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Low-income housing rental assistance, perceptions of neighborhood food environment, and dietary patterns among Latino adults: The AHOME Study

Marlene Camacho-Rivera, ScD, MPH¹, Emily Rosenbaum, PhD², Cecile Yama, BS³, and Earle Chambers, PhD^{3,*}

¹Department of Community Health and Social Medicine, CUNY School of Medicine, New York, NY

²Department of Sociology and Anthropology, Fordham University, Bronx, NY

³Department of Family and Social Medicine, Albert Einstein College of Medicine – Montefiore Medical Center, Bronx, NY

Abstract

Introduction—Federal rental assistance programs, in the form of the traditional public housing program and the Housing Choice Voucher Program (HCVP - formerly known as Section 8), are designed to reduce the economic rental burden for low-income residents. While residents using federal housing vouchers, which allow low -income residents in public housing to move out of public housing to rent -subsidized homes, have been found to have better cardiovascular outcomes compared to the cardiovascular outcomes of low -income public housing residents, the mechanisms explaining these associations remains an understudied area.

Purpose—The aim of this study is to assess whether residents participating in HCVP or unassisted residents had greater access to healthy foods such as fruit and vegetables, and less access to unhealthy foods such as fast food and sugar sweetened beverages, when compared to residents living in public housing (referent group).

Methods—The Affordable Housing and Obesity Mediating Environment(AHOME) study is a cross -sectional study of Latinos residing in low -income housing in the Bronx, NY (n=362). Participants were interviewed to assess food patterns and perceptions of neighborhood environment.

Results—The analytic sample was primarily female (74.5%)with a mean age of 46.4 years(SD=14.68). Residents participating in HCVP had similar availability of fruits and vegetables in the home compared to residents receiving no assistance or public housing residents. HCVP

*Corresponding author: Earle Chambers, 1300 Morris Park Avenue, Block, Room 408, Bronx, NY, 10461, Telephone: 718-430-3057, Fax: 718-515-5416, earle.chambers@einstein.yu.edu.

Compliance with Ethical Standards

Conflict of Interest All authors declare that they have no competing interests.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Institutional Review Board approval was obtained from both the Albert Einstein College of Medicine and Fordham University, and all participants gave written consent in either English or Spanish.

participants consumed more fast food ($\beta=.34$; $CI=.10-.58$) but had similar sugar sweetened beverage consumption compared to public housing residents. Unassisted residents had more fast food consumption ($\beta=.25$; $CI=.01-.49$) but less sugar sweetened beverage consumption ($\beta=-.52$; $CI=-.76-.28$) than public housing residents. Perceptions of neighborhood food environment were not significantly associated with dietary patterns.

Conclusion—This study shows variability in consumption of sugar sweetened beverage consumption and fast food consumption, but not in availability of fruits and vegetables, across residents participating in HCVP, public housing residents, and unassisted residents. Evaluating the health benefits associated with low-income housing mobility programs, such as HCVP, requires examining how housing may influence dietary patterns above and beyond an individual's socioeconomic position.

Keywords

Food availability; Latino; Housing; Neighborhood

Introduction

The goal of the federal rental assistance program is to provide low-income eligible residents with stable, affordable housing by reducing the socioeconomic burden of rental costs. The two main rental assistance programs for the lowest income residents are in the form of the traditional public housing program and the distribution of federal housing vouchers from the Housing Choice Voucher Program (HCVP). One disadvantage of the traditional public housing program is that these units tend to be located in areas of neighborhoods of high concentrated poverty.

There is a large body of observational studies which documents that individuals living in high poverty neighborhoods have a disproportionately higher prevalence of a range of chronic conditions including obesity, cardiovascular disease (CVD) and diabetes than those living in non-poor neighborhoods. (1, 2) These studies provide evidence in support of the possibilities that neighborhood characteristics influence health outcomes through a variety of ways including the availability of healthy foods, walk ability, and access to recreational open space. (3, 4) Observational research suggests that while fewer supermarkets are located in or near black or low-income neighborhoods, (5–9) more fast food outlets are present in these neighborhoods compared to higher income or predominantly white neighborhoods. (8, 10–12)

