HHS Public Access

Author manuscript

J Racial Ethn Health Disparities. Author manuscript; available in PMC 2018 March 22.

Neighborhood Socioeconomic Disadvantage, Neighborhood Racial Composition and Hypertension Stage, Awareness, and Treatment among Hypertensive Black Men in New York City: Does Nativity Matter?

Helen Cole, DrPH[1,2], **Dustin T. Duncan, ScD**[3,4,5], **Gbenga Ogedegbe, MD, MS, MPH**[3,4], **Samantha Bennett**[3,4], and **Joseph Ravenell, MD, MS**[3]

[1] Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Barcelona, Spain

[2]Institut Hospital del Mar d'Investigacions Mèdiques, Barcelona, Spain

[3]Department of Population Health, New York University School of Medicine, New York, NY USA

[4] College of Global Public Health, New York University, New York, NY, USA

[5] Population Center, New York University, New York, NY, USA

Abstract

Objective—Neighborhood-level poverty and racial composition may contribute to racial disparities in hypertension outcomes. Little is known about how the effects of neighborhood social environments may differ by nativity status among diverse urban Black adults. We aimed to characterize the influence of neighborhood-level socio-demographic factors on hypertension outcomes among US- and foreign-born Black men with uncontrolled blood pressure.

Design—We conducted a cross-sectional analysis of baseline data from two large community-based trials of hypertensive Black men aged 50 and over linked with census tract data from the 2012 American Community Survey 5-year estimates. We defined census tracts with high racial segregation as those where 60% or more self-identified as Black and high poverty census tracts as those where 20% or more lived below the poverty line. Multivariable general estimating equations models were used to measure associations between neighborhood characteristics and stage of hypertension, hypertension awareness, and treatment to yield adjusted prevalence ratios (aPR). Models were run separately for US- and foreign-born Black men.

Results—Over 64% of the 1,139 participants lived in a census tract with a high percentage of Black residents and over 71% lived in high poverty census tracts. Foreign-born Black men living in neighborhoods with a high concentration of Black residents were less likely to be treated for their high blood pressure (aPR 0.44, 95% CI 0.22-0.88), but this result did not hold for US-born

Corresponding author: Helen Cole, DrPH, hvscole@gmail.com, Phone: 646-501-2593.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Black men. There were no significant associations between neighborhood poverty and hypertension outcomes.

Conclusions—Neighborhood context may impact treatment for hypertension, one of the most important factors in hypertension control and decreasing hypertension-related mortality, particularly among foreign-born Black men.

Keywords

neighborhood context; Black men; hypertension; health disparities

Introduction

Life expectancy among Black men is approximately 4.7 years lower than for White men,[1] a difference that is in part attributable to inadequate treatment and poor control of hypertension among Black men.[2] In 2015, a report from the American Heart Association revealed that the hypertension-related death rate among Black men was 47.1 per 100,000 compared to 17.6 per 100,000 for White men.[3] Over the past two decades, awareness of having hypertension, a precursor to undergoing treatment and achieving blood pressure control, has increased among Black men. As of 2010, Black men were no longer less likely to be aware of having hypertension compared to White men. Rates of treatment for hypertension among Black men also increased from 46.8% in 1999 to 72.6% of hypertensive Black men in 2010.[4] However, even among those currently being treated, racial disparities in hypertension control remain, where only 49.7% of treated hypertensive Black men achieved control compared to 65.0% of treated hypertensive White men, according to analyses of the 2010 NHANES data.[4]. Black men also face significant socioeconomic disadvantages compared to White men. For example, Black men are more likely than others to be unemployed, to have a history of incarceration, to have unstable housing or to experience homelessness. [5-7] In addition, due to political and economic macrosocial policies, Black men are more likely than others to live in highly segregated and high poverty neighborhoods.[7-9]

In addition to individual-level social and behavioral determinants of health, the social environments of neighborhoods in which individuals reside also have important effects on health. A study by Buys and colleagues noted that neighborhood disadvantage was significantly associated with hypertension prevalence among a population of older Black and White adults, suggesting the importance of acknowledging and addressing neighborhood disadvantage to improve hypertension management in older adults.[10] Similarly, Coulon found that neighborhood poverty was linked to higher systolic and diastolic blood pressure. [11] Living in a socioeconomically disadvantaged area may increase physiologic responses to stress, which in turn may lead to a higher allostatic load and worse health outcomes.[10] Therefore, it is important to consider the socioeconomic context when planning interventions to prevent hypertension and other negative cardiovascular disease outcomes. [12]

While several studies have investigated the relationship between neighborhood racial composition, neighborhood socioeconomic status, and hypertension prevalence, awareness,

or related behaviors across various geographies and populations, results from studies have been inconsistent. Kershaw and colleagues found that the relationship between race and disparities in hypertension is modified by neighborhood racial composition and neighborhood poverty, where race differences were largest in highly segregated, low-poverty areas.[13] Morenoff and colleagues, on the other hand, found that among those who were on medication, Blacks were only 40-50% as likely as Whites to have their blood pressure controlled and the neighborhood context did not account for this difference.[14]

