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Public Housing Relocations and Relationships of Changes in Neighborhood Disadvantage and Transportation Access to Unmet Need for Medical Care

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Abstract

Introduction—Cross-sectional research suggests that neighborhood characteristics and transportation access shape unmet need for medical care. This longitudinal analysis explores

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relationships of changes in neighborhood socioeconomic disadvantage and transportation access to unmet need for medical care.

Methods—We analyzed seven waves of data from African American adults (N = 172) relocating from severely distressed public housing complexes in Atlanta, Georgia. Surveys yielded individual-level data and administrative data characterized census tracts. We used hierarchical generalized linear models to explore relationships.

Results—Unmet need declined from 25% pre-relocation to 12% at Wave 7. Post-relocation reductions in neighborhood disadvantage were inversely associated with reductions in unmet need over time (OR = 0.71, 95% CI = 0.51–0.99). More frequent transportation barriers predicted unmet need (OR = 1.16, 95% CI = 1.02–1.31).

Conclusion—These longitudinal findings support the importance of neighborhood environments and transportation access in shaping unmet need and suggest that improvements in these exposures reduce unmet need for medical care in this vulnerable population.

Keywords

Public housing relocations; unmet need for medical care; transportation access; neighborhood socioeconomic disadvantage

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Access to health care is a critical component of achieving health equity in the United States (U.S.) and a major goal of *Healthy People 2020* and of the Affordable Care Act.[1,2] Unmet need for medical care ("unmet need") results in increased morbidity, mortality, and long-term health care costs.[1,3] Impoverished populations and racial/ethnic minorities bear a disproportionate burden of illness; these groups are also less likely to have adequate access to health care.[2,4–6]

An emerging line of research suggests that neighborhood poverty and transportation access shape unmet need for medical care among U.S. adults. Neighborhood poverty is associated with unmet need for medical care.[7,8] Disadvantaged areas may face challenges attracting and maintaining health care resources, such as health care providers.[9,10] However, the vast majority of studies that have explored relationships of neighborhood characteristics to unmet need for medical care use ecological[7] or multilevel cross-sectional designs,[8,9,11–13] which limit our ability to assess causality. Adequate transportation is fundamental to health care utilization.[14–18] Individuals report poorer health when transportation problems impede their ability to reach care; individuals who report transportation barriers to care are more likely to be female, poor, less educated, and to belong to a racial/ethnic minority than those who were able to travel to care.[16,19] Most studies that have explored the relationship of transportation access to unmet need for medical care use individual-level measures of transportation (e.g., self-reported transportation barriers).[14–18] *Neighborhood* access to transportation (e.g., public transportation access, the density of privately-owned vehicles that could be borrowed) may be particularly important for impoverished populations. Poor people are less likely to own, or have access to, a personal vehicle to get to work than the population as a whole and are more likely to rely on public transportation, walk, or use other transportation modes.[20] Perhaps as a result, natural experiments (e.g., mass transportation strikes) suggest that area-

level changes in transportation access are associated with changes in health care utilization among impoverished populations.[19,21,22]

This longitudinal, multilevel study explores (1) trends in the odds of unmet need for medical care in the sample over time and (2) the extent to which neighborhood-level socioeconomic disadvantage and neighborhood- and individual-level transportation are associated with the odds of unmet need for medical care over time. We studied this topic in a predominately substance-misusing sample of African American adults who were being relocated from highly distressed public housing complexes in Atlanta, Georgia (GA).[23,24] Between 1994 and 2013, 50,000 residents living in highly distressed public housing complexes in Atlanta were relocated under Housing Opportunities for Everyone (HOPEVI) and Section 18 of the 1937 Housing Act.[25] Following the relocations, most residents moved to voucher-subsidized rental units scattered across the region, and the housing complexes were destroyed.[24]

People living in public housing have some of the poorest health profiles of any group in the U.S.[26,27] In addition, residents may belong to highly stigmatized groups (e.g., substance users), which may affect health and make it difficult to access medical care.[28–31] Research suggests that relocaters experienced post-relocation improvements in mental and physical health and had lower rates of substance use and sexual risk behaviors post-relocation.[23,32–36] To our knowledge, no studies have explored the impact of relocations on unmet need for medical care over time. Our own research suggests that relocaters did not experience significant improvements in unmet need for medical care immediately following relocations.[37] In addition, travel distance to safety-net primary health care clinics increased immediately following relocations, which may have resulted in greater barriers to medical care.[38] However, relocations also brought people to qualitatively different neighborhoods, which in the main were less violent and less impoverished than the neighborhoods containing the complexes.[24] These communities may have more resources and prosocial norms supporting health care seeking and preventative behaviors.[13,35,36,39,40]

The present analysis seeks to:

1. Evaluate temporal trends in the odds of unmet need for medical care, and explore whether trends vary by gender or drug/alcohol dependence. (Note: By design, the study oversampled substance misusers.[32] Similarly, health care utilization varies by gender.[41]);
2. Investigate relationships of changes in exposure to neighborhood-level socioeconomic disadvantage and individual- and neighborhood-level transportation access to the odds of unmet need for medical care, and explore whether relationships vary by gender or drug/alcohol dependence.

