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# Geographic Disparities in Access to Agencies Providing Income-Related Social Services

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**ABSTRACT** *Geographic location is an important factor in understanding disparities in access to health-care and social services. The objective of this cross-sectional study is to evaluate disparities in the geographic distribution of income-related social service agencies relative to populations in need within Boston. Agency locations were obtained from a comprehensive database of social services in Boston. Geographic information systems mapped the spatial relationship of the agencies to the population using point density estimation and was compared to census population data. A multivariate logistic regression was conducted to evaluate factors associated with categories of income-related agency density. Median agency density within census block groups ranged from 0 to 8 agencies per square mile per 100 population below the federal poverty level (FPL). Thirty percent (n=31,810) of persons living below the FPL have no access to income-related social services within 0.5 miles, and 77 % of persons living below FPL (n=83,022) have access to 2 or fewer agencies. 27.0 % of Blacks, 30.1 % of Hispanics, and 41.0 % of non-Hispanic Whites with incomes below FPL have zero access. In conclusion, some neighborhoods in Boston with a high concentration of low-income populations have limited access to income-related social service agencies.*

**KEYWORDS** *Geographic information system (GIS), Social determinants of health, Health services geographic accessibility, Poverty*

## INTRODUCTION

Low socioeconomic status is a major risk factor for disease, morbidity, and mortality.[1–3] Geographic concentrations of poverty are associated with especially poor health outcomes and high utilization of emergency care.[4,5] Social services are an important means of reducing poverty and providing financial support to disadvantaged individuals and families. For example, programs such as Supplemental Security Income (SSI) and Temporary Assistance for Needy Families (TANF) provide financial support to low-income elderly, blind, and disabled persons as well as families of children in need.[6,7] Children enrolled in TANF are three times more likely to have health insurance compared to children living in poverty without TANF.[8]

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Targeted distribution of the agencies that enroll eligible individuals in these important services may reduce overall program costs by decreasing oversupply and maximizing usage by populations in need and, more importantly, provide equity of access by increasing supply to underserved areas.[9] However, enrollment in TANF has steadily declined in the past two decades; the number of TANF recipients was 66 % lower in 2005 when compared to a decade earlier despite rising numbers of eligible families.[10,11] Declines in TANF enrollment have been directly linked to declines in Medicaid enrollment and increased uninsurance.[12]

In evaluating disparities in access to health care and social services, geographic location is an important factor, especially for low-socioeconomic status populations with limited transportation means.[13] Density measures have been used to evaluate the geographic distribution of many public health exposures, including tobacco, alcohol, and fast-food outlets as well as health service locations and related health outcomes.[14–18] Several studies have evaluated the relationship between the density of primary care providers, as a proxy for access, and utilization of health-care services. A higher density of physicians has been correlated with improved access and higher utilization, especially for minority and disadvantaged populations.[19–22] However, no known studies have evaluated this relationship among income-related social service agencies.

This analysis evaluates access to income-related social services, comparing the point density of these agencies to the geographic distribution of populations in need, defined as those living below the federal poverty level (FPL), within Boston. For this study, we defined access as both an appropriate linear distance for walking (0.5 miles) as well as the total number of agencies available. The socioeconomic status and racial/ethnic composition are a characteristic of the populations in need with the lowest geographic access to these services, and the heterogeneity of access to services is evaluated at the block group and neighborhood level.

## METHODS

### Agency Density at the Census Block Group Level

The geographic location of income-related social service agencies was determined from The Online Advocate resource database (now viewable at www.HelpSteps.com) at Boston Children's Hospital.[23] The resource database has been developed over several years by combining existing government-sponsored databases, agency referrals, and search engines to identify, contact, and confirm agency locations and services provided in the greater Boston area. The database evolved from an original comprehensive database of all social support agencies in Boston maintained by the Boston Public Health Commission and was updated through April 2010 at the time of this study.[24] Income-related social service agencies were defined as services providing direct income support (e.g., assistance with receiving SSI or TANF and/or free job training). Eligibility for TANF in Massachusetts in 2000 for a single-parent family of three required earnings of less than $8496/year; eligibility for SSI included having little or no income, and all items owned must be worth less than $2000 in total.[25–27] Each agency was identified as point locations with latitude and longitude coordinates acquired by geocoding street addresses from the database using Google's geocoding application programming interface (API).

