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Exposure to Violence, Substance Use, and Neighborhood Context

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Abstract

Adolescent exposure to violence and substance use are both public health problems, but how neighborhood context contributes to these outcomes is unclear. This study uses prospective data from 1,416 adolescents to examine the direct and interacting influences of victimization and neighborhood factors on adolescent substance use. Based on hierarchical Bernoulli regression models that controlled for prior substance use and multiple individual-level factors, exposure to violence significantly increased the likelihood of marijuana use but not alcohol use or binge drinking. There was little evidence that community norms regarding adolescent substance use influenced rates of substance use or moderated the impact of victimization. Community disadvantage did not directly impact substance use, but the relationship between victimization and marijuana use was stronger for those in neighborhoods with greater disadvantage. The results suggest that victimization is particularly likely to affect adolescents' marijuana use, and that this relationship may be contingent upon neighborhood economic conditions.

1. INTRODUCTION

The Department of Justice considers exposure to violence among children and adolescents to be a "national crisis" which must be better understood and more effectively addressed (The United States Department of Justice, 2012). This concern stems from research indicating that a large proportion of youth witness violence perpetrated against others or are themselves victims of aggressive attacks at some point during their lives (Finkelhor et al., 2009; Truman, 2011). Among 14–17 year olds, an age group particularly likely to be

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exposed to violence, the 2007 National Survey of Children's Exposure to Violence indicated that 48% had witnessed violence in the year prior to the survey, 47% had been personally assaulted, and 19% had been injured during an assault (Finkelhor et al., 2009). Research has also shown that exposure to violence can have negative and often severe consequences, impairing social relationships, academic performance, and mental health, and can lead to aggressive and violent behaviors as well (Begle et al., 2011; Buka et al., 2001; Finkelhor et al., 2011; Gorman-Smith and Tolan, 1998; Lynch, 2003; Macmillan, 2001; Schwab-Stone et al., 1995).

The effects of violent victimization on tobacco, alcohol, and substance use during adolescence have also been evidenced (Kilpatrick et al., 2000; Sullivan et al., 2004; Zinzow et al., 2009), but this body of research is relatively under-developed compared to studies examining other types of behaviors stemming from exposure to violence. Furthermore, few studies have sought to identify factors which may moderate the relationship between exposure to violence and substance use (for exceptions, see: Hay and Evans, 2006; Lin et al., 2011; O'Donnell et al., 2002; Sullivan et al., 2004), which limits our ability to identify the individuals most at risk for drinking and drug use following victimization.

This study seeks to increase our understanding of the relationship between exposure to violence and substance use. We examine the effect of experiencing and witnessing violence on subsequent alcohol and marijuana use, the most frequently used substances among adolescents (Johnston et al., 2011), as well as on binge drinking, using prospective data from youth and adolescents living in Chicago. In addition, we investigate the degree to which two neighborhood characteristics – economic disadvantage and community norms regarding adolescent substance use – moderate the impact of victimization on substance use. To date, there has been minimal attention paid to the potential for neighborhood context to affect the relationship between exposure to violence in the community and substance use by adolescents (with the exception of Browning and Erickson, 2009), despite research indicating that economically and socially disadvantaged neighborhoods have higher rates of violence (Anderson, 1999; De Coster et al., 2006; Shaw and McKay, 1942) and victimization (Browning and Erickson, 2009; Gibson et al., 2009; Sampson and Lauritsen, 1994) compared to more advantaged areas. The current study will explore whether or not residence in such areas affects alcohol use, binge drinking, and marijuana use among adolescents, and the degree to which neighborhood factors ameliorate or exacerbate the likelihood that victims will engage in substance use.

2. REVIEW OF THE LITERATURE

2.1 Neighborhood Influences on Adolescent Substance Use

Both theoretical and empirical work suggest that neighborhood context influences adolescent delinquency and drug use (Anderson, 1999; Elliott et al., 1996; Sampson et al., 1997; Shaw and McKay, 1942; Wilson, 1987). Nonetheless, some research has failed to document significant direct effects of contextual factors on delinquency (Bernburg and Thorlindsson, 2007; Beyers et al., 2003; De Coster et al., 2006; Elliott et al., 1996; Maimon and Browning, 2010; Sampson et al., 2005). Such results have led to an acknowledgement that neighborhood influences are complex, and that they may be more likely to interact with

other (more proximal) influences on delinquency than to have direct effects on these outcomes (Leventhal and Brooks-Gunn, 2000).

This study examines the degree to which two neighborhood factors – economic disadvantage and cultural norms – have direct effects on adolescent alcohol use, binge drinking, and marijuana use and potentially moderate the impact of victimization on adolescents' use of these substances. We focus on these two contextual factors because we suspect they influence drinking and drug use via similar and related mechanisms. Beginning with neighborhood economic disadvantage, we posit that children living in impoverished areas could be at increased risk for alcohol and other drug use as a coping mechanism intended to provide relief from the stressors of daily life in these environments. There is much evidence that economically disadvantaged communities have higher levels of various social and public health problems, including unemployment; physical disorder such as abandoned buildings and graffiti; public displays of intoxication and drug use; visible street crimes such as prostitution, robbery, and gang fights; and frequent displays of aggression and violence (Anderson, 1999; Sampson and Raudenbush, 1999; Shaw and McKay, 1942; Wilson and Kelling, 1982). The repetitive stressors of living in these high-risk environments, where there may be little hope for future success, may lead youth to engage in alcohol and drug use as a way of alleviating or escaping from these adverse conditions (Lambert et al., 2004).

Youth living in disadvantaged neighborhoods may also be more likely to encounter alcohol- and drug-using adults and a culture that is more tolerant of such behaviors (Galea et al., 2005; Kulis et al., 2007; Sampson and Bartusch, 1998). Like youth, parents and other adults in the community may engage in substance use as a way of alleviating the stressors faced in these environments. Increased exposure to adult users may increase the likelihood youth will perceive drinking and drug use as normative, acceptable, and unlikely to result in negative consequences, all of which could increase their own substance use (Agostinelli and Grube, 2005; Akers, 1985; Hawkins et al., 1992).