In addition to documented disparities by race, differences in health outcomes by nativity have been documented among Blacks [15-17], indicating the need to address both between and within race disparities. Foreign-born Blacks are among the fastest growing immigrant communities in the US and largely reside in the same geographic areas as US-born Black populations.[18] More than one quarter of the Black population of the US urban areas of New York City, Boston, and Miami are foreign-born.[19] Among foreign-born Black men, immigration status, visa type, and acculturation may also affect likelihood of accessing care, specifically among Black immigrants. For example, Black immigrants who are undocumented are excluded from obtaining health insurance coverage through the Affordable Care Act. However, those with refugee status, who are over represented among Black immigrants,[18] have access to Medicaid and Medicare. Even among those with insurance, accessing care may be particularly challenging among Black immigrants due to barriers associated with cultural differences, language, or knowledge of how to use the US healthcare system.[20] Few studies of neighborhood effects on health have distinguished between nativity among participants. However, White and colleagues found no association between segregation and self-reported hypertension and even the potential for a protective effect of high segregation for older foreign-born Blacks.[21]

Evidence also suggests the adverse effects of poor social and economic exposures that lead to poor health outcomes among Black men are cumulative over the life course. Thus, experiences during early childhood and adult exposures together lead to poor health outcomes, which become more evident with age.[6, 9] Furthermore, past studies have generally included samples of the general population, and have not honed in on those with uncontrolled blood pressure, who are most at risk for adverse blood pressure-related outcomes. Among Blacks, within-race diversity such as nativity is rarely acknowledged, despite an urban population which is over one quarter foreign-born.[19] To address the limitations of the existing research, we aimed to investigate the relationship between neighborhood socioeconomic status, neighborhood racial composition, and aspects of hypertension among a sample of uncontrolled hypertensive middle aged and older Black men, specifically: severity (i.e., stage of hypertension), awareness and treatment. In addition, considering the increasing diversity of the urban Black community in the United States, we assessed whether results differ by nativity status. By examining these relationships among a sample of uncontrolled hypertensive Black men, we focus on a group in need of effective treatment to achieve hypertension control, rather than the population at large.

Methods

Sample and Data Collection

Data for this study came from the baseline data for the Men's Health Initiative (MHI), which consisted of two community-based randomized controlled trials (Mister B[22] and FAITH-CRC, the protocol for which is not yet published) testing behavioral interventions to improve blood pressure control and encourage colorectal cancer screening among Black men age≥50 in NYC. Data was collected between 2010 and 2014 through recruitment at barbershops, churches, mosques, and other community-based or faith-based organizations in all 5 boroughs of New York City. This study is based on a cross-sectional analysis of the baseline data for all enrolled participants who meet the inclusion criteria of being 1) self-identifying as black or of African descent, 2) age 50 or over, 3) having uncontrolled blood pressure as indicated by having high blood pressure readings at the time of screening (>= 135/85 mm Hg, or 130/80 mm Hg with comorbid diabetes or chronic kidney disease), 4) not having an up-to-date colorectal cancer screening, 6) English speaking, and 7) having a working telephone. All participants completed a baseline survey at the time of enrollment consisting of demographic, behavioral, and psychosocial questionnaires related to blood pressure control or colorectal cancer screening status. The New York University School of Medicine Institutional Review Board approved the study and all participants provided informed consent. All procedures were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. Informed consent was obtained from all participants included in the study.

Study Variables

Men's Health Initiative data was linked to neighborhood indicators derived from American Community Survey data at the census tract level by participants' geocoded addresses. The predictor variables were neighborhood socioeconomic status, measured using percentage of residents living below poverty from the 2012 American Community Survey 5-year estimates, and neighborhood segregation, measured using the percentage of Black residents calculated from total population and by race estimates from 2010 US census short form. Neighborhood variables were measured at the census tract level.[23-28] Census tracts where greater than 20% of the residents live below poverty were classified as high poverty. Similarly, census tracts where 60% or more of the residents self-identified as black were considered high concentration of Black residents. These measures have been used by others in past studies of neighborhood effects and health.[23, 25, 29, 30]

The outcome variables were characteristics of hypertension derived from baseline data collected for the studies, including: 1) stage of hypertension, 2) awareness of having hypertension and 3) treatment for hypertension. Blood pressure was measured by trained research assistants using an automated and validated blood pressure machine (Welch Allyn VitalSigns 800 monitor). Blood pressure for each participant was measured 3 times and the average of the three readings was used in analyses. As mentioned above, only men with high readings were recruited for the study. For the first outcome, the average of the 3 blood pressure readings was classified as Stage 1 (average systolic blood pressure of 140-159 mm

Hg, or average diastolic blood pressure of 90-99 mm Hg) or Stage 2 (average systolic blood pressure >/= 160 mm Hg or diastolic blood pressure >/= 100 mm Hg) as determined by JNC-7 guidelines.[31] Additional variables were measured using self-reported items from the baseline surveys for the Mister B (described elsewhere) and FAITH-CRC studies.[22] The second outcome variable for this study was awareness of hypertension, where those who answered “yes” to the question “Has a doctor or other healthcare provider ever told you that you have high blood pressure?” were considered aware. The final outcome, blood pressure treatment, was determined by the question “Do you currently take medication for your blood pressure?”.

Access to care was assessed using a single item indicating whether the participant had any type of insurance (yes/no). Past research suggests greater validity when study participants are asked whether they have insurance at all rather than specific type of insurance.[32] Other variables included: age (in years, at the time of study recruitment), nativity (U.S. born vs. foreign-born), years in the U.S. (among foreign-born participants), language spoken at home, and marital status. Measures of individual-level socioeconomic status included poverty level expressed as percentage of the area median income according to benefit categories established by the United States Department of Housing and Urban Development, employment status, and education (less than high school, high school or equivalent, some college, and college graduate or greater). Self-reported general health was measured using a single item and dichotomized (excellent, very good, or good vs fair or poor).