The geographic coordinates of income-related social service agencies were used to develop a measure of agency density at the level of the census block group. A census block group contains approximately 1500 people, with a range from 600 to 3000.[28]

Since census block group boundaries do not necessarily correspond to boundaries that affect the use of income-related social service agencies, using block groups alone may be an inaccurate unit of geography when describing access to these social services. Thus, a point density method (ESRI Spatial Analyst) with a radius of 0.5 miles around each agency was used to create a density surface of geographic access to income-related social service agencies across these boundaries, defined as agencies per square mile, adjusted for underlying population density and poverty status. Sensitivity analyses were conducted using radii of 0.75 and 1.0 miles. The density surface was scaled to a resolution of 100 $m^2$. A radius of 0.5 miles has been previously used as a buffer of a walkable distance.[29,30]

The point density of income-related social service agencies was averaged across census block groups for comparisons with population demographic characteristics at the block group level. Thus, agencies just outside the border of a block group were accounted for by averaging a point density without boundaries across each block group. The mean agency density of each block group was then adjusted by the total population and the population living below the FPL. Since the population eligible for income services is families and individuals living in poverty, the average income-related social service agency density per 100 persons living below FPL within a given census block group served as the primary dependent variable.

### Block Group-Level Demographic Risk Factors of Health Disparities

The following variables and health disparity risk factors were obtained for each census block group: race/ethnicity (percentage of the population that was Black, Hispanic, or non-Hispanic White (NH-White)), poverty (percentage of residents living below the FPL), and unemployment (percentage of residents unemployed). Census information was extracted from the 2000 US Census, during which the federal poverty level was $14,150 for a family of three.[31–33] Boston neighborhoods and boundary information was acquired through the Boston Atlas.[34]

### Statistical Analysis

Medians and interquartile ranges were used as summary indicators. Block groups were categorized into three evenly populated levels of geographic access to income-related services (0, 1–2, and 3+ agencies per square mile per 100 population below FPL). Block groups were excluded from this analysis if they did not include at least 15 persons living below the FPL since such low numbers would excessively inflate the population weights. Eleven out of 522 block groups were excluded on this basis including 18,752 persons (3.2 % of total Boston population).

Ordinal logistic regression was used to evaluate factors associated with access to income-related services. The outcome was the three-level ordinal measure of income-related services described above. Risk factors in the multivariate model included block group population size; percentage of the population that was Black, Hispanic, or NH-White; percentage of residents in poverty; and percentage of residents unemployed. This model assumes that the odds are proportional for each level of the outcome. To assess the sensitivity of this assumption, a multivariate logistic regression was conducted using the presence or absence of income-related services as the outcome.

Geographic information system software (ArcGIS 10; ESRI, Redlands, CA, USA) was used for the geographic analysis, and Stata v.11 (StataCorp LP, College Station, TX, USA) was used for the statistical analysis. All tests were two-sided, and $P \leq 0.05$ was considered statistically significant.

## RESULTS

### Agency Density

As of the 2000 US Census, the city of Boston comprised a population of 580,306 persons across 522 block groups; 561,754 (96.8 %) persons and 511 (97.8 %) block groups were included in the analysis. The racial/ethnic composition of the population was 25.6 % Black, 14.9 % Hispanic, and 53.1 % NH-White; 107,888 persons lived below the FPL (19.2 %), and 20,803 were unemployed (3.7 %). In 2000, 21.3 % of Blacks, 30.6 % of Hispanics, and 13.5 % of NH-Whites lived below FPL.

