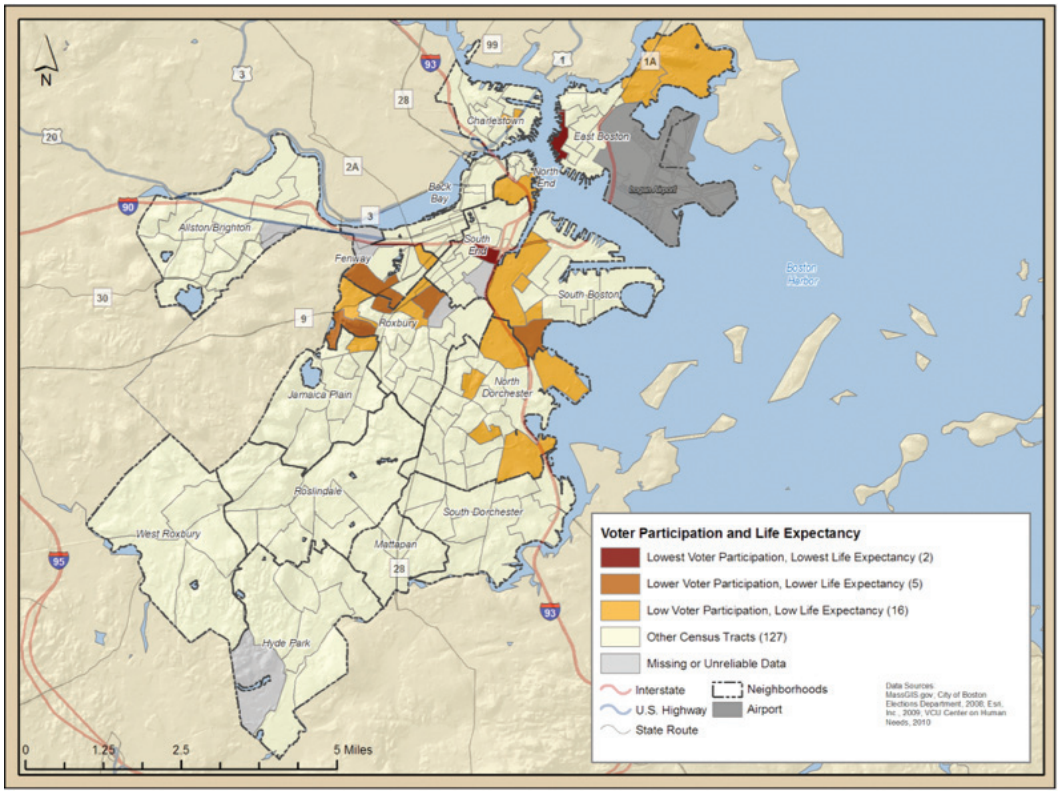
[d]Boston's high concentration of college students in particular areas of the city has a moderating effect on the relationship between voter participation and mortality. We therefore included an interaction term in the model (voter participation multiplied by percent college students), as well as a second interaction term for race (percent Black multiplied by voter participation).

in Black neighborhoods with high voter participation ($P < .038$). (See Appendix A for more details on the regression methodology and model coefficients.)

In predicting life expectancy (adjusted $r^2 = 0.397$), we found that voter participation and social trust were significantly related to life expectancy after controlling for poverty and education.[e] In neighborhoods with low voter participation and fewer college students, life expectancy is lower ($P < .000$). Similarly, in neighborhoods with low social trust and low numbers of college students life expectancy is lower ($P < .010$). An important distinction to note is that the social trust index was measured at the neighborhood level, not the census-tract level, introducing the potential to overestimate its effects in this model. (See Appendix A for more details on the regression methodology and model coefficients.)

Map 11 illustrates the spatial relationship between voting and life expectancy. The areas in dark red indicate census tracts with a co-occurrence of low participation by eligible voters (less than one third of the voting-eligible population actually voting) and the lowest life expectancy rates (less than 73.6 years). These areas include East Boston (near William F. McClellan Highway and Decatur Street) and South End (near Tremont and Berkeley Streets). Areas in dark and light orange indicate a co-occurrence of lower-than-usual voter participation (less than 46.5% of voting eligible population actually voting) and life expectancy (less than 77.2 years).

