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Marijana Kotlaja

University of Nebraska at Omaha, mkotlaja@unomaha.edu

Emily M. Wright

University of Nebraska at Omaha, emwright@unomaha.edu

Abigail A. Fagan

Florida State University

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Neighborhood Parks and Playgrounds: Risky or Protective Contexts for Youth Substance Use?

Marijana M. Kotlaja¹, Emily M. Wright¹, and Abigail A. Fagan²

Abstract

Neighborhood parks and playgrounds are thought to reduce the stressors of disorganized urban environments by adding greenspace and fostering community cohesion, and, in doing so, may reduce crime and delinquency. Yet, they may also foster criminal behaviors, including substance use, as they can provide areas for would-be offenders to gather without surveillance or fear of being caught. This study provides one of the first examinations of the relationship between the number of parks and playgrounds in a neighborhood and adolescent substance use. To do so, we analyze data from 1,584 youth living in 76 neighborhoods in Chicago. Using multivariate, multilevel Rasch models that control for many other factors that may affect adolescent substance use, we find that youth living in areas with more parks and playgrounds have a greater odds of engaging in substance use compared with those living in areas with fewer parks and centers.

Keywords

substance use, neighborhood parks, delinquency, social disorganization, neighborhoods, drugs

Introduction

Adolescent substance use is a public health concern (National Academy of Sciences, 2004). In the United States, 22% to 35% of high school students report current use of tobacco, alcohol, and marijuana (Kann et al., 2014), and rates of lifetime drug use are even higher (Johnston, O'Malley, Bachman, & Schulenberg, 2013). Substance use during adolescence has been linked to impaired brain development, an increased likelihood of future substance use/abuse, and the co-occurrence of other behavioral health problems such as violence and risky sexual behavior (Blum, Ireland, & Blum, 2003; Hingson, Heeren, & Winter, 2006; Jacobus & Tapert, 2013; Wechsler & Nelson, 2001). In addition, alcohol use has been identified as the leading risk factor for mortality among those aged 15 to 19 years (Mokdad et al., 2016).

¹University of Nebraska Omaha, Omaha, NE, USA

²University of Florida, Gainesville, FL, USA

Corresponding Author:

Emily M. Wright, School of Criminology and Criminal Justice, University of Nebraska Omaha, 6001 Dodge Street, 218 CPACS, Omaha, NE 68182-0149, USA. Email: emwright@unomaha.edu

The extent and consequences of illegal substance use by adolescents has led to calls for more preventive interventions to reduce use (National Prevention Council, 2011; National Research Council and Institute of Medicine, 2009; U.S. Department of Health and Human Services, Office of the Surgeon General, 2016). Doing so requires a full understanding of the circumstances that place adolescents at risk of substance use. Research has indicated that adolescents' individual characteristics, peer groups, families, and schools affect their likelihood of smoking, drinking, and illicit drug use (Durlak, 1998; Hawkins, Catalano, & Miller, 1992). There is also some evidence that rates of substance use vary significantly across neighborhood contexts (Bernat, Lazovich, Forster, Oakes, & Chen, 2009; Karriker-Jaffe, 2011; Wilcox, 2003), but the specific ecological factors that contribute to this variation have not yet been clearly identified (Lambert, Brown, Phillips, & Jalongo, 2004; Leventhal & Brooks-Gunn, 2000).

Compared with studies examining other individual or social risk and protective factors for adolescent substance use, less research has investigated neighborhood factors related to this behavior (Allison et al., 1999; Feinberg, Jones, Cleveland, & Greenberg, 2012; Gardner, Barajas, & Brooks-Gunn, 2010). When neighborhood context has been considered, studies have typically focused on the impact of economic disadvantage on adolescent substance use; other structural and social features have been less subject to empirical examination (Bryden, Roberts, Petticrew, & McKee, 2013; Hanson & Chen, 2007; Jackson, Denny, & Ameratunga, 2014; Karriker-Jaffe et al., 2012). Although it is important to understand how economic disadvantage affects substance use, such information has limited utility for prevention efforts, given the difficulties involved in increasing employment and income levels in a neighborhood or community (Sampson, 2011).

The purpose of this study is to examine the degree to which the number of neighborhood parks and playgrounds are related to adolescent substance use. We focus on these features of the community because they have been posited to be related to crime and have been subject to environmental crime prevention and urban renewal projects (Hilborn, 2009). These efforts try to improve the built environment of a neighborhood, for example, by creating more "greenspace," with the expectation that doing so can mitigate the negative effects of living in urban disorganized neighborhoods and provide public spaces in which youth and/or adults can engage in positive interactions and prosocial behaviors (Christian et al., 2015). However, whether or not the presence of parks and playgrounds will reduce adolescent substance use is uncertain. Whereas some criminological theories posit that neighborhood resources and organizations will reduce youth delinquency (Bursik, 1988; Peterson, Krivo, & Harris, 2000; Wilcox, Quisenberry, Cabrera, & Jones, 2004), some studies suggest that neighborhood parks and playgrounds are criminogenic, as they provide areas for would-be offenders to gather without surveillance or fear of being

caught if they engage in crime (Kimpton, Corcoran, & Wickes, 2017; McCord & Houser, 2017). Few of these studies have investigated the impact of neighborhood parks and playgrounds on adolescent substance use, however, and this study seeks to fill this gap in the literature.