It is also possible that in disadvantaged neighborhoods, residents will be more tolerant of illegal substance use by adolescents. Research suggests that in such areas, there may be a variety of value systems regarding crime, violence, and deviance (Berg et al., 2012), and this heterogeneity and/or ambiguity in attitudes can weaken residents' total opposition to deviance (Kornhauser, 1978; Sampson and Bartusch, 1998; Shaw and McKay, 1942). As Sampson and Wilson (1995) note, when economic hardships are prevalent in neighborhoods, "a system of values emerges in which crime, disorder, and drug use are less than fervently condemned and hence expected as part of everyday life." While this does not mean that residents of disadvantaged neighborhoods will necessarily condone illegal behavior, their attitudes regarding crime and deviance may be more "flexible" compared to those living in more advantaged areas. That is, while most residents of impoverished communities do not actively endorse illegal behaviors, they may place less emphasis on strict conformity and/or be more willing in certain circumstances to set aside normative beliefs such as the need to (always) obey the law (Kirk and Papachristos, 2011). In fact, Sampson and Bartusch (1998) found that disadvantaged communities had, on average, greater tolerance for youth fighting and alcohol, compared to less disadvantaged areas. However, they also note that, at an

individual level, residents of all neighborhoods were relatively intolerant of youth deviance (Sampson and Bartusch, 1998).

Consistent with broader sociological and contextual theories of adolescent development (Kirk and Papachristos, 2011; Kornhauser, 1978; Warner, 2003; Warner et al., 2011) which emphasize the role of community norms and cultural values in shaping the behavior of children, a greater tolerance of deviant behaviors is likely to increase deviance among youth. Likewise, repeated exposure to a culture in which adults hold the view that drinking and drug use by teenagers is a "rite of passage" and not particularly harmful is posited to facilitate drinking and drug-using among youth (Agostinelli and Grube, 2005; Foley et al., 2004; Hawkins et al., 1992).

While there are theoretical reasons to suspect that neighborhood economic disadvantage and cultural norms will influence adolescent alcohol and drug use, there has been limited empirical investigation of these issues, and studies to date have produced contradictory evidence, which results in a lack of clarity regarding the exact nature of these relationships (Gardner et al., 2010). Many studies have shown that neighborhood concentrated disadvantage does not have a significant, direct association with adolescent substance use (Brenner et al., 2011; Ennett et al., 2008; Gottfredson et al., 1991; Tobler et al., 2009). Some research has reported that teenagers in lower socioeconomic (SES) communities report *increased* levels of substance use compared to those in higher SES areas (Kulis et al., 2007). However, a more common finding is that adolescents in lower SES neighborhoods have *depressed* levels of substance use (Chuang et al., 2005; Lo et al., 2006; Maimon and Browning, 2012; Snedker et al., 2009; Song et al., 2009) compared to those in higher SES areas. That is, many studies have found that, at both the individual (Hawkins et al., 1992; Humensky, 2010; Patrick et al., 2012), and contextual (Botticello, 2009; Chuang et al., 2005; Gardner et al., 2010; Song et al., 2009) levels of analysis, higher income and SES are related to increased alcohol and/or marijuana use by teenagers.

Fewer studies have examined the impact of cultural norms on adolescent substance use, particularly investigations relying on multi-level analyses and neighborhood measures collected from sources other than the youth themselves[1]. Van Horn et al. (2007), who utilized key leader reports of community norms regarding adolescent substance use, found that youth substance use was higher in neighborhoods in which residents were more accepting of substance use. In contrast, the L.A. FANS study (Musick et al., 2008) failed to find a direct relationship between community norms and youth substance use, although in this study, norms were operationalized by asking adult residents about their disapproval of *adult* substance use, not youth use.

[1]The body of research increases when including studies that measure community norms based on youth reports and/or which analyze data at the individual level only (e.g., Bersamin et al., 2005; Lipperman-Kredaj et al., 2010). It is preferred, however, to collect data about neighborhood conditions from sources independent of those reporting on outcomes, because same source reporting may inflate the relationship between independent and dependent variables. In addition, individuals' views of the neighborhood are likely to be biased by their own experiences and may not capture the "true" dynamics of the environment (Sampson and Raudenbush, 2004; Van Horn et al., 2007). Thus, the optimal strategy is to investigate the relationship between objective assessments of community characteristics and individual-level outcomes, and to analyze these relationships using multi-level modeling techniques which reduce the correlated error that may arise when individuals are clustered in communities (Leventhal and Brooks-Gunn, 2000; Sampson and Raudenbush, 1999).

2.2 Victimization, Substance Use, and Neighborhood Context

A growing body of research has suggested that victimization, both witnessing violence (sometimes referred to as “indirect victimization”) and directly experiencing violence, increases the likelihood of smoking, drinking, and using illegal drugs among adolescents alcohol and other drug use (Kilpatrick et al., 2000; Kilpatrick et al., 2003; Lin et al., 2011; Sullivan et al., 2004; Taylor and Kliewer, 2006; Vermeiren et al., 2003; Zinzow et al., 2009). However, some literature suggests that substance use can increase victimization and/or that the two have reciprocal effects (Jennings et al., 2012; Thompson et al., 2008; Zhang et al., 2001), which emphasizes the need to examine the relationship using longitudinal data to better establish temporal ordering.

Most importantly, our study assesses the degree to which exposure to violence may be moderated by neighborhood context, an area that has received very little attention to date (Foster and Brooks-Gunn, 2009). We are aware of only one study that has investigated this issue, and it focused solely on economic disadvantage. Browning and Erickson (2009) found that among high school students in Toronto, community disadvantage moderated the relationship between alcohol use and direct victimization, such that drinkers were more likely than non-drinkers to be victims of assaults or threats in poor neighborhoods versus more affluent areas. Because this study relied on cross-sectional data, another interpretation of the results is that victimization was more likely to lead to drinking in disadvantaged areas.

