# How Living in the 'Hood Affects Risky Behaviors Among Latino and African American Youth

ANNA MARIA SANTIAGO, EUN LYE LEE,
JESSICA L. LUCERO, AND REBECCA WIERSMA

*Using data from a natural experiment in Denver, we investigate whether the initiation of running away from home, aggressive or violent behavior, and marijuana use during adolescence are statistically related to the neighborhood contexts in which low-income Latino and African American youth were raised. Our analysis is based on retrospective child, caregiver, household, and neighborhood data for a sample of approximately 850 Latino and African American youth whose families were quasi-randomly assigned to public housing operated by the Denver (CO) Housing Authority during part of their childhood. We used Cox PH models and accelerated failure time models to estimate ethnic differentials in the hazards and timing of initiation of these risky behaviors during adolescence. We found that multiple dimensions of neighborhood context—especially safety, ethnic and nativity composition, and socioeconomic status—strongly and robustly predicted initiation of running away, aggressive or violence behavior, and marijuana use during adolescence.*

**Keywords:** risky behaviors, neighborhood effects, natural experiments, Cox PH models, accelerated failure time (AFT) models

The last decade has seen a marked upsurge in the fraction of low-income families of color residing in neighborhoods with poverty rates exceeding 40 percent (Bischoff and Reardon 2013; Jargowsky 2013). Although the facts of this growing spatial inequality are indisputable, the potential consequences are very much a point of contention. Despite a rapidly expanding social scientific literature focusing on the role of neighborhood contexts on child and adolescent outcomes emerging over the past twenty years (for recent comprehensive reviews

Anna Maria Santiago is professor at the School of Social Work at Michigan State University. Eun Lye Lee is postdoctoral scholar at the Prevention Research Center for Healthy Neighborhoods at Case Western Reserve University. Jessica L. Lucero is assistant professor in the Department of Sociology, Social Work, and Anthropology at Utah State University. Rebecca Wiersma is Oakland MSW Field Coordinator at the School of Social Work at Michigan State University.

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of this literature, see Galster 2008; Leventhal, Dupéré, and Brooks-Gunn 2009; Zimmerman and Messner 2010; Chilenski 2011; Karriker-Jaffe 2011; Foster and Brooks-Gunn 2012; Jackson, Denny, and Ameratunga 2014; and Oakes et al. 2015), numerous questions remain as to the magnitude, mechanisms, and contingent natures of such effects and the extent to which these effects shape the short- and long-term opportunities available to children.

In this paper, we assess the effects on low-income, minority youth of early and sustained residence in different kinds of neighborhoods on their involvement in risky behaviors during adolescence. Specifically, we investigate whether running away from home, using aggressive or violent behavior, or marijuana use was statistically related to a wide variety of conditions in the neighborhoods in which the youth were raised. To answer these questions, we use administrative and survey data from Latino and African American current and former public housing tenants who were exposed to a naturally occurring experiment in Denver, Colorado, and whose children resided in public housing for substantial periods during childhood. Our survey of caregivers provides retrospective information on a battery of youth outcomes, child, caregiver and household characteristics, and perceived neighborhood contexts. Administrative data provide us with a rich array of neighborhood environmental contexts.

Our paper introduces several methodological innovations to the study of spatial inequality. First, we use a natural experiment using quasi-random allocation to subsidized public housing units in Denver to assess neighborhood effects on low-income Latino and African American children. We rigorously test the degree to which this initial assignment process mimicked a random process and determine through a series of balancing tests and Monte Carlo simulations that this indeed was the case. Therefore, the natural experiment in our study likely removes the correlation between any remaining unobservable parental characteristics that potentially affect both the location initially assigned by the City and County of Denver Housing Authority (DHA) and subsequent initiation of child risky behaviors that may follow from this location. The potential for selection biases to reappear grows, however, as time passes since initial assignment. Therefore, we use instrumental variable estimates of neighborhood environment for those locations where families moved after initial assignment to assess the robustness of our results.

Our work advances the literature on neighborhood effects on children's risky behavioral outcomes in three ways. First, because the primary caregivers of sampled children were quasi-randomly assigned to neighborhoods when they first entered the public housing program, the challenge of parental geographic selection bias has been substantially overcome. Second, we evaluate an unprecedented variety of measures of neighborhood environmental contexts measured at different spatial scales. Third, in contrast to previous studies that have focused primarily on the experiences of low-income, African American children, we examine differences in these effects for Latino children as well.

## THEORETICAL AND EMPIRICAL LITERATURE REVIEW

Since the late 1980s, interest in the investigation of neighborhood effects on child and youth outcomes has revived among social scientists (Wilson 1987; Billy, Brewster, and Grady 1994; Leventhal and Brooks-Gunn 2000; Zimmerman and Messner 2010; Jackson, Denny, and Ameratunga 2014). This wave of neighborhood effects research has been motivated by a growing recognition of the complex, multisystem constellation of risk factors that increases the vulnerability of children (Werner and Smith 1982; Rutter 1989; Sameroff et al. 1993; Foster and Brooks-Gunn 2012; Gilliard-Matthews et al. 2015). Underlying the study of neighborhood developmental contexts is the assumption that children and youth who face a multitude of adverse conditions and risk factors in their neighborhoods tend to have poorer outcomes as well as constrained access to opportunities across childhood and into adulthood (Coulton and Korbin 2007). Yet, scholarship to date has not conclusively ascertained whether any bona fide causal connection exists between neighborhood and child outcomes and, if so, what the underlying

causal mechanism is. In the next section, we provide an overview of the theoretical literature that examines how neighborhoods might influence youth risky behaviors and assess the extant empirical literature testing these purported associations.

## How Neighborhoods Might Influence Child and Adolescent Risky Behaviors

The theoretical framework that underlies much of the existing literature is Bronfenbrenner's ecological systems model of human development, which postulates that children's developmental outcomes are shaped by the proximal (for example, family) as well as distal (for example, neighborhood) contexts in which children live and interact (for example, Bronfenbrenner and Morris 1998). Ecological systems theory argues that neighborhood may influence children's behavior through an array of causal mechanisms operating through social, institutional, or biological processes (see Duncan, Connell, and Klebanov 1997; Gephart 1997; Leventhal and Brooks-Gunn 2000; Sampson 2001; Sampson, Morenoff, and Gannon-Rowley 2002; Leventhal, Dupéré, and Brooks-Gunn 2009; Harding et al. 2010; Galster 2012; Foster and Brooks-Gunn 2012; and Oakes et al. 2015). The potential mechanisms relevant for risky behaviors include peer influences, socialization and social control, exposure to violence and social disorder, and local institutional resources. Because these mechanisms are well documented in the literature, we describe them only briefly.

### *Peer Influences*

Youth may develop and modify attitudes, values, behaviors and expectations about running away, use of aggressive or violent behavior, or marijuana use as a result of interactions with similarly aged neighborhood peers as well as peer pressure (Case and Katz 1991). These peer effects may be transmitted among youth through peer interaction and social learning (Crane 1991; South, Baumer, and Lutz 2003).

### *Socialization and Social Control*

Youths' attitudes, values, behaviors and expectations about the use of aggressive or violent behavior and marijuana drug use may be shaped by neighborhood adult role models and norms enforced by the community or local culture (Wilson 1987; Sampson 2001; Burlew et al. 2009; Foster and Brooks-Gunn 2012).

### *Exposure to Violence and Social Disorder*

Exposure to neighborhood violence may lead to early initiation of risky behaviors as a way of coping with the heightened levels of stress associated with such exposure (Lambert et al. 2004; Tyler and Bersani 2008; Copeland-Linder et al. 2010; Farrell et al. 2010; Furr-Holden et al. 2011; Jennings et al. 2011; Sampson, Sharkey, and Raudenbush 2008; Sanbonmatsu et al. 2011; Fagan, Wright, and Pinchevsky 2015).

### *Local Institutional Resources*

Public and private institutions controlling services and facilities for children (for example, medical facilities, parks, recreational centers, counseling or mentoring centers) vary in their quantity and quality on the basis of neighborhood context, thereby affecting access to safe, supervised activities for children and youth differently (Leventhal and Brooks-Gunn 2000; Leventhal, Dupéré, and Brooks-Gunn 2009; Foster and Brooks-Gunn 2012).

Although evidence supports several of the identified neighborhood effect mechanisms, the specific causal mechanisms that reputedly produce these behavioral outcomes remain poorly understood. No consensus has been reached on which mechanism or mechanisms are the primary pathway or pathways associated with specific behavioral outcomes, which remains a critical realm of future research (Galster 2012; Oakes et al. 2015).

## Prior Evidence on Neighborhood Attributes and Child and Adolescent Risky Behaviors

### *Neighborhood Concentrated Disadvantage*

A series of comprehensive reviews of observational studies on neighborhood effects and child and adolescent well-being (see Leventhal and Brooks-Gunn, 2000; Galster 2008; Leventhal, Dupéré, and Brooks-Gunn 2009; Sanbonmatsu et al. 2011; and Foster and Brooks-Gunn 2012) underscore the persistent negative influence of living in socioeconomically disadvan-

taged neighborhoods on child and adolescent behavioral outcomes. Across these studies, neighborhood concentrated disadvantage was defined and operationalized using some derivative of a composite measure of tract-level census data including poverty rates, female headship or single parent households, percent African American, and various ratios depicting the relative share of children residing in two-parent families. Citing work spanning several decades of research using data ranging from national longitudinal studies (for example, PSID, NLSY) or case studies in multiple metropolitan areas (for example, LAFANS, PHDCN, Moving to Opportunity), the aforementioned authors report that aggressive, violent or criminal behavior, risky sexual behavior, and externalizing behaviors during adolescence were strongly associated with increasing levels of socioeconomic disadvantage in the neighborhoods in which these youths resided. Further, these youth are more likely to encounter difficulties in adulthood such as unemployment, substance abuse, and mental health disorders (Kellam et al. 2008; Poduska et al. 2008). However, this purported association between neighborhood disadvantage and marijuana use has not proven as straightforward: some studies (for example, Fite et al. 2009; Mennis and Mason 2012) have reported early initiation of marijuana use in more disadvantaged neighborhoods while others have reported the inverse (Boardman 2001; Bolland et al. 2007; Ford and Beverage 2006; Hoffman 2002; Snedker, Herting, and Walton 2009) or no relationship (Allison et al. 1999) at all.

### *Exposure to Violence*

Exposure to high levels of crime and violence has been found in observational studies to further exacerbate behavioral problems during adolescence. Kimberly Tyler and Bianca Bersani (2008) find that early exposure to gun shots, bullying, and residential break-ins, significantly increased the likelihood of running away during mid-adolescence. Dana Haynie and colleagues (2009) find that exposure to neighborhood violence increased the risk of youth running away from home, dropping out of school, teen childbearing, attempting suicide, and having juvenile or criminal justice involvement. Further, increased actual or perceived levels of neighborhood violence were associated with higher levels of physical aggression and violent behavior among youth (Vanfossen et al. 2010; Brook et al. 2011; Foster and Brooks-Gunn 2012). A recent study by Abigail Fagan, Emily Wright, and Gillian Pinchevsky (2015) reports higher marijuana use among youth who experienced violence victimization.

### *Experimental Evidence*

The causal interpretation of these neighborhood-behavioral outcome relationships measured in these observational studies is subject to many methodological challenges, however, perhaps the most daunting one being geographic selection bias (Galster 2008). A consensus has developed that studies based on random-assignment experiments or natural quasi-experiments that mimic the random assignment of households to neighborhoods are the strongest designs to estimate unbiased neighborhood effects and to generate reliable causal inferences (Leventhal and Brooks-Gunn 2000; Leventhal, Dupéré, and Brooks-Gunn 2009; Oakes et al. 2015).

The only extant example of either of these random or quasi-random neighborhood assignment approaches relevant to child and adolescent risky behaviors is the well-known Moving to Opportunity (MTO) demonstration (Gennetian, Sanbonmatsu, and Ludwig 2011; Sanbonmatsu et al. 2011). Early findings suggested substantial reductions on girls' rates of risky behaviors and boys' drug use attributed to residence in lower-poverty neighborhoods (see Gennetian, Sanbonmatsu, and Ludwig 2011; Goering and Feins 2003). However, after initial declines in risky behavior, boys living in lower-poverty neighborhoods four to seven years after their first move were more likely to reengage in risky behavior (see Sanbonmatsu et al. 2011). By the end of the demonstration project, girls assigned to low-poverty neighborhoods were less likely to have serious behavioral problems. Group differences on more serious antisocial, problem or criminal behavior were not significant (Sanbonmatsu et al. 2011).

As provocative as these findings are, because of methodological and operational shortcom-

ings, they do not settle unambiguously all questions about neighborhood impacts on children's initiation of risky behavior (see extensive discussion in Sampson 2008). First, MTO randomly assigned participants to one of three comparison groups but not to their specific initial or subsequent neighborhoods, thereby enabling potential self-selection of neighborhood characteristics by anyone in the study. Second, after the first year of residence in a low-poverty location, households in the treatment group were free to move to different, higher-poverty neighborhoods if they desired; as Tom Kingsley and Kathryn Pettit (2007) note, 85 percent did so. As a result, relatively few MTO treatment group households experienced sustained exposure to low-poverty neighborhoods. Third, the low-poverty neighborhoods where treatment group households lived typically had inferior public services, limited access to transportation and jobs, and primarily racial or ethnic minority residents (Sampson 2008). Fourth, the separable impacts of different aspects of the residential environment cannot be ascertained given the "bundled" nature of the "treatment" being applied in MTO.

Thus, the existing literature has not provided definitive evidence about the potential behavioral benefits to low-income Latino and African American youth from sustained residence in more-advantaged, safer and opportunity-rich neighborhoods. Our study hopes to contribute clarification by leveraging a natural experiment related to the DHA.

## DATA

The Denver Child Study derives its study population from a natural experiment involving the Denver Housing Authority's conventional and dispersed housing programs. Since 1969, the DHA has operated a dispersed housing program providing approximately 1,500 low-income families with opportunities to live in scattered-site, single-family and small-scale, multifamily units in addition to approximately three thousand units of conventional public housing. Unlike the conventional developments, which tend to be located in less-advantaged neighborhoods, dispersed housing units are found in approximately 60 percent of all neighborhoods throughout the city and county of Denver. From 1987 onward, eligible applicants who came to the top of the common DHA wait list were offered vacant housing units in either conventional or dispersed programs appropriate for their family size and gender of children. Applicants who did not accept their initial offer received a second offer for the next similarly sized unit that became available. Applicants who did not accept this second offer were dropped to the bottom of the wait list, creating a wait of a year or more (see Santiago et al. 2014). Although nearly nine out of ten applicants accepted their first or second offers and three-quarters of all DHA applicants accepted housing units in their initially assigned neighborhoods, a nontrivial number of applicants did not, which prompted us to assess the DHA initial assignment process more closely.

We conducted an array of statistical balancing tests to ascertain the extent to which applicants were quasi-randomly assigned neighborhood characteristics through the DHA housing allocation process (for details, see appendix A). Findings demonstrate that the process mimicked random assignment but with one notable exception. African American households in DHA, regardless of their size, tended to be concentrated in areas with higher percentages of African Americans. Although we cannot ascertain whether this pattern was the result of any systematic actions by the DHA or geographic self-selection by African American applicants, the outcome was inconsistent with quasi-random assignment of this neighborhood characteristic. To address this inconsistency, our statistical analyses are stratified by ethnicity and results involving neighborhood racial mix should be interpreted with caution.

Of course, bias can arise after initial assignment due to potential selection on unobservables that affect who stays and who leaves their original DHA dwellings.[1] To avoid such bias, we use instrumental variables (IV) for neighborhood characteristics. We are therefore con-

1. In the analyses reported here, between 62 and 67 percent of study youth were residing in the neighborhood originally assigned by DHA.

fident that the relationships we observe between neighborhood characteristics and youth behaviors can be interpreted in causal terms rather than in relation to parental geographic selection.

Another important feature of our natural experiment in Denver is the comparatively long exposures children in DHA households had to their assigned neighborhoods. Our sample had a six-year mean (five-year median) DHA residential duration, approximately twice as long as reported for the MTO experimental group (mean = 2.7 years; median = 3.3 years). Previous studies underscore the importance of accounting for the duration of neighborhood exposure to estimate the true effects that neighborhoods have on youth outcomes (Wodtke, Hardling, and Elwert 2011; Crowder and South 2011; Chetty, Hendren, and Katz 2015).

