Exploring the Intersection of Neighborhood Racial and Economic Composition and Individual

Race on Substance Use among Male Adolescents

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Introduction

Research has demonstrated significant racial differences in adolescent substance use (Lee et al., 2010; Wallace et al., 2009), as well as substance use differences across neighborhood and community contexts (Hawkins et al., 2004; Wright et al., 2007). While individual racial differences are well established, our understanding of how the racial and economic composition of the neighborhood interacts with individual race to affect substance use is less well understood. The present study addresses this gap and tests the intersection of neighborhood racial and economic composition and individual race on adolescent substance use.

Race and Substance Use

National studies of adolescent substance use consistently show differences in patterns of use between African Americans and Whites (Centers for Disease Control and Prevention [CDC], 2009; Johnston et al., 2009). Since 1992, Monitoring the Future (MTF) data have shown that in the 8th, 10th, and 12th grades, Whites, compared to African Americans, report higher annual prevalence of use of any illicit drug other than marijuana (Johnston et al., 2009; Wallace et al., 2003a). Similarly, data from the 2009 national Youth Risk Behavior Survey (YRBS) show that African American students in grades 9-12 are less likely to report adolescent lifetime cocaine, inhalant, hallucinogen, and illegal prescription drug use, as well as past-month tobacco use, than their White peers (CDC, 2009). In addition, White adolescents report higher drinking prevalence than their African American counterparts (CDC, 2009; Johnston et al., 2009; Lee et al., 2010; White et al., in press). White, compared to African American, adolescents tend to begin drinking earlier (Chartier et al., 2009; White et al., 2007) and these differences remain at least until early

young adulthood (Lee et al., 2010).

In contrast to other substance use trends, racial differences in marijuana use are not as consistent. Since 1977, MTF data show that 12th grade African American, compared to White, adolescents report lower levels of adolescent lifetime marijuana use (Johnston et al., 2009). However, annual prevalence among 8th graders has shifted from a higher prevalence among European-American adolescents in 1992 to a higher prevalence among African American adolescents in 2008 (Johnston et al., 2009). Similarly, according to 2009 YRBS data, African American adolescents report higher adolescent lifetime marijuana prevalence than European-American adolescents (CDC, 2009). Wallace and colleagues (2003a) found that between 1996 and 2000, African American boys in 8th, 10th, and 12th grades reported higher adolescent lifetime prevalence than White boys, whereas African American girls reported a nearly equal or lower prevalence than White girls.

Community Characteristics and Substance Use

Despite research showing that the prevalence of alcohol, tobacco, and hard drug use is higher among White, compared to African American, adolescents, the literature on community characteristics suggests that African American adolescents would be *more* at risk for substance use than White counterparts. A substantial body of empirical work, based on the theory of social disorganization (Shaw & McKay, 1942/1969), as well as the idea of concentrated disadvantage in urban, predominantly African American communities popularized by Wilson (1987), suggests that community characteristics such as high population density, ethnic/racial heterogeneity, residential instability, and low socioeconomic status (SES) are risk factors for delinquent behavior (Beyers et al., 2000; Kingston et al., 2009; Leventhal & Brooks-Gunn, 2003; Sampson, 1997; Sampson & Raudenbush, 1999). In addition, neighborhood characteristics of physical and

social disorder, such as vandalism, graffiti, loitering, and drug dealing, have been shown to be associated with deviance (Sampson & Raudenbush, 1999). African Americans, compared to Whites, are more likely to live in neighborhoods with these characteristics (Mason & Mennis, 2010), and African American adolescents are more likely to engage in violent and criminal behavior than White adolescents (Snyder & Sickmund, 2006).

Relatively few studies, however, have examined the relationship between neighborhood context and adolescent substance use (see Gardner et al., 2010, for a review), and those that have show results that are often contrary to those found when examining other problem behaviors, such as violence. While epidemiological studies have demonstrated that substance use clusters spatially across communities, and that neighborhoods vary in their levels of adolescent substance use (Hawkins et al., 2004; Reboussin et al., 2010), research increasingly finds that substance use, particularly alcohol and hard drug use, is more prevalent in suburban and higher-income communities than in urban, lower-income communities (Ansary & Luthar, 2005; Chilenski & Greenberg, 2009; Luthar & D'Avanzo, 1999; Luthar & Goldstein, 2008; Luthar & Latendresse, 2005; Reboussin et al., 2010; Snedker et al., 2009). Thus, it appears that community characteristics may be differently associated with substance use than they are with delinquency.