In contrast to the traditional public housing program where a particular unit is subsidized, HCVP participants have the opportunity of using the voucher to relocate to housing options in the private market that accept vouchers and are not inherently restricted to a given location. Observational and experimental studies have demonstrated that individuals living in households subsidized through HCVP live in higher quality units than individuals living in traditional public housing units. (13, 14) The Moving to Opportunity (MTO) program was a housing-mobility experiment conducted by the U.S Department of Housing and Urban Development (HUD) in 1994–1998 where volunteer low-income public housing families with children received vouchers to subsidize a private rental apartment within lower-poverty

neighborhoods. (15, 16) Although MTO intended to improve outcomes for families by improving their neighborhood and housing conditions compared to controls, researchers have documented beneficial effects of MTO on health. (17) The final evaluation of MTO found that moving from public housing to units subsidized with housing vouchers was associated with lower rates of obesity and diabetes, as well as improved mental health. (13, 18) Additional studies show that households subsidized with vouchers are typically higher quality units within lower poverty neighborhoods, presumably with greater access to resources that encourage health promoting behaviors. (19) Prior research from the Affordable Housing as an Obesity Mediating Environment (AHOME) study found that the prevalence of CVD was significantly higher among residents living in public housing than unassisted participants or residents participating in HCVP. (20)

However, most research on the association between use of housing assistance programs and health has rarely examined the mechanisms that may explain differences in health outcomes. A recent MTO study highlighted the need to elucidate the “black box” mechanisms linking the role of housing conditions to neighborhood effects on health. (21) For example, studies of residents living within public housing have reported low levels of fruit and vegetable consumption (21–23) and greater availability of fast food restaurants. (24, 25) Further research is needed to compare the dietary patterns of individuals living in public housing, units subsidized through HCVP, and unassisted units, as well as the neighborhood characteristics in which different housing types are located that may influence diet. Therefore, the goals of this study were (1) to assess whether the presence of fruits and vegetables in the home, presence of sugar sweetened beverages (SSB) in the home, and the consumption of fast food differed among residents living in public housing, HCVP subsidized units, or unassisted unit and (2) whether residents’ perceptions of their neighborhood food environment were associated with fruit and vegetable and SSB presence in the home, and fast food consumption. We hypothesize that residents living in public housing will report fewer fruits and vegetables in the home, report a greater number of SSB in the home, and higher consumption of fast food, when compared to HCVP participants or unassisted residents. Furthermore, we hypothesize that public housing residents will report less availability of healthy food options in their neighborhoods compared to HCVP participants or unassisted residents.

Methods

Our current study is a continuation of the previous AHOME study, across -sectional study of low-income Latinos residing in the 18 neighborhoods that comprise the South and West Bronx, NY. The neighborhoods are comprised of clusters of census tracts identified by the New York City Department of City Planning to serve as the basis for small-area population projections to support PlaNYC 2030, the city’s sustainability plan. Housing type, as defined in our study design, consists of public housing units, units subsidized by HCVP vouchers, and housing with no federal assistance inhabited by those that would otherwise qualify for government assistance. (20) Federal rental assistance programs are not entitlement programs (such as Medicaid or Medicare), and so not all income-eligible households receive assistance. In fact, nationally, only one-in-four income -eligible households receive federal rental assistance. (26) Among the subset of unassisted participants in this study are

households that have applied for, but not yet received, federal rental assistance, as well as those that have never applied.

To recruit approximately equal numbers of interviews with participants in each housing type into our study sample, a stratified sampling design with proportional systematic sampling was established. The 18 neighborhoods of the study area were arranged into three primary sampling strata based on the prevalence of public housing at the neighborhood level; stratum I is defined by no public housing, stratum II is defined by relatively little public housing (1.98% to 7.87% of all units), and stratum III by a lot of public housing (22.8% to 44.25%). Seventy-four percent of all public housing is located within the Morrisania, Mott Haven, and Claremont -Bathgate neighborhoods and as the prevalence of public housing increased in a neighborhood, the prevalence of HCVP vouchers decreased, demonstrating that public housing residents and HCVP voucher residents lived in different geographic contexts. A sample size of 6,250 house holds was identified in fall 2010 from the US Postal Service address lists by Survey Sampling International (<http://www.surveysampling.com>). Recruitment and data collection lasted approximately 18 months(January 2011 to August2012).