If teenagers are likely to use alcohol and drugs to cope with negative life events (Agnew and White, 1992; Windle and Windle, 1996), and those living in disadvantaged neighborhoods are at increased risk for victimization and other adverse experiences (Lambert et al., 2004; Sampson and Lauritsen, 1994), residence in disadvantaged areas may be likely to intensify the impact of exposure to violence on substance use. Agnew (2006) has hypothesized this type of relationship, positing that the effects of strains such as exposure to violence will be most likely to lead to deviant coping strategies (e.g., drinking and marijuana use) in disadvantaged areas, largely due to an accumulation of strain and pressure which must be alleviated. Similarly, in the broader literature of youth delinquency and substance use, risk amplification and/or cumulative disadvantage processes have been suggested (Bellair and McNulty, 2010; Hawkins et al., 1992), whereby the likelihood of delinquency is thought to be greatest for children who experience multiple individual, peer, family, school, and/or community factors that place them at risk for engaging in delinquency (i.e., "risk factors;" for additional discussion, see: Hawkins et al., 1992; Rutter et al., 1998).

Empirical research has suggested that community characteristics can interact with these types of risk factors in such a fashion. That is, contextual risk factors, particularly economic disadvantage, have been shown to have a stronger adverse impact on problem behaviors for those who also experience individual deficits (e.g., genetic polymorphisms associated with problem behaviors) or negative social influences such as harsh or inconsistent parenting practices (Beaver et al., 2012; Brody et al., 2003; Hay et al., 2006; Schuck and Widom, 2005). In contrast, other studies have found evidence of “contextual dissipation” (Wickrama and Bryant, 2003), in which individual-level risk factors lose their salience in high-risk contexts such as economically and socially disadvantaged neighborhoods (Bellair and McNulty, 2010; Coulton et al., 1999; Gibson, 2012; Snedker et al., 2009; Zimmerman and

Messner, 2011). For example, one study found that for adolescents in Chicago, the effect of child physical abuse on subsequent violence was weaker for those living in more disadvantaged compared to more affluent neighborhoods (Wright and Fagan, 2013). It could be that youth living in high-risk areas come to view victimization and violence as normative (e.g., see Anderson, 1999); as such, exposure to violence may be less salient than when viewed as a more aberrant, traumatic and/or stressful situation that must be managed through substance use. Following this perspective, it is possible that victimization which occurs in a disadvantaged neighborhood may be viewed as "just another" stressful situation and may not have the same impact as it would for those living in more benign conditions.

Whether or not community norms regarding adolescent deviance amplifies or weakens the impact of victimization on substance use is largely unknown, given the limited empirical attention to this issue. Following studies suggesting that neighborhoods in which there is less condemnation of deviance have higher rates of crime and other social problems (Kirk and Papachristos, 2011; Kornhauser, 1978; Warner, 2003; Warner et al., 2011), we anticipate that youth living in communities that are more tolerant of adolescent substance use will be more likely to respond to victimization with alcohol and drug use. Stewart and Simons (2010) found evidence of this type of relationship, in that teenagers who endorsed "street codes" (i.e., attitudes supporting the use of violence in certain situations; see Anderson, 1999) were more likely to commit violence when they lived in neighborhoods with greater support of street codes compared to neighborhoods that strictly condemned inter-personal violence. However, a similar study by Ousey and Wilcox (2005) did not find an interaction between school norms regarding violence and individual attitudes regarding violence when examining students' perpetration of violence.

2.3 The Current Study

As this review makes clear, there is evidence that victimization increases the likelihood of substance use during adolescence, but the direct effects of neighborhood characteristics on individual substance use and their potential to moderate the impact of exposure to violence are less certain. It is possible that substance use will be increased for those living in economically disadvantaged areas and in neighborhoods with less condemnation of drinking and drug use by teenagers, but these circumstances could intensify, weaken, or have no moderating effects on the relationship between victimization and substance use. This study investigates these issues by addressing three research questions:

1. Does victimization increase the likelihood of alcohol use, binge drinking, and marijuana use?
2. What are the direct effects of neighborhood norms regarding adolescent substance use and concentrated disadvantage on alcohol use, binge drinking, and marijuana use, controlling for adolescent exposure to violence and other individual-level risk factors?
3. To what degree do neighborhood norms and disadvantage moderate the effects of victimization on alcohol use, binge drinking, and marijuana use?

3. METHODS

3.1 Sample

This study relies on data from the Project on Human Development in Chicago Neighborhoods (PHDCN) (Earls et al., 2002), a multiple-component study examining how neighborhood context impacts children's development. To gather information on social processes across diverse communities, Chicago's 847 census tracts were divided into 343 neighborhood clusters (NCs) that were geographically contiguous. The Longitudinal Cohort Study (LCS) followed multiple cohorts of youth and their primary caregivers living within 80 NCs over time. To create this sample, the 343 NCs were stratified by seven categories of racial/ethnic diversity and three levels of socio-economic status. Eighty NCs were then selected from the 343 NCs via stratified probability sampling. Households with at least one child in one of seven age cohorts (newborns and children ages 3, 6, 9, 12, 15, and 18) were eligible for inclusion, and 6,228 individuals (75% of the eligible population) agreed to participate. These children and their caregivers were interviewed every 2.5 years, with wave one conducted in 1994–97, wave two in 1997–2000, and wave three in 2000–02 (for more information about the PHDCN, see Earls et al., 2002).

To gather information related to neighborhood structural and social conditions, the PHDCN utilized data collected from the 1990 U.S. Census and the Community Survey. Data regarding neighborhood disadvantage was abstracted from the 1990 U.S. Census.[2] Information regarding social processes such as residential culture and norms was taken from the Community Survey portion of the PHDCN. Using a three-stage sampling design, city blocks were sampled within each NC, dwelling units were sampled within blocks, and one adult resident was sampled within each dwelling unit. The Community Survey collected information from all 343 NCs about neighborhood conditions via interviews with these residents in 1994–1995; we focus only on those NCs from which the respondents of the LCS were nested.

Given the focus of this study on adolescent substance use and violence, analyses were restricted to youth from three age cohorts (Cohorts 9, 12, and 15) of the LCS who resided in 79 of the 80 NCs[3]. At wave one, 2,344 youth participated in the study, 1,987 (85%) participated at wave two, and 1,747 (75% of the original sample) participated at wave three. The analysis sample is based on 1,400–1,416 individuals (depending on the outcome) remaining at wave three who had valid information on all measures[4].

[2]Staff at the Inter-university Consortium for Political and Social Research calculated NC-linked U.S. Census measures in order to ensure the confidentiality of the subjects of the PHDCN.