For instance, research shows that availability of substances is associated with greater use (Connell et al., 2010; Hawkins, et al., 2004), and it may be the case that substances are more widely available in higher-income communities in which adolescents have more frequent opportunities for use and more disposable income. In addition, in a study of delinquent behavior, including substance use, among suburban high school students, the adolescents reported that their parents were more tolerant of substance use compared to other deviant behaviors (Luthar & Ansary, 2005). However, other studies have shown a positive association between adolescent

substance use and adolescents' impressions of neighborhood disorganization (Burlew et al., 2009; Winstanley et al., 2008) suggesting that some aspects of socially disorganized neighborhoods may be risk factors for use.

In sum, the evidence is conflicting about how neighborhood context influences adolescent substance use. While studies of crime and delinquency generally show positive associations between the level of social disorganization and the rates of crime and delinquency, the results have been less consistent for studies of substance use. In fact, living in a higher-income community may actually be a risk factor for use.

Race, Neighborhoods, and Adolescent Substance Use

In the same way that substance use differs greatly between African Americans and Whites, neighborhood residence also differs by race (Bayer et al., 2003; Schelling, 1971). Although racial segregation decreased for African Americans between 1980 and 2000, they remained most likely to live in racially segregated areas compared to any other ethnic minority group (Iceland et al., 2002). African Americans tend to live in predominantly African American neighborhoods, which have lower average individual and family SES, higher crime rates, and fewer educational and recreational differences compared to predominantly White or mixed race neighborhoods (Krivo et al., 2009; Wilson, 1987). While many of these characteristics (which define a socially disorganized neighborhood) are risk factors for delinquency, whether they are risk factors for substance use remains an important question to address. Further, how these characteristics exert influences in conjunction with individual race is also important to address.

Most of the studies reviewed above examined adolescents of different races living in the same community and tried to understand how individual race may alter the effect of the same neighborhood on individual behavior. Few studies, to our knowledge, have compared

neighborhoods effects across different types of communities for individuals of the same race (for exceptions, see Fuller et al., 2005; Kulis et al., 2007). Thus, for the most part, it has been difficult to determine if and how individual race interacts with the racial and economic composition of the neighborhood to influence adolescent substance use.

Current Study

The current longitudinal study examines whether the intersection of neighborhood racial and income composition and individual race predicts patterns of individual substance use after controlling for family socioeconomic status. It does so by comparing adolescents of the *same* race across neighborhoods with *differing* racial and socioeconomic profiles. Further, we use longitudinal data to examine the short- and longer-term effects of neighborhood on adolescent substance use.

We define neighborhood composition according to socioeconomic and racial composition. We hypothesize that living in *less* disadvantaged neighborhoods would predict more alcohol, tobacco and hard drug use. Moreover, we hypothesize that being a racial minority in a neighborhood would affect one's substance use behaviors. Thus, African American adolescents living in African American neighborhoods, compared to African American adolescents living in White or racially mixed neighborhoods, would be less likely to use alcohol, tobacco, and hard drugs. Due to empirical evidence of higher prevalence of marijuana use among African American adolescents, however, we hypothesize that the former would be more likely to use marijuana than the latter. Also, White adolescents living in White neighborhoods, compared to White adolescents living in African American or racially mixed neighborhoods, would be more likely to use alcohol, tobacco, and hard drugs, but would be less likely to use marijuana.