This analysis (Figure 1) was guided by the Gelberg-Andersen Model for Vulnerable Populations (G-AMVP).[42] The G-AMVP has been used successfully to describe *predisposing, enabling*, and *need* predictors of health care utilization among precariously housed populations and substance users in the U.S.[43–46] *Predisposing* characteristics include individual-level factors that exist prior to the perception of illness, including sociodemographic characteristics (e.g., gender) and variables that reflect vulnerability, such as housing. *Need* includes factors that may initiate health care seeking, such as perceived

health status. *Enabling* characteristics include factors that may serve as facilitators or barriers to care, such as neighborhood resources (e.g., transportation).

Methods

This longitudinal multilevel study followed a predominately substance-misusing cohort of African American adults relocating from seven public housing complexes targeted for demolition in Atlanta, Georgia. All residents of these complexes were relocated to private market voucher-subsidized rental units, and the vacant complexes were demolished. Baseline (Wave 1) data captured pre-relocation conditions; Wave 2–7 captured post-relocation conditions in nine-month intervals. Institutional Review Board approval and a Certificate of Confidentiality were obtained prior to study implementation. Study methods have been described in detail elsewhere.[23,32–34]

Eligibility and sampling

Study eligibility criteria included: resident for >1 year in one of the seven public housing complexes targeted for demolition in the final wave of public housing relocations in Atlanta (2008–2010); self-identified as a non-Hispanic Black/African American adult (>18 years); sexually active in the past year; and not living with a current study participant. Because of the study's overarching interest in understanding the impacts of relocations on drug use, we used quota sampling methods to construct a sample that varied with regard to baseline substance misuse: we sought to create a sample in which one-quarter of participants met criteria for drug/alcohol dependence; one-half misused substances but were not dependent (i.e., self-reported recent use of illicit drugs or alcohol misuse, including binge drinking), and one-quarter did not misuse substances (i.e., no illicit drug use in the past five years and no recent alcohol misuse).

Recruitment and retention

Study staff recruited onsite in each complex; community- and faith-based organizations near each complex distributed flyers; and participants could refer individuals for screening. Intensive retention methods, including calling participants monthly to maintain relationships and update contact information, incentives to remain in contact, and contacting network members when participants were difficult to reach, were implemented to keep attrition low and random.

Data collection

Individual-level data were gathered via Audio Computer-Assisted Self-Interview (ACASI) survey at each wave. Participants received $20 for the baseline interview; incentives increased by $5 at each subsequent wave. Participant home addresses were geocoded to census tracts at each wave (2010 tract boundaries were used throughout), and administrative data were analyzed to describe characteristics of these tracts at each wave.

Measures

All individual-level measures were time-varying (reflecting the six-month reporting period prior to the interview) and binary unless otherwise specified. Baseline data described census

tract characteristics pre-location. Tract-level data for Waves 2–7 was time-varying, and reflected the time period of data collection for that wave or the most proximate year for which data were available.

Outcome—Unmet need for medical care, the binary outcome of interest, was measured as a "yes" response to the question "During the past six months, was there a time that you wanted medical care but could not get it at that time?"[47] When individuals were HIV-positive, survey questions assessing unmet need for medical care captured HIV-related care specifically. Given the small proportion of study participants with diagnosed HIV infection (fewer than 10%), this measure includes both HIV-uninfected participants reporting unmet need for general medical care and HIV-infected participants reporting unmet need for HIV-related medical care.

Exposures—Enabling exposure variables included census tract-level socioeconomic disadvantage and census tract- and individual-level transportation access.

Tract-level percent poverty, percent unemployed, percent adults older than 25 years without a high school diploma/GED, median household income, and the percent of residents who were Black were constructed using data from the U.S. Census Bureau and the Longitudinal Tract Database, which maps 2000 tract data to 2010 boundaries.[48] The locations of violent crimes were obtained from law enforcement agencies, geocoded to census tracts, and used to calculate the violent crime rate per 1,000 residents for each tract. Offenses within a 100-foot buffer of the tract boundary were included in the tract's calculation.

Several tract-level predictors were correlated. To avoid multicollinearity in multivariable models, we used principal components analyses (PCA) to condense these correlated variables into components. The resulting component captured "tract-level socioeconomic disadvantage" (median household income, poverty rate, percent residents older than 25 without a high school diploma or GED, violent crime rate, and percent of residents who are Black; tracts with higher percentages of Black residents may be more disadvantaged due to historic, persistent structural discrimination in the U.S.[49]).

Tract-level transportation access was created using data from the U.S. Census Bureau. "Tract private vehicle access" was defined as the percent of employed Black residents (aged 16 and older) with access to at least one vehicle for transportation to work, as reported in the Census. "Tract public transportation access" was defined as the percent of employed Black residents (aged 16 and older) without access to a vehicle who reported using public transportation to get to work in the census. In addition to exploring the independent relationships of these two variables to unmet need for medical care, we also combined them to form a tract-level measure of "any transportation access," which was the sum of the percentages of residents with private vehicle access and residents without access to a vehicle who used public transportation to get to work.

We created four measures of enabling individual-level transportation characteristics. These variables were "individual transportation barriers," which captured the frequency that lack of transportation "caused problems" (ordinal); typical travel time to usual source of care in

minutes (continuous); typical one-way travel cost to usual source of care in dollars (continuous); and typical mode of transportation to usual source of care (categorical).