Statistical Analysis

Nine participants were excluded due to duplicate enrollment for the current analysis. Participants who were missing valid neighborhood-level data (n=40) or blood pressure measurements (n=3) were also excluded from analyses. Thus 1,139 participants (96.4% of the original study sample) were included in the final analysis. First, we generated descriptive statistics of the sample, stratified by neighborhood classification (high vs low poverty and high vs. low racial concentration of Black residents) and used chi-squared and ANOVA tests to determine whether these variables varied by type of neighborhood.

Next, bivariate and multivariate models were fit to examine the association between aspects of neighborhood social environment (i.e., neighborhood poverty and neighborhood racial composition) and aspects of hypertension (stage one vs. stage two, awareness, and treatment). Using generalized estimating equation (GEE) models, we ran separate models for each neighborhood predictor, adjusting for potential confounders (i.e. age, nativity, education, comorbidity, and insurance status) and controlling for clustering of census tracts. The GEE models were fit using PROC GENMOD in SAS with an exchangeable correlation structure matrix, similar to procedures for other studies investigating neighborhood characteristics and health.[33] We specified a logistic regression model with a robust error variance to calculate prevalence ratios (PRs) since the prevalence of the outcomes of interest were high.[34-36] Additionally, we ran each model separately by nativity again adjusting for age, education, comorbidity and insurance status. Statistical significance was determined by 95% confidence intervals (CI) and *p*-values less than 0.05. All data analyses were conducted in SAS version 9.2 (SAS Institute Inc., Cary, NC).

Results

The 1,139 participants lived in 507 unique census tracts. Table 1 shows the neighborhood racial and socioeconomic distribution characteristics among the sample. The mean percent of neighborhood poverty among participants was 28.4% and over two thirds lived in neighborhoods designated as “high poverty”, meaning that at least 20% of residents in those neighborhoods had household incomes below the poverty line. Approximately 64% lived in neighborhoods with a high concentration of Black residents, defined as neighborhoods where at least 60% of residents were Black.

Table 2 shows sample demographic and socioeconomic characteristics by neighborhood racial composition and poverty level. The mean age of the sample was 57.7 years. Over 30% reported having less than a high school education and over 75% had household incomes less than 30% of the area median income. Neighborhoods with low and high percentages of Black residents varied in the proportion of study participants who were foreign-born (21.2% vs 30.7%, $p<0.001$), level of education (26.3% vs 34.4% with less than a high school education, respectively, $p<0.001$), and employment status (30.1% vs 26.4% employed, $p= .024$). Similarly, high and low poverty neighborhoods varied in the percentage of foreign-born participants (37.2% vs 23.6%, $p<0.001$), level of education (25.2% vs 34.2% with less than a high school education, $p=0.003$), and individual poverty level (68.1% vs 78.6% were in the highest poverty bracket, respectively, $p=0.016$).

Fewer differences between participants by neighborhood racial composition and poverty were noted for hypertension-related outcomes, as demonstrated in Table 3. Overall 73.7% of participants had stage 1 rather than stage 2 hypertension, 67.0% were aware of having hypertension, and 65.1% of those who were aware of their condition were taking medication for it. Participants living in neighborhoods with a high concentration of Black residents were less likely than those in neighborhoods with a low concentration of Black residents to be treated for hypertension ($p=0.015$).

Results of the regression analyses are reported in Tables 4 and 5. We found no association between neighborhood-level poverty and stage of hypertension, awareness of hypertension, or treatment for hypertension across models. There were also no significant associations between neighborhood racial composition and stage of hypertension or awareness. However, there was a significant association between being treated for high blood pressure and neighborhood racial composition (aPR=0.66, 95% CI 0.47-0.94), where those living in high segregated census tracts (those where more than 60% of residents were Black) were significantly less likely to be treated for high blood pressure (i.e., to report taking medication for hypertension) than those living in less segregated census tracts, taking into account age, education and nativity. In models stratified by nativity, these results held only for foreign-born Blacks (aPR=0.44, 95% CI 0.22-0.88). There was no significant relationship between neighborhood racial composition and being treated for hypertension among US-born blacks (see Table 5).

Discussion

We examined a community-based sample of middle aged and older US- and foreign-born hypertensive Black men with uncontrolled blood pressures, a unique yet vulnerable population experiencing higher hypertension-related mortality compared to other demographic groups.[37] Due to the inclusion criteria for the parent studies, all of the participants in the sample self-identified as Black or of African descent, all were men, age 50 or over, and all had average blood pressure readings of 135/85 or above. As all men in our sample had uncontrolled blood pressure, they represent a particularly vulnerable group- both those who have hypertension and are not receiving treatment, and those who are being treated yet have not achieved blood pressure control.

We found a significant negative association between living in a neighborhood with a relatively high percentage of Blacks and being treated for high blood pressure among foreign-born Black men aware of having hypertension. These results may indicate that, among foreign-born Black men, those who live in a neighborhood with a high concentration of Blacks may be less likely to be treated than those in neighborhoods with lower proportions of Blacks. Conversely, our results may also indicate that men in neighborhoods with lower concentrations of Blacks may be more likely to be on medication for their high blood pressure yet still have uncontrolled blood pressure (and thus were eligible for this study). Thus, results of our study lead to additional future research questions regarding how neighborhood racial composition relates to both access to and effectiveness of hypertension treatment among Black men, particularly among foreign-born Blacks. We found no evidence that neighborhood poverty affects stage of hypertension, hypertension awareness or treatment among US or foreign-born Black men.