Methods

Sample and Data Collection

The study relies on data from the Pittsburgh Youth Study (PYS; Loeber et al., 2008), which is uniquely positioned to test these interactions. Given that Pittsburgh was one of the most segregated cities in the U.S. in 1990 (Bangs & Hong, 1996), these data from the PYS are able to isolate the effects of living in African American and White neighborhoods more clearly than possible from studying urban areas where there is less residential, racial segregation. In addition, the PYS is longitudinal, unlike national data sets, which are often cross-sectional, and thus ideal for the current study, which intends to capture ages of substance use onset prospectively and to examine the effects of neighborhood composition in late childhood on substance use in adolescence. In addition, the PYS is nearly half African American and half White, thus providing adequate sample power to detect the hypothesized race differences in neighborhood effects on substance use. On the other hand, the PYS consists only of boys, because the study was designed to better understand delinquent behaviors, crimes and violence. Thus, this initial study provides information on individual and neighborhood racial effects on substance use for boys, which should be replicated with girls in future studies.

The PYS recruited boys attending public school in Pittsburgh, PA, which historically was a steel-town and largely working class (Loeber et al., 2008). The city had a fairly stable population throughout the twentieth century, and in 1989, 369,879 people lived in Pittsburgh, 26% of whom were African American. There are 90 distinct neighborhoods in the city (Loeber et al., 2008), defined along natural geographic boundaries such as hills and rivers. The median household income in 1989 was $20,747, and 16.6% of families were living below the federal poverty line (U.S. Census, 1990).

Three cohorts of boys from the first (youngest), fourth (middle), and seventh (oldest) grades were originally sampled in 1987. The participation rate was approximately 85%. Those who participated did not differ from those who refused in terms of racial background or school achievement scores, which were the only two variables that could be compared using school records. Approximately one third of the families of the boys who participated were receiving public assistance at the beginning of the study. Families were paid for their participation and written consent was obtained from legal guardians of the participants and assent from the participants themselves until age 18. After age 18, the participants provided written consent. Students were screened for their risk for antisocial behaviors and approximately 500 boys were selected for each cohort (250 boys scoring in the top 30% for antisocial behavior risk and 250 from the remaining 70% of the initial screening sample), resulting in a total sample of 1,517. The sampling pool was largely African American (57%) and White (41%) with 2% Hispanic, Asian or mixed descent.

For the purposes of this study, only the African American and White youth in the youngest cohort were included ($N = 484$) due to our interest in early onset and patterns of substance use during adolescence (the middle cohort was followed up only for 3 years). There were 11 boys with missing information on neighborhood tract at age 10 and they were eliminated from the analysis, leaving a final sample of 473. Boys were assessed at 6-month intervals for the first four years and then annually until age 19. Retention has averaged over 90% through adolescence (Loeber et al., 2008). Data from ages 5 to 18 were used in this study because we were interested in substance use onset by the end of adolescence.

Measures

Individual race was based on self-report, African American (coded 0; $n = 272$) or White (coded 1; $n = 201$). Neighborhood characteristics were measured using raw data from the 1990 Census that were matched to the neighborhood in which the participant was living at age 10, for a total of 188 neighborhood tracts. Census data included 10 indicators: size of neighborhood population, percentage of the population which is African American, percentage living in the same house for at least 5 years, percentage unemployed, proportion of households on welfare, median household annual income, percentage of divorced or single parent homes, percentage of families below the federally-defined poverty level, mean household size, and percentage of youth aged 10 to 19. Neighborhood population was log-transformed to correct for skew. All other indicators were normally distributed.

Substance use was measured using a 16-item *Substance Use Scale*, based on the National Youth Survey (Elliott et al., 1985). Alcohol, tobacco, marijuana, and hard drug use prevalence was assessed as early onset (by age 14)[2] and adolescent lifetime onset (by age 18). We selected early onset and adolescent onset as the outcomes due to their implications for future substance use. For example, there is some evidence, which shows a relationship between early substance use onset and later use and dependence (e.g., Behrendt et al., 2009). Similarly, adolescent-onset, compared to adult onset, substance use has been shown to predict a more rapid escalation in use (Clark et al., 1998).[1] Composite variables were created to measure prevalence. At each phase, beginning with the first phase when the boys were 6 years old on average, participants were asked: In the past year (or six months), have you (a) used tobacco (cigarettes, pipes, or chewing tobacco); (b) drank alcohol (beer, wine, or hard liquor); (c) used marijuana or hashish; and (d) used hallucinogens, cocaine, crack, heroin, PCP, tranquilizers, barbiturates, codeine,

amphetamines, and other prescription medications for nonmedical reasons? These latter ten

substances were combined to reflect hard drug use. The first year that the participant indicated

that he had used the substance became the age of onset for initiation of that substance.