Effect modifiers—Effect modifiers included self-identification as a woman and sub-stance (drug or alcohol) dependence, as measured by the Texas Christian University Drug Screen II.[50]

Other covariates—Covariates capturing other individual-level enabling characteristics included: perceived community violence (continuous),[51] proportion of social network providing actual support;[52] and baseline lifetime experience of discrimination in a medical setting.[53] Predisposing characteristics included: age in years (continuous); married or living as married at baseline; any employment; less than a high school education at baseline; homeless; and number of months living in neighborhood (continuous). *Need* was measured as self-rated health (ordinal), using the SF-12 scale,[54] and being HIV-infected.

Analysis

Distributions of all variables were assessed across waves. Plots were used to visualize proportion of unmet need for medical care over time, and whether trajectories varied by gender and substance dependence status.

We modeled relationships with hierarchical generalized linear models (HGLM) using a logit link in three stages to: 1) assess temporal trajectories in unmet need for medical care, and whether trajectories varied by gender or drug/alcohol dependence; 2) assess the relationship of each individual- and tract-level variable to unmet need for medical care, controlling for time (“bivariate analysis”); and 3) describe multivariable relationships. All HGLMs had three levels: level 1 was time, level 2 was the individual participant, and level 3 was the baseline tract. All HGLMs included a subject-specific intercept, a slope for time, and an interaction term for time and substance dependence. Time was measured as the number of months since Wave 2, the first post-relocation interview.

Continuous variables were centered at their baseline values, resulting in a baseline variable and a “change since baseline” measure for Waves 2–7. We determined a priori that the following variables were theoretically relevant and should be included in multivariable models, regardless of statistical significance in bivariate analyses: all tract-level variables, all individual-level transportation measures, age, gender, substance use, self-rated health, and length of stay in the neighborhood. Tract-level variables, individual-level transportation measures, gender, and substance use were included in multivariable models in order to assess the study aims. Similarly, length of stay in the neighborhood was retained in order to capture the potential disruption caused by relocations.[25,27] Age and self-rated health were retained in multivariable models to control for health care utilization and need.[1,26] Remaining variables with p-values < .05 were retained in the final model. Tract-level transportation variables (i.e., private vehicle, public transportation, and overall access) were correlated and as a result, modeled separately. We ran three multivariable models, each model included all individual-level variables, tract-level socioeconomic disadvantage, and one of the tract-level transportation variables.

Results

A total of 172 participants were enrolled at baseline, 86.2% of participants were retained at Wave 7. At Wave 1 (Table 1), participants were, on average, 43 years old (standard deviation [SD] = 14). Fifty-six percent (n = 96) were women. Sixty percent (n = 92) of participants reported having health insurance at baseline; this increased to 73% (n = 110) by Wave 7. Baseline characteristics of participants who completed Wave 7 (n = 149) were comparable to those of participants who did not complete Wave 7 (n =18) (data not shown).

Participants dispersed from the seven census tracts where the public housing complexes were located at baseline to 94 tracts by Wave 7. Participants had moved an average of 7.33 miles (SD = 5.53) from their original housing complexes by Wave 7. On average, relocations brought participants to tracts with improved socioeconomic conditions, with the greatest improvements experienced between Waves 1 and 2. For example, prior to relocating, on average participants lived in tracts where 46% of households lived in poverty and where there were 35.6 violent crimes per 1,000 residents. By Wave 2, on average participants lived in tracts where a third of the households were living in poverty and there were 20.7 violent crimes per 1,000 residents. These improvements were sustained over time.

Travel-time to usual source of care remained relatively stable over time, though average travel costs increased by $7 from Wave 1 to 7, from $2.11 to $9.33. The majority of participants used public transportation to travel to their medical care provider at each wave, this proportion declined over time. Prior to relocations, 63% (n = 105) of participants used public transportation to travel to their medical provider, this decreased to 51% (n = 66) by Wave 7. Tract-level use of public transportation among workers without cars decreased (13% at Wave 1 to 9% at Wave 7), suggesting that participants moved to tracts with less access to public transportation than the tracts containing their public housing complex. In contrast, tract-level vehicle access tended to increase over time, ranging from 81% at Wave 1 to 86% at Wave 7.

Temporal trajectories in reported unmet need for medical care

At baseline, 25% of participants reported unmet need for medical care, in the last six months. Unmet need for medical care, declined over time, with 12% reporting unmet needs for medical care at Wave 7. The proportion of unmet need for medical care declined linearly over time (Figure 2), with rates of decline similar for women and men. Although women consistently reported slightly higher unmet need for medical care across waves, these differences were not statistically significant. Substance-dependent participants reported higher proportion of unmet needs for medical care both prior to and immediately following relocations, but experienced steeper declines over time (Model 1: OR = 0.93, 95% CI = 0.90–0.97).

Relationships of changes in exposure to neighborhood socioeconomic disadvantage and transportation access to unmet need for medical care

Change in tract-level socioeconomic disadvantage was not statistically significant in bivariate models (0.84, 95% CI = 0.63–1.10). Reductions in tract-level socioeconomic

disadvantage were inversely associated with a lower odds of unmet need for medical care. Specifically, a one SD reduction in tract-level socioeconomic disadvantage was associated with an approximately 29% reduction in the odds of unmet needs for medical care (OR = 0.71, 95% CI = 0.51–0.99).

