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Neighborhood Context and Transitions in Marijuana Use among Urban Young Adults

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Abstract

Background: In emerging adulthood when many youth are maturing out of marijuana use, Blacks continue to have high rates of use and disorder. Theory suggests that factors tied to neighborhood disadvantage may partially explain this phenomenon but research is limited.

Objectives: This study examines the influence of neighborhood physical and social disorder on transitions in marijuana use during emerging adulthood in a low-income urban sample.

Methods: 379 primarily Black young adults residing in low-income neighborhoods in Baltimore City were followed-up annually from ages 18 to 21. Neighborhood environment was evaluated using a valid and reliable field-rater assessment of the residential block. Longitudinal latent class and latent transition analyses were performed.

Results: Fit indices supported three-classes of marijuana use: no use, infrequent use and frequent use. Between ages 18 and 21, young adults tended to transition toward lower levels of use.

However, neighborhood physical disorder was associated with transitioning to increased marijuana use (no use to frequent use; AOR=2.712; $p=0.023$) while positive neighborhood social activity was

associated with a decreased risk (AOR=0.002; $p=0.013$). Neighborhood social activity was also associated with decreases in use (frequent to infrequent use; AOR=2.342; $p=0.020$).

Conclusions/Importance: These findings demonstrate that physical disorder within the context of a low-income urban neighborhood adversely impacts marijuana use. However, even in the presence of physical disorder, interventions that foster collective efficacy among residents through positive social activity may prevent initiation and progression of marijuana use.

BACKGROUND

In emerging adulthood, when many youth are maturing out of marijuana use, Blacks continue to have high rates of use and disorder (Kennedy et al., 2016; Wu et al., 2016). Factors tied to social disadvantage may partially explain this phenomenon and neighborhood setting may be a key exposure. Two recent studies suggest a link between neighborhood factors and marijuana use among Black emerging adults (Kogan et al, 2017; White et al., 2017); bolstering this hypothesis. Growing up poor in an impoverished neighborhood has been referred to as a “double burden,” as it subjects youth and young adults to social and economic adversities that are above and beyond the burdens that accompany familial poverty (Kneebone, Nadeau & Berube, 2011). More than one-fifth of Blacks live in high poverty neighborhoods, compared to just 4.1% of Whites (Kneebone & Holmes, 2016). In urban settings, these disparities in the “double burden” are particularly pronounced.

High poverty neighborhoods in which Blacks and other minorities disproportionately reside often lack the economic resources to sustain schools and other pro-social environments such as parks, libraries, community centers, as well as community services that promote healthy child development (Jencks & Mayer, 1990). Exposure to positive and stimulating environments early in life is essential not only for successfully navigating adolescence but for making a healthy and productive transition to adulthood (Case, Fertig & Paxson, 2005; Shonkoff et al., 2012). These resources support youth by providing adult role models, supervision and monitoring, in addition to structure and routines. They also promote social cohesion in communities, which fosters trust and solidarity among residents and forms the foundation for collective efficacy (Sampson, Raudenbush & Earls, 1997). In neighborhoods with collective efficacy, residents monitor youth activities, confront individuals “hanging out” on the street, and call out disorderly behavior. Neighborhoods in which residents are unwilling to intervene on behalf of the community invite a wide array of illegal behavior, like drug selling and use to flourish.

In addition to lacking social resources, impoverished neighborhoods often suffer from physical disorder, e.g. abandoned buildings, unmaintained properties, vacant lots, drug paraphernalia on the streets. The lack of collective efficacy and social cohesion may also allow for detrimental businesses that are associated with drug markets and drug use (e.g. alcohol outlets). Disorder theory (Wilson & Kelling, 1982) posits that residents surrounded by disorderly conditions may presume that local officials will not intervene; thus residents may become more willing to violate social norms within the neighborhood. As incivilities increase over time, resident control over activities becomes weakened and crime and fear among residents is heightened. This can contribute to emotional distress and coping as a

motivation for substance use, both of which increase vulnerability to adverse effects of substance use (Copeland-Linder et al., 2011; Fagan, Wright & Pinchevsky, 2015; Green et al., 2010). Physically disordered neighborhoods with abandoned housing and vacant lots can also serve as havens for drug selling and taking, providing youth with increased opportunities to both purchase and use drugs (Crum et al., 1996; Furr-Holden et al., 2011).

Much of the research that links the neighborhood environment to marijuana use has relied on aggregate measures from the Census (e.g. percent vacant dwellings) or individual-level self-reports (e.g. how safe do you feel in your neighborhood) to characterize neighborhoods. For example, Tarter et al. (2009) found that living in a neighborhood with a greater proportion of vacant dwellings in childhood was associated with marijuana use in young adulthood among males. Reboussin et al. (2014, 2015) found that neighborhood disadvantage, as measured by the Census, and youth perceptions of disorder were associated with marijuana use during adolescence among urban youth. Wilson et al. (2005) also found that perceptions of neighborhood disorder were associated with marijuana use during adolescence. Other findings have been inconsistent. In a study of youth participating in the Project of Human Development in Chicago Neighborhoods (PHDCN), no association was found between neighborhood disadvantage and marijuana use (Fagan et al., 2013). In a national study of adolescents, rates of marijuana initiation were greater among adolescents living in neighborhoods with a higher unemployment rate but no relationship was found with youth perceptions of neighborhood safety (Tucker et al., 2013).