Figure 1 depicts a map of the density of agencies providing income-related services in Boston according to the point density method. Green areas represented higher density of agencies and correspondingly greater geographical access to the

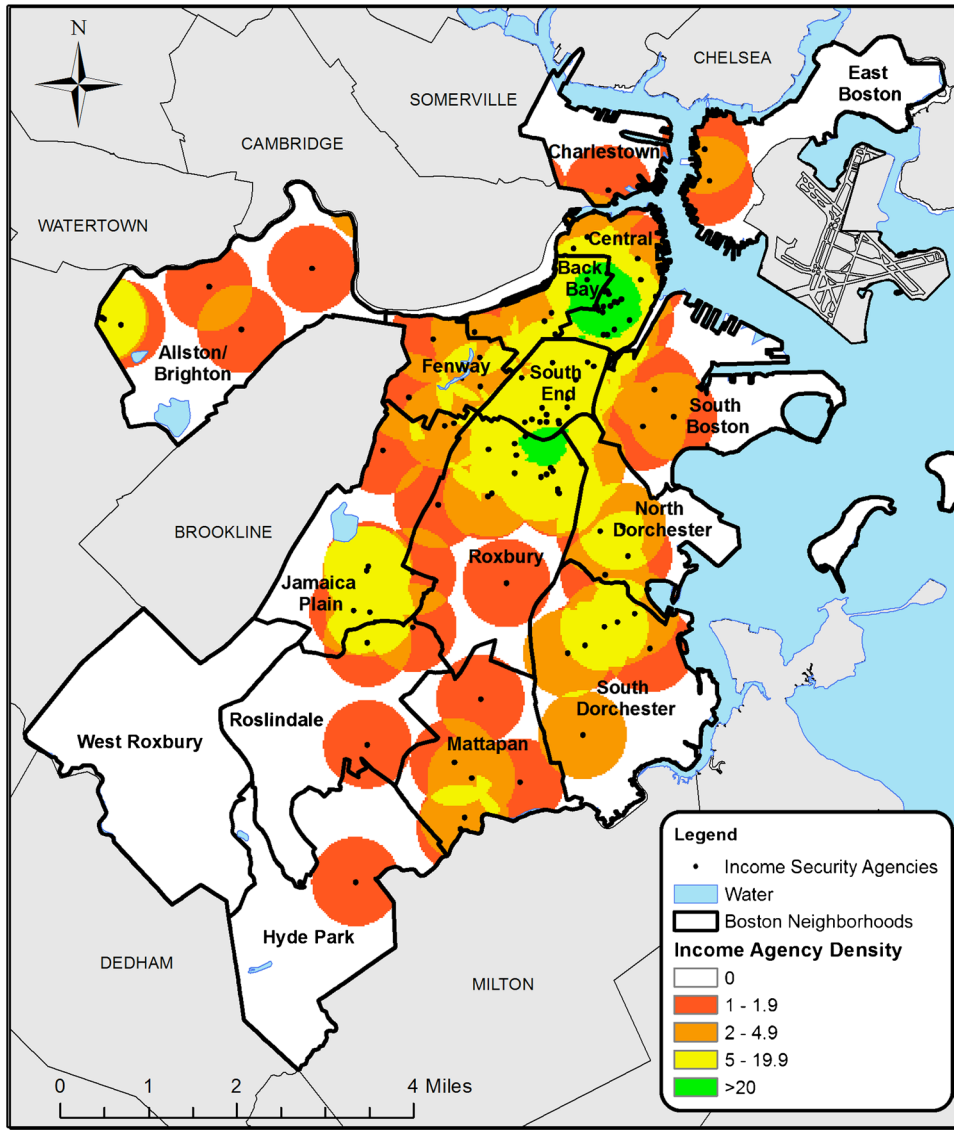


**FIG. 1** Income agency density.

services provided by those agencies. White areas represented lowest access to income-related services. Overall, block groups in downtown Boston had significantly higher density of these agencies, while geographic access was minimal further south and west. Results using radii of 0.75 and 1.0 miles were similar (data available upon request).