In bivariate models (Table 2, Model 2), post-relocation increases in the reported frequency of transportation barriers (OR = 1.11, 95% CI: 1.00–1.22), and baseline cost of (OR = 1.13, 95% CI = 1.00–1.28) and travel time to medical provider (OR = 1.02, CI = 1.00–1.03) were significantly associated with greater odds of unmet need for medical care. In contrast, walking or driving to the health care provider was significantly associated with lower odds of unmet need for medical care (OR = 0.43, 95% CI = 0.21–0.90; Table 2, Model 2). In multivariable models, post-relocation increases in the frequency of self-reported barriers to transportation were associated with greater odds of unmet need for medical care (OR = 1.16, 95% CI = 1.02–1.31; Table 2, Model 3). All other individual-level transportation variables lost significance once potential confounders were included in the model (Table 2, Models 2 and 3).

Measures of tract-level neighborhood transportation access were not associated with the outcome in bivariate or multivariable models (Table 2, Models 2 and 3).

The magnitudes and directions of tract-level socioeconomic disadvantage, and individual- and tract-level transportation were comparable across the three multivariable models (available from the first author upon request), though the relationship between socioeconomic disadvantage and unmet need for medical care was borderline statistically significant for models including tract-private vehicle ownership (OR = 0.60, 95 CI: 0.36–1.00) and not statistically significant for models including tract-level public transportation access (OR = 0.77, 95% CI = 0.54–1.10).] Relationships were not moderated by gender or substance misuse status.

Notably, baseline lifetime experience of discrimination in a medical setting was associated with greater odds of unmet need for medical care. Participants that experienced prior medically-related discrimination had nearly three times the odds of reporting unmet need for medical care as compared to those that did not (OR = 2.61, 95% CI = 1.20–5.69).

Discussion

This multilevel, longitudinal analysis suggests that African American adults relocating from severely distressed public housing complexes in Atlanta, Georgia experienced reductions in unmet need for medical care over time, and that these changes were associated with post-relocation changes in the neighborhoods where these adults lived and in their transportation access. Specifically, in this sample post-relocation improvements in neighborhood socioeconomic disadvantage and post-relocation declines in individual-level transportation barriers predicted reductions in unmet need for medical care over time.

In contrast to past studies that have found immediate improvements in depression and substance use following relocations,[23,32] improvements in unmet need for medical care were gradual: 25% of participants reported unmet need for medical care at Wave 1, 21% reported

unmet need for medical care by Wave 4, and 12% reported unmet need for medical care by Wave 7. During the months following the relocations, participants may have been unable to prioritize seeking needed medical care because of immediate competing demands (e.g., procuring housing).[25,27,55]

Although there is a notable literature supporting the association of transportation barriers to unmet needs for medical care, particularly for impoverished populations, evidence regarding the contribution of specific transportation barriers (e.g., distance) is mixed.[14] In our study, post-relocation declines in the frequency of self-reported barriers to transportation were associated with lower odds of unmet need for medical care. The majority of participants relied on public transportation to travel to their usual source of care and relocations brought participants to census tracts with lower access to public transportation. However, tract-level transportation access variables were not statistically significantly related to unmet need for medical care. Atlanta is an automobile-centric area that lacks a strong, integrated public transportation system.[17,56] Mode of transportation to work may not reflect mode of transportation to health care. Additionally, patterns of transportation use may vary for employed and unemployed individuals, and many study participants were unemployed. Alternative measures of neighborhood transportation access, such as density and frequency of public transport, may more accurately capture area-level transportation access. However, these measures are not readily available for public use. One interpretation of our results is that, over time, participants either identified alternative modes of travel (e.g., borrowing a car from a new neighbor) to pre-relocation providers or found a new source of care that was closer to their new home.

Neighborhood poverty has been associated with unmet need for medical care in ecologic and cross-sectional studies.[7,8] In our longitudinal study, a one SD improvement in the tract socioeconomic disadvantage component was associated with an approximately 29% reduction in the odds of unmet need for medical care. Participants relocating to less socioeconomically disadvantaged communities may have experienced more resourced and cohesive communities;[35,36] these communities may have more prosocial norms around health care seeking and greater trust in providers.[13,39,40] Community collective efficacy (i.e., the capacity of a community to work together towards a common good)[51] is associated with fewer barriers to accessing health care and greater trust in providers.[11,13]

Notably, participants who experienced discrimination in a medical setting in their lifetime had nearly three times the odds of reporting unmet need for medical care as compared to those who did not. Past experiences of discrimination may serve as a significant barrier to seeking care, particularly for groups with multiple stigmatizing behaviors or conditions (e.g., substance users, public housing residents).[28–31] Public housing recipients have been refused care due to their Medicaid status.[57] Experiences of discrimination are associated with greater unmet need for medical care and lower quality of care and trust in providers.[29] Notably, spatial access to safety-net clinics declined as a result of relocation,[58] suggesting that relocaters may require extra support in identifying and linking to culturally relevant care accepting public insurance.