Measures from the Census as well as self-reports of the neighborhood environment have disadvantages. Because Census data is only collected every ten years (or aggregated over five-year periods), these data are not necessarily current for a particular research question. The geographic area is based on administrative boundaries (e.g. census tract and zip codes) and may not represent important social or geographic boundaries (Schaefer-McDaniel et al., 2010). The Census variables to choose from are limited to economic and structural (or physical) factors ignoring neighborhood social processes such as collective efficacy. Subjective self-report measures of perceived neighborhood disorder raise concerns about “same-source bias”, meaning that respondents may answer differently based on their own behavior (Brandt et al., 2005, Mair et al., 2008). These measures may also be biased because of the stigma associated with low-income urban neighborhoods; people may be more likely to evaluate them as having high levels of disorder regardless of actual levels of disorder (Sampson et al., 2002). Systematic social observation (SSO) is an alternative strategy that was developed to address these concerns (Sampson et al., 2002; Sampson & Raudenbush, 1999). It is a standardized approach for directly observing the physical, social and economic characteristics of neighborhood. Trained researchers record indicators of neighborhood order and disorder using a standardized assessment tool. Many SSO tools examining neighborhood emphasize the assessment of physical disorder that facilitates walking, biking and other activities relevant to healthy weight management, physical activity and chronic disease prevention (Schaefer-McDaniel et al., 2010). To understand how the neighborhood environment leads to involvement in risk behaviors like drug use, assessments of both physical and social disorder are needed. One such tool is the Neighborhood Inventory for Environmental Typology (NIETy) Instrument (Furr-Holden et al., 2008). The NIETy has been shown to be both reliable and valid (Furr-Holden et al., 2010; Milam et al., 2016).

NiFeTy assessments occur at the level of the residential block and capture aspects of both the physical and social environment. Neighborhood disorder, as assessed using the NiFeTy, has been shown to be associated with youth-reported exposure to alcohol, tobacco and marijuana (Furr-Holden et al., 2011, 2015).

The purpose of the current study is to examine the effect of neighborhood physical and social disorder, using an SSO approach, on marijuana initiation, progression and decline during the transition to young adulthood in a sample of primarily low-income, Blacks living in Baltimore City in 2005. In 2005, 28.2% of families with children under the age of 18 in Baltimore City were living below the federal poverty level. We use latent transition analysis (LTA) to examine the influence of neighborhood on transitions in marijuana use; both increases and reductions in use. LTA is an empirically-based procedure that allows the data to guide our understanding of how marijuana use progresses. The objectives of this study are to: (1) identify stages of marijuana involvement from ages 18 to 21 in a sample of primarily low-income, urban dwelling Blacks; (2) examine the probability of transitions between stages, and (3) investigate the influence of neighborhood physical and social disorder in 12th grade on these transitions.

METHODS

Participants

Data were drawn from a community-based longitudinal study conducted by the Baltimore Prevention Intervention Research Center at Johns Hopkins University. The study population consisted of 799 children and families entering 1st grade in nine Baltimore City Public Schools in 1993. The children were recruited for participation in two school-based, preventive, interventions targeting early learning and aggressive and disruptive behavior (Ialongo et al., 1999). Students and teachers were randomly assigned to one of two interventions or control classrooms. Interventions were provided over the first-grade year. The sample of 799 children was predominantly Black (85%) and 46% were male. The mean age at entrance into first grade was 6.2 years (SD=0.37). About 2/3 of children were receiving free or reduced price meals; a proxy for low socioeconomic status. To qualify for free meals the household income had to be at 100% the federal poverty level or below and between 100–185% for reduced price meals.

Approximately 88% of the sample (n=701) were interviewed at least once between 12th grade and age 21 and have data on our measures of marijuana use. Participants who were lost to follow-up were more likely to be White (22%) than participants not lost to follow-up (14%). There were no differences with respect to teacher ratings of behavior in first grade, academic achievement, gender or free-lunch status. Of these 701 youth with at least one follow-up assessment, 379 continued to reside in Baltimore City in 12th grade. The current study sample was restricted to these 379 young adults (mean age=17.8 years, SD=0.37 at 12th grade) because the environmental assessments described below were only conducted in Baltimore City. The young adults that continued to reside in Baltimore City were more likely to be Black ($p<0.001$). They were also more likely to have received free or reduced price meals in 12th grade ($p<0.01$) possibly due to the fact that lower income families do not have the resources to move to more affluent areas outside of Baltimore City. There were no

differences in gender or marijuana use in 12th grade between young adults who continued to live in Baltimore City and those who did not, nor differences on self-reports of anxious and depressive symptoms or teacher ratings of aggressive/disruptive behaviors in first grade. Among the 379 youth residing in Baltimore City in 12th grade, 36% moved to a different census tract between 12th grade and the age 21 assessment. However, 70% of those that moved continued to reside in Baltimore City at age 21.

Neighborhood Assessments—Assessments of the environment were obtained using the Neighborhood Inventory for Environmental Typology (NifETy) Instrument (Furr-Holden et al., 2008). The NifETy is a standardized inventory designed to assess characteristics of the environment shown to be related to violence, alcohol, tobacco and other drug (VATOD) activity. Assessments were conducted between June 2005 and November 2005 on the block face where young adults lived during the time of their 12th grade interview. A team of two trained field raters traveled to specified blocks and manually entered NifETy data into handheld electronic devices. The block face included both sides of the street along an entire block (e.g. 601–699 North Broadway). Assessments were conducted between 11am and dusk and were found to be reliable during this time period (Furr-Holden et al. 2010). The NifETy Instrument included 75 items operationalized into 7 domains: (1) physical layout, (2) types of dwellings, (3) adult activity, (4) youth activity, (5) physical order and disorder, (6) social order and disorder and (7) violence and ATOD indicators. Full details of the methodology can be found in Furr-Holden et al. (2008). The NifETy has good psychometric properties; the ICC is 0.84 for the total scale, 0.71 for the VATOD subscale and 0.67 to 0.79 across raters (Furr-Holden et al 2010).

Measures

Marijuana Involvement—For characterizing marijuana involvement, we considered responses to five questions about the extent of marijuana use gathered in the spring of 12th grade and annually post high school at ages 19, 20 and 21. We herein refer to this as the age 18 to 21 assessments.