Map 11:
Voter Participation and Life Expectancy by Census Tract, Boston



Note: *Lowest* voter participation, 13.7% to 32.7%; *lower* voter participation, 13.7% to 46.5%; *low* voter participation, 13.7% to 52.1%. *Lowest* life expectancy, 71.0 to 73.6 yrs; *lower* life expectancy, 71.0 to 77.2 yrs; *low* life expectancy,71.0 to 79.4 yrs.

[e]Here again, the high concentration of college students has a moderating effect on the relationship between voter participation and life expectancy. Thus, we included interaction terms in the model (voter participation multiplied by percent college students, and social trust multiplied by percent college students).

Social Capital and Lead Toxicity

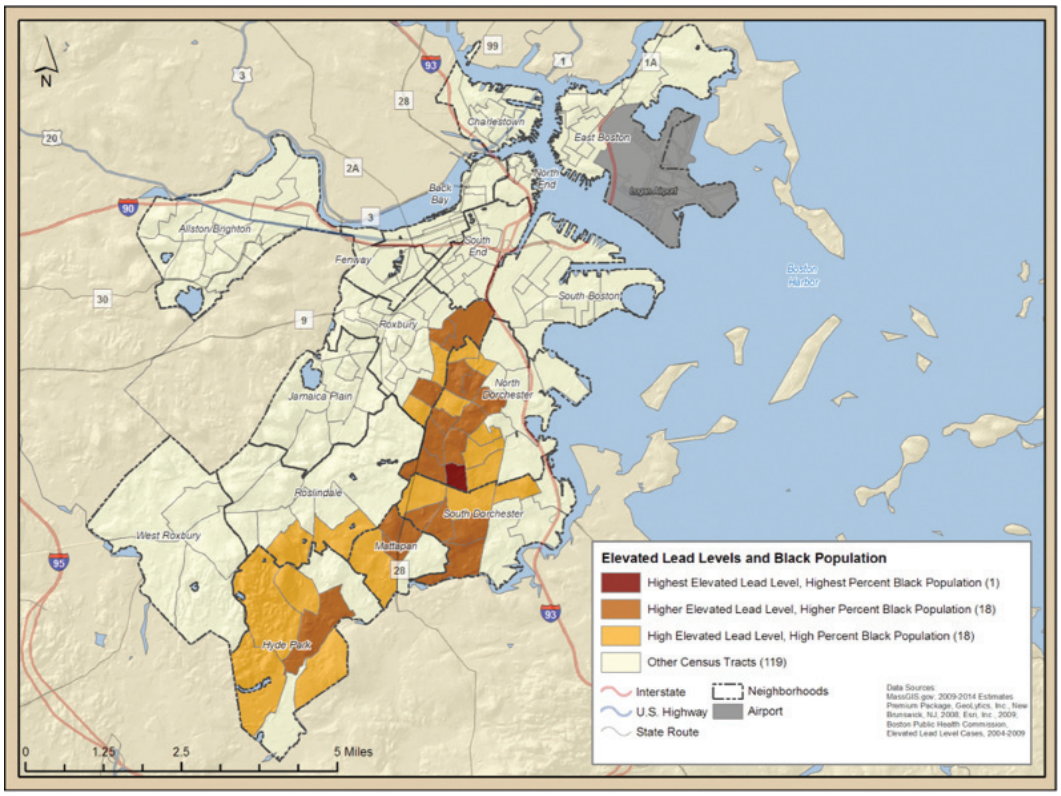
Bivariate analysis shows that elevated blood lead levels in children are significantly correlated with social capital indicators (voter participation and social trust index) at the census-tract level in Boston. Elevated blood lead levels in children are also associated with the following community characteristics: low educational attainment, race, low prevalence of owner-occupied housing, and high unemployment. In order to determine the independent effects of socioeconomic characteristics, demographic characteristics, and social capital, we conducted a multivariate linear regression predicting elevated blood lead levels. Because of the importance of housing stock in exposure to lead among children, the model controls for the percentage of owner- and renter-occupied housing built before 1980. In the final model (adjusted $r^2 = 0.367$), we found that the neighborhood-level social trust index was significantly related to elevated blood lead levels after controlling for race and the age of owned and rented housing stock.