Although this is a case study from a single metropolitan area, we believe that our findings can be generalized to other low-income, Latino and African American families who apply for and remain on the waiting list long enough to obtain public housing. It may not be fully generalizable to the population of minority families who obtain subsidized rental housing, and certainly may not be to the larger population of minority families who qualify for housing assistance. Nevertheless, it is similar to—yet considerably more general than—the populations forming the samples for the MTO-based scholarship noted earlier.

## Denver Child Study Retrospective Survey and Analysis Sample

At the core of the Denver Child Study was a retrospective survey administered to current and former DHA residents identified as primary caregivers whose families entered DHA during the period between January 1, 1987, and December 31, 2005; had resided in DHA for a minimum of two years; had at least one child under eighteen when they moved into DHA; and were of Latino or African American ethnic origin.[2] Attempts to recruit subjects for the study were made by mail and phone, in both English and Spanish when appropriate. Surveys were administered by phone or in person between April 2006 and February 2008 to all eligible caregivers with valid contact information (N=1,334). A total of 710 caregivers and their 1,702 children met all of the eligibility criteria for the study, yielding a final response rate of 53 percent. Caregivers were asked about their children's physical and mental health, education, exposure to violence, risky behaviors, employment, and marriage and childbearing. Additionally, residential histories from birth through age eighteen or age of time of the survey (if younger than eighteen) were compiled for all eligible children in the household. Finally, respondents were asked to provide extensive details about all of the neighborhoods in which the children lived during childhood and about the characteristics of all members of the household corresponding to each place of residence.

Because the outcomes of interest for this study are running away from home, use of aggressive or violent behavior, or marijuana use during adolescence (between ages eight and eighteen), the final analysis sample from the Denver Child Study includes only youth who were at least eight years old at the time of the survey; were randomly assigned to a DHA neighborhood prior to onset of the specific outcomes of interest; resided in DHA for a minimum of two years; and had complete information for all variables used in our analytical models. These criteria resulted in analysis samples of 855 for running away from home, 782 for aggressive or violent behavior, and 742 for marijuana use.

## Youth, Caregiver, and Household Characteristics

Our analytical models control for an array of youth, caregiver, and household characteristics associated with the initiation of running away from home, use of aggressive or violent behavior, or marijuana use during adolescence (see table 1). In addition to controlling for gender and ethnicity, the analytical models control for caregiver age, immigrant status, disability status, educational attainment, and earnings with

2. A nontrivial number of youth in our study were raised by grandparents or other family members. Therefore, we have opted to refer to the adult respondents in our study as caregivers rather than parents.

**Table 1.** Descriptive Characteristics of Youth, Caregivers, Households, and Neighborhoods

| | Run Away from Home (N=855) | | Use of Aggressive or Violent Behavior (N=782) | | Marijuana Use (N=742) | | Denver, 2008 | |
|---|---|---|---|---|---|---|---|---|
| Predictor Measures | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| **Youth characteristics** | | | | | | | | |
| Gender and ethnicity of youth | | | | | | | | |
| Latina female | 0.28 | 0.45 | 0.29 | 0.45 | 0.28 | 0.45 | – | – |
| Latino male | 0.30 | 0.46 | 0.29 | 0.46 | 0.30 | 0.46 | – | – |
| African American female | 0.21 | 0.41 | 0.21 | 0.41 | 0.21 | 0.41 | – | – |
| African American male | 0.22 | 0.41 | 0.21 | 0.41 | 0.21 | 0.41 | – | – |
| **Caregiver and household characteristics** | | | | | | | | |
| Number of siblings in household | | | | | 1.86 | 1.33 | – | – |
| Caregiver age | 40.80 | 9.35 | 40.99 | 9.40 | 40.87 | 9.20 | – | – |
| Caregiver immigrant status (omitted=no) | 0.17 | 0.38 | | | | | – | – |
| Caregiver disability status (omitted=not disabled) | | | 0.08 | 0.28 | | | – | – |
| Caregiver educational attainment (omitted=no degree) | | | | | | | | |
| High school diploma or higher | | | 0.63 | 0.48 | 0.62 | 0.49 | – | – |
| Caregiver earnings (in dollars) | 12,200.90 | 13,205.47 | 11,733.30 | 12,643.74 | 11,892.60 | 12,654.68 | – | – |
| Natural log of caregiver earnings (in dollars) | 2.49 | 2.09 | 2.47 | 2.08 | 2.48 | 2.09 | – | – |
| Caregiver available to monitor-supervise children FT-PT (omitted=not available) | 0.48 | 0.50 | | | | | – | – |
| Household stressor scale (range 0–5) | 1.34 | 1.18 | | | 1.29 | 1.11 | – | – |
| Total number of moves from birth to time of initiation | | | | | 3.25 | 2.37 | – | – |
| **Neighborhood characteristics (all continuous variables reflect predicted values at age of initiation)** | | | | | | | | |
| Social vulnerability score (range 0–400) | 119.90 | 28.72 | 122.40 | 30.98 | 119.80 | 29.40 | 96.73 | 42.01 |
| Percentage African American residents | 14.31 | 8.98 | 14.60 | 9.30 | 13.98 | 9.32 | 11.54 | 16.66 |
| Occupational prestige score (range 0–100) | 37.39 | 1.69 | 37.27 | 1.65 | 37.40 | 1.73 | 41.01 | 4.37 |
| Percentage foreign-born residents | 27.31 | 7.06 | 26.45 | 7.12 | 27.15 | 7.27 | 15.83 | 10.76 |
| Violent crime rate per 1,000 | 10.91 | 3.48 | 11.31 | 3.73 | 10.94 | 3.49 | 5.62 | 6.69 |
| Property crime rate per 1,000 | 49.82 | 13.30 | 53.31 | 15.17 | 49.33 | 13.62 | 46.76 | 43.59 |

*Source:* Authors' calculations.

*Note:* Denver 2008 data were derived from the Geolytics Neighborhood Change Database and Piton Foundation's Neighborhood Facts Database.

all time-varying characteristics measures at time of first offer or time of initiation of specified risky behavior depending on the analytical model discussed. Household indicators include measures controlling for the number of siblings in the household and number of residential moves through time of first offer or initation of risky behavior. In addition, we included a household economic stressors index of five items inquiring about difficulties faced by the household in terms of finances, employment, health insurance, unemployment or job loss, illness or injury, health and health insurance, utilities and housing. This index measures the magnitude of stressors facing the household during each year in a youth's life. Scores ranged from 0 to 5, with higher values indicating a higher degree of household stress. The Cronbach's alpha for this index was 0.52. For youth who did not engage in any risky behaviors, caregiver and household characteristics were measured at age of time-of-survey for youth under age eighteen or at age eighteen for youth who were eighteen or older (for additional details, see Santiago et al. 2014, chapter 3).

As shown in table 1, 49 percent of the sample youth were female and 58 percent were Latino. Approximately one out of every five youth were first- or second-generation immigrants. The primary caregiver was, on average, between forty and forty-one years old. One in ten caregivers was disabled. Approximately 63 percent had completed a high school diploma, post–high school technical certificate, or college degree. Caregiver earnings averaged $12,000 across the three analysis samples, ranging from $0 to $66,352. The typical youth had 1.9 siblings and had moved, on average, 3.3 times during childhood. Households experienced, on average, 1.3 economic stressors measured at time of initiation of the specific risky behavior.

## Neighborhood Context Indicators

Residential history information obtained on the survey was verified for accuracy and then geo-coded using the U.S. Census Bureau's *American FactFinder*. We were able to link 92 percent of the residential locations identified by caregivers to a census tract which then permitted us to link these locations to a rich set of census and noncensus neighborhood indicators from two sources: U.S. Census and the Piton Foundation's Neighborhood Facts database. We used linear interpolation or extrapolation to derive annual estimates of neighborhood conditions for the period between 1970 and 2007 (see detailed discussion in Santiago et al. 2014, chapter 3, appendix B). Because we also asked the caregiver when (if ever) specific outcomes occurred during childhood, we were able to use this timing information to temporally match outcomes with corresponding neighborhood indicators.

In this paper, census indicators for neighborhood ethnic composition (percentage foreign born and African American) and socioeconomic status (social vulnerability index and occupational prestige) were derived from the Neighborhood Change Data Base (a Geolytics proprietary product). Our composite measure of neighborhood disadvantage, which we call our social vulnerability index, was estimated using principal components analysis that across the 1970 to 2000 censuses consistently produced a single component composed of the roughly equally weighted sum of census tract percentages of poor, unemployed, renters, and female household heads. Index scores range from 0 to 400 and the Cronbach's alpha for this index was 0.910.

We compute an occupational prestige score based on the 1989 General Social Survey prestige score by occupation (Davis et al. 1991) weighted by the observed proportional distribution of occupations of employees in the census tract. This scale has a minimum possible score of 29.44 (when all employees are laborers) and a maximum possible score of 62.24 (when all employees are in managerial-professional occupations).

We obtain two indicators of exposure to neighborhood violence (violent crime rate and property crime rate per one thousand population) from the Piton Foundation's Neighborhood Facts Database. This database provides small area, annual estimates for a wide array of noncensus demographic, health, and criminal justice indicators for the neighborhoods that comprise the city and county of Denver. Piton data are aggregated to seventy-seven named community areas consisting of two census tracts, on average.

To get a sense of the places where our sample youth resided, we present descriptive statistics in the bottom panel of table 1. Variation is substantial around the means, indicating that the youth we analyze lived in a wide array of neighborhoods across the city and county of Denver. Nonetheless, DHA youth were also living in neighborhoods that were less diverse and advantaged relative to the typical youth living in Denver as a whole. The typical youth in our DHA analysis samples resided in a neighborhood that was approximately 27 percent foreign born, 14 percent African American, had relatively low levels of occupational prestige (mean=37) suggesting an occupational mix that was laborer intensive, and experienced moderate levels of social vulnerability (mean=123) suggesting some level of concentrated disadvantage. In contrast, the typical Denver resident lived in a neighborhood that was 16 percent foreign born, 12 percent African American, higher levels of occupational prestige (mean=41), and levels of social vulnerability that were 22 percent lower. Further, these youth resided in neighborhoods that had, on average, violent crime rates that were nearly twice the average for Denver as a whole (10.9 versus 5.6 per 1,000, respectively) and property crime rates that were about 5 percent higher (49.8 versus 46.8 per 1,000, respectively).

## Youths' Risky Behavioral Outcome Measures

Caregivers in the Denver Child Study were asked about a variety of behavioral issues affecting children who were age eight or older at the time of the survey, for example, "Has your child ever (insert run away from home, used aggressive or violent behavior, used marijuana)? . . . If so, how old was your child when this first occurred?" The dependent variables of interest here are whether a child had initiated one or more of three risky behaviors between the ages of eight and eighteen: ran away from home, used aggressive or violent behavior, or used marijuana. We used the responses to these questions to estimate the prevalence of adolescent runaway, aggressive or violent behavior, and marijuana use as well as to determine the average age of initiation into each of these risky behaviors. We recognize the potential shortcomings of these behavioral indicators. First, they are subject to recall error by the caregiver survey respondent, though we intentionally chose outcomes for which this likely would be minimal. Second, they are based on caregiver perceptions of the behaviors. Although caregivers may have firsthand knowledge or child reports as the basis of these perceptions, their perceptions may not always be accurate, because children may deliberately hide some of these behaviors from them. Third, they are subject to caregivers' willingness to reveal socially sensitive behaviors of their children to the interviewer. Although all three concerns likely create considerable noise in our dependent variables, we assume no systematic pattern in these errors related to neighborhood indicators. Given the concerns about caregiver self-reports of these behaviors, however, we also report the prevalence rates and ages of initiation from the following sources: the National Longitudinal Survey of Youth 1997 (NLSY97) for running away (Pergamit 2010); the Project on Human Development and Chicago Neighborhoods data for aggressive and violent behavior (Molnar et al. 2008); and Colorado data from the National Survey on Drug Use and Health survey for marijuana use (Substance Abuse and Mental Health Services Administration 2013).

As shown in table 2, caregivers reported that approximately 7 percent of their children ran away from home during adolescence; the average age at time of first occurrence was 14.6 years. Nearly one in five (18 percent) youth used aggressive or violent behavior with the average age of initiation at 12.2 years. About one in ten using marijuana; the average age of initiation was 15.8 years. The prevalence rates for running away from home derived from NLSY97 data were similar: 7.8 percent but occurring at slightly younger ages (see table 2). Given considerable variation in the ways in which aggression and violent behavior are measured, there was no single source that provided comparable statistics for the prevalence of such behavior during adolescence. However, estimates from Beth Molnar and her colleagues (2008) provide some parameters from which to gauge our findings: approximately 14 percent of Chicago youth were identified as engaging in aggressive

**Table 2.** Prevalence and Age of Initiation of Risky Behaviors During Adolescence

| | Contemporaneous Neighborhood Models | | First Offered Neighborhood Models | | Instrumental Variable Neighborhood Models | | Denver or U.S Rates[a] |
|---|---|---|---|---|---|---|---|
| Risky Behavior | Mean | SD | Mean | SD | Mean | SD | |
| **Running away from home** | | | | | | | |
| Ever ran away from home | | | | | | | |
| Full sample | 0.065 | 0.248 | 0.066 | 0.249 | 0.063 | 0.243 | 0.1 |
| Latinos | 0.063 | 0.249 | 0.067 | 0.251 | 0.063 | 0.243 | |
| African Americans | 0.064 | 0.246 | 0.065 | 0.248 | 0.064 | 0.245 | |
| **Age when first ran away from home** | | | | | | | |
| Full sample | 14.62 | 1.525 | 14.92 | 1.614 | 14.59 | 1.524 | 13.0 |
| Latinos | 14.73 | 1.585 | 14.90 | 1.482 | 14.74 | 1.527 | |
| African Americans | 14.48 | 1.455 | 14.94 | 1.784 | 14.39 | 1.530 | |
| **Use of aggressive or violent behavior** | | | | | | | |
| Ever used aggressive or violent behavior | | | | | | | |
| Full sample | 0.172 | 0.378 | 0.178 | 0.382 | 0.182 | 0.386 | 0.138 |
| Latinos | 0.119 | 0.325 | 0.127 | 0.333 | 0.121 | 0.326 | |
| African Americans | 0.246 | 0.431 | 0.241 | 0.428 | 0.266 | 0.443 | |
| **Age of initiation of aggressive-violent behavior** | | | | | | | |
| Full sample | 12.24 | 2.757 | 12.21 | 2.795 | 12.09 | 2.736 | 12.0 |
| Latinos | 12.22 | 2.762 | 12.11 | 2.662 | 12.09 | 2.696 | |
| African Americans | 12.25 | 2.768 | 12.27 | 2.890 | 12.09 | 2.777 | |
| **Marijuana use** | | | | | | | |
| Ever smoked marijuana | | | | | | | |
| Full sample | 0.096 | 0.295 | 0.096 | 0.295 | 0.099 | 0.300 | 0.121 |
| Latinos | 0.094 | 0.292 | 0.094 | 0.293 | 0.097 | 0.297 | |
| African Americans | 0.098 | 0.298 | 0.098 | 0.298 | 0.103 | 0.305 | |
| **Age of initiation of marijuana use** | | | | | | | |
| Full sample | 15.83 | 1.648 | 15.90 | 1.687 | 15.84 | 1.736 | 13.9 |
| Latinos | 15.80 | 1.784 | 15.86 | 1.826 | 15.86 | 1.868 | |
| African Americans | 15.87 | 1.474 | 15.95 | 1.529 | 15.81 | 1.575 | |

*Source:* Authors' calculations.

*Note:* Prevalence and age of onset were based on caregiver restrospective reports of these behaviors for children age eight and older at the time of the Denver Child Study survey.

[a]Self-reported prevalence rates for aggressive behaviors were derived from the Project on Human Development in Chicago Neighborhoods (Molnar et al. 2008). Self-reported prevalence rates and age of onset for running away from home were estimated by Pergamit (2010) using data from the National Longitudinal Survey on Youth, 1997. Prevalence rates for marijuana use for Denver youth derived from Substance Abuse and Mental Health Services Adminstration (2013).

behavior with an average age of initiation at twelve years. Prevalence rates for adolescent marijuana use in Colorado were 12 percent; the average age of initiation was 13.9 years. Although prevalence rates and initiation ages were similar for running away from home and marijuana use between Latino and African American youth, the reported use of aggressive or violent behavior was more than twice as high for African American youth (25 percent) relative to Latino youth (12 percent) in the study, though the mean age of initiation was similar.