[3]One of the 80 NCs dropped out when the sample was limited to youth in Cohorts 9–15.

[4]Due to listwise deletion, of the 1,747 respondents participating at wave three, 347 were dropped from the analyses when estimating effects on binge drinking and 331 were dropped when estimating alcohol and marijuana use. A comparison of the sample of all youth in Cohorts 9–15 participating at wave one (N=2,345) and the analysis samples (N=1,400 and 1,416) yielded no significant differences on the primary independent or dependent variables. However, compared to the initial sample, the analysis samples had significantly more Hispanic and White youth and fewer African Americans, slightly higher family income levels, and a greater proportion of parents reporting problems with drugs or alcohol. These variables are all included as control variables.

3.2 Measures

Analyses rely primarily on data collected at waves two and three of the PHDCN, though some control variables were assessed only at wave one. While victimization and substance use were measured at all three waves of the study, at wave one, exposure to violence in the community was assessed using a limited number of items which captured only indirect victimization (i.e., witnessing or hearing about victimization perpetrated to others). At wave two, adolescents were asked to report both indirect and direct forms of violence, as described below, and this more comprehensive set of items was selected as the primary independent variable in the current study. Adolescent reports of substance use at wave three were utilized as the primary dependent variables, and measures of substance use reported at wave two are included as lagged measures, thus allowing us to take advantage of the prospective data and control for temporal ordering as much as possible.

3.2.1 Dependent variables—Three dependent variables represent adolescent substance use, as self-reported by youth at wave three based on questions derived from the National Household Survey on Drug Abuse (1991). Respondents reported the number of days in the past year they used alcohol and marijuana, respectively, using a nine-point frequency scale which ranged from 0 days to 200 or more days. Alcohol use was somewhat prevalent, but the majority of the sample reported no alcohol use in the past year (57%) or drinking less than once per month (30%). Marijuana use was not very common: 81% of the sample reported no use in the last year, 10% reported using marijuana less than once per month, and 9% reported more frequent use. Given this pattern of responses, and to be consistent with much of the victimization/substance use literature, we created dichotomous outcomes reflecting *past year alcohol use* and *past year marijuana use* which distinguished users (43% and 19% of the sample, respectively) from non-users. We also included a measure of *binge drinking*, based on adolescent reports of having 5 or more drinks in a row during the last 30 days using a six-point frequency scale (from 0 to 10 or more times). This item was also dichotomized to differentiate those who reported no binge drinking from those who reported binge drinking on at least one occasion in the last month (12% of the sample).

3.2.2 Independent variables—The measure of *victimization* was assessed with 12 items reported by youth at wave two. This variable was operationalized as the number of different violent events reported by the respondent, based on dichotomous (yes/no) responses of whether or not the youth had been or had witnessed someone else being: chased, hit, attacked with a weapon, shot, shot at, or threatened at least once in the past year. Following other analyses of the PHDCN data (Gibson et al., 2009; Zimmerman and Pogarsky, 2011), the 12 dichotomous items were summed to measure the total number (count) of victimization episodes reported by youth.

Two neighborhood-level measures reflected social and structural neighborhood characteristics. Following previous studies regarding neighborhood norms (Kirk and Papachristos, 2011; Wright and Benson, 2010; Wright and Fagan, 2013), a measure of *community norms unfavorable to drug use* was created using a three-level item response model. This model avoids the loss of data from missing item responses (Osgood et al., 2002), takes item severities into account, and accounts for respondents' characteristics (e.g.,

gender) as covariates (Raudenbush et al., 2003; Raudenbush and Sampson, 1999). The measure was derived from the Community Survey, where residents were asked to rank how wrong they considered it to be for 13- to 19-year olds to smoke cigarettes, use marijuana, and drink alcohol, with each ranked on a five-point Likert scale (from "not wrong at all" to "extremely wrong"). The measure derived from the item response model reflects greater neighborhood levels of *in*tolerance of substance use, adjusting for residents' characteristics, missing data, and item severities (neighborhood internal consistency reliability = 0.50)[5].

Neighborhood disadvantage was based on a principal components factor analysis using information from the 1990 U.S. Census, with census tract information linked to corresponding NCs. Similar to prior research (Sampson et al., 2005), this measure draws from four poverty-related variables (alpha = 0.88): the percentage of residents in a neighborhood cluster who were below the poverty line, receiving public assistance, unemployed, and living under female headed households. Higher values on this variable reflect greater economic disadvantage.

3.2.3 Control Variables—Empirical research has shown that adolescent substance use is associated with children's demographic characteristics as well as other individual, peer, and family experiences (Hawkins et al., 1992), and that some of these risk factors (e.g., low self-control, exposure to delinquent peers) are elevated in disadvantaged communities (Gardner et al., 2010; Gibson et al., 2010; Zimmerman and Messner, 2011). Our models thus control for an array of individual-level factors which might account for the relationship between victimization and substance use.

Youth self-reports at wave one assessed demographic characteristics including age, gender and race/ethnicity. *Age* reflects the youth's age in years. *Male* was a dichotomous variable that reflects the youths' gender. Two dichotomous variables, *Hispanic*, and *African American*, denote the race/ethnicity of the youth, with *Caucasians/Other* serving as the reference category.

In terms of family factors, *household salary* is a composite measure from waves one and two that indicates the total household income earned in the past year based on reports from the primary caregiver using an 11-point scale (1=less than $5,000; 11=more than $90,000). *Parent problems with drugs or alcohol* is a dichotomous measure assessed at wave one only, based on the primary caregiver's reports of whether or not drinking or drug use ever caused problems with their or their partner's health, family, job, or the police.