The demographic characteristics of AHOME participants compare well with those of a criterion sample of renters residing in the study area from the 2011 New York City Housing and Vacancy Survey; however, AHOME participants are more economically disadvantaged, more likely to report Puerto Rican ethnicity, and less likely to be born in the United States. The original AHOME consisted of a survey interview and clinical assessment, and an assessment of participant's physical activity during the 7 days following the interview. Additional information on sample selection and study design were published previously. (20) Institutional Review Board approval was obtained from both the Albert Einstein College of Medicine and Fordham University, and all participants gave written consent in either English or Spanish.

Dietary Patterns

Fruit and Vegetable Presence in the Home—The Home Food Inventory, which was validated by Fulkerson et al.(2008), assesses the types of fruits, vegetables, cheese, dairy, meats, fish, snack foods, cereals, candy, and condiments present in the home. Presence of foods in the home has been shown to be significantly associated with dietary practices, intake, and eating patterns. (27–29)The Home Food Inventory has been shown to correlate with dietary patterns in adults. (27)Participants were asked to look in areas of their home where they store food and report whether they found the food item categories grouped in the survey at the time of interview. Two of these categories pertained to fruits and vegetables, with a total of 49 fruits and vegetables listed. The vegetable section was modified to include culture-specific items such as platanos, yuca and nham (tubers). On the survey, participants mark yes or no to report whether or not they had the fruit or vegetable in their home. In addition, for each type of fruit or vegetable, participants were asked to mark whether the fruit or vegetable was fresh, in a can/jar, or frozen. The total count of fruits and/or vegetable items present in the home at the time of the interview (ranging from 0 –49)is reported for each participant.

Sugar Sweetened Beverage (SSB) Presence in the Home—As part of the Home Food Inventory, participants were asked about the presence of various beverages currently in their homes including: (1) Regular soda pop (2) Diet soda pop (3) Prepared iced teas or lemonade, e.g., Snapple (4) Prepared light iced teas or lemonade, e.g., diet Snapple (5) Sports drinks (6) 100% fruit juice (7) Fruit drinks (8) Bottled water (9) Soymilk, rice milk. Of these, diet soda, prepared light iced teas/lemonade, bottled water, and soy/rice milk, and 100% fruit juices were not considered SSBs and thus were excluded from our analysis. The total count of SSB items present in the home at the time of the interview is reported for each participant.

Fast food consumption—In order to determine fast food consumption participants were asked “During the past 30 days, on how many days per week did you eat a meal prepared at a fast food restaurant, like McDonalds or KFCs?” Participants reported one of the following options 0 =never; 1 =one day; 2 =two days; 3 =three or four days; 4 =five or six days; 7 = every day; or refuse to respond. To address skewness in participants’ responses, we further collapsed responses into two categories (1) participants who reported eating fast food less than two days per week and (2) participants who reported eating fast food two or more days per week.

Neighborhood characteristics

The ability of residents to shop locally, indicative of the neighborhood food environment, was evaluated using items from the Project on Human Development in Chicago Neighborhoods (PHDCN) as well as the Neighborhood Environment Walkability Scale. The scale has been found to have good test-retest reliability and can discriminate perceptions of neighborhood environments between residents of higher and lower SES neighborhoods. (30) Participants were asked to rate shopping in their neighborhood on a Likert-type scale from strongly agree to strongly disagree. Based on exploratory factor analyses conducted within our sample, two questions were used to capture both perceived access and perceived quality of fruits and vegetables within the neighborhood. These questions included: (1) I can do most of my shopping at local stores and (4) the fresh produce in my neighborhood is of high quality. Responses were coded on a five -point Likert scale (0=strongly agree; 1= agree; 2 =neither agree nor disagree; 3 =disagree; 4=strongly disagree) where a higher value indicates more availability of healthy options.

Additional Covariates

BMI—After completing the survey, clinical interviewers (CIs) measured each participant’s height and weight twice each, recording both measurements. Participants’ were weighed using a portable bio-impedance analysis scale (Tanita BF -522W), and weight was recorded to the nearest tenth of a kilogram. The average of both measurements was used for analysis. Body mass index (BMI) was calculated in kilograms per square meter.