Theoretical Background

Social disorganization theories (Bursik & Grasmick, 1993; Sampson, Raudenbush, & Earls, 1997; Shaw & McKay, 1942) recognize that rates of crime vary across social contexts and posit that crime is elevated in areas that have more economic deprivation and social disorganization, especially a lack of social control. According to one prominent social disorganization theory (Sampson et al., 1997), neighborhoods with high rates of poverty also tend to have high residential turnover and racial/ethnic diversity, which together undermine collective efficacy, defined as the levels of trust and cohesion that exist among residents and their willingness to intervene when they see youth engaging in disorderly and deviant behavior. In areas in which collective efficacy is low, youth will be more likely to engage in delinquency and substance use because they will perceive that such actions will not be detected and/or will not result in punishment. Alternatively, when youth reside in neighborhoods with high levels of collective efficacy, they will perceive more informal social control and monitoring of their behaviors and will, thus, be less likely to commit illegal activities.

Social disorganization theories also recognize that high poverty neighborhoods will have more limited educational, social, and physical institutions and resources compared with more affluent areas (Bursik & Grasmick, 1993). For example, they have lower quality schools, fewer youth-serving organizations (e.g., Boys and Girls Clubs), and fewer high-quality parks and playgrounds (C. R. Browning & Soller, 2014; Galea, Rudenstine, & Vlahov, 2005). These resources and organizations provide a forum for youth to learn new skills and interact with positive adult role models, which should help promote positive behaviors and prevent delinquent activities such as substance use (C. R. Browning & Soller, 2014; McCord & Houser, 2017). When youth are not provided with structured, stable opportunities to engage in positive activities, they will be more likely to participate in unstructured and deviant activities (C. R. Browning & Soller, 2014).

Although social disorganization theories suggest that the presence of parks and playgrounds will reduce youth substance use, environmental criminology (Brantingham & Brantingham, 1991) cautions that they may actually foster delinquency. This perspective draws more from routine activities theory (Clarke, 1995; Felson, 1994) than social disorganization theory to explain how the physical features of a community are linked to crime. According to routine activities theory, crime occurs when motivated offenders come into contact with suitable targets (i.e., victims) in the

absence of capable guardians. The likelihood that these three elements will converge is strongly related to the physical features of a place, street, or neighborhood (Clarke, 1995). According to Brantingham and Brantingham (1995), certain areas of a city are “crime generators” because they provide public spaces where large numbers of people converge, some proportion of who will be motivated offenders. When these spaces also include suitable targets and few guardians, they will generate crime, and eventually become “crime attractors” known for providing opportunities for offending.

Community parks and playgrounds have been characterized as crime generators and crime attractors in some of this literature, especially when these areas have few guardians and more hidden spaces that allow offenders to commit crimes without being caught (Groff & McCord, 2012; Kimpton et al., 2017). Parks and playgrounds may be especially likely to foster youth delinquency when they provide a physical space for young people to congregate without adult surveillance (Kimpton et al., 2017). Similarly, C. R. Browning and Soller (2014) caution that community resources and amenities such as neighborhood parks and playgrounds will promote healthy behaviors only when they provide a structured setting, which promotes conventional activities. If adult guardianship is lacking, youth may be more likely to use these settings to gather with their peers and commit deviant acts such as illegal substance use (Mennis & Mason, 2012).

Social disorganization theories and environmental criminology, thus, posit diverging views regarding the direct relationship between neighborhood parks/playgrounds and youth substance use. However, both perspectives acknowledge the potential for neighborhood resources such as parks and playgrounds to interact with other factors that are associated with substance use. For example, both perspectives suggest that the impact of parks and playgrounds will vary depending on levels of adult monitoring that occur in or around these areas. Because collective efficacy represents the level of informal social control that exists in a neighborhood, it is possible that collective efficacy will moderate the impact of neighborhood parks/playgrounds. If parks and playgrounds act as crime generators, youth substance use would likely be greater in areas with more parks/playgrounds and less collective efficacy compared with areas with high levels of collective efficacy.

Both theoretical perspectives would also suggest that the presence of neighborhood parks and playgrounds could interact with salient peer and individual risk factors to influence youth substance use. Two such factors are examined in the current study: exposure to delinquent peers and youth participation in unstructured, routine activities. According to social learning theory, youth are especially likely to engage in substance use when their peers model and/or reinforce substance use (Akers, 1985; Akers, Krohn, Lanza-Kaduce, & Radosevich, 1979). Research has shown that youth who

reside in disorganized neighborhoods are more likely to be exposed to delinquent peers, including peers who engage in illicit drug use (Chuang, Ennett, Bauman, & Foshee, 2005; Zimmerman & Messner, 2011). In addition, studies by Zimmerman (Zimmerman & Farrell, 2017; Zimmerman & Vasquez, 2011) have indicated that neighborhood “opportunities for crime” amplify the impact of exposure to delinquent peers on substance use. However, these studies have measured neighborhood opportunities for crime using factors other than the presence or absence of neighborhood parks and playgrounds.

Similarly, some research has shown that youth who reside in disorganized neighborhoods are more likely to engage in unstructured routine activities (Wikstrom & Treiber, 2016), that is, informal activities that are not supervised by adults (Osgood, Wilson, O’Malley, Bachman, & Johnston, 1996). Little research has examined the degree to which neighborhood factors moderate the impact of routine activities (Wikstrom & Sampson, 2003). However, C. R. Browning and Soller (2014) suggest that the impact of neighborhood parks will vary depending on levels of unstructured, routine activities, a hypothesis we test in the current study. As with exposure to delinquent peers, substance use is posited to be higher among youth who live in neighborhoods with more parks/playgrounds and who engage in more unstructured routine activities, compared with those who spend less time in unstructured activities.