We also control for peer and individual factors. A measure of youth's *routine activities* is based on youth reports at wave two of their engaging in unstructured, unsupervised activities with peers. Four items (e.g., hanging out with peers and going to parties) were summed and

[5]Our measure of community norms differs slightly from that used in prior analyses of PHDCN data (Kirk and Papachristos, 2011; Sampson and Bartusch, 1998; Wright and Benson, 2010). We removed one item asking residents about youth engaging in "fist fights," given that substance use is the dependent variable in the current study. The correlation between our measure and the previously-used four-item measure is high (r = .97). The reliability of the measure likely indicates that variation in the degree to which residents agreed that substance use among teenagers was wrong. As discussed by Raudenbush and Sampson (1999), internal consistency in item response-derived measures depends on the degree of respondents' agreement across the substance use items and the number of respondents per neighborhood. In the current study, a mean of 41 respondents per neighborhood cluster reported on norms related to adolescent substance use.

standardized (alpha = 0.58) as in prior work (Osgood et al., 1996), with higher levels corresponding to more time spent in unsupervised activities. *Peer substance use* was based on responses to three items asking youth the number of their friends who used marijuana, alcohol, and tobacco in the past year (1=none of them, 2= some of them, 3=most of them, 4=all of them). Items were summed (alpha = 0.85) and standardized with higher values reflecting greater peer substance use. Following Gibson et al. (2010), children's *low self-control* was measured at wave one according to 17 items (alpha = 0.75) covering inhibitory control (e.g., "has trouble resisting temptation"), decision time (e.g., "often acts on the spur of the moment"), sensation seeking (e.g., "will try anything once"), and persistence (e.g., "tends to give up easily"), as reported by parents on the Emotionality, Activity, Sociability, and Impulsivity (EASI) Temperament survey (Buss and Plomin, 1975). Responses were summed, standardized, and scored such that higher values indicate lower levels of self-control. Children's *perceived harm of drug use* was assessed using seven items (alpha = 0.75) from the National Household Survey on Drug Abuse (1991). Using a four-point Likert scale, youth reported "how much people would hurt themselves" if they regularly used tobacco, alcohol and marijuana. Items were standardized and summed, with greater scores representing more perceived harm.

Finally, models control for *prior alcohol use*, *prior binge drinking*, and *prior marijuana use*. These variables were assessed at wave two using the same items as at wave three; that is, respondents reported on the frequency of alcohol and marijuana use in the past year using a nine-point Likert scale (from 0 days to 200 or more days) and on the frequency of having five or more drinks in a row in the past month using a six-point Likert scale (from zero to 10 or more times). Items were dichotomized to distinguish those reporting no use from those reporting alcohol use, binge drinking, or marijuana use at least once.

3.3 Analytic Strategy

We utilized hierarchical modeling techniques (Hierarchical Linear Modeling [HLM]) (Raudenbush and Bryk, 2002) using the statistical software HLM 7.0 (Raudenbush et al., 2004a) to adjust for the correlated error that may exist given that youth respondents in the PHDCN were nested in 79 NCs. These techniques allow analyses to be based on appropriate sample sizes and partition existing variance at different levels of analyses (the individual and neighborhood levels). Hierarchical Bernoulli regression models, analogous to logistic regression models, were utilized to predict the three dichotomous outcomes.

The analyses proceeded in four stages. Unconditional models revealed significant variation ($p<.05$) in all three dependent variables across NCs, which provided justification for the exploration of neighborhood influences on these outcomes. Second, intercepts-as-outcome models were analyzed. Individual-level models were estimated to examine the relationship between victimization and alcohol use, binge drinking, and marijuana use. In these models, only victimization, as the primary independent variable, was allowed to vary; all other individual-level predictors were treated as fixed effects. All individual-level predictors were grand-mean centered.[6]

[6]Grand-mean centering is appropriate when the substantive research question is at the aggregate-level (Enders and Tofighi, 2007).

Third, the neighborhood-level variables were added to the models to assess their main effects on rates of substance use at wave three.[7] In the last step, slopes-as-outcomes models were analyzed; these assessed whether or not the relationships between victimization and each form of substance use were moderated by neighborhood context, controlling for the individual-level predictors as well as the main effects of the neighborhood variables. The criterion for statistical significance when estimating individual-level effects was $p < .05$ but, similar to some prior research (Bellair and McNulty, 2010; Ennett et al., 2008; Tobler et al., 2011), the criterion was relaxed to $p < .10$ when estimating neighborhood-level effects due to the restricted level-two sample size (79 NCs).

4. RESULTS

The analysis sample was approximately 14 years old at wave two when exposure to violence was measured, 49% male, and predominately of minority race/ethnicity, with 48% reporting their race/ethnicity as Hispanic, 32% African American, and 20% Caucasian/other race or ethnicity (see Table 1). Youth reported an average of about two forms of victimization. About 43% of the sample reported consuming alcohol at least once in the past year, 12% reported binge drinking at least once in the past month, and one-fifth (19%) reported using marijuana at least once in the past year.

The results from the hierarchical Bernoulli models assessing the influence of victimization on the likelihood of substance use (Research Question 1) are shown in Table 2. Controlling for prior substance use, demographic characteristics, and other individual, family, and peer risk factors which may affect substance use, victimization was not significantly related to the likelihood of alcohol use or binge drinking at wave three. Victimization was significantly related to marijuana use. Adolescents reporting greater numbers of victimization events had an increased likelihood of marijuana use at wave three (b=.14, $p <$. 01), even taking into account prior marijuana use.

As seen in Table 2, many of the control variables were related to substance use, with most relationships in the expected directions. For example, older respondents were significantly more likely than younger children to report any substance use at wave three, as were those who reported greater involvement in routine, unsupervised activities with peers and those who had more substance-using peers. Males were more likely than females to report any binge drinking at wave three, African Americans were less likely than Caucasians to report any alcohol use or binge drinking, and individuals whose caregivers reported higher household salaries had a greater likelihood of binge drinking compared to those from lower income families. Those with lower levels of self-control had a greater likelihood of marijuana use, while adolescents who perceived substance use as more harmful had a lower likelihood of alcohol and marijuana use. Finally, substance use at wave two predicted a greater likelihood of substance use at wave three for all three dependent variables.

[7]When conducting the individual-level analyses, the reliability of the intercept was reduced. To adjust for this situation, the Empirical Bayes estimates were modeled at level-two (Raudenbush and Bryk, 2002; Raudenbush et al., 2004b).

The results in Table 3 show the direct effects of neighborhood norms and concentrated disadvantage on the likelihood of each type of substance use, controlling for individual-level variables and prior substance use (Research Question 2; shown in the top half of the table), and cross-level interactions examining the impact of neighborhood variables on the relationship between victimization and substance use[8] (Research Question 3; shown in the bottom half of the table). The findings demonstrated no support for direct effects of neighborhood context on substance use in this sample. Neither community norms concerning adolescent drug use nor concentrated disadvantage had a significant effect on rates of substance use in models that took into account victimization, other individual-level variables, and prior substance use.