### Agency Density and Unemployment

Most areas of concentrated unemployment (>10 %) had access to at least one agency providing income-related services (Fig. 2a).[35,36] However, some areas of Boston with high unemployment of the eligible working population had no access to income-related services. Access generally increased as the percentage of the population unemployed increased; however, more than 5000 persons unemployed (25.6 % of all unemployed individuals) had zero geographic access to agencies providing income-related services (Table 1).[31]

### Agency Density and Poverty

More than 30,000 persons living below FPL (29.5 % of population living below FPL) had no access to an income-related service agency within a 0.5-mile radius (Table 1, Fig. 2b). Only 23.0 % of the population living below the FPL lived in block groups with the highest level of access to these agencies (>2 agencies per square mile per 100 population below FPL). This lack of access for those living below FPL appeared to be consistent across major racial/ethnic groups; 27.1 % of poor Blacks, 24.8 % of poor Hispanics, and 32.4 % of poor NH-Whites lived in block groups with zero agencies providing income-related services (Fig. 2c–e).

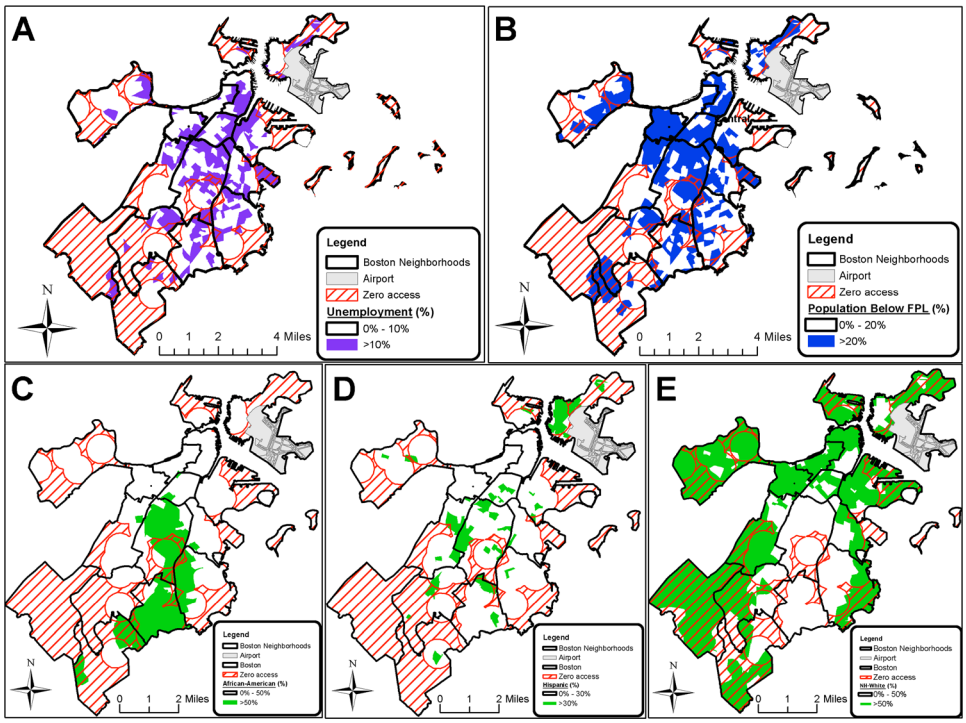


**FIG. 2** Areas of zero access relative to **a** unemployment, **b** poverty, and **c**–**e** distribution of race/ethnicity. Areas with poverty rates of 20 % or more are defined as "poverty areas" by the US government .[35,36]

**TABLE 1 Income-related social service distribution and associated population characteristics at census block group level**

| | >2 agencies/square mile per 100 population below FPL | 0–2 agencies/square mile per 100 population below FPL | 0 agency/square mile per 100 population below FPL |
|---|---|---|---|
| Total number of agencies | 100 | 12 | 0 |
| Population (% total) | 148,409 (26.4) | 223,735 (39.8) | 189,610 (33.8) |
| Population below FPL (%) | 24,866 (23.0) | 51,212 (47.5) | 31,810 (29.5) |
| Number of census block groups | 149 (28.5) | 187 (35.8) | 175 (33.5) |
| Population characteristics | | | |
| Number unemployed (%) | 6994 (33.6) | 8474 (40.7) | 5335 (25.6) |
| Number of blacks below FPL (%) | 8413 (27.4) | 13,992 (45.6) | 8310 (27.1) |
| Number of Hispanics below FPL (%) | 5110 (20.0) | 14,090 (55.2) | 6315 (24.8) |
| Number of NH-Whites below FPL (%) | 8432 (21.0) | 18,720 (46.6) | 13,018 (32.4) |