Family socioeconomic status (SES) at age 10 was included as a control variable and

measured using Hollingshead's (1975) index of social status from data collected from the

primary caretaker. (If family SES data at age 10 were not available, then data were used from

ages 9 or 8.) The SES index is the product of occupational status and highest educational level of

caretakers (the higher score attained between two caretakers or the score attained by the single

caretaker). Family SES ranged from 9 to 66 in a normal distribution ($M = 38.65$, $SD = 11.35$).

Neighborhood impression of crime and safety was included as a control variable due to

evidence indicating that adolescents' impressions of greater social disorganization in their

neighborhood is associated with higher levels of substance use (Winstanley et al., 2008) and that

neighborhood social disorganization is confounded with neighborhood socioeconomic status

(Shaw & McKay, 1942/1969). This variable was assessed at age 10 using parents' or caregivers'

responses on a 17-item questionnaire inquiring about the amount of crime and neglect in the

immediate area (Elliott et al., 1996). (If age 10 neighborhood impression data were not available,

then data were used from age 9 or age 8.) The questionnaire used a three-point Likert scale (1 =

not a problem, 2 = *somewhat of a problem*, and 3 = *a big problem*) with summed scale scores

ranging from the least (17) to the most (51) crime and disorganization ($M = 25.67$, $SD = 9.08$, α

= .96). The aggregated variable was normally distributed.

Data Analysis

We conducted a latent profile analysis (LPA) using Mplus 6.0 (Muthén & Muthén, 1998-

2010) to create neighborhood classes using the 10 Census variables listed above.[3] All Census

variables were standardized to minimize the effect of scale differences on models. In LPA, a categorical latent variable (i.e., neighborhood class membership) is used to explain the dependent relationships among a set of observed variables (i.e., 10 Census indicators) (Collins & Lanza, 2010). This analysis can be useful for empirically deriving distinctive clusters of neighborhood tracts that share similar characteristics within clusters but that are maximally different from other neighborhood tract clusters. We expected that resulting neighborhood classes would reflect the stark racial segregation of Pittsburgh's neighborhoods (Bang & Hong, 1996).

Substance use data were first compared by race, neighborhood class, and race by neighborhood group membership using chi square analyses. Then, for each race, eight binary logistic regression models were run in SPSS 18 (2009) to test: prevalence of early onset alcohol (1), tobacco (2), marijuana (3), and hard drug (4) use; and adolescent lifetime prevalence alcohol (5), tobacco (6), marijuana (7), and hard drug (8) use.[4] These models were tested separately for African American and White adolescents so that we could compare individuals of the same race living in different types of communities. In each of the regression models, individual race by neighborhood race groups were regressed on the substance use outcome variables, controlling for SES and neighborhood impression of crime and safety.

Results

Substance Use Descriptive Analyses

Descriptive analyses showed that slightly over half (56%) of the boys had tried alcohol by the age of 14, a third (34%) had smoked tobacco, and over a fourth (27%) had smoked marijuana, while 5% had tried hard drugs. Adolescent lifetime (by age 18) prevalence of alcohol use (78%) was the highest compared to tobacco (56%), marijuana (60%), and hard drug (13%) use.

Latent Profile Analysis

The 10 items from the 1990 Census were analyzed for 188 neighborhood tracts using LPA. We sequentially tested models with different number of classes (two through five classes). A four-class solution fit the data best based on BIC and Lo-Mendell-Rubin Adjusted Likelihood Ratio chi-square test.[5] The four neighborhood classes were: (1) predominantly African American, lower-income neighborhoods (25 tracts), (2) racially mixed, middle-income neighborhoods (61 tracts), (3) predominantly White, middle-income neighborhoods (50 tracts) and (4) predominantly White, upper-income neighborhoods (52 tracts). The racial descriptions of the neighborhoods are consistent with previous studies that have defined neighborhoods as predominantly a single race when that race constitutes at least 70% of the tract population (Krivo et al., 2009).[5] The neighborhood classes were significantly different across all of the measured Census variables as well as individual-level variables, including neighborhood impression, family SES, and percent of participants who were African American (Table 1). As expected, the majority of the adolescents living in the neighborhood class that was predominantly African American and low income was African American and reported the lowest family SES. Their parents reported the most negative neighborhood impressions.