Limitations

These findings should be interpreted in light of the study's limitations. We could not randomly select residents from the complexes because no sampling frame of substance misusers in the complexes existed. Additionally, we could not use targeted sampling or respondent-driven sampling, which rely on network-based recruiting,[59,60] because relocations were underway when recruitment began and so networks had been disrupted. However, our sample's sociodemographic composition was similar to those of the underlying populations of residents in each of the seven complexes.[32] Similarly, we could not create a control group of non-relocaters for this study: no severely distressed complexes remained in Atlanta at the time of data collection, and the non-distressed complexes that remained had very different resident demographics and were located in qualitatively different neighborhoods. It is possible that the reductions in unmet need for medical care observed here were driven by historical changes in Georgia, though the Affordable Care Act was not implemented until 2014 (after the vast majority of data collection) and Georgia elected not expand Medicaid.[61] It is possible that improvements in unmet needs for medical care may have also been associated with improvements in health more generally. However, self-rated health remained stable across waves and was not associated with unmet need for medical care in multivariable models.

Conclusion

This study has multiple strengths. Its retention rate was high, despite the inclusion of active substance users and a highly mobile cohort. This high retention rate supports the internal validity of our findings. It is also the first to examine multilevel, longitudinal relationships of neighborhood characteristics to unmet need for medical care among U.S. adults and among relocaters specifically. Collectively, these findings, generated by a longitudinal, multilevel analysis, support the importance of neighborhood environments and transportation access in shaping unmet need for medical care in vulnerable populations, and suggest that improvements in these exposures reduce unmet need for medical care in a highly vulnerable population. Screening for transportation access and neighborhood conditions may help to identify populations at risk for unmet need for medical care. Similarly, addressing transportation-related barriers to care and helping individuals identify accessible, culturally relevant providers may help to reduce unmet need for medical care in this highly vulnerable population.

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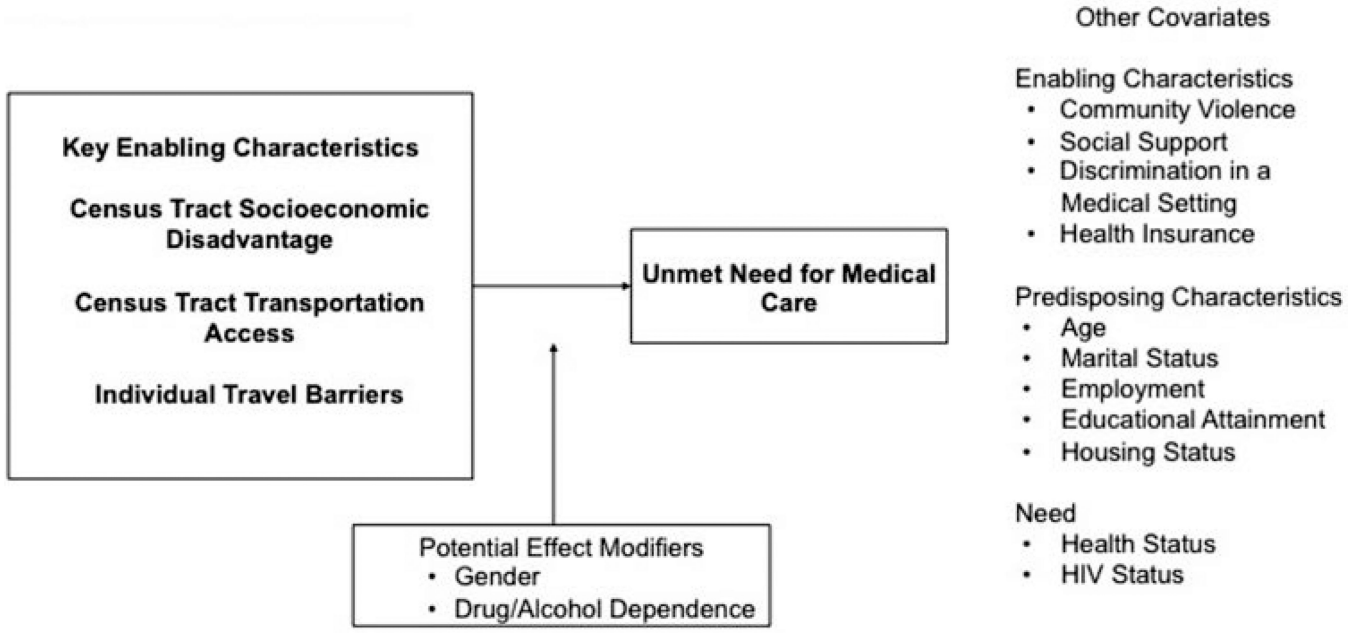

Figure 1.
Conceptual framework of relationships between neighborhood disadvantage, transportation access and unmet need for medical care.