Receiving treatment for hypertension has substantial implications for whether one is able to control their blood pressure and subsequently avoid the sequelae of hypertension, namely disability and death. Thus, it is critical to understand the mechanisms contributing to the association between treatment for hypertension and neighborhood racial composition among foreign-born Black men. Differences in access to care also vary by nativity among Blacks. Immigration status, visa type, and acculturation may also affect the health of Black immigrants. For example, Black immigrants who are undocumented are excluded from obtaining health insurance coverage through the Affordable Care Act. However, those with refugee status, who are over represented among Black immigrants,[18] have access to Medicaid and Medicare. Even among those with insurance, accessing care may be particularly challenging among Black immigrants due to barriers associated with cultural differences, language, or knowledge of how to use the US healthcare system.[20]

Existence of social services may assist immigrants in overcoming such barriers. In addition, immigrants residing in ethnic enclaves (i.e., neighborhoods with high concentrations of similar ethnic groups) may have greater social support or capital due to neighborhood and culture-specific networks.[38] However, our results indicate that immigrant Black men with hypertension, who live in neighborhoods with high concentration of Black residents (regardless of nativity), are less likely to be treated for hypertension. Such neighborhoods may not support access to treatment for hypertension among this population. Although both

US-born and foreign-born Blacks, are treated as a monolithic minority group in census categories surveillance efforts, and most research, varying perceptions of subgroups of Blacks from non-Blacks and other Blacks also affect minority experience in the US. Foreign-born Blacks and those in subsequent generations of foreign-born Black communities, may experience a "duality" of being either a member of the out-group, placed in a minority racial category with all other Blacks, or being a member of a "model minority"- harder-working, better educated, and somehow "better" than native-born Blacks.[39] Furthermore, foreign-born Blacks are exposed to the same forms of oppression and racism as US-born Blacks, and in addition may experience discrimination from US-born Blacks. Forced integration of foreign-born blacks and US-born blacks due to residential segregation and other societal factors has also caused tension, mistrust and competition between black groups.[39] Among a population sample of adults in Chicago, Morenoff and colleagues found that, despite playing a significant role in accounting for black/white disparities in hypertension prevalence and awareness, neighborhood social context (i.e., affluence/gentrification, concentration of immigrants, and age structure) did not influence black/white disparities in hypertension treatment or control among those who were aware of having hypertension.[14] Our results, however, indicate that racial composition specifically may matter for hypertension treatment and control among Black immigrants.

The additional possibility is that foreign-born men in neighborhoods with lower concentrations of Blacks may be more likely to be *ineffectively* treated for hypertension, thus leading to the apparent relationship between neighborhood racial composition and treatment. In our sample, both those who were treated and those who were not, had uncontrolled blood pressure, thus both access to and quality of care may be at play, which is in line with evidence that Black men may not receive care which is equal in quality to that of their White peers.[40] Landrine and Corrall argue that the presence of poorer quality healthcare facilities in predominantly Black neighborhoods contributes to disparities in accessing quality care.[41] It may also be the case that, particularly for foreign-born Black men, cultural or linguistic barriers may lead to ineffective treatment for men receiving care in neighborhoods with fewer Blacks. For example, Ludwig and Reed found that, among a community of Liberian immigrants, lack of knowledge and a difference in understanding of the importance of treating chronic disease, caused significant discord between immigrant views of hypertension and Western medical views.[20] This is particularly salient for the treatment of hypertension, which is largely asymptomatic. Thus, the ability of medical facilities in these neighborhoods to effectively treat hypertension among immigrant Black men may be challenged by cultural beliefs and practices unfamiliar to many providers.

Our study is unique in that our sample included only middle age and older Black men, a group often not fully represented in medical and public health research.[42, 43] In addition to identifying a relationship between neighborhood racial composition and low likelihood of hypertension treatment among foreign-born Blacks, our results also highlight the importance of disaggregating data according to nativity or other within-race differences. Among our participants, prior to testing separate models by nativity, the strong relationship between neighborhood racial composition and hypertension treatment appeared to be among all Black men. However, stratified models by nativity lead to more informative and targeted results indicating that this relationship held only among foreign-born Blacks. Furthermore,

our participants were recruited in barbershops, churches, and other community-based organizations, which together have the advantage of reaching a broad scope of Black men, independent of socioeconomic status, nativity, and many other factors which may ultimately bias results. We recruited participants from all 5 boroughs of New York City, and participants resided in 507 census tracts. We were also able to make use of objectively measured blood pressure data, which enabled us to capture awareness of potential hypertension diagnoses among our participants and to more accurately determine the stage of hypertension.

Our study also had several limitations. Due to inclusion criteria for the parent trial, our participants all had blood pressure of 135/85 or higher at the time of enrollment, thus variation in level of blood pressure in our sample is lower than in the population at large. Our participants were also selected based on a number of qualifying characteristics, so generalizability of the results may be reduced. In addition, our study took place in New York City, a city which in many ways is unique, including the porosity of neighborhoods in New York City, cost of living differences by neighborhood may mean that young people cannot necessarily live where they work, and participate in other activities.[44, 45] There are easily accessible and multiple modes of public transportation between boroughs in New York City, thus participants may be more mobile than in cities with less infrastructure for public transportation and thus may be influenced by other areas of the city where they spend time. While others have also used census tract as a way to define neighborhoods, other more ego-centric neighborhood definitions may be more relevant.[46] We used relatively simple measures of neighborhood composition by race and poverty. We chose these measures to allow for comparison with past studies using these measures, however more complex measures such as the Index of Concentration at Extremes may provide a more accurate account of geospatial social deprivation, taking in to account whether groups are concentrated into extremes of privilege or deprivation,[27] which may be missed using our approach. Finally, we have assessed only neighborhood racial composition and poverty level. However, additional indicators of neighborhood composition such as concentration of immigrant residents may also be important and are not addressed in this study.