Poverty-adjusted agency density=number of income-related social service agencies per square mile per 100 population below federal poverty level (averaged across census block groups)

*FPL* federal poverty level (annual income for a family of 4 under $13,359 in 2000)

## Agency Density and Boston Neighborhoods

The median density of agencies within block groups across Boston's 16 neighborhoods ranged from 0 to 8 agencies per square mile per 100 population living below FPL (Table 2). Despite a large proportion of residents living below FPL (>15 % of the population), neighborhoods such as Charlestown, East Boston, Alston/Brighton, and South Dorchester had zero access to income-related services. Four of the poorest neighborhoods (>20 % of population below FPL), Mattapan, Jamaica Plain, Allston/Brighton, and Roxbury, had less than 1 agency per square mile per 100 population living below FPL. These neighborhoods are highly segregated, where Mattapan and Roxbury are both comprised of >60 % Blacks and Allston/Brighton is comprised of 68.5 % Whites. The majority of agencies providing income-related services appeared to be in Central, South End, and Back Bay/Beacon Hill (Table 2).

## Modeling Agency Density

A statistically significant positive association was observed between the percentage of the population living below FPL and higher categories of income-related agency density (0, 1–2, and 3+ agencies per square mile, not adjusted for population). The odds of a block group having more access to income-related agencies was significantly higher for block groups with a higher percent (≥20 %) of the population living below FPL versus block groups with <20 % living below FPL (odds ratio=19.6, 95 % CI=4.3–90.3), adjusting for total population, percent of the population below FPL, and race/ethnicity distribution. There was also a trend towards a positive association between unemployment rates and access to income-related social services ($P$=0.06). Conversely, geographic access to income-related social services was not

**TABLE 2 Agency density and demographic distribution, by neighborhood**

| Neighborhood | Median agency density, poverty-adjusted (IQR) | # of agencies | Total population | % population below FPL | % unemployed | % Black | % Hispanic | % White |
|---|---|---|---|---|---|---|---|---|
| West Roxbury | 0.0 (0.0) | 0 | 22,344 | 7.5 | 1.6 | 7.3 | 5.1 8 | 81.1 |
| Hyde Park | 0.0 (0.01) | 1 | 32,452 | 11.4 | 2.5 | 38.8 | 13.3 | 42.8 |
| Charlestown | 0.0 (0.6) | 1 | 14,318 | 18.6 | 2.3 | 4.2 | 12.0 | 77.3 |
| Roslindale | 0.0 (0.2) | 2 | 30,526 | 13.5 | 2.8 | 14.4 | 20.9 | 54.6 |
| East Boston | 0.002 (0.8) | 2 | 37,495 | 19.2 | 3.4 | 3.1 | 38.8 | 49.9 |
| Allston/Brighton | 0.002 (0.4) | 7 | 67,851 | 22.5 | 2.7 | 4.3 | 9.2 | 68.5 |
| South Dorchester | 0.19 (2.2) | 9 | 62,813 | 17.3 | 3.6 | 40.4 | 1.3 | 29.9 |
| South Boston | 0.38 (2.0) | 2 | 25,644 | 18.4 | 2.6 | 2.4 | 8.3 | 83.7 |
| Mattapan | 0.38 (2.6) | 6 | 36,527 | 22.7 | 4.0 | 77.4 | 12.4 | 3.3 |
| Jamaica Plain | 0.62 (4.7) | 10 | 36,763 | 21.3 | 3.1 | 16.6 | 23.3 | 49.5 |
| Roxbury | 0.79 (3.3) | 17 | 55,663 | 26.8 | 4.7 | 61.6 | 25.1 | 4.5 |
| North Dorchester | 1.11 (3.7) | 5 | 27,363 | 20.6 | 4.5 | 23.0 | 13.6 | 35.7 |
| Fenway/Kenmore | 1.40 (2.1) | 5 | 35,482 | 23.6 | 7.1 | 8.0 | 8.4 | 67.6 |
| Central | 3.73 (5.5) | 17 | 22,189 | 15.4 | 4.9 | 4.2 | 3.5 | 68.7 |
| South End | 4.02 (7.8) | 17 | 30,506 | 22.9 | 3.9 | 24.3 | 16.7 | 43.9 |
| Back Bay/Beacon Hill | 8.00 (14.3) | 11 | 23,818 | 9.4 | 5.1 | 2.1 | 3.7 | 84.8 |