To summarize, the degree to which the existence of neighborhood parks or playgrounds may increase, decrease, or have no effect on youth substance use is unclear given conflicting theoretical explanations of the potential impact of these neighborhood features on these types of delinquent behaviors. The potential for parks/playgrounds to moderate the impact of collective efficacy, exposure to delinquent peers, and routine activities is also uncertain, although social disorganization theories and environmental criminology both suggest that interactions are likely to occur.

Empirical Research Examining the Relationship Between Parks, Playgrounds, and Crime

Our review of the literature indicates very little empirical examination of the relationship between neighborhood parks/playgrounds and adolescent substance use. The neighborhood characteristic examined most frequently with regard to youth substance use has been the socioeconomic status (SES) of the area. Studies typically classify neighborhood SES based on indicators from the U.S. Census related to residential income, employment, and education, and sometimes also include structural indicators such as the percentage of single-parent homes. This research has shown mixed evidence regarding the relationship of neighborhood SES with adolescent substance use. Some studies have reported a negative relationship between neighborhood SES and alcohol use by adolescents

and young adults (i.e., drinking is more likely in low-SES areas), some studies find the opposite effect (i.e., that drinking is greater in high-SES areas), and many have not reported a significant relationship between these constructs (Bryden et al., 2013; Hanson & Chen, 2007; Jackson et al., 2014; Karriker-Jaffe, 2011). The impact of collective efficacy on youth substance use has also been rarely investigated. Although the majority of this research has shown null effects (Fagan, Wright, & Pinchevsky, 2015; Jackson et al., 2014; Maimon & Browning, 2012), a few studies have, unexpectedly, indicated a positive relationship between collective efficacy and youth substance use (S. Browning, 2012; Fagan, Wright, & Pinchevsky, 2014; Musick, Seltzer, & Schwartz, 2008), with more use reported by youth who live in areas with greater collective efficacy.

To date, only a few studies have examined the relationship between neighborhood parks, playgrounds, and crime, and to our knowledge, none has investigated effects on youth substance use. In parallel studies conducted in Philadelphia and Louisville, rates of crime were elevated in parks compared with other areas of the city, especially when assessing public disorder crimes such as drug and alcohol offenses and vandalism (Groff & McCord, 2012; McCord & Houser, 2017). A study in Brisbane, Australia, found that areas of the city defined as public “greenspace” (which included parks, playgrounds, sports fields, and gardens) had elevated levels of public nuisance crimes, drug-related offenses, theft, and violence (Kimpton et al., 2017). In terms of the relationship between neighborhood playgrounds and crime, a study conducted in Columbus, Ohio (Peterson et al., 2000), found that the number of playgrounds in a census tract was not significantly related to the number of violent index offenses recorded by law enforcement. However, the number of playgrounds was negatively related to violence in lower SES communities compared with higher SES communities. A study conducted in Seattle (Wilcox et al., 2004) found that the number of playgrounds in a census tract was unrelated to violent crime but was significantly associated with a greater rate of burglaries, controlling for neighborhood SES and the presence of physical disorder. Taken as a whole, these findings support tenets from environmental criminology more than those from social disorganization theory, as they suggest that public parks and playgrounds can be crime generators that provide motivated offenders with places to gather, suitable targets to steal from, and a lack of guardianship, making crimes easier to commit.

Whether or not parks and playgrounds serve as generators for adolescent substance use has not yet been a focus of research. According to Mason and colleagues (Mason et al., 2009; Mason et al., 2015), adolescents identify city parks as an activity space in which they will gather with peers to engage in crime, including tobacco and marijuana use. Although these findings support some of the predictions of environmental

criminology, this research is based on a relatively small sample (i.e., less than 300 youth) of mostly African American adolescents, and results may not be generalizable to other types of populations. In addition, the research was not designed to examine the impact of parks and playgrounds, specifically, but rather to compare different places that may influence substance use.

Our review of the literature uncovered no studies that examined whether or not the impact of parks and playgrounds on substance use is moderated by other community or individual factors. The current study, thus, builds on and expands on the body of available evidence to investigate the direct and moderating effects of neighborhood parks and playgrounds on adolescent substance use. We investigate the following research questions. First, we examine the association of neighborhood parks and playgrounds on youth substance use while controlling for relevant individual- and neighborhood-level factors. Second, we examine whether neighborhood social control (as measured by collective efficacy) moderates the impact of neighborhood parks and playgrounds on youth substance use. Finally, we examine the possibility that neighborhood parks moderate the relationship between youths' exposure to delinquent peers and their drug use, as well as between their unstructured and unsupervised activities (i.e., their routine activities) and their substance use.

Method

Data

Data for these analyses came from the Project on Human Development in Chicago Neighborhoods (PHDCN; Earls, Brooks-Gunn, Raudenbush, & Sampson, 2002), a multilevel longitudinal study of children, families, and neighborhood-level causes and consequences of urban violence. The data used here were compiled from four separate components: (a) the Longitudinal Cohort Study (LCS), (b) the Systematic Social Observation (SSO) Study, (c) the 1990 U.S. Census, and (d) the Community Survey. The LCS data were used to derive individual-level rates and predictors of substance use. To collect these data, PHDCN researchers divided Chicago's 847 census tracts into 343 geographically continuous neighborhood clusters (NCs). These 343 NCs were then stratified by seven categories of racial/ethnic diversity and three levels of SES, and 80 NCs were selected via probability sampling. Within these 80 NCs, youth and their primary caregivers were selected for inclusion in the LCS. Although the LCS involved a multiple cohort design with data collected from youth aged 0 through 18 years old at baseline, the current study includes only youth from the age 9-, 12-, and 15-year-old cohorts. We rely on data from the first and second waves of data collection, conducted from 1994 to 1997 and 1997 to 2000, respectively. In total, the final sample consists of 1,584 male and female youth living within 76 NCs.¹

Measures

Table 1 provides the descriptive properties of the measures used in this study. All individual-level predictors were provided by youth or primary caregivers. As shown in Table 1, the demographic characteristics of the sample indicate an approximately equal number of males ($n = 792$) and females ($n = 792$). Most of the sample identified as Hispanic (46%) or African American (35.8%). The average age for males at the second wave of data collection was 13.93 years and the average age for females was 14.12 years.