In conclusion, we found evidence for an association between neighborhood context and hypertension-related outcomes. Specifically, we found an association between neighborhood racial composition and being treated for diagnosed hypertension among foreign-born Blacks. Interventions to improve hypertension-related outcomes among Black men should take neighborhood social context and access to care into account.

Acknowledgements

We thank the participants of the study and the NYU Center for Healthful Behavior Change Men's Health Initiative research staff that contributed to the project. The parent study was funded by the National Institutes of Health (NHLBI Grant # 5R01HL096946-05, Dr. Joseph Ravenell, Principal Investigator), the Comprehensive Center of Excellence in Disparities Research and Community Engagement (NCMHD grant # 5P60MD003421) and the Centers for Disease Control and Prevention, Prevention Research Centers Program (U48DP002671). We thank Jeff Blossom for geocoding the participants' addresses and calculating neighborhood-level measures in ArcGIS. At the time this article was written, the corresponding author was with the Center for Healthful Behavior Change, Department of Population Health, NYU School of Medicine.

References

1. Kochanek KD, Arias E, Anderson RN. How did cause of death contribute to racial differences in life expectancy in the United States in 2010? NCHS Data Brief. 2013; (125):1–8.
2. Wong MD, Shapiro MF, Boscardin WJ, Ettner SL. Contribution of major diseases to disparities in mortality. N Engl J Med. 2002; 347(20):1585–1592. [PubMed: 12432046]
3. Roger VL, Go AS, Lloyd-Jones DM, Benjamin EJ, Berry JD, Borden WB, Bravata DM, Dai S, Ford ES, Fox CS, et al. Heart disease and stroke statistics--2012 update: a report from the American Heart Association. Circulation. 2012125(1):e2–e220.
4. Guo F, He D, Zhang W, Walton RG. Trends in prevalence, awareness, management, and control of hypertension among United States adults, 1999 to 2010. Journal of the American College of Cardiology. 201260(7):599–606.
5. Jones DJ, Crump AD, Lloyd JJ. Health disparities in boys and men of color. Am J Public Health. 2012; 102(Suppl 2):S170–172. [PubMed: 22401517]
6. Williams DR. The health of men: structured inequalities and opportunities. Am J Public Health. 2008; 98(9 Suppl):S150–157. [PubMed: 18687602]
7. Gilbert KL, Ray R, Siddiqi A, Shetty S, Baker EA, Elder K, Griffith DM. Visible and Invisible Trends in Black Men's Health: Pitfalls and Promises for Addressing Racial, Ethnic, and Gender Inequities in Health. Annu Rev Public Health. 2016; 37:295–311. [PubMed: 26989830]
8. Schulz AJ, Williams DR, Israel BA, Lempert LB. Racial and spatial relations as fundamental determinants of health in Detroit. Milbank Quarterly. 2002; 80(4):677. [PubMed: 12532644]
9. Gilbert KL, Elder K, Lyons S, Kaphingst K, Blanchard M, Goodman M. Racial Composition Over the Life Course: Examining Separate and Unequal Environments and the Risk for Heart Disease for African American Men. Ethn Dis. 2015; 25(3):295–304. [PubMed: 26673460]
10. Buys DR, Howard VJ, McClure LA, Buys KC, Sawyer P, Allman RM, Levitan EB. Association between neighborhood disadvantage and hypertension prevalence, awareness, treatment, and control in older adults: results from the university of alabama at birmingham study of aging. Am J Public Health. 2015; 105(6):1181–1188. [PubMed: 25322309]
11. Coulon SM, Wilson DK, Alia KA, Van Horn ML. Multilevel Associations of Neighborhood Poverty, Crime, and Satisfaction With Blood Pressure in African-American Adults. Am J Hypertens. 2015
12. Vanasse A, Courteau J, Asghari S, Leroux D, Cloutier L. Health inequalities associated with neighbourhood deprivation in the Quebec population with hypertension in primary prevention of cardiovascular disease. Chronic Dis Inj Can. 2014; 34(4):181–194. [PubMed: 25408177]
13. Kershaw KN, Diez Roux AV, Burgard SA, Lisabeth LD, Mujahid MS, Schulz AJ. Metropolitan-level racial residential segregation and black-white disparities in hypertension. Am J Epidemiol. 2011; 174(5):537–545. [PubMed: 21697256]
14. Morenoff JD, House JS, Hansen BB, Williams DR, Kaplan GA, Hunte HE. Understanding social disparities in hypertension prevalence, awareness, treatment, and control: The role of neighborhood context. Social Science & Medicine. 2007; 65(9):1853–1866. [PubMed: 17640788]
15. Yi S, Elfassy T, Gupta L, Myers C, Kerker B. Nativity, language spoken at home, length of time in the United States, and race/ethnicity: associations with self-reported hypertension. Am J Hypertens. 2014; 27(2):237–244. [PubMed: 24190903]
16. Griffith DM, Johnson JL, Zhang R, Neighbors HW, Jackson JS. Ethnicity, nativity, and the health of American Blacks. J Health Care Poor Underserved. 2011; 22(1):142–156. [PubMed: 21317512]
17. Doamekpor LA, Dinwiddie GY. Allostatic load in foreign-born and US-born blacks: evidence from the 2001-2010 National Health and Nutrition Examination Survey. Am J Public Health. 2015105(3):591–597.
18. Capps, R., McCabe, K., Fix, M. New Streams: Black African Migration to the United States. Migration Policy Institute; Washington, DC: 2011.
19. Kent, MM. Immigration and America's Black Population. Population Reference Bureau; 2007.
20. Ludwig B, Reed H. “When you are here, you have high blood pressure”: Liberian refugees’ health and access to healthcare in Staten Island, NY. International Journal of Migration Health and Social Care. 2016; 12(1):26–37.