## METHODS

We merged information regarding sampled households, caregivers, youth and their corresponding neighborhood environments to create a pseudo-longitudinal database in which the *child-year* becomes the unit of analysis. We used this database for modeling how the neighborhood to which a youth was exposed affected their hazard in engaging in our three risky behaviors during adolescence. The youth, caregiver, and household covariates served as controls.

Our analytical approach for causal identification exploits the DHA natural experiment that produces exogenous variation in neighborhood context. Specifically, we take three complementary approaches in measuring youths' neighborhood exposure. First, we measure all neighborhood indicators contemporaneously when the youth first engaged in the behavior, or at time-of-survey or age eighteen (whichever younger) if the youth never engaged in the behavior. This measure would be most appropriate if context generated behavioral effects occur fairly quickly and if any subsequent mobility patterns since initial DHA assignment were not substantially influenced by uncontrolled parental characteristics that also affected youths' behaviors. Second, we measure neighborhood as the indicators associated with the dwelling first offered to (not necessarily accepted by) the household. This measure would be most appropriate if context generated behavioral effects only after sustained, consistent exposure and change in context since initial assignment was minimal. Third, we measure neighborhood with instrumental variable (IV) estimates based purely on variables that were exogenous to all selection processes and were not themselves causally related to the risky behavior outcomes being analyzed (other than through their relationship to adolescent neighborhood context). This measure would be most appropriate if context generated behavioral effects through cumulative exposure but youth were exposed to temporally varying contexts due to residential mobility or in-place changes.

Our primary instrument was the corresponding set of neighborhood characteristics associated with the neighborhood *first offered* by DHA to the applicant. Our independent evaluation of DHA records shows that 75.5 percent accepted this first offered neighborhood from DHA.[3] We can safely assume that neighborhood characteristics first offered to applicants will be uncorrelated with their unobserved characteristics that might be associated both with whether they accept and remain in the offered neighborhood and economic outcomes for their children when they become young adults. Using similar logic, we specify as additional identifying instruments the calendar year when the DHA offer is first made. We emphasize that we only consider youths' initiation of running away from home, aggressive or violent behavior or marijuana use occurring after their families have been quasi-randomly assigned to a DHA public housing unit, thereby preserving the value of the natural experiment for drawing causal inferences.

The results of our first-stage ordinary least squares (OLS) regressions of contemporaneous adolescent neighborhood context variables on the above instruments (and all the covariates in our second-stage model) are presented in appendix B. Overall results are encouraging: the R-squares range from 0.18 to 0.29 and all chi-squares are highly significant. Characteristics of the neighborhood first offered by DHA proved to be strong instruments for their corresponding characteristics during our sampled young adults' adolescence. Covariates mea-

3. Although 69.5 percent accepted the originally offered DHA dwelling another 6 percent accepted the second unit in the same neighborhood as the first dwelling.

sured at time of first offer and the calendar year of offer were weaker instruments for neighborhood characteristics during adolescence.

### Cox Proportional Hazard and Accelerated Failure Time Specifications

Our analytical approach models the timing of a particular risky behavioral outcome at time $t$ for an individual $ij$ with covariate vector $\chi$ using a Cox proportional hazards model:

$$\lambda(t|\chi_{ij}) = \lambda_0(t)\ \exp(\beta_1\chi_{1ij} + \ldots + \beta_n\chi_{nij}) = \lambda_0(t)\ \exp(\chi_{ij}\,\beta)$$

where $\lambda(t|\chi_{ij})$ is the observed time of outcome (or the censoring time of age eighteen) for youth $ij$ and $\lambda_0(t)$ is the baseline hazard. We then conducted a global chi-square test to ascertain whether the residuals of the Cox model violated the assumption of proportionality. If they did (as was the case of running away from home), we calculated accelerated failure time (AFT) models to estimate the extent to which the time to initiation of the risky behavior was accelerated or decelerated.[4] The AFT model is generally preferred to the Cox proportional hazard model with data that violate the assumptions of proportionality because it is more robust to omitted covariates and less sensitive to choice of probability distribution. In the AFT model, the outcome is the natural logarithm of the survival time $t$, which is expressed as a linear function of the covariates:

$$ln(tij) = \chi_{ij}\,\beta + \varepsilon_{ij}$$

where all symbols are defined as before. In AFT models, a time ratio (TmR) greater than 1 means prolonged time to initiation while TmR < 1 means accelerated time to initiation of the risky behavior. Specifically, we use the frailties version of the AFT model to address the clustering of siblings within families.

We intentionally omit from our models any variables describing the youths' (parentally assessed) exposure to violence, fertility, educational performance, or other outcomes, inasmuch as these may themselves be affected by neighborhood environment. This way, we avoid over-controlling and thus minimizing the apparent influence of neighborhood on risky behavior. We can therefore interpret our models as akin to yielding reduced-form estimates of the degree to which neighborhood indicators correlate with running away from home, use of aggressive or violent behavior, or marijuana use through unspecified intervening causal pathways.

Given the potential of multicollinearity across our neighborhood variables, we conducted several sensitivity tests that resulted in the exclusion of any predictors with variance inflation factors (VIFs) exceeding 5.[5] Finally, to provide the most parsimonious model and avoid maximum likelihood algorithm convergence problems, we model only a subset of youth, caregiver and household control variables that proved predictive. We experimented with a much more expansive set of controls in preliminary runs that are available on request. Given the theoretical rationale for exploring ethnic heterogeneity in neighborhood effects (Crowder and South 2003; Galster and Santiago 2006; Galster, Andersson, and Musterd 2010; Bennett 2011; Galster 2012; Small and Feldman 2011; Francois, Overstreet, and Cunningham 2012; Sharkey and Faber 2014), and the issue related to nonrandom assignment of racial composition, we present stratifications of our analyses for Latino and African American youth.

## RESULTS

Standardized hazard and time ratios and robust standard errors for our models predicting whether the youth ever ran away from home, used aggressive or violent behavior or used marijuana during adolescence are presented

4. We use Stata's STREG algorithm with a lognormal model for the AFT model; for estimating the parameters, we use maximum likelihood.

5. We use the conventions for the VIF cutoff point and decisions to remove violating predictors that Peter Rogerson describes (2001). There are two exceptions when theoretically important neighborhood indicators with VIFs exceeding 5 are retained in the models for running away and marijuana use: violent crime rates and social vulnerability. The VIFs for these two neighborhood indicators fall between 5 and 6. We conduct sensitivity analyses to assess the effects of including one or both of these indicators in our models and find no significant changes in the results.

**Table 3.** Standardized AFT Models Predicting Running Away from Home

| Predictor Measures (All Continuous Variables Reflect Standardized Values Measured at Time of Initiation, First Offer or Predicted) | Neighborhood Characteristics | | | |
|---|---|---|---|---|
| | First Occurrence | | | |
| | Latino | | African American | |
| | TR | SE | TR | SE |
| **Youth characteristics** | | | | |
| Gender and ethnicity of youth (omitted=African American male) | | | | |
| Female (omitted=no) | 0.937 | (0.036) | 1.059 | (0.041) |
| **Caregiver and household characteristics** | | | | |
| Caregiver age | 1.265*** | (0.051) | 1.285*** | (0.041) |
| Caregiver immigrant status (omitted=no) | 1.032 | (0.078) | 1.875*** | (0.263) |
| Caregiver educational attainment (omitted=no degree) | | | | |
| High school diploma or higher | 0.925 | (0.049) | 1.143* | (0.074) |
| Natural log of caregiver earnings (in dollars) | 1.006 | (0.055) | 0.852** | (0.050) |
| Caregiver was available to monitor-supervise children FT-PT (omitted=not available) | 0.951 | (0.099) | 0.717** | (0.085) |
| **Neighborhood characteristics** | | | | |
| Social vulnerability score (range 0–400) | 0.873 | (0.075) | 1.120* | (0.062) |
| Percentage African American residents | 1.028 | (0.048) | 1.024 | (0.024) |
| Occupational prestige score (range 0–100) | 1.071 | (0.053) | 1.131*** | (0.036) |
| Percentage foreign-born residents | 1.045 | (0.033) | 1.089* | (0.040) |
| Violent crime rate per 1,000 | 1.286*** | (0.096) | 1.001 | (0.041) |
| Property crime rate per 1,000 | 0.922* | (0.034) | 0.960** | (0.015) |
| Number of observations | 494 | | 361 | |
| Number of clusters | 233 | | 181 | |
| Number of failures | 31 | | 23 | |
| Time at risk | 6,912 | | 4,926 | |
| Sigma | 0.215 | | 0.186 | |
| Log-likelihood | −41.19 | | −28.53 | |
| $Chi^2$ | 90.01*** | | 295.00*** | |

*Source:* Authors' calculations.
*Note:* Exponentiated coefficients. Robust standard errors in parentheses. Frailties models reflect adjustments for clustering by families.
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

in tables 3 through 5.[6] Each table compares estimated parameters across ethnic strata for three alternative specifications of neighborhood treatment: measured contemporaneously when the youth first engaged in the behavior or at time-of-survey or age eighteen (whichever was younger) if the youth never engaged in the behavior (model 1); at time of first offer (model 2), or cumulative exposure at time of initiation as reflected by our instrumental variables (model 3). Across all of the stratified models, overall model performance was acceptable as demonstrated by the log-likelihood values and statistically significant chi-square tests. Heterogeneity of estimated neighborhood effects depending on ethnicity is clear, as expected. Given concerns about potential selection bias, our discussion focuses on the re-

6. The interpretation is that a 1 standard deviation change in the predictor is associated with the increase/decrease in hazard equal to the estimated standardized hazard ratio given in the table. In the AFT models, the time

| Neighborhood Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|
| First Offer | | | | Instrumental Variables | | | |
| Latino | | African American | | Latino | | African American | |
| TR | SE | TR | SE | TR | SE | TR | SE |
| 0.921* | (0.032) | 1.049 | (0.039) | 0.923* | (0.036) | 1.064 | (0.040) |
| 1.205*** | (0.048) | 1.359*** | (0.059) | 1.228*** | (0.048) | 1.369*** | (0.057) |
| 0.971 | (0.063) | 2.008*** | (0.278) | 0.953 | (0.059) | 1.916*** | (0.265) |
| 0.923 | (0.047) | 1.063 | (0.072) | 0.917 | (0.050) | 1.099 | (0.076) |
| 0.967 | (0.052) | 0.914 | (0.047) | 0.958 | (0.046) | 0.912 | (0.048) |
| 0.907 | (0.095) | 0.801* | (0.070) | 0.904 | (0.090) | 0.801* | (0.074) |
| 0.994 | (0.058) | 1.081 | (0.053) | 1.194 | (0.144) | 1.230* | (0.108) |
| 1.092* | (0.047) | 0.996 | (0.029) | 1.092* | (0.042) | 0.991 | (0.028) |
| 1.036 | (0.031) | 1.107** | (0.041) | 1.058 | (0.041) | 1.115** | (0.047) |
| 1.019 | (0.030) | 1.082 | (0.045) | 1.048 | (0.038) | 1.111* | (0.048) |
| 0.946 | (0.038) | 0.964 | (0.026) | 0.853 | (0.076) | 0.884 | (0.065) |
| 1.051 | (0.057) | 1.074 | (0.051) | 0.973 | (0.070) | 1.024 | (0.043) |
| 494 | | 361 | | 494 | | 361 | |
| 233 | | 181 | | 233 | | 181 | |
| 31 | | 23 | | 31 | | 23 | |
| 6912 | | 4926 | | 6912 | | 4926 | |
| 0.223 | | 0.18 | | 0.213 | | 0.18 | |
| −50.42 | | −25.6 | | −47.46 | | −26.03 | |
| 81.43*** | | 197.70*** | | 85.25*** | | 230.10*** | |

sults from our instrumental variable models. The magnitudes of the estimated neighborhood effects, however, do not differ substantially across the three models, especially when statistically significant parameters are compared. This suggests that the size of the neighborhood effects on outcomes investigated here are robust to alternative measures of a given indicator. Given space constraints, we discuss results for only neighborhood indicators, not covariates.

As shown in table 3, the risk of running away from home was prolonged by about 9 percent for Latino youth residing in neighborhoods with more African American residents and by about 11 percent for African American youth residing in neighborhoods with more foreign-born and higher occupational status

ratio refers to the acceleration or delay of risk. Also the AFT model conditions for clustering in families using frailties.

**Table 4.** Standardized Cox PH Models Predicting Hazard of Initiating Aggressive or Violent Behavior

| | Neighborhood Characteristics | | | |
|---|---|---|---|---|
| | Initiation | | | |
| | Latino | | African American | |
| Predictor Measures (All Continuous Variables Reflect Standardized Values Measured at Time of Initiation, First Offer or Predicted) | HR | SE | HR | SE |
| **Youth characteristics** | | | | |
| Gender and ethnicity of youth (omitted=African American male) | | | | |
| Female (omitted=no) | 0.554* | (0.136) | 0.752 | (0.140) |
| First born in family (omitted=0) | 0.681 | (0.182) | 0.389*** | (0.088) |
| **Caregiver and household characteristics** | | | | |
| Caregiver age | 0.104*** | (0.031) | 0.115*** | (0.030) |
| Caregiver disability status (omitted=not disabled) | 1.526 | (0.651) | 4.916*** | (1.920) |
| Caregiver educational attainment (omitted=no degree) | | | | |
| High school diploma or higher | 1.273 | (0.326) | 1.216 | (0.375) |
| Natural log of caregiver earnings (in dollars) | 1.121 | (0.150) | 1.118 | (0.185) |
| **Neighborhood characteristics** | | | | |
| Social vulnerability score (range 0–400) | 0.337* | (0.178) | 0.763 | (0.150) |
| Percentage African American residents | 0.839 | (0.278) | 1.101 | (0.144) |
| Occupational prestige score (range 0–100) | 0.557* | (0.159) | 0.825 | (0.134) |
| Percentage foreign-born residents | 0.633* | (0.139) | 0.673 | (0.137) |
| Violent crime rate per 1,000 | 1.225 | (0.661) | 1.071 | (0.133) |
| Property crime rate per 1,000 | 2.600*** | (0.509) | 1.320** | (0.139) |
| Number of observations | 455 | | 327 | |
| Number of clusters | 224 | | 172 | |
| Number of failures | 55 | | 87 | |
| Time at risk | 6,519 | | 4,477 | |
| Log-likelihood | −255.9 | | −388.6 | |
| $Chi^2$ | 105.50*** | | 151.30*** | |

*Source:* Authors' calculations.

*Note:* Exponentiated coefficients. Robust standard errors in parentheses.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

neighbors, respectively. Perhaps counterintuitively, the risk of running away was delayed for African American youth in more disadvantaged neighborhoods: a 1 standard deviation higher social vulnerability score was associated with a 23 percent delay in running away during adolescence.

Several neighborhood characteristics were significant predictors of adolescent use of aggressive or violent behavior (see table 4). For African American youth, residence in neighborhoods with 1 standard deviation higher violent crime rates resulted in 2.1 times higher hazards of using aggressive or violent behavior. However, residence in neighborhoods with 1 standard deviation higher fractions of foreign-born residents or levels of social vulnerability reduced the hazards of initiating such behavior for African American youth by 42 and 52 percent, respectively. For Latino youth, a 1 stan-

| Neighborhood Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|
| First Offer | | | | Instrumental Variables | | | |
| Latino | | African American | | Latino | | African American | |
| HR | SE | HR | SE | HR | SE | HR | SE |
| 0.524* | (0.137) | 0.877 | (0.162) | 0.484** | (0.135) | 0.812 | (0.157) |
| 0.629 | (0.181) | 0.441*** | (0.082) | 0.631 | (0.177) | 0.449*** | (0.082) |
| 0.115*** | (0.040) | 0.108*** | (0.028) | 0.101*** | (0.038) | 0.102*** | (0.027) |
| 1.545 | (0.740) | 5.815*** | (2.774) | 1.745 | (0.800) | 4.077** | (2.008) |
| 1.293 | (0.371) | 1.268 | (0.415) | 1.464 | (0.440) | 1.165 | (0.370) |
| 1.117 | (0.150) | 1.252 | (0.237) | 1.103 | (0.153) | 1.220 | (0.225) |
| 1.023 | (0.359) | 1.088 | (0.276) | 0.401 | (0.242) | 0.481* | (0.157) |
| 0.475** | (0.136) | 1.025 | (0.147) | 0.489* | (0.154) | 1.015 | (0.143) |
| 0.877 | (0.219) | 0.956 | (0.155) | 0.684 | (0.225) | 0.774 | (0.138) |
| 0.954 | (0.169) | 0.672 | (0.158) | 0.847 | (0.186) | 0.576* | (0.153) |
| 1.854* | (0.536) | 1.12 | (0.134) | 1.988 | (1.172) | 2.104* | (0.697) |
| 0.611 | (0.241) | 0.973 | (0.221) | 1.540 | (0.739) | 0.913 | (0.281) |
| 455 | | 327 | | 455 | | 327 | |
| 224 | | 172 | | 224 | | 172 | |
| 55 | | 87 | | 55 | | 87 | |
| 6,519 | | 4,477 | | 6,519 | | 4,477 | |
| −263.1 | | −393.4 | | −262.1 | | −393.6 | |
| 83.54*** | | 133.40*** | | 92.31*** | | 136.10*** | |

dard deviation higher fraction of African American neighbors was associated with a 52 percent reduction in the hazard of using aggressive or violent behavior during adolescence.