Differences in Substance Use Prevalence by Race and Neighborhood

Comparing substance use between African Americans and Whites, there were statistically significant differences for early and adolescent lifetime onset of all substances except early alcohol use (see the first row block in Table 2). In particular, White boys were nearly twice as likely to report early tobacco use onset and almost six times as likely to report adolescent lifetime hard drug use as African American boys. African American, compared to White, boys were more likely to report early onset and adolescent lifetime onset of marijuana use.

Examining differences in prevalence by neighborhood class, there were significant neighborhood differences for tobacco (early onset), marijuana (early onset and adolescent lifetime), and hard drug (adolescent lifetime) use (see the second row block in Table 2). Overall, tobacco and hard drug use prevalence was relatively higher among White, upper-income neighborhoods compared to the other neighborhood classes. In contrast, adolescent lifetime marijuana prevalence rates were relatively higher in African American, low-income neighborhoods and White, upper-income neighborhoods (73.1% and 72.7%, respectively), compared to racially mixed, middle-income (60.0%) and White, middle-income (48.2%), neighborhoods.

Finally, we examined differences in prevalence according to the intersection of individual race and neighborhood class (see Table 3). We created six neighborhood groups based on the combination of a boy's neighborhood of residence at the age of 10 and his race. The six groups were: (1) African American adolescents living in predominantly African American, lower-income neighborhoods ($n = 138$); (2) African American adolescents living in predominantly White, middle-income neighborhoods ($n = 19$); (3) African American adolescents living in predominantly racially mixed, middle-income neighborhoods ($n = 111$); (4) White adolescents living in predominantly White, middle-income neighborhoods ($n = 105$); (5) White adolescents living in predominantly White, upper-income neighborhoods ($n = 72$); and (6) White adolescents living in predominantly racially mixed, middle-income neighborhoods ($n = 23$). Only four African American adolescents were living in a White, upper-income neighborhood and only one White adolescent was living in a African American neighborhood. These five individuals were excluded from the subsequent analyses.

Neighborhood groups (i.e., individual race by neighborhood class) showed significant differences in tobacco, marijuana, and hard drug use prevalence, although the results for hard drug use should be interpreted with caution due to some small cells (Table 3). Specifically, Whites living in all types of neighborhoods, especially White, upper-income neighborhoods, reported the highest rates of early onset tobacco use. Whites living in White neighborhoods also reported the highest rates of adolescent lifetime prevalence of tobacco, and African Americans living in middle-income racially mixed neighborhood reported the lowest. For early onset marijuana use, Whites living in White, middle-income neighborhoods and African Americans living in racially mixed, middle-income neighborhoods reported the lowest rates. Whites living in White upper-income neighborhoods and African Americans in African American, low-income and racially mixed middle-income neighborhoods reported the highest rates of adolescent marijuana prevalence, whereas Whites living in racially mixed, middle-income neighborhoods reported the lowest. Finally, hard drug use was higher for Whites than African Americans regardless of neighborhood.

Within race, however, there were no significant neighborhood differences in substance use for African American boys. Among White boys, there was a significant difference by neighborhood group in early and adolescent lifetime prevalence of marijuana use. Contrary to expectations, White boys living in White, upper-income neighborhoods reported higher early onset (33.8%) and adolescent lifetime prevalence (73.8%), compared to their counterparts living in White, middle-income (16.8% and 48.4%, respectively) or racially mixed, middle-income neighborhoods (30.4% and 34.8%, respectively). The former, compared to the latter also showed higher adolescent lifetime prevalence for hard drug use (36.5% versus 20.8% and 26.1%, respectively).