1. Have you used marijuana since this time last year?
2. Did you use marijuana in the last month?
3. How many times have you used marijuana in the past year?
4. Have you ever used marijuana every day or almost every day for two or more weeks?
5. During the past 12 months, have you had any social problems from using marijuana?

Social problems included things such as having a friend or family member tell you that you shouldn't be using marijuana and getting in trouble at home or with the police because you used marijuana (see Appendix). This item was coded 1 if any social problems were reported in the past year and 0 otherwise. The response options for the third question about times used marijuana in the past year were: 0=none, 1=once, 2=twice, 3=3–4 times, 4=5–9 times, 5=10–19 times, 6=20–39 times, 7=40 or more times. Among those who used marijuana in

the past year, the median response option was 3 (or 3–4 times in the past year). For analysis, we dichotomized this question at the median to compare those that used marijuana three or more times in the past year to those who used marijuana just a couple of times in the past year. The remaining questions had binary responses (1=yes, 0=no).

Neighborhood Environment—Eighteen binary items from the NIfETy instrument were used to classify neighborhood physical disorder and social activity (see Table 1). These items were selected because they were used by Furr-Holden et al. (2015) in this sample one year post high school (age 18) as well as other investigations of neighborhood environment (Cohen et al., 2003a; Perkins et al., 1996; Sampson, 1997). Twelve items classified neighborhood physical disorder with prevalences ranging from 6.1% (presence of intoxicated people, signs of using alcohol/drugs or signs of drug selling) to 39.8% (presence of unmaintained properties). Six items classified positive neighborhood social activity. Prevalence ranged from 3.2% (presence of youth in transit) to 42.2% (presence of adults sitting on steps). Items were summed to create two scales of neighborhood environment; the Cronbach's alpha was 0.79 for the physical environment scale and 0.66 for the social activity scale.

Control Variables—The school district provided information on the students' sex and ethnicity. School records indicating each student's free and reduced-price meal status were collapsed into a dichotomous variable of free or reduced price meal versus self-paid meal as an individual indicator of student poverty.

Data Analysis

Latent class analysis (LCA) was applied to examine the structure underlying the five behaviors comprising the marijuana profile from ages 18 to 21 using full information maximum likelihood. This approach allows for missing data under the missing at random (MAR) assumption where young adults with data on at least one outcome variable are included in the analysis, unless they are missing data on covariates. The only covariate with missing data in our sample was free/reduced price meal status in 12th grade (25.8% missing). Because of the large degree of missingness, we imputed missing lunch values using multiple imputations by chained equations (Royston 2009). Lunch status was imputed using a prediction model containing the variables with complete data used in the primary analysis. Twenty imputations were performed using the ICE procedure in Stata Version 13 (StataCorp, College Station, TX). The prevalence of receiving free or reduced price meals was 39.4% compared to 38.8% using complete case analysis. Primary analysis of the imputed datasets was performed in Mplus Version 7.1 (Muthen & Muthen, 2012). Possible correlation of the five marijuana behaviors among participants residing in the same neighborhood was examined prior to LCA using PROC GLIMMIX in SAS. For each behavior, the variance of the random intercept was not significantly different from zero based on a chi-squared test on the restricted likelihood indicating no evidence of clustering at the neighborhood level.

The goal of performing LCA was to identify subgroups of young adults with similar marijuana profiles representing qualitatively different stages of marijuana use. We started

with the most parsimonious one class model (“all marijuana involvement the same”) with progression to a less parsimonious model with four classes of marijuana involvement. Goodness of fit was evaluated using global fit indices that combine goodness of fit and parsimony such as Akaike’s information criterion (AIC), the Bayesian information criterion (BIC) and the sample size adjusted Bayesian information criteria (a-BIC) as well as the Lo-Mendell-Rubin and parametric bootstrapped likelihood ratio tests of fit (Nylund et al., 2007). Entropy was used as a measure of classification accuracy with values approaching one indicating a clear distinction of classes. We considered the distinguishability of the classes based on the measure of entropy as well as the interpretability and meaningfulness of the latent classes for the competing solutions.

As a first step to understanding the underlying latent class structure of marijuana use, we fit an LCA model for each age separately. Next, we combined across years and fit a longitudinal LCA so that the additional information from multiple time points might increase our power to detect classes with fewer respondents. In the combined longitudinal LCA, measurement invariance was imposed but the latent class prevalences were allowed to vary over time. After deciding on the number of classes, we performed a latent class regression analysis to examine the cross-sectional relationship between the classes and the sociodemographic and neighborhood characteristics of our sample. Next, we estimated the probability of transitioning between the latent classes of marijuana involvement from ages 18 to 21 and the influence of neighborhood environment on transition rates using latent transition analysis (LTA). LTA builds upon LCA by expressing change in class membership over time in terms of transition probabilities and models the impact of covariates on transitions using a multinomial logistic regression formulation (Lanza et al., 2010). Specifically, we fit two models: (1) a model examining the impact of neighborhood physical disorder on transitions in marijuana involvement adjusting for neighborhood social activity, gender, race, and receipt of free or reduced-price meals, and (2) a model examining the impact of neighborhood social activity on transitions in marijuana involvement adjusting for neighborhood physical disorder, gender, race and receipt of free or reduced-price meals.