21. White K, Borrell LN, Wong DW, Galea S, Ogedegbe G, Glymour MM. Racial/ethnic residential segregation and self-reported hypertension among US- and foreign-born blacks in New York City. Am J Hypertens. 2011; 24(8):904–910. [PubMed: 21509051]
22. Ravenell J, Thompson H, Cole H, Plumhoff J, Cobb G, Afolabi L, Boutin-Foster C, Wells M, Scott M, Ogedegbe G. A novel community-based study to address disparities in hypertension and colorectal cancer: a study protocol for a randomized control trial. Trials. 2013; 14:287. [PubMed: 24011142]
23. Duncan DT, Kawachi I, White K, Williams DR. The Geography of Recreational Open Space: Influence of Neighborhood Racial Composition and Neighborhood Poverty. Journal of Urban Health-Bulletin of the New York Academy of Medicine. 2013; 90(4):618–631. [PubMed: 23099625]
24. Subramanian SV, Chen JT, Rehkopf DH, Waterman PD, Krieger N. Comparing individual- and area-based socioeconomic measures for the surveillance of health disparities: A multilevel analysis of Massachusetts births, 1989-1991. Am J Epidemiol. 2006164(9):823–834.
25. Subramanian SV, Chen JT, Rehkopf DH, Waterman PD, Krieger N. Racial disparities in context: a multilevel analysis of neighborhood variations in poverty and excess mortality among black populations in Massachusetts. Am J Public Health. 2005; 95(2):260–265. [PubMed: 15671462]
26. Krieger N, Chen JT, Waterman PD, Rehkopf DH, Subramanian SV. Race/ethnicity, gender, and monitoring socioeconomic gradients in health: a comparison of area-based socioeconomic measures--the public health disparities geocoding project. Am J Public Health. 2003; 93(10): 1655–1671. [PubMed: 14534218]
27. Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter?: the Public Health Disparities Geocoding Project. Am J Epidemiol. 2002; 156(5):471–482. [PubMed: 12196317]
28. Duncan DT, Aldstadt J, Whalen J, White K, Castro MC, Williams DR. Space, race, and poverty: Spatial inequalities in walkable neighborhood amenities? Demographic Research. 2012; 26:409–448.
29. Franzini L, Taylor W, Elliott MN, Cuccaro P, Tortolero SR, Janice Gilliland M, Grunbaum J, Schuster MA. Neighborhood characteristics favorable to outdoor physical activity: disparities by socioeconomic and racial/ethnic composition. Health Place. 2010; 16(2):267–274. [PubMed: 19896408]
30. Kelly CM, Schootman M, Baker EA, Barnidge EK, Lemes A. The association of sidewalk walkability and physical disorder with area-level race and poverty. J Epidemiol Community Health. 2007; 61(11):978–983. [PubMed: 17933956]
31. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr. Jones DW, Materson BJ, Oparil S, Wright JT Jr. et al. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension. 2003; 42(6):1206–1252. [PubMed: 14656957]
32. Pierannunzi C, Hu SS, Balluz L. A systematic review of publications assessing reliability and validity of the Behavioral Risk Factor Surveillance System (BRFSS), 2004-2011. BMC Med Res Methodol. 201313:49.
33. Hirsch JA, Moore KA, Evenson KR, Rodriguez DA, Diez Roux AV. Walk Score(R) and Transit Score(R) and walking in the multi-ethnic study of atherosclerosis. Am J Prev Med. 2013; 45(2): 158–166. [PubMed: 23867022]
34. Spiegelman D, Hertzmark E. Easy SAS calculations for risk or prevalence ratios and differences. Am J Epidemiol. 2005; 162(3):199–200. [PubMed: 15987728]
35. McNutt LA, Wu C, Xue X, Hafner JP. Estimating the relative risk in cohort studies and clinical trials of common outcomes. Am J Epidemiol. 2003; 157(10):940–943. [PubMed: 12746247]
36. Behrens T, Taeger D, Wellmann J, Keil U. Different methods to calculate effect estimates in cross-sectional studies. A comparison between prevalence odds ratio and prevalence ratio. Methods Inf Med. 2004; 43(5):505–509. [PubMed: 15702210]
37. Mensah GA, Dunbar SB. A framework for addressing disparities in cardiovascular health. J Cardiovasc Nurs. 2006; 21(6):451–456. [PubMed: 17293734]

38. Osypuk TL, Diez Roux AV, Hadley C, Kandula NR. Are immigrant enclaves healthy places to live? The Multi-ethnic Study of Atherosclerosis. Soc Sci Med. 2009; 69(1):110–120. [PubMed: 19427731]

39. Greer, CM. Black Ethnics: Race, Immigration, and the Pursuit of the American Dream. Oxford University Press; New York, NY: 2013.