Substance Use Prevalence Regressed on Neighborhood Group

The binary logistic regression models for early onset and adolescent lifetime prevalence were tested separately for the African American and White samples. For both races, the adolescents living in the racially mixed, middle-income neighborhoods were the reference category because our hypotheses involved looking explicitly at the adolescents who were living as racial minorities in their neighborhoods. Based on the log-likelihood chi-square test, none of the models were significant for African Americans (data not shown but can be requested from the first author). Comparing prevalence among White boys, the models for early onset and adolescent lifetime marijuana use and adolescent lifetime alcohol use were significant (Table 4). The only significant neighborhood effect, however, was for adolescent lifetime marijuana use among White adolescents living in White, upper-income neighborhoods. Consistent with the bivariate results, they were *more* likely than their peers living in mixed race neighborhoods to use marijuana ($OR = 4.3$).

Discussion

The current study aimed to further explore racial differences in substance use by testing how individual race intersected with neighborhood racial composition to predict adolescent substance use. Hypotheses were guided by the consistent differences in substance use between African American and White adolescents reported in the literature (Substance Abuse and Mental Health Services Association [SAMHSA], 2010; Wallace et al., 2003), as well as evidence that neighborhood context may influence substance use (Gardner et al., 2010).

The results of the neighborhood latent class analysis suggested that race and neighborhood socioeconomic factors are difficult to distinguish from each other. For the most part, African Americans lived in the lowest income neighborhoods with high percentages of

African American residents, whereas Whites lived in the highest income neighborhoods, with very low percentages of African American residents. We were able to parse out some of the differences between race and economics, however, when we looked at White adolescents living in neighborhoods with different SES levels. These results proved crucial and pointed to the importance of not confounding race and SES but rather attempting to disentangle their effects. For African Americans, however, it was more difficult to differentiate the effects of race and SES, because most of the predominantly African American neighborhoods were low-income neighborhoods. In addition, this finding suggests that economic, even more than racial, segregation is more common among African Americans compared to Whites. Thus, it may be that the higher prevalence of some problem behaviors among African Americans, such as violence, are due to concentrated economic disadvantage, which places strains on communities. In contrast, the lower prevalence of other problem behaviors, such as adolescent alcohol or hard drug use, may also be due to concentrated economic disadvantage in that it reduces the economic opportunity to use.

Overall, the current study found that for African American adolescent males, the combination of neighborhood racial composition and individual race was not a significant predictor of most types of substance use. This finding is consistent with prior work showing that neighborhood environment is less influential on African American, compared to White, youth (e.g., Choi, Harchi, and Catalano, 2006). In addition, our measure of neighborhood racial composition was assessed when the boys were about 10 years old, and thus, this measure may not account for subsequent moves to other types of neighborhoods, which might have affected boys' later onset of substance use.

For Whites, neighborhood SES appeared to have an effect. Those living in predominantly White, and more importantly, *upper-income* neighborhoods tended to report higher prevalence of all types of substance use. This finding supports prior work showing that affluence is a risk factor for adolescent substance use (e.g., Ansary & Luthar, 2009). Marijuana use prevalence, in particular, was significantly associated with neighborhood racial and SES context for Whites. At the bivariate level, marijuana prevalence rates for Whites living in White, upper-income neighborhoods were significantly higher than they were for their peers living in White, middle-income, and racially mixed, middle-income neighborhoods.

These findings remained consistent for adolescent lifetime marijuana use in the multivariate analyses. Contrary to expectations, White boys living in White upper-income neighborhoods were *more likely* to try marijuana by age 18 than their peers of the same race living in racially mixed neighborhoods. This finding is consistent with prior work (Chen & Killeya-Jones, 2006), which found that adolescents in a school in a more advantaged community, which was mostly White, were more likely to report marijuana use than their peers in an urban, mostly African American school. We also found overall higher rates of early onset and adolescent lifetime prevalence of marijuana for African Americans than Whites. This finding is consistent with Johnston et al. (2009), whose data showed a trend toward a higher lifetime prevalence of marijuana use among African American, compared to White, 12th graders.

Among White adolescents, economic factors may be particularly influential for marijuana use. These youth may have more disposable income than their peers and thus increased economic opportunity to use. In addition, they may be more likely to live in communities characterized by two-parent working households and thus experience less supervision of after-school activities. Finally, they may have increased opportunity through peers who also use (Chen

& Killeya-Jones, 2006). Gardner et al. (2010) identified several risk factors in higher-income neighborhoods that may help to explain increased substance use including: "achievement pressures, a large supply of low-quality job opportunities, lax parental monitoring, low social support, and low collective efficacy" (p. 437). While studies have begun to look at mediating variables that may explain the relationship between greater economic advantage and increased substance use (e.g., Luthar & Goldstein, 2008), more research is needed to fully understand the complex dynamics involved.