RESULTS

The prevalence of individual marijuana involvement measures from ages 18 to 21 are presented in Table 2. Prevalence generally decreased over time with the exception of a slight increase in past month use between ages 20 and 21 (8.2% to 9.2%). Table 3 contains the fit indices for the age-specific and combined longitudinal latent class models. The fit indices were consistent across models and suggest a three-class solution is appropriate. Next, we examined the assumption of measurement invariance for the three class longitudinal LCA model. The fit statistics for a three class model that does not impose measurement invariance provided a poorer fit to the data (AIC=2692, BIC=2960, a-BIC=2744) suggesting the three class model with measurement invariance is appropriate (AIC=2629, BIC=2720, a-BIC=2647). In Figure 1, the three class model with measurement invariance was examined for interpretability. The most prevalent class is referred to as the *No Use* class and is characterized by respondents who have not used marijuana in the past year. The estimated prevalence of this class is 73% at age 18 and increases to 86% by age 21. The next most prevalent class is referred to as the *Infrequent Use* class. Almost all young adults in this class

have used marijuana in the past year but less than half have used it in the past month or more than a couple of times in the past year. Despite that their level of use appears low risk, 60% of young adults in this class have experienced social problems associated with their use in the past year. The prevalence of membership in this class decreases with age, from 17% at age 18 to 7% by age 21. The final class we refer to as the *Frequent Use* class. This class is characterized by past month use of marijuana and using more than a couple of times in the past year. Almost 80% of young adults in this class have used marijuana almost every day for a period of two weeks and have experienced social problems from use in the past year. The estimated prevalence of this class is fairly stable from ages 18 to 21 (10%, 9%, 7% and 7% from ages 18 to 21). As shown in Table 4, young adults living in more physically disordered neighborhoods (AOR=1.19; 95% CI=1.04, 1.35; $p=0.013$) and males (AOR=1.94; 95% CI=1.01; 3.74; $p=0.047$) were significantly more likely to be in the *Frequent Use* relative to the *No Use* class while Blacks were significantly less likely (AOR=0.23; 95% CI=0.09; 0.62; $p=0.004$). Young adults living in neighborhoods with more positive social activity were significantly more likely to be in the *Infrequent* relative to *Frequent Use* class (AOR=1.37; 95% CI=1.05, 1.78) while young adults living in more physically disordered neighborhoods were less likely (AOR=0.80; 95% CI=0.65, 0.99; $p=0.040$).

Table 5 shows the probabilities of transitioning across stages of marijuana involvement from ages 18 to 21. The probabilities on the diagonal represent no change in marijuana involvement over the course of one year. Four transition probabilities were estimated to be approximately equal to zero and were fixed to be exactly equal to zero to ease model estimation as in Lanza et al. (2010). Overall, transition probabilities tended toward no marijuana involvement or movement to a less severe class of marijuana involvement (declines in marijuana involvement are located below the diagonal). Rate of initiation of marijuana use was greatest between ages 18 and 19 (11.5%) declining between ages 19 and 20 (2.9%) and increasing again between ages 20 and 21 (7.9%). The pattern was similar for progression in marijuana involvement from infrequent to frequent use (15.5%, 0%, and 8.2%). There was a high degree of stability among young adults who were frequent marijuana users; 61%, 82%, 65% of frequent marijuana users at ages 18, 19 and 20 remained frequent users the following year. Decreased involvement was therefore greatest for young adults reporting infrequent marijuana use compared to young adults reporting frequent marijuana use.

Table 6 reports the adjusted odds ratios for neighborhood physical disorder and social activity predicting transitions between stages of marijuana involvement relative to remaining in the same class. Associations with progression are reported first, followed by declines in use. Higher levels of neighborhood physical disorder was associated with advancing from no marijuana use to frequent use (AOR=2.712; 95% CI=1.145, 3.107; $p=0.023$) rather than remaining in the same class. Conversely, young adults living in neighborhoods with more social activity were less likely to advance from no use to frequent use (AOR=0.002; 95% CI=0.000, 0.254; $p=0.013$). Neighborhood physical disorder was not significantly associated with declines in use, however, higher levels of social activity in the neighborhood was associated with an increased likelihood of transitioning from frequent to infrequent marijuana use (AOR=2.342; 95% CI=1.145, 4.789, $p=0.020$).

CONCLUSION

Emerging adulthood is a discrete developmental period, spanning the ages of 18–25 that is marked by social role transitions and increasing responsibilities (leaving the family home, completion of education, career entry, family formation) (Arnett, 2005). Our findings highlight that in this primarily low income, urban Black sample, it is also a time when rates of marijuana initiation and progression in use decline. Specifically, we found rates of initiation to be highest between ages 18 and 19 (11.5%) and declining to 7.9% between ages 20 and 21. This is consistent with findings from a similar cohort in urban Chicago where rates of initiation were highest at age 17 (Doherty et al., 2008). Prior research suggests, however, that marijuana use continues longer into young adulthood for Blacks compared to Whites (Brown et al., 2004; Doherty et al., 2008). Consistent with this research we found that although rates of initiation declined in young adulthood, there was substantial stability in use over time among frequent users, i.e. the majority of frequent users at ages 18, 19 and 20 remained frequent users the following year (61%, 82% and 65%, respectively). While decreasing use among infrequent users over young adulthood is often associated with increasing social role obligations (e.g. family, career) that come with young adulthood, evidence suggests, however, that frequent marijuana users are less likely to take on conventional social roles (Green & Ensminger, 2006), which may explain the stability among the frequent use class. The frequent use class is also associated with the reporting of problems in the social domain associated with use. These problems might be an indicator of frequent users' difficulty to take on conventional social roles that would facilitate a reduction in marijuana use. There is evidence from other studies that Blacks and those with lower SES transition earlier into parenthood but later to marriage and residential and financial independence than Whites or higher SES Blacks (Berzin & DeMarco, 2010; Cohen et al., 2003b; Entwisle et al., 2000; Haynie et al., 2008; Rinelli & Brown, 2010). While some transitions may redirect a negative trajectory (e.g. graduation), others may not (e.g. early parenthood). Increased financial strain, inability to cover healthcare costs, and higher rates of unemployment may contribute to increased stress levels among Blacks attempting to transition into adult roles which may negatively affect their ability to transition out of drug use initiated as an adolescent (Hardaway & McLoyd, 2008).