Greater evidence of contextual moderation was found. As shown in the bottom of Table 3, although community norms did not significantly moderate the relationship between exposure to violence and the likelihood of alcohol use at wave three, the cross-level interaction between victimization and concentrated disadvantage was marginally significant (b=.03, $p < .10$). The positive coefficient indicates that the relationship between victimization and alcohol use was stronger for those living in neighborhoods with higher versus lower levels of disadvantage. Neither community norms nor disadvantage was shown to moderate the victimization/binge drinking relationship. The cross-level interaction between victimization and community norms was marginally significant (b=.13, $p < .10$) in models predicting the likelihood of marijuana use. The findings suggested that the relationship between victimization and marijuana use was stronger for adolescents living in neighborhoods in which residents voiced stronger condemnation of substance use compared to neighborhoods that were more tolerant of adolescent substance use. The cross-level interaction between victimization and concentrated disadvantage was statistically significant (b=.01, $p < .05$), and, similar to the results for alcohol use, indicated that the positive effect of victimization on the likelihood of marijuana use was stronger for youth living in more disadvantaged neighborhoods compared to less disadvantaged areas.

Figure 1 graphically depicts the relationship between victimization, disadvantage, and marijuana use. To make the findings more interpretable, neighborhood concentrated disadvantage was trichotomized to differentiate neighborhood clusters (NCs) at the highest (two standard deviations above the mean), lowest (two standard deviations below the mean) and average (mean) levels of disadvantage[9]. As shown, the impact of victimization on the likelihood of marijuana use at wave three was greater at higher levels of disadvantage. At each of the three levels of concentrated disadvantage, more reported victimization was related to an increased likelihood of marijuana use, but this relationship was strongest (i.e., has the steepest slope) for youth in the most disadvantaged neighborhoods; the relationship was weakest for those living in the least disadvantaged neighborhoods, as indicated by the flattening of this slope.

[8]These models also control for all individual-level variables and the main effects of the neighborhood predictors.
[9]These models also controlled for the main effect of neighborhood norms and all individual-level predictors.

5.0 DISCUSSION AND CONCLUSION

This paper examined the inter-relationship between adolescent exposure to violence, neighborhood cultural norms and structural disadvantage, and substance use using a diverse sample of adolescents and rigorous analyses of prospective data that controlled for prior substance use as well as multiple individual-level factors that can influence substance use. To summarize the findings, victimization increased the likelihood of marijuana use at wave three, controlling for prior use, but victimization did not affect the likelihood of alcohol use or binge drinking. There was little evidence that neighborhood characteristics had significant direct effects on rates of substance use once individual-level predictors and prior substance use were controlled for, but the results suggested that neighborhood context influenced the relationship between exposure to violence and alcohol and marijuana use.

The positive relationship between victimization and marijuana use was hypothesized based on prior research showing that exposure to violence increases substance use (Kilpatrick et al., 2000; Sullivan et al., 2004; Zinzow et al., 2009). The null effects on alcohol use and binge drinking, indicating that victims were no more likely to engage in these forms of substance use compared to non-victims, were not expected. In this sample, any use of alcohol, as well as problematic levels of drinking (i.e., binge drinking, or having five or more drinks in a row on one occasion) were predicted by individual-level factors other than exposure to violence, particularly peer-related experiences including the frequency with which teenagers engaged in unstructured, unsupervised activities with their peers (i.e., "routine activities"; see Osgood et al., 1996), and the number of their peers who engaged in substance use. Alcohol use, but not binge drinking, was also related to respondents' attitudes regarding the harmfulness of substance use, which can also be shaped by peers (Akers, 1985; Zimmerman and Vasquez, 2011). Other research has indicated that adolescent drinking, including binge drinking, is often a social event, engaged in with friends (Windle et al., 2009). Such behaviors may be viewed as normative and/or fun and may not be utilized as coping mechanisms intended to alleviate the stress of victimization[10]. It could also be that exposure to violence is more likely to impact higher frequency and/or more problematic levels of alcohol use, as shown in some prior research (Kaufman, 2009; Zinzow et al., 2009).

Few studies to date have assessed the direct effects of neighborhood characteristics on substance use or how such factors may condition the impact of victimization on this outcome (Gardner et al., 2010; Lambert et al., 2004), and a primary aim of the current study was to help advance the literature in this area. While we posited that neighborhood disadvantage and community norms tolerant of adolescent substance use would have direct effects on substance use, neither relationship was evidenced in this sample. That is, neither community characteristic had a statistically significant impact on the likelihood of adolescent substance use. Additional analyses conducted to further explore these null findings indicated negligible direct effects when examining the sole impact of community norms or disadvantage on substance use (without the other predictor in the model).

[10]It should be noted, however, that victimization was significantly related to an increased likelihood of alcohol use (b=.11, $p < .01$) and binge drinking (.12, $p < .05$) when peer substance use was excluded from the models.

While not anticipated, these results are consistent with some prior work that has also failed to find direct effects of neighborhood characteristics on youth substance use (Brenner et al., 2011; Musick et al., 2008; Tobler et al., 2009; Zimmerman and Vasquez, 2011). The findings do not replicate work by Van Horn et al. (2007), however, who found significantly lower rates of teenage substance use in communities with lower tolerance of adolescent substance use. This study was one of few to assess the impact of community norms on adolescent substance use, and additional research is needed to further explore the ways in which community characteristics, especially cultural norms and values, may impact youth development in general and substance use in particular (Sampson and Bean, 2006).