Dependent variable. The *propensity for substance use* serves as the primary dependent variable in this analysis. Substance use measures were taken from the Self-Report Delinquency Questionnaire (Huizinga, Esbensen, & Weiher, 1991) and were self-reported by the youth in the LCS. At Wave 2, youth were asked to report how often in the past year they had used any of seven substances: tobacco, alcohol, marijuana, cocaine, crack, glue/inhalants, and least significant difference (LSD)/hallucinogens. Due to the skew in the frequency of responses, we dichotomized (1 = yes, 0 = no) responses to each type of substance use. To predict the odds of substance use reported at Wave 2, we used a multivariate, multilevel Rasch model (Raudenbush, Johnson, & Sampson, 2003) described below.

Neighborhood variables. We created a variable assessing the proportion of face blocks in a neighborhood that had neighborhood parks and playgrounds. The measures for neighborhood parks and playgrounds were taken from the SSO component of the PHDCN, which was conducted in 1995. Data were collected through direct observation, whereby the characteristics of neighborhoods were gathered using videotapes and observer logs. To record the physical, social, and economic characteristics of the neighborhoods, researchers drove down each block of the 80 NCs in a vehicle equipped with videotape recorders and recorded neighborhood and street conditions. These videos were later coded for analysis purposes. Researchers also logged information related to neighborhood conditions while driving through the NCs. Each block segment on one side of the street was videotaped and observed. These block segments were termed "block-faces," and comprised the unit of analysis for the SSO study. These block-faces were linked to the same 80 NCs in which the youth participating in the LCS resided. For our neighborhood parks and playgrounds measure, block-faces where parks and playgrounds with recreational equipment were evident were coded as "present" (=1); our measure of neighborhood *parks and playgrounds* indicates the proportion of block-faces in an NC that had parks and playgrounds with recreational equipment.

Neighborhood measures related to concentrated disadvantage and residential stability were taken from the 1990 U.S. Census. Each NC comprises several adjacent census tracts, and census Inter-university Consortium for Political and Social Research (ICPSR) to provide NC-level census information. Drawing from prior research (Cerda, Sanchez, Galea, Tracy, & Buka, 2008; Molnar, Cerda, Roberts, & Buka, 2008; Molnar, Miller, Azrael, & Buka, 2004), *concentrated disadvantage* was calculated as a factor analysis score of the percentage of residents in a neighborhood who were living below the poverty line, receiving public assistance, and unemployed ($\alpha = .805$). The variable is measured such that higher values reflect greater economic disadvantage. *Residential stability* was assessed as the percent of residents who had lived in the same house for 5 years and the percent of owner-occupied homes in an NC. Based on research by Sampson and colleagues (1997), this item was created through principal components factor analysis of the NC census data described above.

Data for the measure of collective efficacy were derived from the Community Survey portion of the PHDCN. The Community Survey took place between 1994 and 1995 and involved surveys with a sample of adults drawn from all 343 NCs. Residents were asked questions regarding their neighborhood's political and organizational groups, cultural values, social networks, informal and formal social control, and the level of social cohesion between neighbors. The Community Survey segment of the PHDCN followed a three-stage sampling design where city blocks were sampled within each NC, dwelling units were then sampled within blocks, and one adult resident was sampled within each dwelling unit. The present study includes responses from adults living in the 80 NCs in which the individual respondents from the LCS were nested. Following Sampson et al. (1997), neighborhood *collective efficacy* was based on 10 items assessing social cohesion and informal social control between neighbors. To measure social cohesion, respondents were asked to indicate on a 5-point scale how strongly they *agreed* or *disagreed* that people around here are willing to help neighborhoods, this is a close-knit neighborhood, people in this neighborhood can be trusted, people in this neighborhood generally do not get along with each other (reverse coded), and people in this neighborhood do not share the same values (reverse coded). To measure informal social control, respondents were asked to indicate on a 5-point scale whether they were *very unlikely* or *very likely* that their neighbors would intervene if children were skipping school and hanging out in a street corner, children were spray painting graffiti on a local building, children were showing disrespect to an adult, a fight broke out in front of their house, and the fire station closest to their home was threatened with budget cuts. Following Sampson et al. (1997) and others (Browning, Dietz & Feinberg 2004; Morenoff, Sampson & Raudenbush, 2001), the two scales of social cohesion and informal social control were combined into a single collective efficacy measure using a three-level item response model data

were compiled from each tract comprising the NC by researchers at *Individual-level control and moderating variables*. Models control for youth demographic characteristics, including gender (male = 1), race/ethnicity (coded as Hispanic, African American, Other race, with Caucasian as the reference group), age, and household salary (see Table 1 for details). The analyses also control for three individual-level factors shown in prior research to be associated with substance use, including the presence of social support from family members and peers (Durlak, 1998; Hawkins et al., 1992) and youth self-control (M. R. Gottfredson & Hirschi, 1990; Ragan & Beaver, 2010). Last, models include a measure of past year drug use taken from Wave 1 (see Table 1).