Consistent with Furr-Holden et al. (2015), the NifETy measure of physical disorder collected on the youth's residential block was associated with marijuana use. Furr-Holden et al. (2015) found a cross-sectional association between neighborhood physical disorder and marijuana use during the year after high school. In the current longitudinal examination in the same sample from ages 18 to 21, neighborhood physical disorder at age 18 was significantly associated with initiation of marijuana use. In particular, higher levels of neighborhood physical disorder were associated with an increased risk of transitioning from no marijuana use in the past year to frequent marijuana use the following year. These findings are also consistent with other investigations examining neighborhood physical environment and young adult substance use (Burlew et al., 2009; Furr-Holden et al., 2011; Lambert et al., 2004; Reboussin et al., 2014, 2015; Tarter et al., 2009). In line with our theoretical framework, the presence of physical disorder in a neighborhood (e.g. vacant buildings, broken bottles, drug paraphernalia on the streets) is often a signal of weakened

community control and a sense of apathy that invites illegal behavior into the neighborhood (Wilson & Kelling, 1982). It may also indicate increased opportunities for use consistent with findings from Crum et al. (1996) and Tarter et al. (2009).

Compared to physical environments, there is much less work examining the neighborhood social environment; a potential proxy for increased neighborhood surveillance and pro-social neighborhood-level norms. In contrast to Furr-Holden et al. (2015) which did not find a cross-sectional relationship between neighborhood social activity and marijuana use, we found that higher levels of neighborhood social activity (e.g. adults sitting on steps, adults watching youth) was protective. Youth living in neighborhoods with more social activity were significantly less likely to transition from no marijuana use to frequent marijuana use during young adulthood. Additionally, neighborhood prosocial activity was significantly associated with an increased likelihood of transitioning from frequent to infrequent use. These findings were significant even after adjusting for neighborhood physical disorder. This suggests that even in the presence of a deteriorating physical neighborhood that lacks community resources, prosocial activities (e.g. youth playing outside, adults interacting in a positive manner) including the presence of adults monitoring activities (e.g. sitting on steps, watching youth) may prevent initiation of marijuana use as well as decrease marijuana use in young adults. This finding provides some support for the idea that even in the absence of economic investment (both public and private), a sense of ownership of the neighborhood through social interactions in the community can still have a positive impact on drug use.

As is the case with most longitudinal studies, some young adults were lost to follow-up and had moved outside of Baltimore City by their senior year of high school so that field-rater objective neighborhood measures were not available. Although those youth who stayed in the city did not differ in their marijuana use in 12th grade or on first-grade behavioral measures such as self-reports of anxious and depressive symptoms or teacher ratings of aggressive/disruptive behaviors, they may represent those with fewer social and economic resources. A little more than a third of young adults moved to a different census tract between age 18 and 21, although 70% continued to reside in Baltimore City. This analysis does not account for these changes in neighborhood environment which could possibly have an impact on changing drug use. Finally, our study was limited by its sample size particularly given the low prevalence of frequent marijuana use. Despite the small sample size, however, there are few longitudinal studies of low income urban Blacks. Although national probability studies have provided critical information on drug use in the U.S. population as a whole, they are less informative in understanding prevalence in subgroups; particularly socioeconomically disadvantaged, ethnic minority populations living in large urban areas. Our ability to more accurately reflect the true nature of minority drug use in the context of the urban neighborhoods where they live and illuminate within group differences makes this a unique contribution to the literature. This is one of the few studies that follows low-income Blacks from childhood to young adulthood and includes extensive measures of individual and social factors as well as an innovative field-rater assessment of the urban neighborhoods where they live.

This study offers insight into patterns of marijuana use during the transition to adulthood among primarily low-income urban Blacks and provides empirical support for the

neighborhood social environment in shaping patterns of marijuana use. Improving the physical environment through municipal intervention including tearing down of vacant and abandoned buildings could make these neighborhoods less inviting for drug activity and reduce rates of marijuana initiation (Kondo et al., 2018). However, even in the absence of municipal or economic intervention, interventions that foster collective efficacy through positive social activities and interactions have the potential to prevent initiation of marijuana use as well as support reductions in marijuana use.

Appendix: Social Problems

Some people have bad effects from using marijuana. The next set of questions is about some problems you might have had from using marijuana in the past year.

Social problems (Yes or No)

1. Has any friend told you that you shouldn't be using marijuana?
2. Has any member of your family ever told you that you shouldn't be using marijuana?
3. Has any friend ever scolded or fussed at you because you used marijuana?
4. Has any family member ever scolded or fussed at you because you used marijuana?
5. Has any teacher ever scolded or fussed at you because you used marijuana?
6. Have you ever gotten into trouble at school because you used marijuana?
7. Have you ever gotten into trouble at home because you used marijuana?
8. Have you ever gotten into trouble with the police because you used marijuana?

REFERENCES

- Aneshensel CS, & Sucoff CA (1996). The neighborhood context of adolescent health. *Journal of Health and Social Behavior*, 37, 293–310. [PubMed: 8997886]
- Arnett JJ (2005). The developmental context of substance use in emerging adulthood. *J. Drug Issues*, 35, 235–254.
- Berzin D, & DeMarco A (2010). Understanding the impact of poverty on critical events in emerging adulthood. *Youth Soc*, 42, 278–300.
- Brandt R, Ward CL, Dawes A, & Flisher AJ (2005). Epidemiological measurement of children's and adolescents' exposure to community violence: Working with the current state of the science. *Clinical Child and Family Psychology Review*, 8, 327–342. [PubMed: 16362258]
- Brown TL, Flory K, Lynam DR, Leukefeld C, & Clayton RR (2004). Comparing the developmental trajectories of marijuana use of African American and Caucasian adolescents: patterns, antecedents, and consequences. *Exp. Clin. Psychopharmacol*, 12, 47–56. [PubMed: 14769099]
- Burlew AK, Johnson CS, Flowers AM, Peteer BJ, Griffith-Henry KD, & Buchanan ND (2009). Neighborhood risk, parental supervision and the onset of substance use among African American adolescents. *Journal of Child and Family Studies*, 18, 680–689.
- Case A, Fertig F, & Paxson C (2005). The lasting impact of childhood health and circumstance. *Journal of Health Economics*, 24, 2, 365–389. [PubMed: 15721050]
- Cohen DA, Mason K, Bedimo A, Scribner R, Basolo V, & Farley TA (2003a). Neighborhood physical conditions and health. *American Journal of Public Health*, 93, 467–471. [PubMed: 12604497]