Evidence that neighborhoods may not exert substantial, main effects on youth behavior, particularly compared to and when controlling for more proximal individual-level factors has led to a recommendation for more nuanced and/or complex models of contextual influence (Elliott et al., 1996; Leventhal and Brooks-Gunn, 2000). Our study aimed to contribute to this burgeoning area of research by examining the degree to which neighborhood norms and/or disadvantage conditioned the impact of victimization on substance use. The results provided limited support for contextual moderation. Only one cross-level interaction was statistically significant (at $p < .05$), and indicated that the effect of victimization on the prevalence of marijuana use was stronger for those living in neighborhoods with higher versus lower levels of disadvantage. A marginally significant ($p < .10$) cross-level interaction between victimization and disadvantage was also detected when assessing alcohol use, and showed a similar relationship, whereby the relationship was stronger in more disadvantaged communities. These findings are consistent with the risk amplification and cumulative disadvantage processes (Bellair and McNulty, 2010; Hawkins et al., 1992), which posit that risk factors (e.g., exposure to violence) will have a stronger impact on problem behaviors (e.g., substance use) in the presence of other risk factors (e.g., concentrated disadvantage) (e.g., see Beaver et al., 2012; Brody et al., 2003; Hay et al., 2006; Schuck and Widom, 2005). The findings are also consistent with neighborhood studies (Anderson, 1999; Wilson, 1987) and General Strain Theory (Agnew, 2006), which suggest that life in poor, urban areas makes positive development significantly more challenging, likely due to accumulation of stressful experiences faced by youth.

It is more challenging to explain the overall lack of significant moderating effects of community norms regarding substance use, or the one marginally significant ($p < .10$) cross-level interaction which showed that the relationship between victimization and marijuana use was stronger for adolescents living in neighborhoods with greater condemnation of substance use. Although community norms may influence youth delinquency in general, as suggested by social disorganization theories (Kornhauser, 1978; Sampson and Bartusch, 1998), our results suggest that they may have weaker direct and moderating effects on substance use. The null findings may stem from the fact that substance use tends to be a more private form of delinquency compared to property and violent offending, and thus may be less susceptible to “outside” (neighborhood) influences (Maimon and Browning, 2012). Sampson (2012) has also posited that neighborhood factors may not have a direct influence on individual behaviors if youth commit law-breaking activities outside of their residential neighborhood. In terms of moderating effects, it could be that youth who experience the

discontinuity of living in more benign conditions (i.e., in neighborhoods less tolerant of substance use) while simultaneously witnessing or experience violence feel the effects of this stressor more strongly, and are thus at greater risk for negative reactions to it (Wright and Fagan, 2013). Given the modest effect reported here, and the paucity of research that has investigated the direct or moderating effects of cultural norms on delinquency or drug use, these possibilities are speculative at best. Additional research is needed to explore how norms as well as other social, cultural, and structural aspects of neighborhoods may affect both the likelihood of substance use and the relationship between victimization and problem behaviors.

Future work can also help to address some of the other limitations of the current project. This study has limited generalizability, given that data were collected in one city (Chicago) during the 1990s. Different patterns of results may be uncovered when examining other contexts and time periods. While our study encompassed a broad range of victimization experiences, violence can take many forms (e.g., child abuse, violence between caregivers, school-related violence, bullying, etc.) and research is needed to compare the unique and combined effects of these various types of victimization on substance use and delinquency, as well as to examine the degree to which neighborhood context moderates these relationships. Furthermore, our outcome variables were dichotomized to assess the impact of victimization on *any* alcohol use, binge drinking, or marijuana use, and additional research is needed to further explore the impact of exposure to violence on the frequency of alcohol and drug use and/or on substance abuse. Although our models were able to control for the temporal ordering to a certain extent, by including assessments of wave two substance use when predicting use at wave three, our analysis strategy did not allow us to examine the potential for reciprocal effects between victimization and substance use, or how continuity and/or changes in victimization are related to continuity and/or changes in substance use. Additional studies using other types of data analysis techniques (e.g., cross-lagged models, growth curve modeling, etc.) are needed to explore such questions. A better understanding of all of these issues can help guide the development of prevention and intervention services for youth and adolescents, particularly those who have been exposed to violence, in order to reduce the likelihood that they will engage in problem behaviors.

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Highlights

- Exposure to violence increases the likelihood of adolescent marijuana use
- Exposure to violence does not influence adolescent alcohol use or binge drinking
- Neighborhood norms regarding teen drug use did not affect adolescent substance use
- The effect of victimization on marijuana use is greater in more disadvantaged areas