As shown in table 5, several neighborhood conditions increased the hazards of marijuana initiation. Most robustly, a 1 standard deviation higher violent crime rate was associated with an 81 percent lower hazard of marijuana use by Latino youth. For African American youth, residence in neighborhoods with higher fractions of immigrants reduced the hazard of marijuana use by 69 percent.

## DISCUSSION

The results reported in this paper make it clear that several aspects of the neighborhood—safety, social status, and ethnicity-nativity—are statistically and substantively important predictors of risky adolescent behaviors. We

**Table 5.** Standardized Cox PH Models Predicting Hazard of Marijuana Use Initiation

| | Neighborhood Characteristics | | | |
|---|---|---|---|---|
| | Initiation | | | |
| | Latino | | African American | |
| Predictor Measures (All Continuous Variables Reflect Standardized Values Measured at Time of Initiation, First Offer or Predicted) | HR | SE | HR | SE |
| **Youth characteristics** | | | | |
| Gender and ethnicity of youth (omitted=African American male) | | | | |
| Female (omitted=no) | 0.642 | (0.220) | 0.769 | (0.282) |
| **Caregiver and household characteristics** | | | | |
| Number of siblings in household | 0.750 | (0.165) | 0.525* | (0.140) |
| Caregiver age | 0.130*** | (0.037) | 0.194*** | (0.052) |
| Caregiver educational attainment (omitted=no degree) | | | | |
| High school diploma or higher | 1.434 | (0.514) | 0.628 | (0.376) |
| Natural log of caregiver earnings (in dollars) | 1.197 | (0.193) | 0.908 | (0.269) |
| Household stressor scale (0–5) | 1.047 | (0.159) | 0.816 | (0.160) |
| Number of moves from birth to onset | 0.805 | (0.110) | 0.971 | (0.152) |
| **Neighborhood characteristics** | | | | |
| Social vulnerability score (range 0–400) | 1.230 | (0.641) | 1.613 | (1.000) |
| Percentage African American residents | 1.280 | (0.411) | 1.428 | (0.419) |
| Occupational prestige score (range 0–100) | 0.649 | (0.178) | 1.031 | (0.442) |
| Percentage foreign-born residents | 0.725 | (0.149) | 0.715 | (0.275) |
| Violent crime rate per 1,000 | 0.392 | (0.204) | 0.680 | (0.419) |
| Property crime rate per 1,000 | 1.939* | (0.516) | 1.109 | (0.257) |
| Number of observations | 432 | | 310 | |
| Number of clusters | 215 | | 162 | |
| Number of failures | 42 | | 32 | |
| Time at risk | 6,179 | | 4,392 | |
| Log-likelihood | −186.7 | | −135.1 | |
| $Chi^2$ | 80.38*** | | 104.10*** | |

*Source:* Authors' calculations.

*Note:* Exponentiated coefficients. Robust standard errors in parentheses.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

organize our discussion around these thematic categories of neighborhood context. Some of our results were unexpected and challenging to explain, although lack of empirical consensus around the determinants of youths' risky behaviors has long characterized this field of study (see Leventhal and Brooks-Gunn 2000; Foster and Brooks-Gunn 2012; Oakes et al. 2015).

## Neighborhood Safety

The findings highlight the mixed roles of neighborhood safety on the hazards of engaging in risky behaviors during adolescence. Neighborhood violent crime rates exhibited a statistically significant and substantively large positive relationship with initiation of the use of aggressive or violent behavior among African American youth. Several underlying (not

| Neighborhood Characteristics | | | | | | | |
|---|---|---|---|---|---|---|---|
| First Offer | | | | Instrumental Variables | | | |
| Latino | | African American | | Latino | | African American | |
| HR | SE | HR | SE | HR | SE | HR | SE |
| 0.586 | (0.214) | 0.865 | (0.299) | 0.555 | (0.204) | 0.785 | (0.296) |
| 0.781 | (0.118) | 0.547** | (0.111) | 0.768 | (0.125) | 0.543** | (0.110) |
| 0.167*** | (0.046) | 0.166*** | (0.064) | 0.145*** | (0.044) | 0.127*** | (0.056) |
| 1.332 | (0.491) | 0.541 | (0.279) | 1.266 | (0.493) | 0.428 | (0.232) |
| 1.271 | (0.221) | 0.911 | (0.221) | 1.225 | (0.229) | 0.892 | (0.229) |
| 1.072 | (0.171) | 0.817 | (0.183) | 1.190 | (0.193) | 0.856 | (0.204) |
| 0.944 | (0.158) | 1.098 | (0.207) | 0.771 | (0.159) | 0.955 | (0.198) |
| 0.832 | (0.405) | 0.789 | (0.384) | 1.675 | (1.360) | 0.437 | (0.390) |
| 0.941 | (0.233) | 1.007 | (0.190) | 1.034 | (0.248) | 1.098 | (0.164) |
| 0.569 | (0.173) | 0.828 | (0.344) | 0.497 | (0.208) | 0.621 | (0.267) |
| 1.147 | (0.245) | 0.444 | (0.212) | 1.267 | (0.471) | 0.313** | (0.134) |
| 0.795 | (0.306) | 1.103 | (0.275) | 0.191* | (0.152) | 1.985 | (1.616) |
| 0.885 | (0.359) | 0.983 | (0.191) | 2.061 | (0.939) | 0.813 | (0.239) |
| 432 | | 310 | | 432 | | 310 | |
| 215 | | 162 | | 215 | | 162 | |
| 42 | | 32 | | 42 | | 32 | |
| 6,179 | | 4,392 | | 6,179 | | 4,392 | |
| −189.8 | | −135.8 | | −187.4 | | −133.3 | |
| 68.19*** | | 49.44*** | | 63.1*** | | 45.9*** | |

mutually exclusive) causal pathways are plausible here. In neighborhoods that have more violent crime there may be weaker collective social norms proscribing violence, more role models exhibiting violence, or higher incidences of youth being victimized by crimes, which creates psychological reactions leading to aggression.

Surprisingly. Latino youth living in places with more violent crime were, all else equal, less likely to use marijuana. Fear of violence in the wider geographic context may induce more caregiver or self-imposed restrictions on youths' movements outside the home or immediate environs (Byrnes, Miller, Chen, and Grube 2010). Such geographic restrictions in activity spaces could result in more intensive parental monitoring of behaviors that may re-

duce chances of youth initiating marijuana use.

## Neighborhood Social Status

Our results indicate that neighborhoods inhabited by higher status residents were associated with delayed incidence of running away from home for low-income African American youth. We posit that neighborhoods of higher social status may be associated with several mechanisms that could produce the observed relationship, including collective socialization, role modeling, and collective efficacy and social control of public spaces that provide neighborhood youth with heightened sense of security and belonging.

Less intuitive is the negative relationship between neighborhood disadvantage and the initiation of risky behaviors such as running away or the use of aggressive or violent behavior by African American youth. Although this finding differs from several prior studies, others have reported that African American youth are less likely to engage in risky behaviors (for example, Allison et al. 1999; Bolland et al. 2007; Snedker, Herting, and Walton 2009)—observations that have been supported by national surveys on youth behaviors such as Monitoring the Future. The initiation of risky behaviors among African American youth in more disadvantaged neighborhoods may be mediated by the presence of family support networks or high-achieving friends within personal networks (Allison et al. 1999). Alternatively, low-income African American youth may weigh the costs associated with initiating risky behaviors, including being subject to heightened police scrutiny as well as the consequences of such behavior on current and future educational or employment outcomes. Further, it may be that neighborhood disadvantage may operate differently for adolescents or be more relevant to engaging in risky behaviors later during the life course. Indeed, Jason Boardman and his colleagues argue that it is "unlikely that neighborhood disadvantage operate in the same way for all subgroups of the population and for all health outcomes and behaviors" (2001, 163). Another potential explanation might revolve around the way we have measured neighborhood contexts: we have included many more neighborhood indicators (such as crime and occupational prestige) that enable us to unbundle the separate effect of a wider array of conditions found in vulnerable neighborhoods. Finally, we speculate that the observed relationship between neighborhood disadvantage and risky behaviors may have been produced by collective social norms involving the definition of the risky behaviors in question. If African American parents in socially vulnerable neighborhoods become less likely to define particular behaviors of their adolescents as running away, aggressive, or violent as a result of these norms, they will be less likely to report in our survey that their children have engaged in them. Put differently, this result may be an artifact of reporting created by a neighborhood effect.

## Neighborhood Ethnic and Nativity Composition

Higher percentages of foreign-born neighbors substantially reduced the hazards of our low-income African American adolescents engaging in any of the three risky behaviors investigated. Additionally, relationships were significant between African American composition of the neighborhood's population and initiation of aggressive or violent behavior and running away during adolescence for Latino youth. We find that higher percentages of these groups in the neighborhood are associated with a lower likelihood of engaging in any of these risky behaviors.

We think our results are consistent with the notion that a dominant ethnic-nativity group in the neighborhood can play powerful normative, role modeling, and behavioral monitoring functions whose impacts extend to other youth beyond those in the given group. For example, groups with multigenerational households and extended family networks (more likely Latino and immigrant in Denver) may more heavily monitor the behavior of all children residing in the neighborhood. A dominant group of ethnic minority–immigrant neighbors may serve as adult role models and make resources available to all resident low-income children of color, thereby enhancing collective socialization in the neighborhood. Immigrant families who maintain values and behaviors from their

countries of origin may experience reduced intergenerational conflict, which is often linked to initiation of adolescent risky behaviors. Further, these families may continue to enforce strong cultural proscriptions regarding such behaviors with their second-generation children. These children, in turn, may serve as agents of "positive behavioral contagion" for other neighboring peers, even when they are in different ethnic groups.

## CONCLUSIONS, CAVEATS, AND FUTURE DIRECTIONS

Researchers have struggled with the daunting methodological challenges of obtaining unbiased estimates of the causal impact of neighborhood on adolescent risky behavioral outcomes, due primarily to incomplete controls for selection biases and little variation in the environments experienced by low-income, minority children over a sustained period. Moreover, previous research has not been able to examine how these neighborhood effects might vary for minority children who were not African American. An innovative public housing program instituted by the Denver Housing Authority provides a unique opportunity to explore both of these issues because the DHA housing allocation process mimics random assignment to a wide range of neighborhoods for Latino and African American families with children who apply for DHA housing. Moreover, families typically reside in DHA housing for nontrivial periods, thereby producing sustained exposure to context. We thus have an unusual opportunity to measure context-individual behavior associations that are plausibly produced by causal relationships.

We use Cox PH and accelerated failure time models, stratified by ethnicity, to estimate parameters. Three alternative measures of each of our neighborhood indicators provide robustness tests. We find that cumulative exposure to multiple dimensions of neighborhood context (especially safety, social status, and ethnicity-nativity) predict whether adolescents run away from home, use aggressive or violent behavior, or initiate marijuana use.

Although we think that our methodological approach offers important advances in providing convincing evidence of causal connections between residential context and behavioral outcomes, we acknowledge that our study has weaknesses. The first is that our measures of youth behaviors are retrospectively reported by caregivers. We recognize that this can yield both random errors associated with the timing of onset and may also introduce inaccuracies in reporting whether the behavior occurred, particularly when such behaviors are illegal. To the extent that these random recall or reporting errors crept into our data, they would push the neighborhood effect findings toward null. Second, we do not investigate the frequency of these behaviors, because this is not recorded in our survey. Third, we do not attempt to probe in this paper potential pathways through which neighborhood environment may affect adolescent behavior through intervening outcomes, especially as they might play out through exposure to violence or school performance. We will address this last shortcoming in future work. Fourth, Denver is not a representative metro area; in particular, it does not exhibit large areas of extreme deprivation, which some others do.

Finally, despite these caveats our results clearly suggest that policymakers should be cognizant of neighborhood as an important developmental context affecting the behavioral outcomes of low-income minority adolescents. Each of the risky behaviors we examine is clearly influenced by more than individual or family characteristics. Moreover, we know that these behaviors create severe and durable physical and mental health problems that, in turn, inhibit intellectual growth, academic performance, and—ultimately—economic opportunities during adulthood (Partnership for Maternal, Newborn and Child Health 2011). Thus, by powerfully influencing risky behaviors, neighborhood plays an important role in shaping future opportunities and outcomes.

The daunting policy challenge is creating and opening access to neighborhood environments that can be more developmentally friendly to all youth (Cook and Wing 2012). Our results imply that well-designed assisted housing programs (potentially involving both site-based and voucher-based subsidies) and community redevelopment programs have the potential to expand the access to places that

enhance opportunities for disadvantaged youth. On the one hand, scattered-site public housing programs like the one operated by the Denver Housing Authority have opened access to good-quality housing in a wider range of neighborhood contexts for thousands of low-income youth and their families. Limits to the scope of assisted housing programs and rent subsidies, however, underscore the need to increase opportunity-rich neighborhoods for low-income families and their children through place-based neighborhood redevelopment and reinvestment. One recent example from the Denver context is the private-public partnership supporting the Mariposa redevelopment of the La Alma/Lincoln Park neighborhood. Replacing the South Lincoln Homes public housing development operated by the DHA, this project involved the creation of a multigenerational, mixed income neighborhood with new rental housing construction and neighborhood revitalization maximizing transit access, walkability and safety, healthy living, and economic sustainability. In addition to the nine hundred units of rental housing of varying sizes and prices that were built, neighborhood revitalization efforts included refurbishing local recreational facilities, parks, and the public library as well as the addition of public art, safe walking spaces, and community gardens. Workforce development activities have been targeted toward at-risk neighborhood youth and include vocational training for various careers in the arts industry as well as the culinary arts. All of these efforts are aligned with Patrick Sharkey's (2013) call for durable reinvestment in our most disadvantaged neighborhoods to stem the intergenerational transmission of neighborhood disadvantage.

## APPENDIX A

### Investigating Quasi-Random Assignment in our DHA Natural Experiment

Natural experiments have been advocated as a vehicle from which valid implications about causal neighborhood effects may be drawn (for example, Oakes 2004). One should have assurance, however, that they in fact produce a quasi-random assignment of households across space. Such would convincingly minimize geographic selection bias by rupturing the association between neighborhood characteristics and unobserved individual characteristics, both of which might be correlated with the outcome under investigation. This appendix uses our natural experiment involving public housing in Denver and investigates whether it produced an essentially quasi-random allocation of both observed and unobserved household characteristics across neighborhood characteristics.

Several investigations of neighborhood effects using natural experiments have probed the degree to which quasi-random assignment was achieved (Oreopoulos 2003; Edin, Fredricksson, and Åslund 2003; Jacob 2004; Lyle 2007; Damm 2009, 2014). Typically, the allocation processes in the natural experiments are described and probed in detail in an effort to uncover points at which nonrandom selections could occur. Regression analysis is then used in balancing tests to assess whether any nonzero relationships between observed individual characteristics and neighborhood characteristics signal nonrandom allocations. We use these strategies here and present another, original approach involving Monte Carlo simulation with typically unoserved individual characteristics.

### Possibilities for Tenant Self-Selection and Staff Selection

First, we explore the possibility of selection arising because prospective tenants can potentially choose between two DHA units that may be located in quite different neighborhoods. Our independent evaluation of DHA records showed that 69.5 percent accepted their first offer from DHA, 18.8 percent accepted their second offer, 7.9 percent ended up rejecting both offers and taking a third offer later (after returning to the bottom of the wait list), and 3.8 percent rejected three or more offers before being placed. However, 75 percent accepted offers of units in the originally assigned neighborhood.