- Cohen P, Kasen S, Chen H, Hartmark C, & Gordon K (2003b). Variations in patterns of developmental transitions in the emerging adulthood period. *Dev. Psychol* 39, 657–669. [PubMed: 12859120]
- Copeland-Linder N, Lambert SF, Chen YF, & Ialongo NS (2011). Contextual stress and health risk behaviors among African American adolescents. *J Youth Adolesc*, 40, 158–73. [PubMed: 20213481]
- Crum RM, & Lillie-Blanton M, & Anthony JC (1996). Neighborhood environment and the opportunity to use cocaine and other drugs in late childhood and early adolescence. *Drug and Alcohol Dependence*, 43, 155–161. [PubMed: 9023071]
- Dannefer D (1987). Aging as an intracohort differentiation: Accentuation, the Matthew effect, and the life course. *Sociological Forum*, 2, 211–236.
- Doherty EE, Green KM, Reisinger HS, & Ensminger ME (2008). Long-term patterns of drug use among an urban African-American cohort: the role of gender and family. *J. Urban Health Bull. N. Y. Acad. Med*, 85, 250–267.
- Entwisle DR, Alexander KL, & Olson LS (2000). Early work histories of urban youth. *Am. Sociol. Rev*, 65, 279–297.
- Fagan AA, Wright EM, & Pinchevsky GM (2013). Racial/ethnic differences in the relationship between neighborhood disadvantage and adolescent substance use. *Journal of Drug Issues*, 43, 69–84. [PubMed: 25147408]
- Furr-Holden CDM, Lee MH, Milam AJ, Duncan A, Reboussin BA, Leaf PJ, & Ialongo NS (2015). Neighborhood environment and marijuana use in urban young adults. *Prevention Science*, 16, 268–278. [PubMed: 25005818]
- Furr-Holden CDM, Lee MH, Milam AJ, Johnson RM, Lee KS, & Ialongo NS (2011). The growth of neighborhood disorder and marijuana use among urban adolescents: a case for policy and environmental interventions. *Journal of Studies on Alcohol and Drugs*, 72, 371–379. [PubMed: 21513673]
- Furr-Holden CDM, Campbell KD, Smart MJ, Milam AJ, Ialongo NS, & Leaf PJ (2010). Metric properties of the Neighborhood Inventory for Environmental Typology (NifETy). *Evaluation Review*, 34, 159–184. [PubMed: 20479211]
- Furr-Holden CDM, Pokorni JL, Smart MJ, Ialongo NS, Holder H, & Anthony JC (2008). The NifETy method for environmental assessment of neighborhood-level indicators of violence, alcohol and other drug exposure. *Prevention Science*, 9, 245–255. [PubMed: 18931911]
- Green KM, & Ensminger ME (2006). Adult social behavioral effects of heavy adolescent marijuana use among African Americans. *Dev. Psychol*, 42, 1168–1178. [PubMed: 17087550]
- Green KM, Doherty EE, Stuart EA, & Ensminger ME (2010). Does heavy adolescent marijuana use lead to criminal involvement in adulthood? Evidence from a multiwave longitudinal study of urban African Americans. *Drug and Alcohol Dependence*, 112, 117–25. [PubMed: 20598815]
- Hardaway CR, & McLoyd VC (2008). Escaping poverty and securing middle class status: how race and socioeconomic status shape mobility prospects for African Americans during the transition to adulthood. *J. Youth Adolesc*, 38, 242–256. [PubMed: 19636721]
- Haynie DL, Weiss HE, & Piquero A (2008). Race, the economic maturity gap, and criminal offending in young adulthood. *Justice Q*, 25, 595–622.
- Ialongo NS, Werthamer L, Kellam SG, Brown CH, Wang S, & Lin Y (1999). Proximal impact of two first-grade preventive interventions on the early risk behaviors for later substance abuse, depression, and antisocial behavior. *Am. J. Community Psychol*, 27, 599–641. [PubMed: 10676542]
- Jencks C, & Mayer S (1990). The social consequences of growing up in a poor neighborhood In Lynn LE & McGeary MFH (Eds.), *Inner-city poverty in the United States* (pp.111–186). Washington, DC: National Academy Press.
- Kennedy SM, Caraballo RS, Rolle IV, & Rock VJ (2016). Not just cigarettes: A more comprehensive look and marijuana and tobacco use among African American and White youth and young adults. *Nicotine and Tobacco Research*, 18, Suppl 1:S65–72. [PubMed: 26980865]
- Kneebone E, & Holmes N (2016). U.S. concentrated poverty in the wake of the Great Recession. *Brookings Institute Report*. Thursday, March 31, 2016.