Our third research question examines whether neighborhood parks and playgrounds moderate the effect of peer drug use on youth substance use, as well as youths' unstructured routine activities on their substance use. Our measure of peer substance use is a four-item scale measuring the number of friends reported by youth who used tobacco, alcohol, marijuana, and other drugs in the past year. Response categories ranged from (1) *none* to (3) *all*. Items were summed to create a standardized scale ($\alpha = .76$; see Fagan, Wright, & Pinchevsky, 2013). Following Osgood and colleagues (1996), unstructured routine activities is a four-item scale collected during the second wave of data collection regarding how often the youth rides around in car/motorcycle for fun, hangs out with friends, goes to parties and other social affairs, goes out after school or in evening for fun and recreation. Response categories ranged from 1 (*never*) to 5 (*almost every week*). Items were summed to create a standardized scale ($\alpha = .58$).

Statistical Analyses

Hierarchical modeling techniques (hierarchical linear modeling [HLM]; Raudenbush & Bryk, 2002) using the statistical software HLM 7.0 (Raudenbush, Bryk, Cheong, & Congdon, 2011) were utilized to adjust for the correlated error that exists with clustered data (e.g., substance use items clustered within youth, youth clustered within neighborhoods). Using these techniques, analyses are based on appropriate sample sizes and existing variance is partitioned at different levels of analyses (items, individuals, and neighborhoods). To address our first research question (the association between neighborhood parks and playgrounds and youth substance use), we

Table I. Descriptive Statistics.

Variable Name	Variable Description	M	SD	Minimum-maximum
Dependent variable				
Propensity for past year drug use	Three-level item response model based on seven indicators of drug use (tobacco . . .) in the past year (Wave 2)	0.08	0.00	0-1
Individual-level variables				
Age	Age of respondent (Wave 2)	14.07	2.46	9.76-19.89
Hispanic	Respondent is Hispanic (Wave 1)	0.46	0.50	0-1
African American	Respondent is African American (Wave 1)	0.35	0.47	0-1
Other race	Respondent is another race/ethnicity (Wave 1)	0.04	0.19	0-1
Caucasian (reference)	Respondent is Caucasian (Wave 1)	0.15	0.35	0-1
Male	Respondent is male (Wave 1)	0.50	0.50	0-1
Household salary	Maximum household salary ranging from less than 1: <5,000 to above 7: >50,000 (Wave 1)	4.01	1.95	1-7
Friend support	Standardized, summed scale of nine items ($\alpha = .70$) rating youth agreement with items such as "I have at least one friend I could tell anything to, able to relax and be myself, share the same approach to life as many friends, people who know me trust me and respect me, when want to go out many friends would enjoy doing things with me, etc. ..." (Wave 1; Fagan, Wright, & Pinchevsky, 2013)	0.00	1.00	-4.08-1.34
Family support	Standardized summed scale of six items ($\alpha = .67$) rating youth agreement with items such as "my family ..will always be there for me; lets me know I'm worthwhile; family has confidence in me; helps me find solutions to problems, always stand by me, and not sure if I can rely on my family (RC)" (Wave 1)	0.00	1.00	-6.17-0.81
Peer drug use	Standardized summed scale measuring the number of friends reported by youth who used tobacco, alcohol, marijuana, and other drugs in the past year (four items, $\alpha = .76$, Wave 2; Fagan et al., 2013)	0.48	0.50	0-1
Unstructured routine activities	Standardized summed scale of four items ($\alpha = .58$) rating youth reports of their engaging in unstructured, unsupervised activities (e.g., hanging out with peers, going for joyrides, going to parties; Osgood, Wilson, O'Malley, Bachman, & Johnston, 1996; Wave 2)	0.00	1.00	-2.50-2.34

(continued)

Table 1. (continued)

Variable Name	Variable Description	M	SD	Minimum-maximum
Low self-control	Standardized summed scale of 17 items ($\alpha = .75$) reported by caregivers related to youth's inhibitory control, decision making, sensation seeking, and persistence (Buss & Plomin, 1975; Gibson, Sullivan, Jones, & Piquero, 2010; Wave 1)	0.00	1.00	-2.52-3.40
Past year drug use	Past year count of having used tobacco, alcohol, marijuana, cocaine, crack, glue, and psychedelics (Wave 1)	0.33	0.79	0.00-5.00
Neighborhood-level variables				
Neighborhood parks and playgrounds	Proportion of face blocks in a neighborhood that had neighborhood parks and playgrounds with recreational equipment, taken from the Systematic Social Observation component of the PHDCN	-0.01	0.04	-0.04-0.19
Concentrated disadvantage	Principal components factor analysis using three items ($\alpha = .805$) from the 1990 Census: the percentage of residents below poverty, households receiving public assistance, and residents unemployed (Fagan et al., 2013)	-0.16	1.00	-1.51-2.35
Residential stability	Based on two items ($\alpha = .76$): the percentage of owner-occupied homes and those living in the same home for 5 years	0.18	1.11	-1.72-2.12
Collective efficacy	Based on 10 items ($\alpha = .85$) measuring social cohesion and informal social control. Residents rated their agreement with five items assessing trust and support between neighbors (e.g., people around here are willing to help their neighbors) using a 5-point Likert-type scale. Another five items asked about the likelihood (on a 5-point scale) that residents would utilize informal social control to help keep the neighborhoods safe (e.g., neighbors would intervene if children were skipping school and hanging out)	0.06	0.22	-0.45-0.64