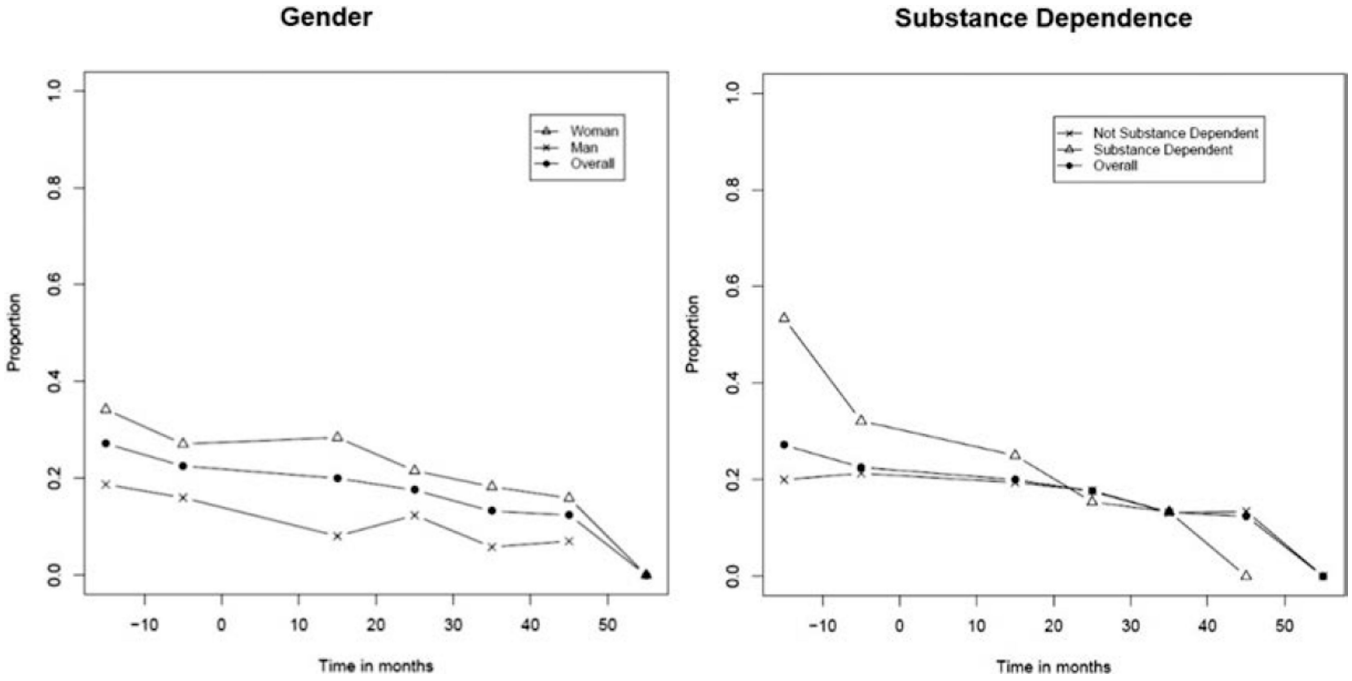

Figure 2.

Proportion of African-American adults relocating from severely distressed public housing complexes in Atlanta, GA reporting unmet medical care needs over time, overall, by gender, and by substance dependence status.

Table 1

DISTRIBUTIONS OF INDIVIDUAL- AND CENSUS-TRACT LEVEL CHARACTERISTICS AMONG 172 AFRICAN AMERICAN ADULTS RELOCATED FROM SEVEN PUBLIC HOUSING COMPLEXES IN ATLANTA, GEORGIA ACROSS 7 WAVES OF FOLLOW-UP[a]

Characteristics of participants and census tracts	Wave 1 n (%) or Mean (SD) N = 171[b]	Wave 2 n (%) or Mean (SD) N = 163	Wave 3 n (%) or Mean (SD) N = 160	Wave 4 n (%) or Mean (SD) N = 156	Wave 5 n (%) or Mean (SD) N = 158	Wave 6 n (%) or Mean (SD) N = 154	Wave 7 n (%) or Mean (SD) N = 149
Unmet need for medical care	42 (25.00)	34 (21.79)	27 (18.00)	32 (21.48)	19 (13.01)	19 (12.58)	18 (12.33)
			Census tract level				
Enabling characteristics							
Socioeconomic disadvantage component[c]	0.97 (0.66)	−0.23 (0.92)	−0.26 (0.93)	−0.19 (0.96)	−0.20 (0.97)	−0.10 (0.98)	−0.10 (0.92)
Percent poverty	46.03 (9.53)	30.24 (11.85)	30.17 (12.03)	31.77 (12.78)	30.88 (12.66)	32.69 (13.72)	32.78 (12.66)
Percent unemployment	21.60 (5.51)	17.01 (7.83)	16.68 (7.56)	18.12 (7.79)	18.01 (7.80)	19.61 (8.35)	19.57 (7.93)
Percent residents >25 with less than high school education	39.04 (10.38)	19.10 (8.56)	19.20 (8.76)	18.42 (8.26)	18.26 (8.01)	17.97 (7.71)	18.44 (7.86)
Median household income	15,831.93 (4,472.43)	33,476.02 (15,788.31)	33,735.55 (15,928.69)	33,530.83 (17094.31)	34,408.44 (16,516.81)	33,868.15 (16,616.57)	33337.14 (16207.40)
Percent residents who are Non-Hispanic Black	81.33 (17.48)	74.01 (28.01)	72.24 (28.72)	73.79 (27.51)	71.80 (29.66)	73.26 (29.14)	75.52 (27.35)
Violent crime rate (per 1,000)	35.59 (15.78)	20.73 (14.68)	20.95 (14.44)	20.71 (14.84)	21.35 (15.14)	21.38 (14.34)	20.55 (13.59)
Percent employed Black workers 16+ with access to vehicle	81.02 (9.17)	84.63 (10.34)	84.22 (11.45)	84.44 (11.07)	84.99 (11.54)	85.07 (10.81)	85.76 (10.49)
Percent employed Black workers 16+ without access to a vehicle who take public transport to work	12.69 (7.75)	10.04 (8.54)	10.40 (9.44)	9.65 (9.19)	9.54 (9.43)	9.36 (8.50)	8.78 (8.36)
Percent employed workers 16+ with access to a vehicle or public transport	93.71 (4.67)	94.67 (4.41)	94.62 (4.80)	94.09 (4.52)	94.53 (4.28)	94.43 (4.62)	94.55 (4.55)
			Individual-level				
Enabling characteristics							
Frequency of barriers to transportation[d]	3.14 (2.69)	2.33 (2.62)	1.71 (2.11)	1.85 (2.22)	1.76 (2.32)	1.21 (1.97)	1.64 (2.29)
Transportation time in minutes to usual source of care	36.44 (23.78)	38.82 (26.71)	36.98 (27.48)	39.71 (28.44)	40.50 (32.91)	35.95 (27.02)	33.92 (26.30)
Transportation cost in dollars to usual source of care	2.11 (2.56)	12.21 (63.17)	6.14 (37.52)	9.37 (79.39)	10.08 (74.77)	2.57 (4.51)	9.33 (70.86)
Transportation mode to usual source of care							
Public transport	105 (62.87)	101 (65.58)	77 (54.61)	89 (60.96)	82 (58.57)	86 (60.14)	66 (50.77)
Drive self or walk	38 (22.75)	32 (20.78)	33 (23.40)	29 (19.86)	28 (20.00)	31 (21.68)	37 (28.46)
Someone else drives	16 (9.58)	7 (4.55)	18 (12.77)	16 (10.96)	13 (9.29)	16 (11.19)	14 (10.77)
Taxi, ambulance, or other transport	8 (4.79)	14 (9.09)	13 (9.22)	12 (8.22)	17 (12.14)	10 (6.99)	13 (10.00)
Perceived community violence[e]	2.73 (2.20)	0.61 (1.11)	0.67 (1.22)	0.58 (1.00)	0.76 (1.28)	0.88 (1.39)	0.82 (1.45)
Proportion of social network providing support	0.71 (0.26)	0.67 (0.29)	0.66 (0.32)	0.62 (0.31)	0.61 (0.32)	0.62 (0.31)	0.60 (0.31)