The following variables significantly predicted lower blood lead levels: social trust index ($P < .008$), percentage of the population that is Asian ($P < .000$), and percentage of the population that is Latino ($P < .000$). The following variables significantly predicted higher blood lead levels: percentage of renter-occupied housing units built before 1980 ($P < .005$) and percent "other race" ($P < .000$). As noted previously, the social trust index was measured at the neighborhood level, not the census-tract level, introducing a potential to overestimate its effects in this model. (See Appendix A for more details on the regression methodology and model coefficients.)

In the multivariate model, race/ethnicity was a stronger predictor of elevated blood lead levels than were socioeconomic variables (such as poverty rate or median income). This may reflect the historical effects of segregation that may restrict neighborhood choices for people of color.

The relationship between the percentage of the population that is Black and the rate of elevated blood lead levels is illustrated in Map 12. The statistical correlation between these two variables is significant and positive ($r = 0.34$, $P < 0.0001$), indicating that census tracts with higher concentrations of Black residents tend to have higher rates of elevated blood lead levels in children. The dark red area indicates neighborhoods where the highest concentrations of Black residents (more than 70%) in Boston co-occur with the highest rate of elevated blood lead levels (more than 3,500 cases per 100,000 persons under age 18). This is in North Dorchester (near Washington Street and Talbot Avenue). The dark orange areas indicate other areas where there is a large Black population (greater than 47.8%) and high rates of lead toxicity (greater than 2,300 cases per 100,000 persons under age 18). These are mainly in North and South Dorchester, Roxbury, Mattapan, and Hyde Park.

Map 12:
Co-occurrence of Black Population and Elevated Blood Lead Levels in Children, Boston, 2004-2008



Note: Rate refers only to population under 6 years of age. Elevated lead levels is defined as greater than 10µg/dl *Highest* Elevated Lead Level = 5909.1 - 3535.4 per 100,000; *Higher* Elevated Lead Level = 5909.1 - 2368.4 per 100,000; *High* Elevated Lead Level = 5909.1 - 1674.1 per 100,000; *Highest* Black Population = 92.6% - 70%; *Higher* Black Population = 92.6% - 47.8%; *High* Black Population = 92.6% - 23.4%

Social Capital and Community Violence

Adherence to social norms and customs has been shown to be related to levels of community violence.[78,79] Kennedy et al. found statistically significant relationships in the United States between indicators of social capital (such as social trust and group membership) and both homicide rates and violent crimes involving firearms, even after controlling for poverty and firearm availability.[80]

According to the Federal Bureau of Investigation, in 2009 Boston had a violent crime rate of 992.0 per 100,000 residents, which was greater than that year's rates for Massachusetts and the United States (Table 7).[81] Boston's violent crime rate reflected rates of murder, rape, robbery, and aggravated assault that exceeded national and state averages.[81] The property crime rate and all of its subcomponents, apart from burglary, was also higher in Boston than in Massachusetts or the United States.[81] It is important to note, however, that crime rates are highly dependent on the type of setting–areas with high population densities tend to have higher crime rates as well–and the social and economic characteristics of the area.

Table 7:
Crime in Boston, Massachusetts and the United States, 2009

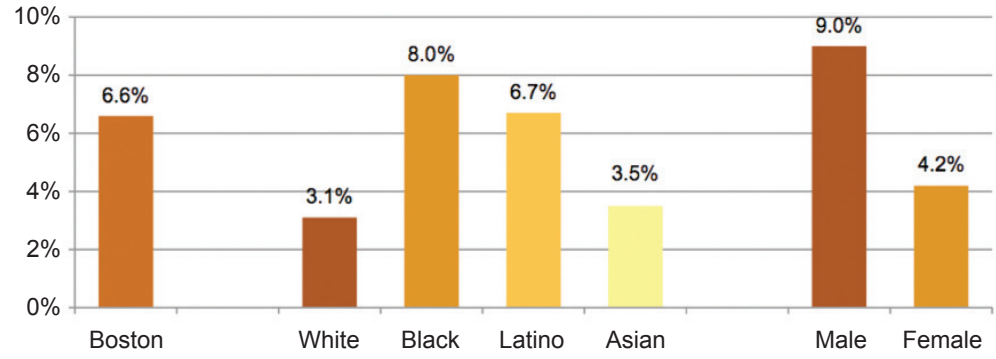
	Boston	Massachusetts	United States
Violent crime rate per 100,000	992.0	457.1	429.4
Murder and non-negligent manslaughter	8.0	2.6	5.0
Forcible rape	43.1	25.8	28.7
Robbery	364.8	112.6	133.0
Aggravated assault	576.1	316.0	262.8
Property crime per 100,000	3324.0	2304.0	3036.1
Burglary	473.4	525.7	716.3
Larceny-theft	2484.2	1600.3	2060.9
Motor vehicle theft	366.4	178.0	258.8

Source: United States Justice Department—Federal Bureau of Investigation; 2009 Crime in the United States.