Perhaps more revealing is probing whether applicants ended up in neighborhoods they would have selected on their own. Before their initial assignment to a DHA dwelling, clients

were asked by DHA whether they had any geographic location preferences. DHA administrative data show that 42.5 percent of the clients in our sample did not articulate any locational preference, approximately 33 percent expressed general geographical areas (such as southwest Denver), and the remaining 23.5 percent provided responses that ranged from specific addresses to specific DHA developments. To assess whether those who stated a preference were assigned to a housing unit in their specified area, we follow the following procedures. For those who specified a particular address, we check to see whether that address was the DHA unit to which the client was initially assigned. For those who specified a preference for a particular DHA development, we use the unit number reported by DHA (which has an abbreviation of the development embedded in it) to assess whether the initial DHA unit was in that development. For those who specified a preference for a particular neighborhood, we rely on our survey data to determine whether the original DHA unit was in the specified neighborhood. Last, initially assigned DHA units were mapped to identify where they were within the Denver metropolitan area for those who specified a preference for a particular area. Once these assessments are complete, we calculate frequencies and percentages for those who specified a geographic preference and got it to occupy (N=190; 25.8 percent) and those who specified a geographic preference but did not occupy a housing unit that met that preference (N=233; 31.7 percent).[7] Because we cannot ascertain the geographic location of all potential DHA unit vacancies that arose during the times that each client was assigned to their initial unit, we cannot perform any formal statistical tests to determine whether the frequencies we obtained for those who were assigned their expressed preference were any different than what would be expected by chance. Nevertheless, we are encouraged by the roughly equal percentages of those expressing a geographic preference granted and not granted, suggesting the equivalent of a coin toss by DHA staff in each case.

A second potential source of selection can arise from the actions of DHA staff members. If occupancy staff members have multiple vacancies to consider at one time, they may make dwelling offers on the basis of observable characteristics of the applicants at the top of the waiting list or by systematically granting particular geographic preferences of applicants based on their characteristics. Although we cannot fully ascertain the extent to which this may have occurred from the administrative data available to us, we also cannot discount this as a possibility. Indeed, evidence from our balancing tests indicates that DHA staff did make some systematic neighborhood allocations on the basis of ethnicity.

In sum, the DHA dwelling allocation process leaves room for selection. A nontrivial share of DHA applicants did not accept their first offer from DHA (30.5 percent) and ended up in a neighborhood they said they preferred (26 percent). It may also be that DHA staff practiced some selection in their dwelling offers, perhaps in response to expressed applicant preferences.

## Relationships Between Individual and Neighborhood Characteristics

Even if some assignments to DHA developments or neighborhood were nonrandom, it would not necessarily follow that we would observe strong statistical relationships between observable DHA tenant characteristics and neighborhood characteristics. Thus, here we use a wide range of continuously measured neighborhood characteristics to probe their potential systematic covariation with characteristics of individual DHA families. Specifically, we use multivariate regression to estimate balancing tests of the statistical associations between twenty-seven individual household and eight characteristics of the neighborhoods first offered by DHA (see table A1). The latter include characteristics of census tracts' population and housing, including our social vulnerability index score, percentage (non-Latino) African American population, percentage foreign-born population, percentage homes built before 1940, occupational prestige score, and property and violent crime

7. There are no significant ethnic differences in these percentages.

rates (see text for details). These regressions control for tenant characteristics that DHA uses in their allocation process (that is, disability status and number of bedrooms for which the family qualifies) because of the distinctive geographic differences in locations of variously sized and ADA (Americans with Disabilities Act) disabled-accessible DHA dwellings. A quasi-random assignment would be reflected in coefficients approximating zero and an insignificant *F* test for the set of applicant characteristics that were reputedly not used in the DHA dwelling allocation process.

Results are shown in table A1. Overall, of the 208 regression coefficients of individual household characteristics, 185 (89 percent) yielded coefficients that were statistically insignificant using the conventional $p < 0.05$ level. The clear violation of quasi-randomness was the consistently strong significance of the ethnicity of the DHA tenant in predicting almost every feature of the offered neighborhood. As a result, all *F* tests on the set of non-allocation variables rejected the null hypothesis of uniformly zero coefficients in all neighborhood characteristics except the percentage of units built before 1940.

We think that this finding may be partly explicable on the grounds that African American applicants could have expressed preferences for DHA dwellings in neighborhoods with higher percentages of blacks and that these preferences were systematically granted by DHA staff members. At least three reasons are plausible for why African American applicants' expressed preferences could have yielded offers in neighborhoods with somewhat higher percentages of black residents. The first is the desire to maintain close ties to kin, friends, and ethnically distinctive institutions. For example, second-generation DHA applicants may have desired to return to the same neighborhoods they came from expressly to maintain close ties with networks providing bonding social capital. Second, black applicants may have perceived a more welcoming, familiar environment in neighborhoods with higher percentages of residents from their same ethnic group. The converse of the same point is that African American applicants may feel less comfortable or welcome in neighborhoods with higher percentages of Latino residents. Third, the relationship may be partially spurious because many of the neighborhoods with higher percentages of black residents are located along the major residential and commercial growth corridor of Denver, which stretches east-northeast from the former Stapleton Airport redevelopment toward the current airport. These areas are likely attractive for nonethnic reasons. Many black DHA applicants likely had previously established intra-ethnic social networks in this corridor through which they learned about the attractive prospects for employment and quality of life there.[8]

We also believe, however, that some systematic assignments may have been made by DHA staff on the basis of tenant ethnicity rather than expressed preferences. We reestimated our balancing tests for various strata of tenants: those expressing a geographic preference and receiving it versus those expressing either no preference or a geographic preference and not receiving it; and those who accepted the first dwelling offered by DHA and those who did not. In all cases (except those who rejected the first offer), the strong correlation between African American tenants and neighborhood ethnic composition persisted. We have no information about why DHA staff members may have steered applicants to neighborhoods where their ethnic group was more concentrated, regardless of their expressed preferences, but we think the evidence persuasive.

Indeed, the central issue remains whether the DHA allocation process succeeded in eliminating the correlation between unobserved tenant–child caregiver characteristics and neighborhood characteristics. In this realm we think this was highly likely. Table A1 shows thirteen characteristics of caregivers that were virtually impossible to observe by DHA and by

8. Most of both African American and Latino study participants who expressed a geographic preference to DHA identified areas where their ethnic group was disproportionately represented, with the former focusing on the east and northeast parts of Denver and the latter on the west and southwest. Maps showing the ethnic residential geography of Denver are available from the authors.

most researchers using public-access observational data to investigate neighborhood effects; we demarcate these as "characteristics not observed by DHA." Only four of the associated 104 coefficients (4 percent) for this set of typically unobserved characteristics were significantly different from zero using conventional standards. The *F* tests on this subset of applicant characteristics could not reject the null hypothesis of their coefficients jointly equaling zero in all cases except one (occupational prestige).

Regardless of underlying cause, what does our finding of neighborhood ethnic composition nonrandom selection on the basis of tenant ethnicity imply for our analysis? Can we say that we have quasi-random assignment *conditional on ethnicity* of tenant? The answer is yes (see tables A2 and A3). We repeat our balancing tests for black and Latino tenants separately. For both strata, only 6 percent of the coefficients of individual household characteristics proved statistically significant at conventional levels, and only 4 percent of the unobserved characteristics did so, results easily due to chance. Moreover, for the majority of neighborhood characteristics in both strata, *F* tests fail to reject the null hypothesis of jointly zero coefficients of all individual tenant characteristics. For all neighborhood characteristics but one, *F* tests fail to reject the null of jointly zero coefficients of all unobserved individual characteristics.

We therefore conclude that this regression evidence suggests the DHA allocation process produced a quasi-random assignment across geography, with the exception of one characteristic observable by the DHA—ethnicity—that is easily controlled in our analyses. Even more importantly, we conclude that the DHA allocation process produced a quasi-random assignment across geography in terms of individual characteristics not observable by the DHA but observable to us from our survey. This gives us some confidence that any additional household characteristics we do not observe in our study are similarly quasi-randomly allocated across neighborhood characteristics. Our confidence is further bolstered by the Monte Carlo experiments.

## Relationships Between Neighborhood and Typically Unobserved Individual Characteristics Using Monte Carlo Simulation

Here we present the results of a complementary test of the degree to which characteristics of caregivers in our sample that typically are not observed in neighborhood effect studies are correlated with characteristics of their neighborhoods at the time of initial assignment by DHA. The balancing test uses multiple regression to assess the partial correlations of individual caregiver characteristics with a given neighborhood characteristic, assuming that each of the former were relatively independent. By contrast, the complementary test described here takes as given the combination of caregiver characteristics, hypothetically allocates this bundle randomly across DHA locations in repeated Monte Carlo trials, estimates the hypothetical pairwise correlations (and standard errors) of the individual and neighborhood characteristics that result, and then compares the actual pairwise correlations to these randomly generated reference points to see whether they are similar.

The intuition guiding this procedure is as follows. An actual random assignment of DHA applicants to DHA dwellings will likely produce by chance a few nonzero pairwise correlations between DHA household characteristics and neighborhood characteristics. A Monte Carlo simulation repeating such random assignments will generate bootstrapped standard errors of correlations across all the permutations of these characteristics. If the actual correlations fall within the respective confidence intervals produced by the simulation, we will fail to reject the null hypothesis that the DHA assignment process yielded a quasi-random geographic assignment of households.

In particular, we implement this strategy as follows. We again consider the unobserved (by DHA and typically in other studies) characteristics of caregivers and census tracts noted earlier. For each of three family sizes of DHA tenants (less than two, two, or three or more children), we calculate the Pearsonian correlation between each pairwise combination of caregiver characteristics and neighborhood characteristics observed when the DHA first assigned our sample

(*Text continues on page 200.*)

**Table A1.** Relationships Between DHA Resident and Offered Neighborhood Characteristics

| | Social Vulnerability | | % Foreign Born | | % African American | |
|---|---|---|---|---|---|---|
| | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| **Observed caregiver characteristics used for DHA assignment** | | | | | | |
| Disabled | −8.9432 | 0.2879 | 1.8565 | 0.1733 | 0.1377 | 0.9477 |
| Number of bedrooms eligible for three | −19.4022** | 0.0014 | −0.0990 | 0.9193 | 2.2680 | 0.1322 |
| Number of bedrooms eligible for four | 15.9609 | 0.1682 | 1.6191 | 0.3879 | 1.4592 | 0.6133 |
| **Observed caregiver characteristics not used for DHA assignment** | | | | | | |
| Not married | −1.3525 | 0.8358 | 0.6148 | 0.5608 | 1.4662 | 0.3679 |
| Employed at time of DHA move-in | 8.1493 | 0.4798 | 0.1524 | 0.9350 | −0.4196 | 0.8840 |
| Hourly wage | −2.1139 | 0.0639 | −0.1050 | 0.5694 | 0.2292 | 0.4200 |
| Receiving welfare at time of DHA move-in | 16.1895** | 0.0086 | −3.6024*** | 0.0003 | −0.4651 | 0.7616 |
| Receiving food stamps at time of DHA move-in | −4.0611 | 0.5216 | 1.4446 | 0.1596 | 1.1474 | 0.4679 |
| Had a checking account at time of DHA move-in | −0.3302 | 0.9538 | −1.2808 | 0.1660 | 2.6842 | 0.0596 |
| Had health insurance at time of DHA move-in | −6.8130 | 0.2573 | −0.1534 | 0.8749 | −1.5845 | 0.2908 |
| Born in United States | −10.0892 | 0.3024 | 1.0307 | 0.5153 | 2.0134 | 0.4092 |
| Spanish language interview completed | −17.3190 | 0.2252 | −0.4722 | 0.8382 | −1.6530 | 0.6424 |
| Age at time of DHA move-in | −0.6680* | 0.0241 | 0.0304 | 0.5249 | −0.0201 | 0.7853 |
| African American | 13.8708** | 0.0096 | −0.2804 | 0.7457 | 10.0679*** | 0.0000 |
| High school diploma at time of DHA move-in | 0.1608 | 0.9774 | 0.0647 | 0.9439 | −0.4465 | 0.7525 |
| Higher education at time of DHA move-in | 2.0297 | 0.8172 | 3.3509* | 0.0188 | 0.0542 | 0.9802 |
| **Caregiver-family characteristics not observed by DHA** | | | | | | |
| Had too little money for food at time at DHA move-in | 4.4665 | 0.4307 | 0.0461 | 0.9599 | 0.6885 | 0.6262 |
| Had difficulty paying all bills at time of DHA move-in | −9.1352 | 0.1041 | 1.5902 | 0.0808 | −2.2443 | 0.1094 |
| Frequency drinking alcohol since becoming a parent | −0.2056 | 0.9211 | 0.4408 | 0.1903 | −0.9359 | 0.0712 |
| Frequency smoking marijuana since becoming a parent | 0.1440 | 0.9487 | −0.1005 | 0.7818 | 0.5174 | 0.3545 |
| Frequency using other drugs since becoming a parent | −3.1725 | 0.3556 | −0.7525 | 0.1763 | 0.1114 | 0.8965 |
| Ever seen psychiatrist | −2.7823 | 0.6292 | −2.2937* | 0.0142 | −0.0092 | 0.9949 |
| Ever lived in public housing | 0.3805 | 0.5029 | 0.0174 | 0.8500 | 0.0176 | 0.9011 |
| Ever lived in owner-occupied house | 0.2882 | 0.4198 | −0.0084 | 0.8840 | 0.1076 | 0.2273 |
| Father always lived in household with child(ren) | −11.3981 | 0.1071 | −0.7946 | 0.4876 | −3.0255 | 0.0865 |
| All children share same biological father | 0.7790 | 0.8835 | 1.2157 | 0.1586 | 0.0422 | 0.9746 |
| CESD depression scale | 0.2289 | 0.4203 | 0.0591 | 0.1990 | −0.0355 | 0.6159 |
| Parenting efficacy scale | −0.9228 | 0.2546 | 0.1272 | 0.3323 | −0.1625 | 0.4212 |
| Parenting beliefs scale | 0.3170 | 0.6536 | 0.1689 | 0.1403 | −0.2279 | 0.1963 |
| Constant | 213.0636*** | 0.0000 | 10.5699* | 0.0114 | 14.6348* | 0.0228 |
| $R^2$ | 0.1082 | | 0.0884 | | 0.1700 | |
| *F* test | 2.2845 | | 1.8254 | | 3.8565 | |
| *p* value | 0.0002 | | 0.0058 | | 0.0000 | |
| *F* test′ | 2.2800 | | 1.8300 | | 3.8600 | |
| *p* value | 0.0002 | | 0.0058 | | 0.0000 | |
| *F* test″ | 0.7100 | | 1.4900 | | 1.0900 | |
| *p* value | 0.7571 | | 0.1157 | | 0.3689 | |
| N=576 households | | | | | | |

*Source:* Authors' calculations.

*Notes: F* test′ based on variables listed as "observed caregiver characteristics not used for DHA assignment" and "caregiver-family characteristics not observed by DHA."

*F* test″ based on variables listed as "caregiver-family characteristics not observed by DHA."