Poverty-adjusted agency density=number of income-related social service agencies per square mile per 100 population below federal poverty level (averaged across census block groups)

*FPL* federal poverty level (annual income for a family of 4 under $13,359 in 2000)

associated with total population ($P$=0.81) nor concentration of Black ($P$=0.48) or Hispanic ($P$=0.94) residents.

## DISCUSSION

Nearly a third of Boston's low-income population lacks walking access to income-related social service agencies, and over three quarters of this population has walking access to a limited number of these resources that can provide important services to reduce poverty. Though the density of agencies providing income-related social services was higher in areas with more concentrated poverty, these services are heterogeneously located in Boston, limiting access for a significant proportion of the eligible population. Despite the segregated geographic distribution of different racial and ethnic populations throughout Boston, there does not appear to be significant difference in geographic access to the income-related social services between racial and ethnic populations, when accounting for level of poverty.

Geographic location is an important factor in understanding disparities in access to health-care and social services, especially for low-socioeconomic status populations.[13] Likewise, increased geographic access may improve utilization of those resources and consequently improve related health outcomes.[19–22] Recent efforts are underway to identify health-care and income resources that are geographically separated from populations with the highest need and worst outcomes.[37–40] Improving geographic access to social service agencies that provide income support and job training could improve utilization by the populations most in need of these services. It has been previously shown that children living in poverty, but utilizing TANF, are three times more likely to have health insurance compared to children living in poverty without TANF.[8] However, enrollment in TANF has declined for more than a decade and this appears to parallel declines in Medicaid enrollment and increased numbers of uninsured.[8,10,12] Though enrollment in TANF is a primary goal of income-related social service agencies, this analysis demonstrates that these agencies are scarce and difficult to reach geographically for many of the poorest residents of the Boston.

Low socioeconomic status is associated with many negative health behaviors, such as smoking and obesity, as well as poor physical and mental health outcomes.[41–45] Individuals living in poverty are less likely to make beneficial changes towards a healthy lifestyle; however, transitioning out of poverty is protective against poor health.[46,47] Reducing poverty by increasing access to resources such as income-related social services may be an important tool for improving the health of disadvantaged populations.

Limitations of the study include the use of cross-sectional data collected by the census. The demographic information is from the 2000 US Census and may have slightly shifted in the past decade: Boston has increased in population by 4.8 %; however, the neighborhoods of Boston have not experienced movement of a large proportion of its population. The distribution of social service agencies relative to demographic characteristics is described at the census block group level. Thus, causal inferences cannot be made and associations are limited to the population level. However, this study evaluates access to services and does not evaluate the effect of access on poverty. Some individuals or subpopulations who live in areas with limited geographic access to income-related social services may have sufficient access through mechanisms not considered in this study, such as agencies that may be closer to their work. Furthermore, this study considers geographic access, but

there are many different definitions of access to a service. Waiting time, transportation, financial and effort costs, ease of use, and social stigma can all be significant barriers to the use of beneficial social services. Nonetheless, geographic access remains to be a major barrier to use of services for low-income individuals with limited means of transportation and resources. These results are applicable to Boston specifically; however, the methodology used to assess geographic access to social services is broadly applicable.

Eliminating poverty is an important goal of society and increasing access to income-related social services is one strategy to reduce poverty. This cross-sectional analysis identifies block groups and neighborhoods in the Boston area with limited geographic access to agencies providing income-related social services despite a large population in need. It is important to note that although income-related social service agencies are unevenly distributed in Boston, the distribution does skew towards those areas with more concentrated poverty. City planning should take into consideration the geographic location of populations in need when deciding where to establish new social service agency locations.

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