40. Smedley, AY., Nelson, AR. Unequal Treatment: Confronting racial and ethnic disparities in health care. Institute of Medicine of the National Academies; Washington, D.C.: 2003.

41. Landrine H, Corral I. Separate and Unequal: Residential Segregation and Black Health Disparities. Ethnicity & Disease. 2009; 19(2):179–184. [PubMed: 19537230]

42. Griffith DM, Neighbors HW, Johnson J. Using national data sets to improve the health and mental health of Black Americans: challenges and opportunities. Cultur Divers Ethnic Minor Psychol. 2009; 15(1):86–95. [PubMed: 19209983]

43. Murthy VH, Krumholz HM, Gross CP. Participation in cancer clinical trials: race-, sex-, and age-based disparities. JAMA. 2004; 291(22):2720–2726. [PubMed: 15187053]

44. Duncan DT, Kapadia F, Halkitis PN. Examination of spatial polygamy among young gay, bisexual, and other men who have sex with men in New York City: the P18 cohort study. Int J Environ Res Public Health. 2014; 11(9):8962–8983. [PubMed: 25170685]

45. Duncan DT, Regan SD, Shelley D, Day K, Ruff RR, Al-Bayan M, Elbel B. Application of global positioning system methods for the study of obesity and hypertension risk among low-income housing residents in New York City: a spatial feasibility study. Geospat Health. 2014; 9(1):57–70. [PubMed: 25545926]

46. Duncan DT, Kawachi I, Subramanian SV, Aldstadt J, Melly SJ, Williams DR. Examination of how neighborhood definition influences measurements of youths' access to tobacco retailers: a methodological note on spatial misclassification. Am J Epidemiol. 2014; 179(3):373–381. [PubMed: 24148710]

Table 1

Descriptive information for neighborhood-level socioeconomic and racial composition

Neighborhood Characteristic	Mean (SD) or %
Neighborhood Socioeconomic Status	
Average income	39,972 (19,377)
Mean percent living below poverty	28.4 (13.5)
Neighborhood poverty	
High (20% of residents or more)	71.3%
Low	28.7%
Mean percent with HS diploma	20.4 (7.0)
Neighborhood Racial Composition	
Mean percent of White residents	16.7 (17.1)
Mean percent or Black residents	64.0 (25.3)
High Black/White Segregation (≥60% Black)	66.30%
High White/Black Segregation (≥60% White)	4.70%

Table 2

Participant demographic and socioeconomic status characteristics by neighborhood racial segregation and poverty level (N=1,139)

Characteristic	Valid N	% or Mean(SD)	Low Concentration of Blacks	High Concentration of Blacks	p-value	Low poverty	High poverty	p-value
Age	1111	57.5 (6.6)	57.3 (5.9)	57.6 (6.9)	0.383	57.8 (6.4)	57.4 (6.7)	0.296
Marital status	1118				0.113			0.338
Married		25.8%	21.6%	28.0%		37.4%	25.3%	
Divorced or separated		29.3%	32.1%	28.0%		32.1%	28.3%	
Widowed		7.3%	7.0%	7.5%		6.9%	7.5%	
Never Married		37.5%	39.4%	36.6%		33.7%	39.0%	
Foreign-born	1127	27.5%	21.2%	30.7%	**<0.001**	37.2%	23.6%	**<0.001**
Education	1130				**<0.001**			**0.003**
Less than HS		31.6%	26.3%	34.4%		25.2%	34.2%	
HS graduate		38.4%	37.3%	39.0%		39.1%	38.1%	
Some college		18.2%	24.2%	15.2%		19.4%	17.8%	
College graduate or higher		11.8%	12.3%	11.5%		16.3%	9.9%	
Household Income by HUD	849				0.336			**0.016**
Individual Poverty Level								
≤30% of median income		75.7%	73.3%	76.9%		68.1%	78.6%	
30-49% of median income		14.3%	14.1%	14.3%		19.4%	12.3%	
50-80% of median income		6.0%	7.2%	5.4%		7.3%	5.5%	
≥80% of median income		4.0%	5.4%	3.3%		5.2%	3.6%	
Employment status	1126				**0.024**			0.224
Employed		27.6%	30.1%	26.4%		31.0%	26.3%	
Unemployed		44.7%	47.9%	43.1%		43.7%	45.1%	
Retired		13.6%	10.4%	15.2%		14.2%	13.3%	
Unable to work		13.9%	11.2%	15.2%		11.2%	14.9%	
Other		0.3%	0.5%	0.1%		0.0%	0.4%	
Insurance coverage	1130	77.4%	78.4%	76.8%	0.539	74.2%	78.6%	0.103

Table 3

Participant health, access to care, and behavioral risk factors by neighborhood racial segregation and poverty level l (N=1,139)