- Kneebone E, Nadeau C, & Berube A (2011). The re-emergence of concentrated poverty: metropolitan trends in the 2000s. Brookings Institute Report. November 2011.
- Kogan SM, Cho J, Brody GH, & Beach SR (2017). Pathways linking marijuana use to substance use problems among emerging adults: A prospective analysis of young Black men. *Addictive behaviors*, 72, 86–92. [PubMed: 28388493]
- Kondo MC, Fluehr JM, McKeon T, & Branas CC (2018). Urban green space and its impact on health. *Int J Environ Res Public Health*, 15(3): 445.
- Lambert SF, Brown T, Phillips CM, & Ialongo NS (2004). The relationship between perceptions of neighborhood characteristics and substance use among urban African American adolescents. *American Journal of Community Psychology*, 34, 205–218. [PubMed: 15663207]
- Lanza ST, Patrick ME, & Maggs JL (2010). Latent transition analysis: benefits of a latent variable approach to modeling transitions in substance use. *J. Drug Issues*, 40, 93–120. [PubMed: 20672019]
- Mair C, Diez Roux AV, & Galea S (2008). Are neighborhood characteristics associated with depressive symptoms? A review of evidence. *Journal of Epidemiology and Community Health*, 62, 940–U921. [PubMed: 18775943]
- Milam AJ, Johnson RM, Nesoff ED, Reboussin BA, & Furr-Holden D (2016). Evaluating nighttime observational measures of neighborhood disorder: Validity of the nighttime NIFeTy assessment. *Journal of Environmental Psychology*, 45, 97–102. [PubMed: 28979058]
- Muthén LK, & Muthén B,O (2012). *Mplus User's Guide*. Seventh Edition. Los Angeles, CA: Muthén & Muthén.
- Nylund KL, Asparouhov T, & Muthén B (2007). Deciding on the number of classes in latent class analysis and growth mixture modeling: A Monte Carlo simulation study. *Struct. Equ. Modeling*, 14, 535–69.
- Perkins DD, Meeks JW, & Taylor RB (1992). The physical environment of street blocks and resident perceptions of crime and disorder: implications for theory and measurement. *Journal of Environmental Psychology*, 12, 21–34
- Reboussin BA, Green KM, Milam AJ, Furr-Holden DM, Johnson RM, & Ialongo NS (2015). The role of neighborhood in urban black adolescent marijuana use. *Drug and Alcohol Dependence*, 154, 69–75. [PubMed: 26162651]
- Reboussin BA, Green KM, Milam AJ, Furr-Holden CD, & Ialongo NS (2014). Neighborhood environment and urban African American marijuana use during high school. *Journal of Urban Health*, 91, 1189–1201. [PubMed: 25323775]
- Rinelli LN, & Brown SL (2010). Race differences in union transitions among cohabitators: the role of relationship features. *Marriage Fam. Rev.*, 46, 22–40.
- Royston P, Carlin JB, White IR, 2009 Multiple imputation of missing values: new features for mim. *The Stata Journal*. 9:252–264.
- Sampson R, Morenoff JD, & Gannon-Rowley T (2002). Assessing “neighborhood effects”: social processes and new directions in research. *Annual Review of Sociology*, 28, 443–478.
- Sampson RJ, & Raudenbush SW (1999). Systematic social observations of public spaces: a new look at disorder in urban neighborhoods. *American Journal of Sociology*, 105, 603–651.
- Sampson RJ, Raudenbush SW, & Earls F (1997). Neighborhoods and violent crime: a multilevel study of collective efficacy. *Science*, 277, 918–924. [PubMed: 9252316]
- Sampson RJ (1997). The embeddedness of child and adolescent development: a community level perspective on urban violence In McCord J (Ed.), *Violence and childhood in the inner-city* (pp.31–77). New York: Cambridge University Press.
- Schaefer-McDaniel N, Caughy MOB, O'Campo P, & Gearey W (2010). Examining methodological details of neighbourhood observations and the relationship to health: a literature review. *Social Science & Medicine*, 70, 277–292. [PubMed: 19883966]
- Shonkoff JP, Richter L, van der Gaag J, Bhutta ZA (2012). An integrated scientific framework for child survival and early childhood development. *Pediatrics*, 129, 460–472.
- StataCorp (2009). *Stata multiple-imputation reference manual*. College Station, TX: StataCorp, LP.
- Tarter RE, Kirisci L, Gavalier JS, Reynolds M, Kirillova G, Clark DB, Wu J, et al., (2009). Prospective study of the association between abandoned dwellings and testosterone level on the development

of behaviors leading to cannabis use disorder in boys. *Biological Psychiatry*, 65, 116–121. [PubMed: 18930183]

Tucker JS, Pollard MS, de la Haye K, Kennedy DP, & Green HD Jr., (2013). Neighborhood characteristics and the initiation of marijuana use and binge drinking. *Drug and Alcohol Dependence*, 128, 83–89. [PubMed: 22938829]

White HR, Beardslee J, & Pardini D (2017). Early predictors of maturing out of marijuana use among young men. *Addictive behaviors*, 65, 56–62. [PubMed: 27768917]

Wilson JQ, & Kelling GL (3 1982), “Broken Windows: The police and neighborhood safety”, *The Atlantic*, retrieved 2016-05-01 Manhattan Institute.

Wilson N, Syme SL, Boyce WT, Battistich VA, & Selvin S (2005). Adolescent alcohol, tobacco, and marijuana use: the influence of neighborhood disorder and hope. *Am J Health Promot.*, 20, 11–19. [PubMed: 16171156]

Wu LT, Zhu H, & Swartz MS (2016). Trends in cannabis use disorders among racial/ethnic population groups in the United States. *Drug and Alcohol Dependence*, 165, 181–90. [PubMed: 27317045]

Figure 1.
Latent Class Model of Marijuana Use from Ages 18 to 21

Table 1

Prevalence of NifETy Indicators at Age 18 Assessment (n=379)