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

| % Units Built Pre–1940 | | % Moved Prior Year | | Occup. Prestige | | Property Crime Rate | | Violent Crime Rate | |
|---|---|---|---|---|---|---|---|---|---|
| Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| 4.3903 | 0.0840 | 0.4278 | 0.6824 | 0.1283 | 0.7557 | −8.4113 | 0.2460 | −1.4556 | 0.2425 |
| 0.3316 | 0.8554 | −1.6398* | 0.0291 | 0.2682 | 0.3645 | −13.1295* | 0.0118 | −2.1009* | 0.0189 |
| −1.2345 | 0.7237 | 1.0968 | 0.4459 | −1.4512* | 0.0107 | 0.6564 | 0.9475 | 1.7253 | 0.3139 |
| −0.4094 | 0.8353 | −0.1515 | 0.8518 | 0.1831 | 0.5670 | −4.8932 | 0.3842 | −0.3378 | 0.7265 |
| 6.0388 | 0.0830 | 3.0050* | 0.0364 | −1.0377 | 0.0668 | 5.2182 | 0.5994 | 3.0159 | 0.0776 |
| −0.5899 | 0.0865 | −0.3527* | 0.0130 | 0.2067*** | 0.0002 | −1.2583 | 0.2001 | −0.4303* | 0.0109 |
| 1.5624 | 0.3996 | 1.5864* | 0.0382 | −0.8063** | 0.0076 | 15.5302** | 0.0035 | 1.8963* | 0.0375 |
| 1.7102 | 0.3711 | −1.3062 | 0.0976 | 0.0908 | 0.7699 | −0.3177 | 0.9536 | −0.2854 | 0.7608 |
| 0.7935 | 0.6447 | −0.3739 | 0.5980 | 0.7627** | 0.0066 | 2.9943 | 0.5424 | 0.4709 | 0.5770 |
| 2.4224 | 0.1820 | −0.7024 | 0.3473 | 0.4972 | 0.0919 | −1.4022 | 0.7866 | −0.7122 | 0.4235 |
| −1.3759 | 0.6409 | −1.7854 | 0.1422 | −0.2258 | 0.6376 | −5.3223 | 0.5276 | 0.4458 | 0.7580 |
| 4.6304 | 0.2824 | −1.8254 | 0.3037 | 0.4430 | 0.5265 | 0.3679 | 0.9761 | −0.2764 | 0.8959 |
| −0.0674 | 0.4497 | −0.0774* | 0.0355 | 0.0239 | 0.1000 | −0.4737 | 0.0632 | −0.0677 | 0.1221 |
| 2.8302 | 0.0792 | 1.5651* | 0.0186 | 0.3148 | 0.2291 | 15.9971*** | 0.0005 | 4.6105*** | 0.0000 |
| 1.8915 | 0.2697 | −0.0465 | 0.9475 | −0.1961 | 0.4812 | 3.7359 | 0.4451 | −1.3924 | 0.0978 |
| −3.6308 | 0.1710 | 1.1814 | 0.2794 | −0.3089 | 0.4732 | −8.2299 | 0.2770 | −0.8420 | 0.5172 |
| 1.3399 | 0.4333 | 1.1050 | 0.1171 | −0.3799 | 0.1717 | 7.6855 | 0.1158 | 1.3214 | 0.1155 |
| −0.3657 | 0.8291 | 0.5504 | 0.4304 | 0.6645* | 0.0160 | −12.3970* | 0.0106 | −1.5869 | 0.0565 |
| 0.0629 | 0.9200 | −0.0063 | 0.9806 | −0.1587 | 0.1193 | −1.1144 | 0.5333 | −0.2580 | 0.4012 |
| −0.4993 | 0.4599 | 0.1089 | 0.6955 | −0.1512 | 0.1686 | −0.7121 | 0.7121 | 0.3598 | 0.2778 |
| 0.8451 | 0.4146 | −0.6033 | 0.1577 | −0.1098 | 0.5143 | 0.6483 | 0.8265 | −0.3806 | 0.4538 |
| 0.0977 | 0.9552 | −0.6641 | 0.3539 | 0.1966 | 0.4864 | −4.2869 | 0.3879 | −0.6084 | 0.4755 |
| 0.0078 | 0.9635 | 0.1167 | 0.0987 | −0.0433 | 0.1204 | 0.2866 | 0.5581 | 0.0597 | 0.4775 |
| −0.0844 | 0.4337 | 0.0296 | 0.5051 | −0.0484** | 0.0059 | 0.1539 | 0.6170 | 0.0563 | 0.2866 |
| −1.3759 | 0.5187 | −0.3611 | 0.6810 | 0.5513 | 0.1118 | −10.6727 | 0.0800 | −1.7662 | 0.0916 |
| 0.3819 | 0.8119 | 0.5339 | 0.4194 | 0.1225 | 0.6385 | −4.9666 | 0.2786 | −0.3739 | 0.6347 |
| 0.0758 | 0.3763 | 0.0200 | 0.5716 | −0.0049 | 0.7247 | 0.0731 | 0.7650 | 0.0152 | 0.7167 |
| 0.3127 | 0.2008 | −0.1729 | 0.0863 | −0.0016 | 0.9681 | −0.7727 | 0.2682 | −0.0854 | 0.4759 |
| −0.2344 | 0.2717 | 0.1033 | 0.2397 | −0.0400 | 0.2485 | −0.2944 | 0.6286 | −0.0289 | 0.7822 |
| 26.4738*** | 0.0007 | 33.3296*** | 0.0000 | 35.1429*** | 0.0000 | 136.9434*** | 0.0000 | 18.5677*** | 0.0000 |
| 0.0524 | | 0.0839 | | 0.1732 | | 0.1063 | | 0.1298 | |
| 1.0417 | | 1.7254 | | 3.9446 | | 2.2403 | | 2.8073 | |
| 0.4079 | | 0.0114 | | 0.0000 | | 0.0003 | | 0.0000 | |
| 1.0400 | | 1.7300 | | 3.9400 | | 2.2400 | | 2.8100 | |
| 0.4079 | | 0.0114 | | 0.0000 | | 0.0003 | | 0.0000 | |
| 0.4300 | | 1.1200 | | 2.1900 | | 1.1300 | | 0.9500 | |
| 0.9592 | | 0.3363 | | 0.0091 | | 0.3332 | | 0.5014 | |

**Table A2.** Relationships Between DHA Resident and Offered Neighborhood Characteristics, African American Subsample

| | Social Vulnerability | | % Foreign Born | | % African American | |
|---|---|---|---|---|---|---|
| | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| **Observed caregiver characteristics used for DHA assignment** | | | | | | |
| Disabled | −16.5307 | 0.1609 | 1.7151 | 0.3839 | −2.1186 | 0.5886 |
| Number of bedrooms eligible for three | −11.8797 | 0.1801 | −2.2010 | 0.1378 | 4.7088 | 0.1107 |
| Number of bedrooms eligible for four | 33.7791* | 0.0453 | −2.3066 | 0.4120 | −5.4033 | 0.3342 |
| **Observed caregiver characteristics not used for DHA assignment** | | | | | | |
| Not married | −8.5925 | 0.3960 | −0.1345 | 0.9366 | 4.4906 | 0.1831 |
| Employed at time of DHA move-in | 2.6748 | 0.8768 | −1.2746 | 0.6588 | −0.2060 | 0.9714 |
| Hourly wage | −2.4384 | 0.1391 | 0.0949 | 0.7301 | 0.4306 | 0.4317 |
| Receiving welfare at time of DHA move-in | 5.3271 | 0.5591 | −2.8763 | 0.0602 | −1.4139 | 0.6413 |
| Receiving food stamps at time of DHA move-in | −4.1395 | 0.6610 | 1.6877 | 0.2856 | 1.9086 | 0.5436 |
| Had a checking account at time of DHA move-in | −3.7498 | 0.6569 | −1.6499 | 0.2433 | 3.4643 | 0.2183 |
| Had health insurance at time of DHA move-in | −12.8891 | 0.1537 | 0.5803 | 0.7004 | −4.1114 | 0.1714 |
| Born in United States | −0.2532 | 0.9852 | 0.3277 | 0.8861 | 4.9926 | 0.2733 |
| Age at time of DHA move-in | −0.7993 | 0.0689 | 0.0697 | 0.3416 | 0.1847 | 0.2057 |
| High school diploma at time of DHA move-in | −11.3109 | 0.1598 | 1.9720 | 0.1429 | −1.1034 | 0.6797 |
| Higher education at time of DHA move-in | 5.3309 | 0.6581 | 1.1702 | 0.5614 | 0.8062 | 0.8406 |
| **Caregiver-family characteristics not observed by DHA** | | | | | | |
| Had too little money for food at time at DHA move-in | −11.9466 | 0.1580 | 0.3821 | 0.7868 | 1.5327 | 0.5856 |
| Had difficulty paying all bills at time of DHA move-in | 2.7109 | 0.7388 | 2.4246 | 0.0756 | −5.3046 | 0.0509 |
| Frequency drinking alcohol since becoming a parent | −1.1718 | 0.6648 | 0.4032 | 0.3731 | −1.2255 | 0.1741 |
| Frequency smoking marijuana since becoming a parent | 2.2313 | 0.4018 | −0.0983 | 0.8252 | 0.9982 | 0.2601 |
| Frequency using other drugs since becoming a parent | −4.5224 | 0.3164 | −0.2199 | 0.7706 | −0.0140 | 0.9925 |
| Ever seen psychiatrist | −6.4189 | 0.4396 | −2.2943 | 0.0994 | 0.6635 | 0.8102 |
| Ever lived in public housing | −0.6897 | 0.4002 | 0.0045 | 0.9741 | 0.0398 | 0.8838 |
| Ever lived in owner-occupied house | 0.3988 | 0.4435 | −0.0418 | 0.6308 | 0.1352 | 0.4349 |
| Father always lived in household with child(ren) | −19.3218 | 0.0590 | −0.3283 | 0.8473 | −5.2695 | 0.1213 |
| All children share same biological father | 4.3872 | 0.5930 | −0.1443 | 0.9163 | −0.4311 | 0.8745 |
| CESD depression scale | 0.5852 | 0.1530 | 0.0092 | 0.8927 | −0.0441 | 0.7458 |
| Parenting efficacy scale | −0.3432 | 0.7795 | 0.0127 | 0.9507 | −0.0666 | 0.8704 |
| Parenting beliefs scale | 0.7286 | 0.4546 | 0.1304 | 0.4238 | −0.3802 | 0.2415 |
| Constant | 227.2691*** | 0.0000 | 13.1581* | 0.0430 | 16.2848 | 0.2068 |
| $R^2$ | 0.1610 | | 0.0970 | | 0.1273 | |
| *F* test | 1.6420 | | 0.9186 | | 1.2479 | |
| *p* value | 0.0281 | | 0.5851 | | 0.1932 | |
| *F* test′ | 1.6400 | | 0.9200 | | 1.2500 | |
| *p* value | 0.0281 | | 0.5851 | | 0.1932 | |
| *F* test″ | 1.0000 | | 0.7200 | | 0.9200 | |
| *p* value | 0.4526 | | 0.7431 | | 0.5358 | |
| N=259 households | | | | | | |

*Source:* Authors' calculations.

*Notes: F* test′ based on variables listed as "observed caregiver characteristics not used for DHA assignment" and "caregiver-family characteristics not observed by DHA."

*F* test″ based on variables listed as "caregiver-family characteristics not observed by DHA."

* $p < .05$; ** $p < 0.01$; *** $p < 0.001$

| % Units Built Pre–1940 | | % Moved Prior Year | | Occup. Prestige | | Property Crime Rate | | Violent Crime Rate | |
|---|---|---|---|---|---|---|---|---|---|
| Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| 9.2370* | 0.0204 | 0.6615 | 0.6353 | 0.5583 | 0.3872 | –6.8709 | 0.5190 | –2.0642 | 0.3339 |
| –2.1949 | 0.4612 | –1.3793 | 0.1890 | 0.4292 | 0.3766 | –8.1380 | 0.3100 | –2.1185 | 0.1875 |
| –4.4109 | 0.4356 | 0.9076 | 0.6485 | –1.7615 | 0.0568 | 17.6105 | 0.2475 | 0.3565 | 0.9068 |
| 2.1990 | 0.5185 | –1.8143 | 0.1311 | 0.5301 | 0.3397 | –7.1744 | 0.4336 | 0.9154 | 0.6179 |
| 3.7928 | 0.5138 | 4.5852* | 0.0257 | –1.8183 | 0.0556 | –0.4107 | 0.9790 | 1.8034 | 0.5645 |
| –0.1265 | 0.8192 | –0.6079** | 0.0020 | 0.3064*** | 0.0008 | –1.3888 | 0.3513 | –0.4763 | 0.1112 |
| 1.7583 | 0.5667 | 0.1676 | 0.8767 | –0.5122 | 0.3061 | 4.9438 | 0.5493 | 1.2837 | 0.4378 |
| 0.6091 | 0.8479 | –1.8380 | 0.1013 | –0.2382 | 0.6455 | 0.8714 | 0.9188 | –0.5976 | 0.7270 |
| 0.3710 | 0.8961 | –1.8512 | 0.0652 | 0.6250 | 0.1778 | 8.7737 | 0.2515 | 0.8714 | 0.5694 |
| 2.0641 | 0.4965 | –0.9200 | 0.3895 | 0.5108 | 0.3020 | –10.7041 | 0.1904 | –1.8074 | 0.2696 |
| –4.6401 | 0.3140 | –1.8607 | 0.2516 | –0.9155 | 0.2230 | 1.0558 | 0.9320 | 0.7951 | 0.7486 |
| –0.0278 | 0.8502 | –0.1316* | 0.0118 | 0.0277 | 0.2493 | –0.8754* | 0.0280 | –0.0495 | 0.5334 |
| 1.3853 | 0.6083 | –1.2263 | 0.1982 | –0.1518 | 0.7303 | –7.3303 | 0.3137 | –2.3580 | 0.1064 |
| –1.5219 | 0.7073 | 1.2532 | 0.3802 | –0.4687 | 0.4782 | –2.2067 | 0.8396 | –0.9769 | 0.6548 |
| 5.5116 | 0.0534 | –0.3139 | 0.7538 | 0.2650 | 0.5673 | 4.4287 | 0.5625 | 1.9245 | 0.2097 |
| –5.3720 | 0.0506 | 1.6787 | 0.0825 | 0.2390 | 0.5921 | –14.1381 | 0.0557 | –2.5178 | 0.0888 |
| 0.7407 | 0.4161 | –0.2733 | 0.3942 | –0.0375 | 0.8001 | –1.0472 | 0.6689 | –0.5268 | 0.2834 |
| –1.2626 | 0.1593 | 0.2061 | 0.5133 | –0.2294 | 0.1167 | 0.1534 | 0.9492 | 0.4912 | 0.3091 |
| 0.4904 | 0.7466 | –1.0601* | 0.0482 | –0.1561 | 0.5281 | –0.2417 | 0.9528 | –0.2171 | 0.7906 |
| –0.4526 | 0.8713 | –0.2568 | 0.7941 | 0.4580 | 0.3149 | –14.5821 | 0.0532 | –0.9572 | 0.5251 |
| 0.3042 | 0.2705 | –0.0405 | 0.6763 | –0.0123 | 0.7844 | –0.4109 | 0.5796 | 0.1324 | 0.3735 |
| 0.0174 | 0.9209 | –0.0094 | 0.8782 | –0.0554 | 0.0530 | 0.3863 | 0.4121 | 0.1037 | 0.2724 |
| –4.4309 | 0.1973 | –2.6489* | 0.0291 | 0.5213 | 0.3515 | –16.7525 | 0.0704 | –2.0959 | 0.2576 |
| –0.8951 | 0.7459 | 1.3245 | 0.1740 | 0.3033 | 0.5005 | –6.3351 | 0.3941 | –0.4218 | 0.7768 |
| 0.0438 | 0.7504 | 0.0416 | 0.3906 | –0.0029 | 0.8965 | 0.6094 | 0.1004 | 0.0436 | 0.5561 |
| 0.1668 | 0.6860 | –0.2396 | 0.1001 | 0.0458 | 0.4963 | –0.4324 | 0.6968 | 0.0431 | 0.8463 |
| –0.1621 | 0.6210 | 0.0545 | 0.6366 | 0.0016 | 0.9763 | –0.1240 | 0.8881 | –0.1809 | 0.3063 |
| 30.7572* | 0.0189 | 43.3677*** | 0.0000 | 33.6352*** | 0.0000 | 166.1123*** | 0.0000 | 24.5571*** | 0.0006 |
| 0.0794 | | 0.1994 | | 0.2185 | | 0.1266 | | 0.1034 | |
| 0.7376 | | 2.1309 | | 2.3920 | | 1.2401 | | 0.9866 | |
| 0.8257 | | 0.0015 | | 0.0003 | | 0.1996 | | 0.4883 | |
| 0.7400 | | 2.1300 | | 2.3900 | | 1.2400 | | 0.9900 | |
| 0.8257 | | 0.0015 | | 0.0003 | | 0.1996 | | 0.4883 | |
| 0.7900 | | 1.6500 | | 1.1100 | | 1.2000 | | 0.8000 | |
| 0.6677 | | 0.0719 | | 0.3521 | | 0.2779 | | 0.6576 | |

