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A multi-level analysis of the impact of neighborhood structural and social factors on adolescent substance use

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ABSTRACT

Background: This paper examined the effects of neighborhood structural (i.e., economic disadvantage, immigrant concentration, residential stability) and social (e.g., collective efficacy, social network interactions, intolerance of drug use, legal cynicism) factors on the likelihood of any adolescent tobacco, alcohol, and marijuana use.

Methods: Analyses drew upon information from the Project on Human Development in Chicago Neighborhoods (PHDCN). Data were obtained from a survey of adult residents of 79 Chicago neighborhoods, two waves of interviews with 1657 to 1664 care-givers and youth aged 8 to 16 years, and information from the 1990 U.S. Census Bureau. Hierarchical Bernoulli regression models estimated the impact of neighborhood factors on substance use controlling for individual-level demographic characteristics and psycho-social risk factors.

Results: Few neighborhood factors had statistically significant direct effects on adolescent tobacco, alcohol or marijuana use, although youth living in neighborhoods with greater levels of immigrant concentration were less likely to report any drinking.

Conclusion: Additional theorizing and more empirical research are needed to better understand the ways in which contextual influences affect adolescent substance use and delinquency.

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1. Introduction

Adolescent substance use is a public health concern (National Academy of Sciences, 2004). In the U.S., 22% to 35% of high school students report current use of tobacco, alcohol, and marijuana (Kann et al., 2014) and lifetime drug use is even higher (Johnston et al., 2013). Moreover, worldwide estimates of substance use disorders and dependency range from 6% to 16% among adolescents (National Research Council and Institute of Medicine, 2009). These rates are concerning given the immediate and long-term consequences of substance use on public health problems including drug abuse, crime and violence, and physical and mental illness (Hingson et al., 2006; Mrug and Windle, 2009).

The extent and consequences of illegal substance use by adolescents has led to calls for more preventative interventions to reduce use (National Prevention Council, 2011; National Research Council

and Institute of Medicine, 2009). Doing so requires a full understanding of the circumstances that place adolescents at risk for substance use. Research has indicated that adolescents' individual characteristics, peer groups, families, and schools affect their likelihood of smoking, drinking, and illicit drug use (Durlak, 1998; Hawkins et al., 1992). There is also evidence that rates of substance use vary significantly across neighborhood contexts (Bernat et al., 2009; Karriker-Jaffe, 2011; Wilcox, 2003), but the specific structural and social factors which contribute to this variation have not yet been clearly identified (Leventhal and Brooks-Gunn, 2000).

1.1. Contextual influences on adolescent substance use

Social disorganization theories (Sampson et al., 1997; Shaw and McKay, 1942) posit that areas of economic and social deprivation will have more delinquency and crime than affluent and socially organized neighborhoods. Social ecological theories (e.g., Bronfenbrenner, 1979) also emphasize the role of the neighborhood context in shaping development and recognize the importance of other social influences, such as peer interactions and family processes. Guided by these theories, studies have increasingly

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examined the impact of neighborhood context on adolescent development (e.g., Ennett et al., 2008; Karriker-Jaffe et al., 2013; Lambert et al., 2004; Sampson, 2012; Tobler et al., 2009; Zimmerman and Messner, 2011).

In contrast to the predictions of social disorganization and social ecological theories, however, much of this literature has failed to show a direct effect of neighborhood factors on substance use, and when significant effects have been evidenced, they have been mixed across studies. For example, a review of 34 studies found that 18% reported a negative relationship between community socioeconomic status (SES) and alcohol use by adolescents and young adults (i.e., drinking was more likely in low-SES areas), 14% of studies showed the opposite effect (i.e., drinking was greater in high-SES areas), and the remainder (68%) did not find a significant relationship (Karriker-Jaffe, 2011). Similarly mixed findings are reported in other systematic reviews of contextual influences on adolescent drinking (Bryden et al., 2013; Hanson and Chen, 2007; Jackson et al., 2014). Studies have shown more consistent direct effects of community SES on smoking, with most showing higher rates of tobacco use in lower-SES communities, but some research has indicated the opposite relationship or a lack of significant effects (Gardner et al., 2010; Hanson and Chen, 2007). Investigations of neighborhood structural factors on marijuana use are too few to draw strong conclusions (Gardner et al., 2010).

Far fewer studies have investigated the impact of neighborhood social processes on substance use. One review (Jackson et al., 2014) found only three studies that analyzed the impact of community attitudes regarding substance use on adolescent drinking, three studies assessing collective efficacy (i.e., social cohesion and efforts to informally control crime or deviance; see Sampson et al., 1997), and five studies examining social capital or neighborhood attachment. Most of these studies indicated null or contradictory effects of social processes on adolescent drug use (e.g., De Haan and Boljevac, 2010; Ennett et al., 2008, 2010; Musick et al., 2008).