In 2009, minors (under age 18) represented more than 14% of all arrests across the United States.[82] Arrests of individuals under age 25 accounted for 43.6% of all arrests.[82] Among Boston students under age 18 surveyed that same year, 14.6% claimed to have carried a weapon in the last 30 days, 5.5% reported missing days of school because they felt unsafe, 7.5% had been threatened or injured with a weapon in the past 12 months, and 5.5% were physically hurt or injured in the past 12 months.[83]

As is the case with social and economic stress, exposure to violence varies depending on demographics. The frequency of being threatened or injured with a weapon at school by gender and race is illustrated in Figure 11.

Figure 11:
Percentage of Boston students (18 and under) who have been threatened or injured by a weapon in the past year



Source: Youth Risk Behavior Survey 2007 and 2009, Youth Risk Behavior Surveillance System (YRBSS), Centers for Disease Control and Prevention (CDC).

In studies elsewhere, a lack of voter participation, social trust, and group membership is associated with increased levels of crime such as homicide and firearm-related violence.[78-80] The rate of nonfatal shootings and stabbings by neighborhood in 2008 is shown in Table 8. That year, Roxbury had the highest rate of assault-related nonfatal gunshot and stabbing wounds. Allston/Brighton, Back Bay, and Fenway had the lowest rates. A portion of our analysis up to this point has been at the census-tract level, which provides

a sufficient number of cases for more robust analysis. However, because our community violence variables are at the neighborhood level, which provides fewer cases of study, our data lack sufficient power to identify significant relationships between social trust measures and violence at the neighborhood level.

Table 8: Nonfatal Shootings and Stabbings by Neighborhood in Boston, 2008

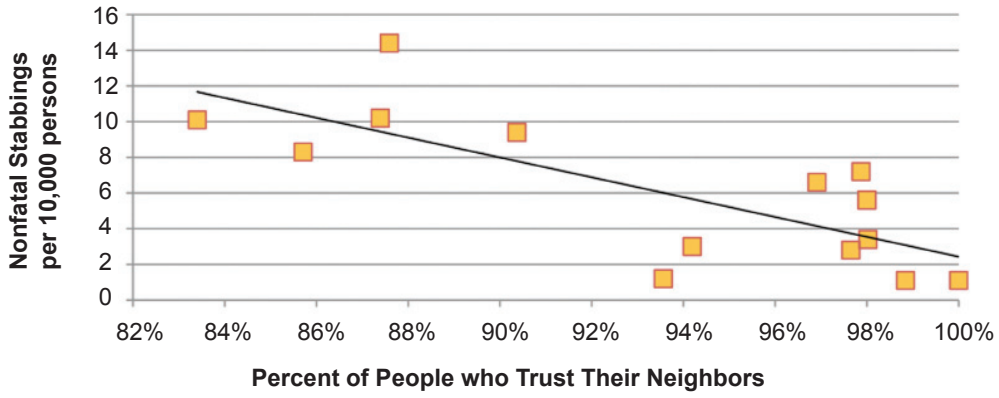
	Stabbings per 10,000 persons	Shootings per 10,000 persons
BOSTON	**5.8**	**3.4**
Allston/Brighton	**1.2**	**---**
Back Bay	**1.1**	**---**
Charlestown	**7.2**	**---**
East Boston	**10.2**	**---**
Fenway	**1.1**	**---**
Hyde Park	**5.6**	**2.8**
Jamaica Plain	**2.8**	**2.2**
Mattapan	**8.3**	**6.5**
N. Dorchester	**10.1**	**7.7**
Roslindale	**3.4**	**1.8**
Roxbury	**14.4**	**8.7**
S. Boston	**3.0**	**---**
S. Dorchester	**9.4**	**8.0**
South End	**6.6**	**3.7**
West Roxbury	**---**	**---**

Note: Neighborhood data are ZIP code–based. Data are not reported for neighborhoods with fewer than 5 incidents.
Source: Weapon Related Injury Surveillance Program, Massachusetts Department of Public Health.
Analysis: Boston Public Health Commission Research and Evaluation Office.