**Table A3.** Relationships Between DHA Resident and Offered Neighborhood Characteristics, Latino Subsample

| | Social Vulnerability | | % Foreign Born | | % African American | |
|---|---|---|---|---|---|---|
| | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| **Observed caregiver characteristics used for DHA assignment** | | | | | | |
| Disabled | −5.8184 | 0.6414 | 1.8870 | 0.3460 | 2.3759 | 0.2451 |
| Number of bedrooms eligible for three | −23.7068** | 0.0064 | 1.5351 | 0.2677 | 0.2721 | 0.8472 |
| Number of bedrooms eligible for four | 5.9880 | 0.7173 | 3.7916 | 0.1531 | 8.5948** | 0.0016 |
| **Observed caregiver characteristics not used for DHA assignment** | | | | | | |
| Not married | 8.3353 | 0.3530 | 0.7505 | 0.6014 | 0.6258 | 0.6695 |
| Employed at time of DHA move-in | 12.3528 | 0.4530 | 0.1215 | 0.9632 | 0.7667 | 0.7756 |
| Hourly wage | −1.7890 | 0.2826 | −0.1919 | 0.4717 | −0.0081 | 0.9762 |
| Receiving welfare at time of DHA move-in | 23.3654** | 0.0079 | −4.4738** | 0.0015 | 1.6032 | 0.2626 |
| Receiving food stamps at time of DHA move-in | −4.7942 | 0.5868 | 1.5199 | 0.2825 | −0.1849 | 0.8980 |
| Had a checking account at time of DHA move-in | 4.7637 | 0.5540 | −1.0435 | 0.4185 | 2.0107 | 0.1272 |
| Had health insurance at time of DHA move-in | 3.7506 | 0.6534 | −0.7858 | 0.5570 | −0.1573 | 0.9083 |
| Born in United States | −18.9955 | 0.1855 | 1.5200 | 0.5079 | −0.7684 | 0.7429 |
| Spanish language interview completed | −19.6426 | 0.2604 | −1.2195 | 0.6624 | −3.5100 | 0.2188 |
| Age at time of DHA move-in | −0.5477 | 0.1931 | 0.0054 | 0.9363 | −0.1609* | 0.0197 |
| High school diploma at time of DHA move-in | 10.4278 | 0.2031 | −1.6450 | 0.2101 | −0.4258 | 0.7503 |
| Higher education at time of DHA move-in | −7.4198 | 0.5828 | 6.2377** | 0.0042 | −3.1085 | 0.1598 |
| **Caregiver-family characteristics not observed by DHA** | | | | | | |
| Had too little money for food at time at DHA move-in | 12.7347 | 0.1120 | 0.1893 | 0.8825 | 0.1502 | 0.9085 |
| Had difficulty paying all bills at time of DHA move-in | −16.6751* | 0.0396 | 0.9923 | 0.4431 | −0.2664 | 0.8400 |
| Frequency drinking alcohol since becoming a parent | 1.8991 | 0.5837 | 0.4648 | 0.4026 | −0.6423 | 0.2573 |
| Frequency smoking marijuana since becoming a parent | −2.3576 | 0.5878 | −0.4499 | 0.5186 | −0.0424 | 0.9524 |
| Frequency using other drugs since becoming a parent | −2.7444 | 0.6290 | −0.9057 | 0.3198 | 0.4718 | 0.6114 |
| Ever seen psychiatrist | 4.7386 | 0.5751 | −2.6909* | 0.0476 | −1.8324 | 0.1854 |
| Ever lived in public housing | 0.9888 | 0.2345 | 0.0504 | 0.7051 | −0.0614 | 0.6513 |
| Ever lived in owner-occupied house | 0.2867 | 0.5797 | 0.0139 | 0.8668 | 0.0311 | 0.7136 |
| Father always lived in household with child(ren) | 0.0185 | 0.9985 | −1.5976 | 0.3229 | −0.5927 | 0.7191 |
| All children share same biological father | −2.5571 | 0.7245 | 2.1622 | 0.0636 | 0.2721 | 0.8185 |
| CESD depression scale | −0.0785 | 0.8485 | 0.1210 | 0.0668 | −0.0129 | 0.8481 |
| Parenting efficacy scale | −1.1420 | 0.3084 | 0.1471 | 0.4127 | −0.0854 | 0.6411 |
| Parenting beliefs scale | −0.1294 | 0.9026 | 0.2155 | 0.2040 | −0.0656 | 0.7042 |
| Constant | 205.1510*** | 0.0000 | 9.5790 | 0.0987 | 16.8546** | 0.0046 |
| $R^2$ | 0.1339 | | 0.1379 | | 0.0975 | |
| *F* test | 1.5906 | | 1.6454 | | 1.1113 | |
| *p* value | 0.0330 | | 0.0241 | | 0.3234 | |
| *F* test′ | 1.5900 | | 1.6500 | | 1.1100 | |
| *p* value | 0.0330 | | 0.0241 | | 0.3234 | |
| *F* test″ | 0.6700 | | 1.2100 | | 0.4000 | |
| *p* value | 0.7894 | | 0.2682 | | 0.9708 | |
| N=317 households | | | | | | |

Source: Author's calculations.

Notes: *F* test′ based on variables listed as "observed caregiver characteristics not used for DHA assignment" and "caregiver-family characteristics not observed by DHA."

*F* test″ based on variables listed as "caregiver-family characteristics not observed by DHA."

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$

| % Units Built Pre–1940 | | % Moved In Prior Year | | Occup. Prestige | | Property Crime Rate | | Violent Crime Rate | |
|---|---|---|---|---|---|---|---|---|---|
| Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value | Coefficient | *p* value |
| −0.4502 | 0.8959 | 0.3339 | 0.8322 | −0.0877 | 0.8768 | −15.4185 | 0.1344 | −1.6817 | 0.2737 |
| 1.7691 | 0.4571 | −1.4448 | 0.1855 | 0.0855 | 0.8270 | −18.9716** | 0.0080 | −2.3218* | 0.0294 |
| 2.4442 | 0.5915 | 1.0476 | 0.6157 | −1.2083 | 0.1075 | −10.4417 | 0.4432 | 2.8824 | 0.1568 |
| −2.4954 | 0.3126 | 1.2581 | 0.2667 | −0.1352 | 0.7394 | 2.0173 | 0.7846 | −0.7143 | 0.5170 |
| 9.6523* | 0.0338 | 2.0870 | 0.3152 | −0.2238 | 0.7640 | 8.3531 | 0.5375 | 3.0368 | 0.1338 |
| −1.0810* | 0.0188 | −0.1988 | 0.3439 | 0.1120 | 0.1381 | −1.0394 | 0.4479 | −0.2946 | 0.1502 |
| 3.1000 | 0.1985 | 2.8812** | 0.0094 | −0.8794* | 0.0271 | 23.9034** | 0.0010 | 3.1783** | 0.0033 |
| 2.4764 | 0.3082 | −1.0096 | 0.3646 | 0.3401 | 0.3950 | −0.0990 | 0.9891 | −0.3682 | 0.7341 |
| 1.4939 | 0.5003 | 0.9920 | 0.3289 | 0.8271* | 0.0239 | 3.1186 | 0.6378 | 0.4605 | 0.6415 |
| 1.5749 | 0.4935 | 0.0894 | 0.9324 | 0.2729 | 0.4708 | 9.1788 | 0.1824 | 0.0599 | 0.9534 |
| 1.6458 | 0.6765 | −2.2479 | 0.2142 | 0.4653 | 0.4736 | −12.3510 | 0.2953 | −0.0525 | 0.9762 |
| 7.0191 | 0.1444 | −2.0726 | 0.3465 | 0.8957 | 0.2573 | 0.3554 | 0.9802 | 0.1693 | 0.9370 |
| −0.1163 | 0.3154 | −0.0320 | 0.5460 | 0.0257 | 0.1770 | −0.0884 | 0.7983 | −0.0769 | 0.1372 |
| 2.8906 | 0.2001 | 1.2061 | 0.2433 | −0.2556 | 0.4907 | 15.6148* | 0.0210 | −0.4633 | 0.6450 |
| −8.4990* | 0.0229 | 0.7687 | 0.6519 | −0.2248 | 0.7133 | −21.1616 | 0.0577 | −2.0401 | 0.2195 |
| −0.5290 | 0.8101 | 1.7401 | 0.0853 | −0.7566* | 0.0374 | 6.3155 | 0.3375 | 0.8047 | 0.4130 |
| 3.1297 | 0.1598 | −0.0765 | 0.9401 | 1.0743** | 0.0035 | −11.1153 | 0.0951 | −1.1199 | 0.2594 |
| −0.8081 | 0.3972 | 0.5121 | 0.2420 | −0.3138* | 0.0463 | 0.7588 | 0.7902 | 0.1137 | 0.7894 |
| 0.8591 | 0.4733 | −0.4362 | 0.4268 | 0.0401 | 0.8386 | −2.4248 | 0.4983 | −0.0385 | 0.9426 |
| 0.7204 | 0.6450 | −0.0550 | 0.9388 | −0.1094 | 0.6707 | 0.2264 | 0.9614 | −0.4980 | 0.4757 |
| 0.4117 | 0.8596 | −0.2186 | 0.8376 | −0.1722 | 0.6529 | 8.9078 | 0.2010 | −0.0299 | 0.9770 |
| −0.2737 | 0.2320 | 0.2222* | 0.0347 | −0.0507 | 0.1786 | 0.5677 | 0.4067 | −0.0328 | 0.7481 |
| −0.1945 | 0.1730 | 0.0811 | 0.2149 | −0.0451 | 0.0552 | 0.0272 | 0.9491 | 0.0157 | 0.8052 |
| 0.6157 | 0.8244 | 1.9359 | 0.1287 | 0.3687 | 0.4197 | −2.4811 | 0.7649 | −1.2950 | 0.2962 |
| 1.5011 | 0.4525 | 0.0742 | 0.9354 | 0.0577 | 0.8607 | −4.5208 | 0.4492 | −0.2585 | 0.7718 |
| 0.0993 | 0.3804 | −0.0175 | 0.7360 | −0.0064 | 0.7321 | −0.5056 | 0.1356 | −0.0018 | 0.9709 |
| 0.5229 | 0.0908 | −0.1319 | 0.3512 | −0.0274 | 0.5900 | −0.6860 | 0.4571 | −0.1351 | 0.3266 |
| −0.3706 | 0.2038 | 0.1281 | 0.3376 | −0.0877 | 0.0681 | −0.5270 | 0.5451 | 0.0746 | 0.5661 |
| 25.3125* | 0.0114 | 26.9287*** | 0.0000 | 36.4559*** | 0.0000 | 115.9573*** | 0.0001 | 16.5494*** | 0.0002 |
| 0.1104 | | 0.0998 | | 0.1744 | | 0.1582 | | 0.1173 | |
| 1.2760 | | 1.1409 | | 2.1728 | | 1.9334 | | 1.3669 | |
| 0.1649 | | 0.2895 | | 0.0008 | | 0.0041 | | 0.1077 | |
| 1.2800 | | 1.1400 | | 2.1700 | | 1.9300 | | 1.3700 | |
| 0.1649 | | 0.2895 | | 0.0008 | | 0.0041 | | 0.1077 | |
| 0.7600 | | 1.0700 | | 1.8400 | | 0.6900 | | 0.3700 | |
| 0.7023 | | 0.3825 | | 0.0367 | | 0.7768 | | 0.9790 | |

households to their DHA units. As a comparative benchmark for these correlations, we conduct Monte Carlo simulations in which each sample household was randomly assigned to one of the DHA units (for the appropriate family size) with its associated bundle of neighborhood characteristics that we observed for the year corresponding to when the initial assignment of household in our study actually occurred.[9] After all households were randomly assigned during each iteration, we calculate correlations for all pairwise combinations of caregiver and neighborhood characteristics. We use ten thousand repetitions of these simulations to produce distributions for all such pairwise correlations and their associated bootstrapped standard errors. This allows us to estimate: a 95 percent confidence interval for each correlation; and how many significantly different pairwise correlations among all the permutations would be expected by chance when produced by a random assignment process.

The results are presented in table A4. Caregiver characteristics are listed in rows and the three family-size strata in columns. The cells show for how many of the possible neighborhood characteristics the initial DHA assignment produced an actual correlation with the given caregiver characteristic that was significantly different from zero at the 5 percent level (two-tailed test); the actual correlation coefficient and the neighborhood characteristic involved are reported in these cases. The exhibit shows that for families with no or one child and families with two children, only eight (5 percent of possible correlations) were statistically different from zero; the corresponding figure for families with three or more children was twelve (8 percent of possible correlations). Our simulations show that in more than 98 percent and 95 percent of the cases, respectively, a larger number of statistically significant correlations were produced by random assignment. This strongly indicates that the relatively rare nonzero correlations we observe from initial DHA allocations of tenants to neighborhoods (table A1) are consistent with those that would have been generated by a process of random assignment. These results suggest that the DHA natural experiment likely removed the correlation between any unobserved caregiver characteristics (which we cannot control in our Denver study) that may potentially affect both initial DHA neighborhood characteristics and subsequent youth outcomes.

## Conclusions

Natural experiments involving residential placements under the auspices of some public program offer potentially powerful vehicles for measuring neighborhood effects because they can rupture the association between unobserved characteristics of the individuals being studied and characteristics of their neighborhood. We investigate in this appendix the extent to which a natural experiment involving public housing in Denver offers such potential.

Our analysis of the Denver Housing Authority's dwelling allocation procedures reveals room for tenant self-selection or DHA staff selection to enter. We find that, *conditioned on ethnicity*, the DHA allocation process produced a quasi-random initial offer of neighborhood characteristics. The empirical implication is that our models estimating neighborhood effects using the current data must control for ethnicity to avoid geographic selection bias. We, in fact, do so in all analyses we conduct.

Even more importantly, two complementary analyses indicate that the DHA allocation process produced a quasi-random assignment across neighborhood conditions in terms of individual characteristics not observable by the DHA (but observable to us from our survey data). This gives us confidence that any additional household characteristics we do not observe in our study are similarly quasi-randomly allocated across neighborhood characteristics. In other words, we are confident that the DHA dwelling allocation process sufficiently limited the possibility that some characteristics of the caregiver we cannot observe are so strongly correlated with both youths' outcomes and the neighborhood in which they resided that it would confound our causal interpretation of neighborhood effects.

9. The programming and execution of these simulations was conducted by Dr. Albert Anderson of Public Data Queries Inc., whose contribution we gratefully acknowledge.

**Table A4.** Number of Statistically Significant Correlations Between Neighborhood Characteristics and Typically Unobserved Household Characteristics

| Household Characteristic | Families with No or One Child | Families with Two Children | Families with Three or More Children |
|---|---|---|---|
| Ever not enough food for family while residing in this location | 0 | 1 (%African American=.14) | 0 |
| Ever unable to pay all bills while residing in this location | 2 (%foreign-born = .13; %vacant = −.16) | 2 (%elem. school ed. = −.17; %vacant = −.14) | 1 (%vacant = −.12) |
| Frequency of alcohol use since becoming a parent | 2 (%unemployed = −.16; %owner =.13) | 0 | 1 (%African American = −.09) |
| Frequency of marijuana use since becoming a parent | 1 (%African American = .17) | 0 | 0 |
| Frequency of drug use since becoming a parent | 1 (%African American = .13) | 0 | 0 |
| Ever seen psychologist, psychiatrist, or counselor | 0 | 0 | 0 |
| Did your parents ever live in public housing when you were growing up? | 1 (%female heads = .22) | 0 | 1 (%foreign born = −.18) |
| Did your parents ever own their home when you were growing up? | 0 | 3 (%elem. school = .26; %college = −.26; %own = .20) | 0 |
| Born in United States | 1 (%college = −.16;) | 0 | 0 |
| Primary language is Spanish | 0 | 0 | 0 |
| Father of child always lived at home while child growing up | 0 | 0 | 5 (%female heads = −.11; %elementary school = −.10; %poor = −.10; %own = .09; %pre−1940 homes= −.12) |
| Parental depression (CESD) scale | 0 | 1 (%Latino = .13) | 2 (%elem. school = .13; %Latino=.13) |
| Parental self-efficacy scale | 0 | 0 | 0 |
| Parental beliefs & practices scale | 0 | 1 (%Latino = −.21) | 2 (%college = −.09; %African American = −.12) |

*Source:* Authors' calculations based on Monte Carlo simulations of Denver Child Study survey data.

*Note:* Number of statistically significant household-neighborhood characteristic correlations actually observed are shown, with the corresponding neighborhood indicators and pairwise correlations shown parenthetically.