1.2. Limitations and gaps in prior research

The reviews cited above concur that more information is needed to better understand if and how contextual influences affect adolescent substance use (Bryden et al., 2013; Jackson et al., 2014; Karriker-Jaffe, 2011). Available literature has focused more on structural factors like SES than social processes such as social capital, collective efficacy, and community norms (Bryden et al., 2013; Jackson et al., 2014). In addition, most research has evaluated either tobacco or alcohol use, with fewer studies evaluating other substances or comparing effects across different substances (Karriker-Jaffe, 2011).

More methodologically rigorous examinations are also needed. Leventhal and Brooks-Gunn (2000) note that relatively few studies have been specifically designed to study neighborhood effects and that few have collected reliable and valid data on neighborhood processes from enough geographical areas and respondents per neighborhood to ensure sufficient variability in constructs and adequate statistical power to find effects. In addition, neighborhood constructs, especially those intended to measure social processes, are typically measured using data from the same adolescents who report on substance use (Wilcox, 2003). However, relying on the same sources to report independent and dependent variables can inflate effect sizes. In addition, individuals' perceptions of their neighborhood environments are likely influenced by their own experiences and/or psychological characteristics and may not represent actual neighborhood conditions (Sampson and Raudenbush, 1999). To avoid bias, neighborhood characteristics are ideally measured with objective sources like archival data (e.g., U.S. Census data), systematic observations, or surveys of community leaders (Leventhal and Brooks-Gunn, 2000; Sampson and Raudenbush,

1999). It is also important to ensure that "neighborhoods" represent meaningful ecological contexts, but the common use of administrative data (e.g., census tracts) to define neighborhood boundaries may not produce areas that match residents' views of their neighborhoods (Sampson, 2012).

Neighborhood studies often fail to investigate the impact of community and individual-level factors and to utilize multi-level analyses when doing so. Based on social ecological theories and research indicating that many individual, peer, and family factors influence adolescent substance use (Hawkins et al., 1992), failure to control for these variables could artificially inflate neighborhood effects. It is also true that analyses which include factors that mediate the effects of neighborhood context on substance use may under-estimate neighborhood direct effects. To avoid this problem in our analyses, our first set of multi-level multivariate analyses includes a limited number of individual-level controls. Model mis-specification can also occur if factors which affect neighborhood selection (e.g., individual SES; Gardner et al., 2010) are not included. Multi-level statistical techniques should be used when simultaneously investigating the impact of community- and individual-level factors in order to minimize correlated error and heteroskedasticity and to avoid biased hypotheses testing (Sampson and Raudenbush, 1999). Finally, many studies have relied on cross-sectional data which limits causal inferences regarding the impact of contextual influences on substance use (Jackson et al., 2014; Leventhal and Brooks-Gunn, 2000).

1.3. The current study

The current study seeks to address these issues and advance our understanding of how neighborhood context affects adolescent substance use. Analyses draw on data from the Project on Human Development in Chicago Neighborhoods (PHDCN; Earls et al., 2002), a study purposefully designed to examine contextual effects on youth development. We examine the impact of structural and social neighborhood constructs on the three substances most commonly used during adolescence – tobacco, alcohol and marijuana – controlling for many individual-level predictors and using prospective measures from multiple informants. Two research questions are examined: (1) To what extent does adolescent substance use (tobacco, alcohol, and marijuana) vary by neighborhood? (2) What are the direct effects of neighborhood structural and social characteristics on adolescent substance use, controlling for individual-level factors?

2. Materials and methods

2.1. Participants

We draw on three sources of data collected in the PHDCN. The first is the Community Survey of adult residents of Chicago neighborhoods. To obtain reliable estimates of neighborhood processes across the city, Chicago's 847 census tracts were divided into 343 neighborhood clusters (NCs) based on knowledge of existing neighborhoods and geographic boundaries and to ensure homogenous units of analysis (Sampson, 2012). Using a three-stage sampling design, city blocks were then sampled within each NC, dwelling units were sampled within blocks, and one adult resident was sampled within each dwelling unit and interviewed in 1994–1995 regarding neighborhood social processes. To assess neighborhood structural characteristics, data from the 1990 U.S. Census were collected and linked to the 343 NCs.

To examine the impact of neighborhood characteristics on youth outcomes, the 343 NCs were stratified by seven categories of racial/ethnic diversity and three levels of SES, and 80 NCs were

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