<i>Physical Disorder Items</i>	%
Broken windows	7.4
Abandoned buildings	20.3
Vacant houses	20.6
Vacant lots	8.4
Unmaintained properties	39.8
Broken bottles	31.4
Graffiti	10.5
Evidence of vandalism	10.3
Intoxicated people, signs of using alcohol/drugs, or signs of drug selling	6.1
Syringes or vials	6.6
Baggies, blunt guts/wrappers or pot roaches	15.0
Alcohol bottles	21.1
<i>Social Activity Items</i>	%
Youth playing	16.5
Youth sitting in a group	24.0
Youth in transit	3.2
Positive adult interactions	30.6
Adults sitting on steps	42.2
Adults watching youth	19.5

Table 2Marijuana Use across Ages 18–21 (%)[/]

	Age 18 N=324	Age 19 N=331	Age 20 N=330	Age 21 N=336
Used marijuana in the past year	26.8	21.1	17.3	14.0
Used marijuana in the past month	13.3	11.5	8.2	9.2
Used marijuana 3+times past year	17.0	15.1	9.4	8.9
Used marijuana every day or almost every day for two weeks	8.3	7.2	6.7	5.9
Social problems from use past year	19.4	13.0	12.4	9.2

[/]The total sample size of 379 reflects the sample of young adults with at least one follow-up visit

Table 3

Fit Statistics for Latent Class Model of Marijuana Use by Age and Overall

No. of Classes	AIC ^{a,d}	BIC ^{b,d}	a-BIC ^{c,d}	LMR ^e p-value	PB ^f p-value	Entropy ^g
Overall						
2	2670	2725	2681	__ ^h	__ ^h	0.899
3	2629	2720	2647	__ ^h	__ ^h	0.882
4	2626	2752	2651	__ ^h	__ ^h	0.889
Age 18						
2	841	883	848	<0.001	<0.001	0.982
3	828	892	838	<0.001	<0.001	0.948
4	835	921	849	0.223	0.667	0.929
Age 19						
2	718	760	725	<0.001	<0.001	0.986
3	716	781	727	0.096	<0.001	0.948
4	723	810	737	0.024	0.333	0.955
Age 20						
2	621	663	628	<0.001	<0.001	0.986
3	616	680	627	0.036	<0.001	0.961
4	623	710	638	0.170	0.667	0.957
Age 21						
2	534	576	541	<0.001	<0.001	0.993
3	532	597	543	0.037	<0.001	0.975
4	539	626	554	0.037	0.286	0.975

^a AIC: Akaike's Information Criterion. Lower values represent better fit.^b BIC: Bayesian Information Criterion. Lower values represent better fit.^c a-BIC: sample-size adjusted Bayesian Information Criterion. Lower values represent better fit.^d Lower values represent better fit.^e LMR: Lo-Mendell-Rubin likelihood ratio test^f PB: Parametric bootstrapped likelihood ratio test^g Values closer to 1 indicated better separation of classes^h These fit statistics not available for longitudinal latent class analysis.

Table 4

Associations of Sociodemographic and Neighborhood Characteristics with Marijuana Class Membership

12 th Grade Predictor	Infrequent Use Vs No Use AOR (95% CI), p-value	Frequent Use vs No Use AOR (95% CI), p-value	Infrequent vs Frequent Use AOR (95% CI), p-value
Male vs Female	0.92 (0.51, 1.65) p=0.779	1.94 (1.01, 3.79) p=0.047	0.47 (0.20, 1.15) p=0.097
Black vs non-Black	0.91 (0.20, 4.06) p=0.901	0.23 (0.09, 0.62) p=0.004	3.95 (0.81, 19.3) p=0.090
Free/reduced price meals	0.99 (0.55, 1.79) p=0.973	1.00 (0.48, 2.07) p=0.998	1.00 (0.48, 2.06) p=0.982
Physical Disorder	0.95 (0.82, 1.11) p=0.519	1.19 (1.04, 1.35) p=0.013	0.80 (0.65, 0.99) p=0.040
Social Activity	1.13 (0.95, 1.65) p=0.779	0.82 (0.66, 1.02) p=0.082	1.37 (1.05, 1.78) p=0.021

Table 5

Estimated Marijuana Class Transition Probabilities

Age 18 to 19	No Use	Infrequent Use	Frequent Use
No Use	0.885	0.107	0.008
Infrequent Use	0.560	0.285	0.155
Frequent Use	0.391	0.000 ^I	0.608
Age 19 to 20	No Use	Infrequent Use	Frequent Use
No Use	0.973	0.027	0.000 ^I
Infrequent Use	0.456	0.544	0.000 ^I
Frequent Use	0.097	0.086	0.817
Age 20 to 21	No Use	Infrequent Use	Frequent Use
No Use	0.921	0.066	0.013
Infrequent Use	0.739	0.180	0.082
Frequent Use	0.351	0.000 ^I	0.649

^I Transition probability fixed to be exactly zero.

Table 6

Neighborhood Environment and Transitions in Marijuana Use

	Physical Disorder ¹	Social Activity ²
	AOR (95% CI), p-value	AOR (95% CI)
Progression in Use		
No Use to Infrequent Use	1.033 (0.569, 1.939), p=0.919	1.066 (0.892, 1.274), p=0.484
No Use to Frequent Use	2.712 (1.145, 3.107), p=0.023	0.002 (0.000, 0.254), p=0.013
Infrequent to Frequent Use	0.543 (0.225, 1.575), p=0.174	0.801 (0.434, 1.479), p=0.479
Decline in Use		
Frequent to Infrequent Use	0.253 (0.044, 1.470), p=0.126	2.342 (1.145, 4.789), p=0.020
Frequent to No Use	1.105 (0.875, 1.395), p=0.403	1.247 (0.592, 2.624), p=0.563
Infrequent to No Use	1.005 (0.847, 1.192), p=0.953	1.014 (0.761, 2.002), p=0.928

¹Model adjusts for neighborhood social activity, race, gender, and free or reduced price meal status.

²Model adjusts for neighborhood physical disorder, race, gender and free or reduced price meal status.