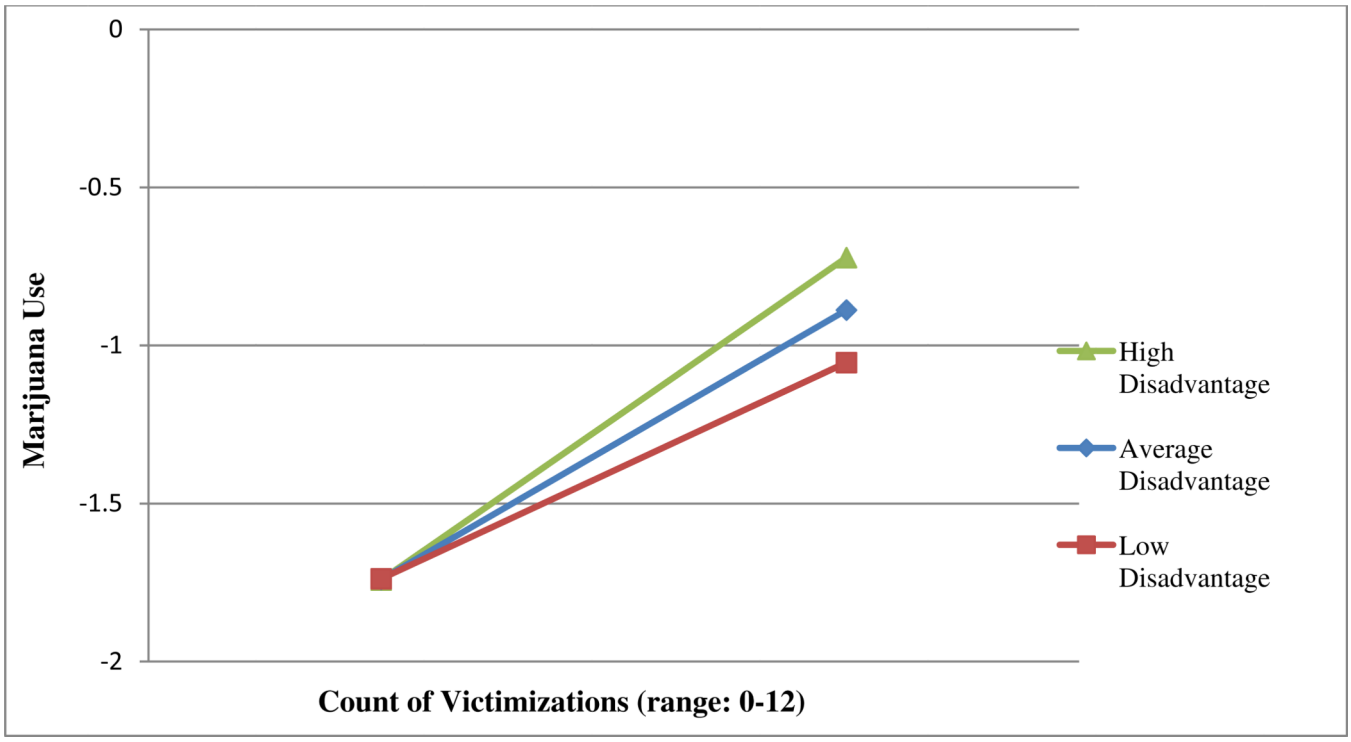

Figure 1.

The Relationship Between Victimization and the Likelihood of Marijuana Use, by Neighborhood Concentrated Disadvantage1

[1]This model also controlled for the effect of neighborhood norms and all individual-level predictors

Table 1

Sample Means and Standard Deviations

	Mean	SD	Min-Max
Outcomes (Wave Three)			
Any Alcohol Use	.43	.50	0–1
Any Binge Drinking	.12	.33	0–1
Any Marijuana Use	.19	.40	0–1
Level-1 Predictors			
Independent Variable (Wave Two)			
Number of Victimizations	1.95	2.08	0–12
Control Variables			
Age (Wave 2)	13.94	2.48	9.11–19.89
Male	.49	.50	0–1
Hispanic	.48	.50	0–1
African American	.32	.47	0–1
Caucasian	.16	.37	0–1
Other Race/Ethnicity	.04	.18	0–1
Household Salary	4.83	2.54	0–11
Parent Problems with Drugs and Alcohol	.17	.38	0–1
Routine Activities	−.02	.99	−2.50–2.34
Peer Substance Use	−.02	.98	−.86–2.99
Low Self Control	−.02	.96	−2.52–3.40
Perceived Harm of Drugs	.01	.99	−4.47–1.52
Prior Alcohol Use	.23	.42	0–1
Prior Binge Drinking	.05	.22	0–1
Prior Marijuana Use	.10	.31	0–1
N_1	1416		
Level-2 Predictors			
Norms Unfavorable to Drug Use	.00	.08	−0.19–0.18
Concentrated Disadvantage	−.01	1.00	−1.51–2.63
N_2	79		

Table 2

The Effects of Victimization on the Likelihood of Alcohol Use, Binge Drinking, and Marijuana Use [a]

	Alcohol Use [b]		Binge Drinking [c]		Marijuana Use [b]	
	b	**SE**	**b**	**SE**	**b**	**SE**
Individual-Level Effects						
Intercept	*−.36***	*(.06)*	*−2.77***	*(.12)*	*−1.74***	*(.08)*
Victimization	*.05*	*(.04)*	*.05*	*(.06)*	*.14***	*(.04)*
Age	.31**	(.04)	.30**	(.04)	.12**	(.04)
Male	.04	(.13)	.93**	(.21)	.24	(.15)
Hispanic [d]	−.16	(.17)	.29	(.27)	−.26	(.21)
African American [d]	−.76**	(.19)	−.82*	(.32)	−.16	(.22)
Household Salary	.04	(.03)	.12**	(.03)	.004	(.03)
Parent Problems with Drugs	.24	(.17)	.46	(.25)	.01	(.23)
Routine Activities	.25**	(.08)	.26*	(.11)	.21*	(.08)
Peer Substance Use	.44**	(.11)	.50**	(.12)	.36**	(.10)
Low Self Control	−.07	(.07)	−.03	(.11)	.21**	(.08)
Perceived Harm of Drugs	−.19*	(.07)	−.02	(.11)	−.31**	(.08)
Prior Alcohol Use	.60**	(.16)	--	--	--	--
Prior Binge Drinking	--	--	.99**	(.27)	--	--
Prior Marijuana Use	--	--	--	--	.74**	(.24)
χ^2	59.50		70.30		71.23	

** $p \leq .01$

* $p \leq .05$

† $p \leq .10$

[a] Bernoulli models were utilized to estimate effects; italicized coefficients indicate that effects were allowed to vary randomly across neighborhood clusters (NCs)

[b] Based on 1416 individuals

[c] Based on 1400 individuals

[d] Caucasian/other race or ethnicity is the reference group

Table 3

Direct and Cross-Level Effects of Neighborhood Characteristics on Rates of Alcohol Use, Binge Drinking, and Marijuana Use [a]

	Alcohol Use		Binge Drinking		Marijuana Use	
	b	**SE**	**b**	**SE**	**b**	**SE**
Neighborhood Direct Effects						
Level 1 Intercept	−.35**	(.003)	−2.78**	(.01)	−1.74**	(.003)
Norms Unfavorable to Drug Use	.04	(.04)	−.19	(.12)	−.06	(.04)
Concentrated Disadvantage	.01	(.003)	−.01	(.01)	−.001	(.004)
Proportion Variation Explained	.03		.03		.02	
Cross-Level Interactions[b]						
Victimization	.08**	(.01)	.05**	(.004)	.14**	(.01)
xNorms Unfavorable to Drug Use	.17	(.18)	−.001	(.05)	.13†	(.07)
xConcentrated Disadvantage	.03†	(.01)	.001	(.004)	.01*	(.01)
Proportion Variation Explained	.04		.001		.09	

** $p \leq .01$

* $p \leq .05$

[a] Bernoulli models using Empirical Bayes (EB) estimates were utilized to assess effects for 1416 individuals in models assessing alcohol use, 1400 individuals in models assessing binge drinking, and 1416 individuals in models assessing marijuana use living in 79 NCs. The models control for all individual-level predictors shown in Table 2.

[b] Cross-level interactions also control for the neighborhood direct effects as well as all individual-level predictors shown in Table 2.