## APPENDIX B

**Table B1.** First Stage Regression Results for Neighborhood Conditions at Time of First Occurrence of Running Away from Home

| | Dependent Variables: Neighborhood Conditions at Time of Initiation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Social Vulnerability | | % African American | | Occupational Prestige | | % Foreign Born | | Violent Crime Rate | | Property Crime Rate | |
| Exogenous Predictors | b | SE | b | SE | b | SE | b | SE | b | SE | b | SE |
| **Covariates at time of first offer** | | | | | | | | | | | | |
| Female (omitted=male) | 2.436 | −2.901 | 1.028 | −0.918 | −0.398* | −0.189 | 0.732 | −0.802 | 0.368 | −0.364 | 1.418 | −1.78 |
| Number of siblings in household | −1.825 | −2.427 | 0.655 | −0.672 | −0.053 | −0.124 | 0.615 | −0.51 | −0.39 | −0.289 | −0.924 | −1.132 |
| Caregiver age | 0.443 | −0.464 | −0.059 | −0.079 | −0.027 | −0.02 | −0.121 | −0.078 | 0.072 | −0.057 | 0.406* | −0.171 |
| Caregiver has high school diploma or higher | −9.778 | −5.179 | 2.541 | −1.652 | 0.453 | −0.317 | −1.072 | −1.281 | −0.699 | −0.628 | −3.848 | −2.632 |
| Natural log of household income | −0.177 | −0.586 | 0.005 | −0.158 | 0.019 | −0.034 | 0.058 | −0.138 | −0.031 | −0.072 | 0.054 | −0.274 |
| Household economic stressor index | −2.676 | −2.321 | 0.323 | −0.713 | 0.162 | −0.14 | −0.588 | −0.578 | −0.289 | −0.273 | −1.089 | −1.197 |
| Number of moves from birth to time of first offer | 1.805 | −0.951 | 0.107 | −0.269 | −0.051 | −0.064 | −0.348 | −0.289 | 0.069 | −0.108 | 1.302* | −0.595 |
| **Timing of DHA first offer (omitted=pre-1990)** | | | | | | | | | | | | |
| Offer 1990–1991 | −9.011 | −9.793 | −0.945 | −3.372 | 0.441 | −0.624 | 3.729 | −2.547 | −1.884 | −1.327 | −1.822 | −6.813 |
| Offer 1992–1993 | −15.856 | −11.03 | −1.322 | −3.914 | 0.457 | −0.702 | 3.505 | −3.504 | −1.823 | −1.455 | −5.461 | −5.801 |
| Offer 1994–1995 | 8.487 | −12.756 | −1.28 | −3.095 | −0.273 | −0.717 | 2.117 | −2.562 | 1.051 | −1.623 | 0.83 | −5.034 |
| Offer 1996–1997 | 21.49 | −13.057 | −1.366 | −3.278 | −0.537 | −0.8 | 1.188 | −3.021 | 2.507 | −1.717 | 5.17 | −5.786 |
| Offer 1998–1999 | 13.548 | −13.79 | −1.697 | −3.185 | −0.831 | −0.751 | 2.712 | −2.988 | 1.963 | −1.763 | 1.315 | −5.664 |
| Offer 2000–2001 | 9.67 | −13.652 | −3.13 | −3.297 | −0.809 | −0.784 | 2.182 | −2.922 | 1.719 | −1.715 | −0.305 | −5.868 |
| Offer 2002–2003 | 32.635* | −13.824 | 1.917 | −3.568 | −0.608 | −0.788 | −2.47 | −3.35 | 3.562* | −1.811 | 6.928 | −6.592 |
| Offer 2004–2005 | 14.234 | −21.581 | −2.454 | −3.78 | 0.631 | −1.055 | −1.014 | −3.985 | 1.642 | −2.487 | 8.381 | −8.918 |
| **Neighborhood of first offer** | | | | | | | | | | | | |
| Social vulnerability score (range 0–100) | 0.420*** | −0.064 | −0.008 | −0.019 | −0.006 | −0.004 | −0.004 | −0.019 | 0.031*** | −0.009 | 0.051 | −0.037 |
| Percentage African American residents | −24.318 | −12.465 | 48.284*** | −5.48 | 1.495 | −1.114 | 4.548 | −3.602 | −2.639 | −1.568 | −13.574* | −6.636 |
| Occupational prestige score (range 0–100) | −0.308 | −1.466 | 0.158 | −0.317 | 0.515*** | −0.091 | −0.413 | −0.33 | −0.163 | −0.183 | 0.155 | −0.618 |
| Percentage foreign-born residents | −6.714 | −44.858 | 6.707 | −8.916 | −0.14 | −2.359 | 70.774*** | −10.376 | 0.297 | −5.338 | −8.088 | −18.045 |
| Violent crime rate per 1,000 | 0.273 | −0.315 | −0.322* | −0.138 | −0.005 | −0.024 | 0.149 | −0.094 | 0.159** | −0.055 | 0.072 | −0.212 |
| Property crime rate per 1,000 | −0.032 | −0.076 | 0.084*** | −0.022 | 0.008 | −0.004 | −0.013 | −0.018 | 0.001 | −0.01 | 0.175*** | −0.037 |
| Constant | 48.155 | −60.604 | −1.987 | −12.688 | 20.376*** | −3.652 | 31.329* | −13.606 | 7.151 | −7.428 | 7.715 | −24.902 |
| Observations | 1024 | | 1025 | | 1024 | | 1025 | | 927 | | 927 | |
| $R^2$ | 0.244 | | 0.265 | | 0.215 | | 0.228 | | 0.266 | | 0.182 | |

*Source:* Authors' calculations.

*Note:* Standard errors in column 2 for each dependent variable.

All chi-square statistics are significant at the $p < 0.001$ level.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

**Table B2.** First Stage Regression Results for Neighborhood Conditions at Time of Initiation of Aggressive or Violent Behaviors

| | Dependent Variables: Neighborhood Conditions at Time of Initiation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Social Vulnerability | | % African American | | Occupational Prestige | | % Foreign Born | | Violent Crime Rate | | Property Crime Rate | |
| Exogenous Predictors | b | SE | b | SE | b | SE | b | SE | b | SE | b | SE |
| **Covariates at time of first offer** | | | | | | | | | | | | |
| Female (omitted=male) | −0.264 | −3.424 | 0.703 | −0.959 | −0.473* | −0.206 | 1.582 | −0.836 | 0.333 | −0.445 | −0.747 | −2.047 |
| Number of siblings in household | −0.681 | −2.337 | 0.3 | −0.68 | −0.041 | −0.121 | 0.526 | −0.479 | −0.045 | −0.331 | 0.444 | −1.336 |
| Caregiver age | 0.39 | −0.47 | −0.042 | −0.079 | −0.028 | −0.021 | −0.094 | −0.078 | 0.06 | −0.062 | 0.281 | −0.181 |
| Caregiver has high school diploma or higher | −8.281 | −5.301 | 2.962 | −1.73 | 0.341 | −0.323 | −0.908 | −1.284 | −0.522 | −0.671 | −2.991 | −3.005 |
| Natural log of household income | −0.125 | −0.588 | 0.001 | −0.167 | 0.018 | −0.035 | 0.031 | −0.136 | −0.026 | −0.073 | 0.06 | −0.304 |
| Household economic stressor index (range 0–5) | −0.792 | −2.328 | 0.491 | −0.718 | 0.035 | −0.139 | −0.426 | −0.595 | 0.029 | −0.284 | 0.07 | −1.403 |
| Number of moves from birth to time of first offer | 1.905* | −0.946 | 0.264 | −0.265 | −0.031 | −0.065 | −0.478 | −0.288 | 0.028 | −0.119 | 1.468* | −0.626 |
| **Timing of DHA first offer (omitted=pre-1990)** | | | | | | | | | | | | |
| Offer 1990–1991 | −10.459 | −9.45 | −1.347 | −3.372 | 0.481 | −0.607 | 4.151 | −2.463 | −2.682* | −1.284 | −6.825 | −6.957 |
| Offer 1992–1993 | −19.987 | −10.926 | −4.118 | −3.949 | 0.339 | −0.72 | 4.805 | −3.86 | −2.381 | −1.609 | −10.921 | −6.221 |
| Offer 1994–1995 | 7.609 | −11.761 | −1.665 | −3.191 | −0.279 | −0.705 | 2.536 | −2.553 | 0.053 | −1.509 | −0.892 | −5.166 |
| Offer 1996–1997 | 26.337* | −12.513 | −1.983 | −3.198 | −0.95 | −0.744 | 1.125 | −2.995 | 1.65 | −1.56 | 6.344 | −6.798 |
| Offer 1998–1999 | 17.215 | −12.782 | −2.334 | −3.193 | −0.744 | −0.743 | 0.979 | −2.92 | 1.378 | −1.637 | 2.616 | −5.956 |
| Offer 2000–2001 | 13.524 | −12.307 | −4.174 | −3.648 | −0.827 | −0.793 | 2.079 | −2.998 | 0.639 | −1.572 | −2.659 | −5.932 |
| Offer 2002–2003 | 31.250* | −12.858 | 0.094 | −3.71 | −0.363 | −0.786 | −2.47 | −3.409 | 2.257 | −1.693 | 2.839 | −6.775 |
| Offer 2004–2005 | 8.12 | −22.077 | −1.189 | −4.34 | 0.925 | −1.125 | −2.012 | −4.437 | 0.511 | −2.535 | 2.968 | −9.674 |
| **Neighborhood of first offer** | | | | | | | | | | | | |
| Social vulerability score (range 0–100) | 0.462*** | −0.072 | −0.015 | −0.023 | −0.008 | −0.005 | −0.001 | −0.021 | 0.034*** | −0.01 | 0.014 | −0.048 |
| Percentage African American residents | −34.298** | −13.186 | 52.554*** | −5.797 | 1.621 | −1.257 | 4.449 | −3.752 | −3.474* | −1.713 | −15.622 | −8.096 |
| Occupational prestige score (range 0–100) | −0.252 | −1.411 | 0.142 | −0.341 | 0.513*** | −0.088 | −0.428 | −0.331 | −0.085 | −0.181 | 0.639 | −0.657 |
| Percentage foreign-born residents | −9.842 | −43.459 | 15.732 | −9.739 | −0.215 | −2.373 | 72.861*** | −10.43 | 2.742 | −5.255 | 2.522 | −19.991 |
| Violent crime rate per 1,000 | 0.454 | −0.329 | −0.308* | −0.139 | −0.005 | −0.026 | 0.154 | −0.089 | 0.196*** | −0.056 | 0.306 | −0.245 |
| Property crime rate per 1,000 | −0.036 | −0.101 | 0.094** | −0.029 | 0.009 | −0.006 | −0.024 | −0.023 | 0.002 | −0.013 | 0.246*** | −0.06 |
| Constant | 39.002 | −60.219 | −3.238 | −13.639 | 20.742*** | −3.647 | 30.203* | −13.625 | 3.622 | −7.733 | −8.68 | −27.214 |
| Observations | 915 | | 916 | | 915 | | 916 | | 834 | | 834 | |
| $R^2$ | 0.277 | | 0.280 | | 0.216 | | 0.249 | | 0.272 | | 0.197 | |

*Source:* Authors' calculations.

*Note:* Standard errors in column 2 for each dependent variable.

All chi-square statistics are significant at the $p < 0.001$ level.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

**Table B3.** First Stage Regression Results for Neighborhood Conditions at Time of Initiation of Marijuana Use

| | Dependent Variables: Neighborhood Conditions at Time of Initiation | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Social Vulnerability | | % African American | | Occupational Prestige | | % Foreign Born | | Violent Crime Rate | | Property Crime Rate | |
| Exogenous Predictors | b | SE | b | SE | b | SE | b | SE | b | SE | b | SE |
| **Covariates at time of first offer** | | | | | | | | | | | | |
| Female (omitted=male) | 1.911 | −3.395 | 1.031 | −0.963 | −0.473* | −0.219 | 1.265 | −0.858 | 0.479 | −0.418 | 0.724 | −1.746 |
| Number of siblings in household | −0.9 | −2.554 | 0.8 | −0.781 | −0.053 | −0.131 | 0.279 | −0.537 | −0.277 | −0.304 | −0.989 | −1.268 |
| Caregiver age | 0.432 | −0.489 | −0.042 | −0.08 | −0.029 | −0.022 | −0.111 | −0.081 | 0.059 | −0.062 | 0.283 | −0.167 |
| Caregiver has high school diploma or higher | −10.869* | −5.212 | 2.831 | −1.661 | 0.421 | −0.324 | −0.906 | −1.295 | −0.962 | −0.624 | −2.969 | −2.701 |
| Natural log of household income | −0.137 | −0.593 | −0.001 | −0.167 | 0.016 | −0.035 | −0.035 | −0.14 | −0.037 | −0.072 | 0.168 | −0.294 |
| Household economic stressor index (range 0–5) | −1.394 | −2.374 | 0.339 | −0.789 | 0.04 | −0.143 | −0.251 | −0.6 | −0.083 | −0.28 | −0.839 | −1.271 |
| Number of moves from birth to time of first offer | 2.113* | −0.999 | 0.201 | −0.286 | −0.031 | −0.065 | −0.512 | −0.297 | 0.106 | −0.114 | 1.674** | −0.61 |
| **Timing of DHA first offer (omitted=pre-1990)** | | | | | | | | | | | | |
| Offer 1990–1991 | −5.673 | −10.032 | −1.436 | −3.742 | 0.181 | −0.635 | 4.104 | −2.61 | −2.006 | −1.269 | −4.55 | −6.31 |
| Offer 1992–1993 | −15.234 | −11.167 | −2.202 | −4.178 | 0.363 | −0.783 | 0.999 | −3.459 | −2.627 | −1.461 | −7.927 | −6.474 |
| Offer 1994–1995 | 9.1 | −12.726 | −1.196 | −3.591 | −0.466 | −0.713 | 2.866 | −2.597 | 0.893 | −1.569 | −0.708 | −5.3 |
| Offer 1996–1997 | 19.686 | −12.641 | −1.655 | −3.608 | −0.647 | −0.772 | 1.51 | −3.052 | 2.102 | −1.628 | 4.443 | −6.42 |
| Offer 1998–1999 | 14.443 | −13.545 | −2.6 | −3.516 | −0.961 | −0.754 | 2.849 | −3.081 | 1.989 | −1.689 | 0.771 | −6.073 |
| Offer 2000–2001 | 8.482 | −13.025 | −3.989 | −3.656 | −0.77 | −0.797 | 2.454 | −2.983 | 1.497 | −1.592 | −0.024 | −5.976 |
| Offer 2002–2003 | 30.830* | −13.733 | 0.116 | −3.903 | −0.782 | −0.798 | −1.599 | −3.405 | 3.409 | −1.756 | 6.61 | −6.831 |
| Offer 2004–2005 | 10.549 | −22.158 | −3.585 | −4.149 | 0.459 | −1.092 | −1.239 | −4.119 | 1.915 | −2.511 | 9.546 | −9.6 |
| **Neighborhood of first offer** | | | | | | | | | | | | |
| Social vulerability score (range 0–100) | 0.429*** | −0.062 | −0.008 | −0.019 | −0.004 | −0.004 | −0.003 | −0.018 | 0.028*** | −0.008 | 0.024 | −0.052 |
| Percentage African American residents | −22.649 | −13.053 | 49.016*** | −5.997 | 1.005 | −1.264 | 4.688 | −3.936 | −1.899 | −1.648 | −7.241 | −7.64 |
| Occupational prestige score (range 0–100) | 0.065 | −1.365 | 0.328 | −0.323 | 0.553*** | −0.09 | −0.507 | −0.324 | −0.188 | −0.17 | 0.195 | −0.602 |
| Percentage foreign-born residents | 14.076 | −42.759 | 13.511 | −9.327 | −0.173 | −2.4 | 68.874*** | −10.23 | 0.716 | −5.063 | −3.769 | −17.127 |
| Violent crime rate per 1,000 | 0.298 | −0.32 | −0.197 | −0.163 | 0 | −0.024 | 0.139 | −0.102 | 0.136** | −0.044 | 0.014 | −0.204 |
| Property crime rate per 1,000 | −0.02 | −0.074 | 0.081*** | −0.022 | 0.008 | −0.005 | −0.026 | −0.016 | 0.007 | −0.009 | 0.220*** | −0.063 |
| Constant | 24.999 | −57.067 | −11.51 | −12.544 | 19.110*** | −3.674 | 36.028** | −13.232 | 8.277 | −7.065 | 7.992 | −25.286 |
| Observations | 904 | | 905 | | 904 | | 905 | | 821 | | 821 | |
| $R^2$ | 0.257 | | 0.294 | | 0.232 | | 0.25 | | 0.272 | | 0.223 | |

*Source:* Authors' calculations.

*Note:* Standard errors in column 2 for each dependent variable.

All chi-square statistics are significant at the $p < 0.001$ level.

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

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