Smoking Status—As smoking status has been associated with fruit and vegetable consumption, (31) as well as fast food and SSB consumption, (32) smoking was included as a covariate in our analyses. Smoking status was measured using items from the National Health and Nutrition Examination Survey III. (28) Participants were asked (1) Have you ever tried cigarette smoking, even 1 or 2 puffs? (2) During the past 30 days, on how many days per

week did you smoke? (3) During the past 30 days, on the days that you smoked, how many cigarettes did you smoke per day? Days per week were recorded as a continuous variable and the number of cigarettes smoked per day was recorded on a scale ranging from one-half a pack to more than one pack. Three categories of smoking status were created for analysis: lifetime abstainers (never smoked), former smokers (respondents who have smoked but not in the past 30 days), and current smokers (respondents who report having smoked any cigarettes, regardless of number, in the past 30 days). In the analysis, lifetime abstainers are used as the reference category.

Additional covariates were chosen based on prior literature linking them to fruit and vegetable, SSB, and fast food consumption. The following variables were also adjusted for in the analysis: sex (1=female; 0=male), age (in continuous years), and education level (less than high school degree =1, high school diploma/equivalent or more education =0).

Data Analysis

Descriptive statistics are presented for the sample according to housing type. Continuous variables are displayed as mean and standard deviation; categorical variables are displayed according to frequency distribution within sample. Differences across groups are assessed by ANOVA and the Tukey post hoc test. Linear regression is used to examine the associations of housing type and food availability/consumption adjusting for individual and neighborhood covariates. Statistical significance is assessed at $p = 0.05$; all analyses were conducted using SPSS version 22.

Results

Within the analyses, 362 participants were included; 23 participants overall were omitted because of missing values on fast food consumption, SSB presence in the home, or fruit and vegetable presence in the home. AHOME was designed to have an equal distribution of participants residing within public housing, HCVP units, and unassisted housing units.

Table 1 displays the demographic and neighborhood characteristics, as well as health-related behaviors and outcomes of participants by housing type. We observe significant differences in mean SSB presence in the home across housing type, but not in mean fruit and vegetable presence in the home or fast food consumption. For example, mean SSB presence in the home was significantly lower among unassisted residents when compared to public housing or HCVP participants. Public housing residents were also significantly less likely to have a high school diploma when compared to unassisted or HCVP participants. There were no significant differences among the groups in other CVD-related health behaviors including BMI and smoking history.

With respect to the neighborhood food environment, across all housing types, residents appear to perceive their neighborhoods similarly in terms of their ability to shop locally and obtain high quality healthy foods.

Table 2 presents the results of three linear regression models displaying the association between housing type and each food availability/consumption outcome. All parameter

estimates displayed are adjusted for sex, age, education, smoking status, body mass index, and neighborhood characteristics.

In the fully adjusted model, unassisted residents and HCVP participants reported significantly higher fast food consumption than public housing residents. Conversely, unassisted residents have significantly ($p = 0.0001$) fewer reported SSB present in the home when compared to public housing residents. In addition, current smokers were significantly more likely to consume fast food and report SSBs present within their homes when compared to non-smokers, irrespective of housing type.

Increased age was significantly associated with fewer sugar sweetened beverages reported within the home ($\beta = -0.01$, $p = 0.001$) and less fast food consumption ($\beta = -0.02$, $p = 0.001$). Intriguingly, participant's educational background was only associated with reported fruit and vegetable presence in the home; participants with less than a high school degree on average reported nearly 3 fewer fruit and vegetable items present within their households compared to those with a high school degree or more ($\beta = -2.66$, $p = 0.001$). Resident's perceptions of the neighborhood food environment were not associated with fruit and vegetable or SSB presence within the home, as well as fast food consumption.

Discussion

The current study was designed to assess whether (1) the presence of fruits and vegetables, and sugar sweetened beverages (SSB) in the home, and the consumption of fast food differed among residents living in public housing, HCVP subsidized units, or unassisted units and (2) whether residents' perceptions of their neighborhood food environment were associated with fruit and vegetable and SSB presence in the home, and fast food consumption. Our hypothesis that residents living in public housing would report fewer fruits and vegetables in the home was not confirmed by our study; our results show that the presence of fruits and vegetables in the home was equally likely between public housing residents and residents using HCVP.