Characteristics of participants and census tracts	Wave 1 n (%) or Mean (SD) N = 171[b]	Wave 2 n (%) or Mean (SD) N = 163	Wave 3 n (%) or Mean (SD) N = 160	Wave 4 n (%) or Mean (SD) N = 156	Wave 5 n (%) or Mean (SD) N = 158	Wave 6 n (%) or Mean (SD) N = 154	Wave 7 n (%) or Mean (SD) N = 149
Lifetime experience of discrimination related to medical care	28 (16.67)	10 (6.33)	9 (5.73)	6 (3.97)	9 (5.84)	8 (5.30)	1 (0.67)
Health insurance (Medicaid, Medicare, Private Insurance, Other)	92 (59.74)	115 (72.33)	108 (68.79)	105 (69.08)	109 (70.78)	111 (73.51)	110 (72.85)
Predisposing Characteristics							
Age (years)	42.92 (13.96)	43.91 (13.87)	45.10 (13.98)	46.24 (13.79)	46.53 (13.79)	46.91 (13.75)	47.28 (13.82)
Married or living as married	16 (9.47)	14 (11.11)	14 (8.92)	13 (7.56)	17 (11.04)	15 (9.93)	14 (9.27)
Employed (part, full, self-employed)	19 (10.98)	20 (12.50)	30 (19.11)	24 (15.89)	30 (19.74)	23 (15.23)	30 (19.87)
Less than high school education	65 (38.46)	—	—	—	—	—	—
Homeless	0 (0)	7 (4.57)	7 (4.67)	3 (2.11)	0 (0)	1 (0.07)	8 (5.88)
Months in the neighborhood	111.80 (115.12)	14.38 (44.39)	65.67 (131.84)	51.35 (107.06)	49.85 (92.21)	69.17 (106.71)	58.11 (87.03)
Need							
Self-rated health[f]	1.85 (1.01)	1.86 (1.04)	1.71 (1.08)	1.95 (1.04)	1.80 (1.12)	1.74 (1.09)	1.87 (1.07)
HIV-infected[g]	15 (8.88)	16 (10.06)	15 (9.55)	17 (11.11)	18 (11.61)	16 (10.60)	17 (11.26)
Effect Modifiers							
Gender[h]							
Woman	96 (56.47)	93 (58.13)	90 (57.32)	87 (56.86)	88 (56.77)	86 (56.95)	87 (57.62)
Man	74 (43.53)	67 (41.88)	67 (42.68)	66 (43.14)	67 (43.23)	65 (43.05)	64 (42.38)
Substance (drug or alcohol) dependent[i]	33 (19.53)	11 (6.88)	18 (11.46)	11 (7.19)	10 (6.45)	9 (5.96)	11 (7.28)

[a] Variables capture behaviors/conditions in the previous 6 months unless otherwise noted.

[b] 172 participants were enrolled, however, baseline data were lost for one participant.

[c] Includes median household income, percent poverty, percent residents >25 with less than high school education, percent unemployed, violent crime rate, and percent of residents who are non-Hispanic Black.

[d] Self-reported frequency of transportation causing problems ranged from 0 to 8 where 0 represents no transportation problems and 8 represents almost daily transportation problems.