Note. The descriptives are based on 10,918 responses across 1,584 youth within 76 neighborhood clusters. PHDCN = Project on Human Development in Chicago Neighborhood

examined multivariate multilevel Rasch models (Raudenbush et al., 2003) to predict the odds of engaging in substance use among youth in our sample. This technique allows us to utilize all 10,918 responses to the Wave 2 substance use items provided by 1,584 youth living within 76 neighborhoods in our sample. This technique effectively avoids the loss of data due to missing item responses (Osgood, McMorris & Potenza, 2002) and takes the item difficulty into account. The multilevel Rasch model is a three-level model in which dichotomous substance use items are nested within persons, who are nested within neighborhoods (Raudenbush et al., 2003). The Level 1 outcome is the log-odds of responding affirmatively to item i of $m \square 1$ substance use items, by j person, living in k neighborhood. The Level 1 model (items within persons) produces a latent variable that represents each person's propensity for substance use (i.e., their likelihood of using various substances). This variable locates item severities on the logit scale (Raudenbush et al., 2003). Thus, the Level 1 model adjusts the within-person propensity for substance use by item severity, missing data, and measurement error. The Level 1 intercept serves as the outcome for the Level 2 and Level 3 models. In these models, the covariates were fixed and grand mean centered across NCs.

The Level 2 model examines the effects of person-level correlates (e.g., age, race, household salary) on the Level 1 intercept (propensity for substance use), while controlling for item severities at Level 1 (see Table 2). All the variables were fixed and grand mean centered, except for peer drug use and unstructured routine activities, which were modeled as random to aid in the testing of cross-level interactions. The Level 3 model allows estimation of the propensity for substance use across neighborhoods. The Level 3 intercepts-as-outcomes model examines the association of neighborhood variables on the Level two intercept (i.e., propensity for substance use, controlling for person-level correlates at Level 2 and item severities at Level 1).

To examine our second research question—whether neighborhood collective efficacy moderates the effect of neighborhood parks on youth substance use—we examined the interaction of collective efficacy and neighborhood parks and playgrounds on youth substance use, while controlling for relevant individual- and neighborhood-level factors. An interaction term was created between *collective efficacy* multiplied by the proportion of *neighborhood parks and playgrounds*. Finally, we examined cross-level interactions between neighborhood parks and playgrounds, peer drug use, and unstructured routine activities to understand whether the impact of youths' neighborhood parks and playgrounds moderated the effects of youths' unstructured activities on their drug use or the relationship between peer drug use and youths' own drug use (our third research question). Thus, these two variables (peer substance use and

unstructured routine activities) were examined with cross-level interactions in these analyses.

Table 2. Direct Effects of Neighborhood Parks and Controls on Youth's Propensity for Substance Use.

	Model 1		Model 2	
	<i>b</i>	(SE)	<i>b</i>	(SE)
Intercept ^a	-6.01**	(0.15)	-6.10**	(0.15)
Individual-level effects				
Age ^b	0.26**	(0.03)	0.25**	(0.03)
Hispanic	-0.04	(0.16)	-0.01	(0.17)
African American	-0.62**	(0.17)	-0.60**	(0.19)
Other race ^c	-0.72*	(0.37)	-0.69†	(0.37)
Male	0.02	(0.11)	0.02	(0.11)
Household salary	0.04	(0.03)	0.02	(0.03)
Friend support	0.13*	(0.06)	0.13*	(0.07)
Family support	-0.10†	(0.06)	-0.10†	(0.06)
Peer drug use	<i>0.98**</i>	<i>(0.07)</i>	<i>0.99**</i>	<i>(0.07)</i>
Unstructured routine activities	<i>0.43**</i>	<i>(0.06)</i>	<i>0.42**</i>	<i>(0.06)</i>
Low self-control	0.06	(0.05)	0.06	(0.05)
Past year drug use	0.48**	(0.07)	0.47**	(0.07)
Neighborhood direct effects				
Neighborhood parks and playgrounds	—	—	3.28*	(0.03)
Concentrated disadvantage	—	—	0.32	(0.32)
Residential stability	—	—	0.07	(0.35)
Collective efficacy	—	—	0.00	(0.96)
Variance components				
Individual-level intercept		2.82		2.83
Neighborhood intercept		0.02		0.01

Note. Italicized coefficients indicate significantly varying effects across neighborhoods.

^aAnalyses are based on 10,918 responses across 1,584 youth within 76 neighborhood clusters.

^bAt Wave 2.

^cReference category is Caucasian.

† $p < .10$. * $p \leq .01$. ** $p \leq .05$.

Results

Tables 2 and 3 provide the results of our three research questions. Table 2 presents the direct effects of individual-level and neighborhood-level covariates on the propensity for substance use (our first research question). Model 1 in Table 2 includes only individual-level demographic characteristics (i.e., age; Hispanic, African American, and Other race with Caucasian as the reference category; male; and household salary) as control variables, as well as other individual-level covariates: family and friend support, low-self-control, past year drug use, peer drug use, and unstructured routine activities. Results in this model indicate that youth who are older, those with more friend support, those who reported substance use at Wave 1, those with more peers who use drugs, and those who engage in more unstructured or unsupervised routine activities have a higher propensity of engaging in substance use. African American and Other race youth, as well as those with more family

support, had lower propensities for substance use. Model 2 includes neighborhood parks and playgrounds in addition to other neighborhood-level covariates. In this model, the individual-level covariates were largely unchanged. However, having a higher proportion of parks and playgrounds in one's neighborhood was a significant predictor of the likelihood of substance use among youth, with more parks and playgrounds related to a higher

Table 3. Interaction Effects of Neighborhood Parks on Peer Drug Use, Routine Activities and Collective Efficacy.