We also hypothesized that residents living in public housing would report a greater number of SSB in the home than HCVP or unassisted residents, which was partially confirmed by our study. Our results demonstrate that the presence of SSB in the home was equally likely between public housing residents and residents using HCVP. However, public housing residents were more likely to report having SSB in the home than unassisted residents.

Lastly, we hypothesized higher consumption of fast food among public housing residents, when compared to HCVP participants or unassisted residents. This hypothesis was not confirmed by our findings, as our results demonstrate that residents of public housing were less likely to consume fast food than residents using HCVP and unassisted residents. The reasons for these differences are unclear; however, our findings may provide some insight on the complexity of the food environment as it relates to the increasing number of mobility studies that have shown significant health benefits among residents using HCVP.

In our study, public housing residents reported having more SSBs in the home when compared to unassisted residents, but reported similar numbers of SSBs in the home as

HCVP residents. In an alternative model with unassisted residents serving as the referent group, we observed that both public housing and HCVP residents reported a higher presence of SSBs in the home. However, public housing residents eat at fast food restaurants less often than residents using HCVP and unassisted residents. These results seem inconsistent as unhealthy food choices often cluster together but this inconsistency may highlight the complexity of the food environment and dietary patterns and measurement particularly among low -income residents (32 –34). There are many factors associated with dietary choices among them are food availability in the neighborhood. There is much debate regarding whether food deserts or food swamps(i.e. high availability of unhealthy food options amongst healthy options) are related to unhealthy food choices with no clear consensus. Furthermore, research shows that individuals consume calories in a number of locations outside of their neighborhoods like their place of employment, school, or anywhere in between. (35–37)All of these environment scan contribute to dietary patterns and total calorie consumption. More work in this area is necessary particularly as it relates to mobility studies and further elucidating the mechanisms that contribute to better health outcomes among movers.

There are growing efforts in many cities particularly NYC to address food deserts i.e. geographic locations with limited access to fruits and vegetables - as a public health issue. In NYC these food deserts have been targeted by a number of public health initiatives through the New York City Department of Health and Mental Hygiene including using mobile food carts and increasing store presentation of health food options in an effort to increase the availability of fresh fruits and vegetables to all residents. The health benefits among those using HCVP compared to public housing residents are presumed to be attributable to the increased access to healthy resources available in the neighborhoods were HCVP residents live compared to neighborhoods of residents of public housing. This study did not include objective (GIS -based)measures of the neighborhood food retail environment, which may have limited our ability to capture additional healthy resources available in the neighborhoods of HCVP residents compared to neighborhoods of public housing residents. A review of the literature has demonstrated that GIS -based measures of the food retail environment far outnumber interview or questionnaire -based measures (23, 31) and several studies have suggested that objective and perceived measures capture different aspects of food access.(38 –40)However, there is evidence to suggest that perceptions of the food environment are more strongly associated with dietary behaviors than objective measures of the food environment. (41)

Our study is the only mobility study to our knowledge that has looked at the presence of food in the home and the perceptions of availability of healthy food options in the neighborhood. Our findings show that the availability of fruits and vegetables is not different across our housing types suggesting that availability is not different among the low -income residents sampled for this study. This is consistent with our findings that perceptions of food availability in the neighborhood were not a significant predictor of presence of any of the food items in the home or fast food consumption. As such, solely focusing on increasing the availability of healthy food items within a neighborhood is unlikely to result in improved dietary behaviors among low income residents. A recent study assessing the effect of a new government-subsidized supermarket on the presence of healthy food items within the homes

of children in the Bronx, New York found that the presence of the supermarket did not result in significant changes of the presence of fruits or vegetables within the home or better dietary behaviors among residents. (29) Additional studies have also reported that improved perceptions of food accessibility among residents did not result in increased fruit and vegetable intake.(30)

This study has limitations, which should be considered when interpreting our findings. We did not conduct dietary recalls or food frequency questionnaires among our participants; as such, our findings regarding fruit and vegetable and sugar sweetened beverage presence within the home may not reflect actual consumption patterns by participants. Fulkerson et al. has shown that the home food inventory measure while significantly associated with dietary consumption measured by 24-hour recall does not correlate 100%. (27) While many of our findings are consistent with other literature examining housing characteristics and health outcomes, our study sample is limited to low-income Latino residents in the Bronx and as such our findings may not be generalizable to other populations and geographic contexts. Lastly our ability to assess causal relationships is limited due to the cross-sectional study design and we are unable to determine whether the characteristics of the food retail environment influenced participants' decisions to live in their neighborhoods or *vice versa*.