Even with the small number of cases available (n = 16 neighborhoods), several statistically significant relationships are found between measures of social capital and violent crime. Nonfatal gunshot rates in 2008 were inversely correlated with the percentage of the population that owned their home ($r = –0.77$, $P < 0.0250$) and the percentage of respondents who liked their neighborhood ($r = –0.89$, $P < 0.0030$), trusted people in their neighborhood ($r = –0.79$, $P < 0.0201$), described people in their neighborhood as willing to help their neighbors ($r = –0.89$, $P < 0.0028$), and reported that neighbors would intervene if they saw a fight ($r = –0.80$, $P < 0.0183$). Similarly, nonfatal stabbings were inversely correlated with the percentage of respondents who liked their neighborhood ($r = –0.75$, $P < 0.0019$), trusted people in their neighborhood ($r = –0.70$, $P < 0.0049$), and reported that neighbors were willing to help each other ($r = –0.57$, $P < 0.0320$).

The association we observed between trust among neighbors and crime rates (nonfatal stabbings in 2008) is illustrated in Figure 12. In neighborhoods where fewer than 90% of respondents trust their neighbors, the nonfatal stabbing rate ranged from approximately 8.3 to 14.4 per 10,000 persons. In neighborhoods where more than 93% trust their neighbors, the nonfatal stabbing rate ranged from 1.1 to 7.2 per 10,000 persons. A similar pattern emerges with nonfatal gunshot rates. Of course, this relationship does not establish causality between these factors. Other factors may be responsible, as is reverse causality: The level of violence in the community may affect residents' level of trust in their neighbors, rather than the reverse.

Figure 12:
Boston's Nonfatal Stabbing Rate Is Lower in Neighborhoods in which People Trust their Neighbors



Source: 2008 Weapon Related Injury Surveillance Program, Massachusetts Department of Public Health; Boston Neighborhood Survey, 2008; Harvard Youth Prevention Center through a cooperative agreement with the Centers for Disease Control and Prevention.

Part III. Conclusions: Socioeconomic Status, Social Capital, and Health Outcomes in Boston

The analyses presented here have shown that elements of social capital, such as social trust and voter participation, are strongly linked to social, economic, and demographic characteristics of communities within Boston. The data available suggest that social capital in Boston neighborhoods is related to favorable health outcomes such as a reduction in premature deaths and longer life expectancy, as well as lower rates of lead toxicity in children. These relationships persist even after controlling for social, economic, and demographic characteristics. Boston neighborhoods in which residents express less trust in their neighbors also tend to have higher rates of nonfatal gunshot injuries and stabbings. Because of the lack of data for community violence at a small geographic level, it is difficult to elucidate the relationship between social capital and violence, but preliminary investigation suggests that nonfatal stabbing rates are more common in communities with a lower percentage of the population that trust their neighbors.

The large student population in Boston complicates analysis of the relationship between social capital and health outcomes. Communities that consist mainly of highly mobile, young adults will have low rates of morbidity and mortality that are not highly correlated with social, economic, and demographic characteristics of the area. Census tracts that contain high collegiate student populations will have comparatively low occurrences of deaths because those populations are likely to move on to different areas before reaching an age at which disease and death rates measurably increase. Because the young adult population is also less likely to participate in elections and may have weaker ties to the community, it is harder to tease out the relationship in Boston between sociodemographics, social capital, and health outcomes.

Understanding of the causal relationship between social capital and health is still evolving. The analysis included in this report is entirely cross-sectional (a study of the relationship between variables at one point in time rather than sequentially) and ecological (a study of the characteristics of populations rather than individuals) and does not address the literature that examines mechanisms by which social capital, cohesion, and other factors might relate to the natural history of disease progression. Health disparities associated with income, education, race, and place are complex, multi-factorial relationships that cannot be reduced to a single etiology or mitigated by a single policy solution. The literature and this analysis suggest, however, that interventions aimed at strengthening community bonds and networks may be important public health strategies in Boston, particularly in the neighborhoods of Mattapan, North and South Dorchester, and the South End.

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