	Valid N	% or Mean(SD)	Low Concentration of Blacks	High Concentration of Blacks	p-value	Low poverty	High poverty	p-value
Blood Pressure Outcomes								
Blood Pressure								
Systolic	1139	146.3 (15.6)	145.8 (15.6)	146.6 (15.6)	0.438	146.0 (15.4)	146.4 (15.7)	0.641
Diastolic	1139	92.0 (10.9)	91.7 (11.2)	92.2 (10.8)	0.457	92.6 (10.4)	91.8 (11.1)	0.233
HTN Stage	1139				0.655			0.985
Stage 1 (<160/<100)		73.7%	74.5%	73.3%		73.7%	73.7%	
Stage 2 (≥160/≥100)		26.3%	25.5%	26.8%		26.3%	26.4%	
Awareness of HTN	1134	67.0%	69.7%	65.7%	0.168	63.7%	63.6%	0.131
Treated for HTN[a]	748	65.1%	70.9%	62.0%	**0.015**	62.9%	65.9%	0.435
Self-Reported Health Outcomes								
General Health								
Fair or poor	1120	40.1%	38.9%	40.7%	0.576	36.8%	41.4%	0.158
Diabetes	1137	19.0%	17.0%	20.0%	0.215	19.9%	18.6%	0.608
High Cholesterol	1129	31.2%	33.7%	29.9%	0.195	29.4%	31.9%	0.417
Kidney Failure	1124	2.0%	1.9%	2.0%	0.863	1.6%	2.1%	0.529

[a]Among those who were aware of having hypertension only (N=760)

Table 4

Adjusted prevalence ratios, parameter estimates and standard errors for the relationship between neighborhood SES and racial composition and blood pressure-related outcomes.[a]

	Stage 2 HTN				HTN Awareness				HTN Treatment[b]			
Neighborhood Poverty (Ref=Low poverty)	**aPR**	**β**		**SE**	**aPR**	**β**		**SE**	**aPR**	**β**		**SE**
High poverty	0.95	−0.055		0.164	1.05	0.050		0.163	1.06	0.061		0.181
Age		−0.001		0.011		0.003		0.011		0.020		0.014
Education (Ref=College grad or higher)												
Some college		−0.172		0.259		0.066		0.257		−0.288		0.305
High school grad		**−0.459**	*	**0.228**		0.017		0.231		−0.158		0.280
Less than high school		−0.378		0.228		−0.231		0.221		−0.023		0.300
Foreign-born		0.039		0.163		**−0.493**	**	**0.156**		0.109		0.207
Self-reported diabetes		−0.470		0.196		**0.634**	**	**0.203**		**0.670**	**	**0.220**
Self-reported high cholesterol		0.075		0.157		**1.074**	**	**0.173**		**0.435**	**	**0.169**
Uninsured		−0.129		0.180		−0.235		0.158		**−1.142**	**	**0.209**

	Stage 2 HTN				HTN Awareness				HTN Treatment[b]			
Neighborhood Racial Composition (Ref=Low)	**aPR**	**β**		**SE**	**aPR**	**β**		**SE**	**aPR**	**β**		**SE**
High concentration of Black residents	1.00	0.000		0.155	0.82	−0.197		0.160	**0.66**	**−0.410**	*	**0.177**
Age		−0.001		0.011		0.003		0.011		0.018		0.014
Education (Ref=College grad or higher)												
Some college		−0.175		0.259		0.049		0.258		−0.302		0.307
High school grad		**−0.463**	*	**0.228**		0.027		0.233		−0.124		0.281
Less than high school		−0.384		0.227		−0.214		0.224		0.013		0.300
Foreign-born		0.046		0.162		**−0.479**	**	**0.154**		0.152		0.207
Self-reported diabetes		**−0.469**	*	**0.196**		**0.649**	**	**0.204**		**0.695**	**	**0.220**
Self-reported high cholesterol		0.095		0.157		**1.067**	**	**0.172**		**0.449**	**	**0.170**

	Stage 2 HTN			HTN Awareness			HTN Treatment[b]		
Neighborhood Racial Composition (Ref=Low)	**aPR**	**β**	**SE**	**aPR**	**β**	**SE**	**aPR**	**β**	**SE**
Uninsured		−0.130	0.180		−0.233	0.158		**−1.134** **	**0.208**

[a]All analyses account for clustering by census tract.

*p<0.05

**p<0.01

[b]Among those who had been told that they had hypertension only (N=760)

Table 5

Adjusted prevalence ratios, parameter estimates and standard errors for the relationship between neighborhood SES and racial composition and blood pressure-related outcomes for US-born and foreign-born men.[a]

	Stage 2 HTN			HTN Awareness			HTN Treatment[b]		
US-born Men only	**aPR**	**β**	**SE**	**aPR**	**β**	**SE**	**aPR**	**β**	**SE**
Neighborhood Poverty (Ref=Low poverty)									
High poverty	0.86	−0.150	0.192	1.13	0.118	0.198	1.01	0.006	0.226
Neighborhood Racial Composition (Ref=Low poverty)									
High poverty	0.96	−0.046	0.171	0.94	−0.065	0.183	0.73	−0.317	0.204

	Stage 2 HTN			HTN Awareness			HTN Treatment[c]			
Foreign-born men only	**aPR**	**β**	**SE**	**aPR**	**β**	**SE**	**aPR**	**β**		**SE**
Neighborhood Poverty (Ref=Low poverty)										
High poverty	1.32	0.280	0.273	0.93	−0.078	0.255	0.91	−0.093		0.285
Neighborhood Racial Composition (Ref=Low concentration of Black residents)										
High concentration of Black residents	1.28	0.249	0.330	0.61	−0.492	0.289	**0.44**	**−0.824**	*	**0.355**

**p<0.01

[a]Adjusted for individual-level covariates: age, education, diabetes, high cholesterol, and insurance status. All analyses account for clustering by census tract.

*p<0.05

[b]Among US-born men who had been told that they had hypertension only (N=577)

[c]Among foreign-born men who had been told that they had hypertension only (N=178)