To our knowledge, the present study is the first to examine the association between perceived measures of neighborhood food availability and fast-food intake across residents living in various types of low-income housing. Findings from the study contribute to a growing body of evidence examining perceived neighborhood access to the food retail environment and dietary behaviors within low-income urban adults. Overall the results from the study indicate that low-income housing rental assistance may influence specific dietary behaviors in different ways; as such, it is important to consider several aspects an individual's diet (e.g. fast food intake, fruit and vegetable, and SSB presence in the home).

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Table 1

Demographic and neighborhood characteristics, and health-related behaviors of low-income Latino adults in the South and West Bronx, NY by housing type

	Housing Type			
Variable	Public Housing (N = 139)	HCVP Vouchers (N =106)	Unassisted (N =117)	F Statistic
Food availability				
# Fruit and vegetable presence in the home	11.63	12.92	11.77	1.18
Sugar sweetened beverage presence in the home	1.30	1.29	0.78	12.04 *
Eats fast food 2 or more days per week	.16	.24	.23	1.38
Neighborhood characteristics				
Can shop locally	.13	.12	.18	.89
Highest quality food environment	.41	.51	.53	2.13
Health behaviors				
Never smoked	.44	.48	.56	1.64
Former smoker	.22	.19	.19	.20
Current smoker	.33	.33	.25	1.28
Body mass index	32.03	30.28	30.04	1.83
Demographics				
Female	.74	.76	.74	.14
Age in years	46.91	47.43	44.81	1.03
Education				
Less than high school diploma	.53	.49	.37	3.68 *
High school diploma	.27	.30	.39	2.22
Greater than high school Diploma	.19	.21	.24	.39

* Significant $p < .05$

Means are displayed for fruit and vegetable presence in home, SSB presence in home, body mass index, and age. Percentages are displayed for fast food consumption, smoking, sex, and education

Adjusted linear regression estimates between housing type, sociodemographic characteristics, and food presence/consumption among low-income Latino adults in the South and West Bronx, NY ($N=362$)

Table 2

Variables	Fruit and Vegetable Presence in the Home			SSB Presence in the Home			Fast Food Consumption		
	β Coeff	95% CI	p-value	β Coeff	95% CI	p-value	β Coeff	95% CI	p-value
Housing type ^a									
HCVP	1.13	(-.65, 2.90)	0.21	-0.01	(-.25, .23)	0.9	0.34	(.10, .58)	0.006
Un assisted	-0.26	(-2.03, 1.48)	0.77	-0.52	(-.76, -.28)	<0.001	0.25	(.01, .49)	0.04
Gender ^b	1.21	(-.48, 2.86)	0.16	0.06	(-.17, .28)	0.61	-0.12	(-.34, 1.12)	0.32
Age (in years)	0.02	(-.03, .07)	0.44	-0.01	(-.02, -.005)	0.001	-0.02	(-.03, -.01)	<0.001
Education ^c	-2.66	(-4.17, -1.16)	0.001	0.03	(-.17, .23)	0.79	0.11	(-.10, 0.31)	0.30
Former smokers ^d	-0.30	(-2.26, 1.58)	0.73	0.14	(-.12, .40)	0.28	0.03	(-.23, 0.29)	0.81
Current smokers ^d	-0.40	(-2.09, 1.28)	0.64	0.28	(.06, .51)	0.01	0.26	(0.03, 0.49)	0.03
BMI	-0.01	(-.08, .08)	0.99	-0.01	(-.02, .006)	0.37	-0.01	(-.02, 0.01)	0.34
Can shop locally	-0.53	(-2.61, 1.54)	0.61	-0.16	(-.44, .12)	0.25	0.04	(-.025, 0.32)	0.79
Food environment	0.21	(-1.28, 1.69)	0.79	0.05	(-.15, .24)	0.65	-0.13	(-.33, 0.07)	0.20

All parameter estimates displayed are mutually adjusted for other covariates in the model CI confidence interval

^aReference group = public housing residents

^bReference group = male

^cReference group = high school education or more

^dReference group = never smokers