	Model 1		Model 2	
	<i>b</i>	(SE)	<i>b</i>	(SE)
Intercept ^a	-6.10**	(0.15)	-6.09**	(0.15)
Individual-level effects				
Age ^b	0.25**	(0.03)	0.25**	(0.03)
Hispanic	0.00	(0.17)	0.03	(0.17)
African American	-0.64**	(0.19)	-0.62**	(0.20)
Other race ^c	-0.70*	(0.37)	-0.70*	(0.37)
Male	0.03	(0.11)	0.03	(0.11)
Household salary	0.03	(0.03)	0.03	(0.03)
Friend support	0.13*	(0.07)	0.13*	(0.06)
Family support	-0.10 [†]	(0.06)	-0.10 [†]	(0.06)
Peer drug use	0.99**	(0.07)	1.00**	(0.07)
Peer drug use × Neighborhood parks and playgrounds	—	—	0.36	(1.6)
Unstructured routine activities	0.43**	(0.06)	0.43**	(0.06)
Unstructured routine activities × Neighborhood parks and playgrounds	—	—	0.34	(1.8)
Low self-control	0.06	(0.05)	0.06	(0.05)
Past year drug use	0.47**	(0.07)	0.47**	(0.07)
Neighborhood direct effects				
Neighborhood parks and playgrounds	3.72*	(1.6)	3.20 [†]	(1.6)
Neighborhood parks and playgrounds × Collective efficacy	14.82	(10.8)	—	—
Concentrated disadvantage	0.02	(0.07)	0.03	(0.08)
Residential stability	0.08	(0.08)	0.08	(0.08)
Collective efficacy	0.51	(0.96)	0.45	(0.37)
Variance components				
Individual-level intercept		2.82		2.66
Neighborhood intercept		0.01		0.05

Note. Italicized coefficients indicate significantly varying effects across neighborhoods.

^aAnalyses are based on 10,918 responses across 1,584 youth within 76 neighborhood clusters.

^bAt Wave 2.

^cReference category is Caucasian.

[†] $p < .10$. * $p \leq .01$. ** $p \leq .05$.

propensity for drug use among adolescents, regardless of their individual characteristics (e.g., prior drug use) and other neighborhood factors (e.g., disadvantage and collective efficacy). Concentrated disadvantage, residential stability, or collective efficacy did not predict the

propensity for drug use among adolescents.

The second research question examined whether the effect of neighborhood parks and play- grounds was influenced by neighborhood collective efficacy (a proxy for social control). Model 1 in Table 2 indicates that neighborhood parks and playgrounds continue to exert a significant main effect on youths' propensity for drug use, but the interaction term with collective efficacy is not significant. The results suggest the effect of neighborhood parks and playgrounds on substance use does not depend on the level of collective efficacy in the neighborhoods. Thus, having more parks and playgrounds in one's neighborhood implies more substance use regard- less of whether collective efficacy is high or low.

Our final research question explored cross-level interactions to determine whether neighbor- hood parks and playground moderate the impact of peer drug use and unstructured routine activities on youths' substance use. Neither cross-level interaction was significant, suggesting that neighborhood parks and playgrounds did not moderate the impact of peer drug use or unstructured routine activities on the propensity of youth drug use. That is, the results indicate that the relationship between parks/playgrounds and substance use does not vary depending on the degree to which youth reported more peers who used drugs or the degree to which they engaged in unstructured routine activities.

Discussion

The goal of this study was to examine the potential that the built environment, specifically the presence of parks and playgrounds in a neighborhood, affects adolescent substance use. Although there have been calls to increase community greenspace, based on findings that parks and other natural environments can reduce the negative effects of residence in disorganized, urban environments, and improve mental and physical health (Christian et al., 2015; Nielsen & Hansen, 2007; O'Campo et al., 2008; Wells & Evans, 2003), our research suggests the need for some caution before enacting such changes. The results of the current study suggest that parks and playgrounds may be criminogenic, as their presence was associated with *more* adolescent substance use.

Although additional studies are needed to replicate this finding, our results indicate a robust effect of neighborhood parks on adolescent substance use, which remained significant even when controlling for individual-level risk and protective factors (e.g., youth's race/ethnicity, self-control, and social support), as well as neighborhood concentrated disadvantage, residential stability, and collective efficacy. Although we are not aware of other studies that have examined the relationship between neighborhood parks and adolescent substance use, our results are

somewhat consistent with Mason and colleagues' (2015), who report that adolescents identify city parks as an activity space in which they will gather with peers to engage in crime, including tobacco and marijuana use. Similarly, the results support some of the tenets of environmental criminology and research indicating higher levels of crime in areas that have a greater concentration of parks and/ or playgrounds. The findings are not well aligned with social disorganization theories, which suggest that greater levels of neighborhood resources, which could include parks and play- grounds, will reduce crime.

The findings revealed that the effect of neighborhood parks and playgrounds on youth sub- stance use was not moderated by neighborhood levels of informal social control, represented in this study by the collective efficacy construct. Collective efficacy theory (Sampson et al., 1997) would suggest that higher levels of informal social control could mitigate the positive association between neighborhood parks and playgrounds and substance use, as youth might refrain from engaging in substance use in these public areas if they perceived that adults in the area were monitoring their actions and were willing to intervene if they witnessed such acts. However, this was not the case; the impact of neighborhood parks did not vary depending on the amount of collective efficacy present in the neighborhood. Collective efficacy also did not have a significant direct effect on substance use, however, which suggests that it may not be important in influencing youth substance use (for similar findings, see Fagan et al., 2015; Jackson et al., 2014; Maimon & Browning, 2012).