[e] Perceived violence average of 5-items with 5 point likert scale, mean scores range from 0 to 5 with higher scores indicative of more frequent, severe community violence.

[f] 5-point likert scale ranging from 0 to 4, with lower scores indicative of better health.

[g] Defined as a positive OraQuick ADVANCE Rapid HIV-1/2 Antibody Test and confirmatory Westernblot.

[h] Women included 3 individuals who were transgender (male to female).

[i] Defined as a score of 3 or greater out of 9.

Table 2

BIVARIATE AND MULTIVARIABLE RELATIONSHIPS OF INDIVIDUAL- AND TRACT-LEVEL CHARACTERISTICS TO UNMET NEEDS AMONG A SAMPLE OF 172 AFRICAN AMERICAN ADULTS RELOCATED FROM SEVEN PUBLIC HOUSING COMPLEXES IN ATLANTA, GEORGIA[a]

Characteristics of participants and census tracts	Model 1: Growth Curve Model OR (95% CI)	Model 2: Bivariate Models[b] OR (95% CI)	Model 3: Multivariable Model AOR (95% CI)
Time for not substance dependent	**0.98 (0.96–0.97)**		**0.97 (0.95–0.99)**
Time for substance dependent	**0.93 (0.90–0.97)**		**0.97 (0.95–0.99)**
Substance dependent	1.03 (0.42–2.54)		0.82 (0.24–2.73)
Census tract-level			
Enabling characteristics			
Socioeconomic disadvantage component			
Baseline		0.84 (0.49–1.46)	0.64 (0.39–1.06)
Change since baseline		0.84 (0.63–1.10)	**0.71 (0.56–0.99)**
Percent employed Black workers 16+ with access to vehicle			
Baseline		1.01 (0.98–1.04)	—
Change since baseline		1.00 (0.99–1.02)	—
Percent employed Black workers 16+ without access to a vehicle who take public transport to work			
Baseline		0.99 (0.96–1.03)	—
Change since baseline		0.98 (0.96–1.00)	—
Percent employed Black workers 16+ with access to a vehicle or public transport			
Baseline		1.02 (0.94–1.11)	0.97 (0.90–1.06)
Change since baseline		0.98 (0.93–1.03)	0.97 (0.91–1.04)
Individual-level			
Enabling characteristics			
Frequency of barriers to transportation			
Baseline		**1.27 (1.11–1.45)**	1.02 (0.89–1.17)
Change since baseline		**1.11 (1.00–1.22)**	**1.16 (1.02–1.31)**
Transportation time in minutes to provider			
Baseline		**1.02 (1.00–1.03)**	1.01 (0.99–1.03)
Change since baseline		1.00 (0.99–1.01)	1.00 (0.99–1.02)
Transportation cost in dollars to provider			
Baseline		**1.13 (1.00–1.28)**	1.02 (0.91–1.15)
Change since baseline		1.00 (1.00–1.00)	1.00 (0.99–1.01)
Transportation mode to provider (ref = public transport)			
Drive self or walk		**0.43 (0.21–0.90)**	1.17 (0.55–3.64)
Someone else drives		1.44 (0.64–3.23)	1.70 (0.52–2.62)
Taxi, ambulance, or other transport		1.55 (0.68–3.52)	1.33 (0.38–4.68)
Perceived community violence			
Baseline		1.15 (0.96–1.38)	1.08 (0.89–1.29)
Change since baseline		1.02 (0.89–1.18)	1.10 (0.91–1.31)
Proportion of social network providing support			

Characteristics of participants and census tracts	Model 1: Growth Curve Model OR (95% CI)	Model 2: Bivariate Models[b] OR (95% CI)	Model 3: Multivariable Model AOR (95% CI)
Baseline		1.34 (0.32–5.25)	1.08 (0.28–4.15)
Change since baseline		1.02 (0.46–2.24)	1.03 (0.41–2.62)
Lifetime experience of discrimination in a medical setting (baseline)		**3.74 (1.59–8.82)**	**2.61 (1.20–5.69)**
Health insurance		**0.38 (0.22–0.64)**	**0.50 (0.27–0.92)**
Predisposing characteristics			
Age in years		0.99 (0.97–1.02)	1.01 (0.98–1.03)
Man		**0.26 (0.13–0.54)**	**0.23 (0.11–0.50)**
Married or living as married (baseline)		0.51 (0.20, 1.28)	—
Employed (baseline)		0.94 (0.47–1.91)	—
Less than high school education (baseline)		**2.43 (1.19–4.98)**	1.80 (0.94–3.46)
Homeless		**2.36 (1.15–4.88)**	1.42 (0.55–3.64)
Number of months in the neighborhood			
Baseline		1.00 (0.99–1.00)	1.00 (0.99–1.00)
Change since baseline		0.99 (0.99–1.00)	1.00 (0.99–1.00)
Need			
Self-rated health			
Baseline		1.29 (0.86–1.93)	1.12 (0.73–1.70)
Change since baseline		0.99 (0.74–1.32)	0.94 (0.64–1.37)
HIV-infected		**0.08 (0.02–0.40)**	0.21 (0.04–1.03)

[a]Relationships were modeled using hierarchical generalized linear models. Covariates captured behaviors/conditions in the past 6 months and were treated as time-varying unless noted otherwise.

[b]Bivariate models included time and the interaction with substance dependence.