It was also interesting to find that practically no White adolescents lived in predominantly African American neighborhoods while a very small number (19) of African American adolescents lived in predominantly White neighborhoods. This finding reinforces the Census data observations that U.S. communities are highly segregated along racial lines. It is important to note, however, that the PYS sampled children in public schools, and it may be that African American adolescents living in predominantly White neighborhoods were more likely to attend private schools. This may explain why we found so few African American adolescents living in White neighborhoods, but it does not explain the why no White adolescents lived in African American neighborhoods.

We had hypothesized that African Americans living in White, compared to African American, neighborhoods would report higher alcohol, tobacco, and hard drug use and less marijuana use. Although we did not identify a group of African American adolescents living in a predominantly White neighborhood, we did identify a sizeable group who lived in a racially mixed neighborhood. These African American adolescents living in racially mixed, middle-income neighborhoods reported the lowest rates of early onset and adolescent prevalence of marijuana, as well as adolescent prevalence of tobacco use. Further, Whites living in racially

mixed neighborhoods reported lower adolescent prevalence rates for tobacco and marijuana than their White peers living in White neighborhoods. Thus, there may be protective mechanisms operating in racially mixed neighborhoods, which should be explored in future research.

Caretaker's impression of neighborhood safety and crime did not predict drug use for either White or African American adolescent boys. This finding is contrary to prior studies, which have found that children's perceptions of neighborhood crime are related to substance use (e.g., Winstanley et al., 2008). The current study controlled for *parental* impressions, however, which may less accurately reflect the environment that the adolescents experience. In addition, an alternative explanation may be that adolescents who engage in substance use may be more likely to describe their neighborhood less positively.

There are several limitations of this study that should be noted. First, substance use was measured by self-report only, however, reliability and validity of self-report substance use data has been established in several studies (Graham et al., 2002). In addition, the sample came from a single urban area, and results may not generalize to adolescent male populations living in other urban or nonurban areas. As noted earlier, however, while less representative than national data sets, the PYS' longitudinal design and nearly even distribution of African American and White participants made it quite appropriate for the current study. In addition, the findings may be relevant for male adolescents living in cities with neighborhoods comparable to Pittsburgh. For instance, Chicago, Detroit, and Saint Louis also have very racially and economically segregated neighborhoods.

There are also historical factors that may limit one's ability to generalize this study's findings to contemporary experiences. Nationally, adolescent alcohol and tobacco use prevalence were lower during the 1990s (when these youth were adolescents) than in previous decades, but

marijuana and hard drug use were increasing after a drop in the late 1980s (Johnston et al., 2009). Thus, more research is needed to examine these associations with varying cohorts nationally. In addition, the racial composition of the PYS data precluded us from studying race and neighborhood effects for other racial and ethnic groups. The process of acculturation can cause stress and conflict (Castro & Nieri, 2010), and first generation Hispanic or Asian adolescents may experience higher risk due to greater acculturation stress than multiple generation African American or White adolescents. Conversely, a strong ethnic identity may serve as a protective factor (Castro & Hernandez-Alarcon, 2002). In addition, the study included only boys, and thus results cannot be generalized to females. In fact, previous studies have found differential effects of communities on girls and boys (e.g., Katz et al., 2007). A longitudinal study of adolescent girls in Pittsburgh began in 1999 (The Pittsburgh Girls Study, Loeber et al. 2002), and it is critical to examine how the associations between neighborhood racial composition and individual racial identity compare for girls, especially given race by sex differences in substance use (Wallace et al., 2003b).