Finally, our analyses indicated that the impact of neighborhood parks and playgrounds was not moderated by peer drug use or unstructured routine activities. That is, youth whose friends engaged in drug use and who engaged in unstructured or unsupervised activities with their peers were significantly more likely to engage in substance use, regardless of whether their neighbor- hood had parks and playgrounds, and having parks and playgrounds in their neighborhood did not make these effects stronger, as we expected. However, our data did not allow us to determine whether the youth who engaged in substance use did so while located at their neighborhood park(s) or playground(s). The analyses could only reveal that having more parks and playgrounds in one's neighborhood was positively associated with a higher likelihood of drug use among youth in those neighborhoods. It is possible that youth travel to different locations to engage in substance use with their peers and in unstructured routine activities, and these behaviors cannot be captured with the PHDCN data. Studies that can pinpoint the specific areas in which youth spend time, and collect data on the activities that occur in those spaces, will help further elucidate this relationship (Mason et al., 2009; Mason et al., 2015). For example, C. R. Browning and Soller (2014) recommend collecting data from youth using phones with GPS trackers and relying on methods such as

ecological momentary assessment (EMA), which collect real-time data on youth activities.

The current study has some other limitations. The results are based on one urban city (Chicago) with data collected in the 1990s, and we cannot be sure our results are generalizable to other contexts or time periods. Our study was also unable to pinpoint exactly how or why neighborhood parks and recreational centers affect adolescent drug use, and it is important that future research examine such issues. For example, other research has shown significant variation across neighborhoods in the conditions and amenities of parks and playgrounds (Scarborough, Like-Haislip, Novak, Lucas, & Alarid, 2010; Wyant, 2008) including levels of monitoring and supervision by adults. Although the SSO data in the current study can estimate the number of parks and playgrounds in a neighborhood, they do not specify the quality of such resources or whether or not they are well supervised, information that could shed light on the mediating and/or moderating mechanisms that may account for the relationship between parks and substance use.

Despite its limitations, our study is methodologically strong because it incorporates a wide variety of risk factors, at both the individual and neighborhood levels, and as such provides a strong examination of the relationship between neighborhood parks on substance use. The analyses were robust, in that, they drew on data from youth living in 76 neighborhoods located throughout Chicago, which varied in the socioeconomic and racial/ethnic makeup. Moreover, the sample was diverse in terms of gender and race/ethnicity, and adolescents provided information on their use of a variety of drugs, including tobacco, alcohol, marijuana, and hard drugs. Furthermore, information regarding neighborhood parks and playgrounds was collected using rigorous and objective methods, and the multilevel analyses we employed accounted for individual and neighborhood covariates of adolescent substance use. For these reasons, we believe that this study has built on and helped extend the literature on the positive and negative impacts of neighborhood parks and playgrounds.

To conclude, although neighborhood parks and playgrounds have been found to positively affect some youth health outcomes (Christian et al., 2015; Nielsen & Hansen, 2007; O'Campo et al., 2008; Wells & Evans, 2003), this study indicates that when it comes to adolescent substance use, neighborhood parks and playgrounds may serve more as risk contexts than protective environments. Although our study cannot identify the specific features of parks and playgrounds that affect substance use among youth, it seems important to ensure that such facilities are monitored by adults and/or law enforcement to reduce the likelihood that they will be crime generators (Brantingham & Brantingham, 1991), attracting youth because they offer a safe space in

which to engage in deviance.

In addition, given the robust relationships between peer substance use, unstructured routine activities, and youth substance use, our study emphasizes that need for adults to consistently monitor youth, in the home, at school, and afterschool, in other areas of their neighborhoods to help prevent substance use. There is a wealth of evidence indicating that prevention programs that help parents set and enforce rules and build more positive relationships with their children prevent the development and escalation of substance use (Fagan, 2013; Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011). Similarly, effective school-based interventions (Foxcroft & Tsertsvadze, 2011; D. C. Gottfredson & Wilson, 2003) and afterschool programs (D. C. Gottfredson, Weisman, Soule, Womer, & Lu, 2004; Tolan, Henry, Schoeny, Lovegrove, & Nichols, 2014) have been developed to help youth resist peer influence and develop between decision making and social skills, so that they will be less likely to engage in substance use.

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Note

1. Within the Systematic Social Observation (SSO) data, only 77 of the original 80 neighborhoods were available for the neighborhood parks and playgrounds measure. Because we restricted the sample to cohorts nine, 12, and 15, and relied on data from Waves 1 and 2 (with some attrition), some neighborhoods had too few youth in them to conduct reliable multilevel analyses, and, thus, were dropped from the models. A total of 76 neighborhoods were included in our multilevel analyses.

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Author Biographies

Marijana M. Kotlaja, MS, is a doctoral candidate in the School of Criminology and Criminal Justice at the University of Nebraska Omaha. Her research agenda focuses on the intersection of race and ethnicity/culture, neighborhood effects, cross-national comparisons, diversity in global contexts, and quantitative research methods.

Emily M. Wright, PhD, is a professor in the School of Criminology and Criminal Justice at the University of Nebraska at Omaha, and the Associate Director of the Nebraska Center for Justice Research at the University of Nebraska, Omaha. Her research focuses on victimization and exposure to violence across various contexts. Her research has appeared in *Criminology*, *Child Abuse & Neglect*, *Journal of Research in Crime and Delinquency*, and *Trauma, Violence, & Abuse*.

Abigail A. Fagan, PhD, is an associate professor at the University of Florida in the Department of Sociology, Criminology & Law. Her research focuses on the etiology and prevention of adolescent substance use, delinquency, and violence, with an emphasis on examining the ways in which scientific advances can be successfully translated into effective crime and delinquency prevention practices.