Finally, as an exploratory study, it was not possible to control for all factors that might have influenced substance use. Neighborhood context and race are complicated concepts that encompass interrelated factors including family, culture, education, and larger social phenomena such as historical segregation and discrimination. Further, neighborhood disadvantage is related to the availability of legal and illegal substances. Liquor outlets are disproportionately located in socioeconomically disadvantaged neighborhoods (Gorman & Speer, 1997; Nielsen et al., 2010), and drug dealing is more prevalent in disadvantaged, African American neighborhoods than in other types of neighborhoods (Saxe et al., 2001). Therefore, neighborhood availability of substances may influence the alcohol and drug use patterns of adolescents. Another factor that

can affect substance use patterns of adolescents is disposable income. Youth in higher, compared to lower, SES families may have more money to spend on drugs. Thus, family SES may be confounded with neighborhood SES, although we did control for family SES in the analyses.

Conclusion

Overall, this study provides a unique lens through which to examine how the intersection of individual race and neighborhood racial context and socioeconomic characteristics influences substance use among male adolescents. There is substantial evidence suggesting that adolescents growing up in disadvantaged, high crime, low SES neighborhoods are at greater risk for delinquent behavior (Hawkins et al., 1992; Kingston et al., 2009), and African American adolescents are more likely than White adolescents to grow up in these types of neighborhoods. Most studies demonstrate, however, that prevalence of alcohol, tobacco, and hard drug use is higher among White adolescents and, for the most part, our results were consistent with these studies.

In addition, while marijuana prevalence was generally lower among Whites, compared to African Americans, it was highest among Whites in predominantly White, higher-income neighborhoods. In fact, the results from this study suggest that, at least among Whites, the economic level of the neighborhood is a significant predictor of adolescents substance use. Overall, our findings for substance use are contrary to those shown for delinquency (e.g., Sampson & Raudenbush, 1999). Thus, substance use behaviors and other delinquent behaviors may be distinct types of adolescent problem behaviors, a finding, which has significant implications for prevention and intervention policy planning. At least among Whites, these results suggest that prevention efforts against substance use may be more critical in higher-income neighborhoods. This recommendation is contrary to the general societal impression of

lower-income communities as risk factors for delinquency, while higher-income communities are protective factors.

The findings from the current study suggest that the deleterious neighborhood effects on adolescent delinquency and violence, observed in prior studies, may have been in part due to the confounding effects of socioeconomic factors in these communities. Thus, it may be that neighborhood *poverty* is a risk factor for crime and violence, but not for substance use. More research is needed to examine mechanisms that account for differing neighborhood effects on adolescent problem behaviors.

Notes

1. We also repeated the analyses for maximum frequency of use among users through age 18. None of the individual race by neighborhood race combinations was significant in the bivariate or multivariate analyses. Thus, we did not include these results in this paper.

2. Early onset was defined as any use up to age 14 based on national data indicating that most adolescents begin using alcohol, which is generally considered a gateway drug, around age 14 (Johnston et al., 2009).

3. Due to the very small number of boys in many of the 188 Census neighborhood tracts, an analytic approach that takes into account the fact that participants were nested within neighborhoods (e.g., hierarchical linear modeling) was considered unfeasible for the current study.

4. Missing data ranged from 0% for neighborhood class to 13% for prevalence of hard drug use.

5. LPA fit indices: for a 2-class model, AIC = 4088.67, BIC = 4221.36, and Entropy = 0.98; for a 3-class model, AIC = 3692.77, BIC = 3893.43, and Entropy = 0.96; for a 4-class model, AIC = 3443.23, BIC = 3711.86, and Entropy = 0.95; and for a 5-class model, AIC = 3612.15, BIC = 3948.74, and Entropy = 0.97. The average posterior probabilities of the 4-class model exceeded 0.94. The Lo-Mendell-Rubin Adjusted Likelihood Ratio (LR) Test showed a significant improvement in model fit for the best fitting 4-class model, compared to the more parsimonious 3-class solution (LR chi-square = 327.39, $\Delta df = 21$, $p = 0.03$), while the 5-class model did not improve the overall model fit, compared to the 4-class model (LR chi-square = 105.16, $\Delta df = 31$, $p = 0.28$).

6. Less than 3% of Pittsburgh's population reported to be other than African American or White in the 1990 Census (U.S. Census Bureau, 1990). Thus, we can infer, for example, that if the

population of a neighborhood consisted of 7% African American, the remaining 93% were

predominantly White.

Acknowledgements

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