Neighborhood Variation in Adolescent Alcohol Use: Examination of Socioecological and Social Disorganization Theories*

ALLISON B. BRENNER, M.P.H.,[†] JOSÉ A. BAUERMEISTER, M.P.H., PH.D., AND MARC A. ZIMMERMAN, PH.D.

Department of Health Behavior and Health Education, School of Public Health, University of Michigan, 1415 Washington Heights, Ann Arbor, Michigan 48109-2029

ABSTRACT. Objective: Risk factors for adolescent alcohol use are typically conceptualized as individual and interpersonal level factors; however, these factors do not fully explain adolescent drinking behavior. We used a socioecological model to examine the contribution of neighborhood factors in a risk and promotive model of adolescent alcohol use among urban high school youth ($N = 711$; 52% female; 82% African American; $M = 18$ years old). **Method:** Using a multilevel model, we considered the role of neighborhood disadvantage on youth alcohol use, after accounting for risk (e.g., peer and parental substance use) and promotive factors (e.g., social support and participation in

prosocial activities). **Results:** Peer alcohol use and peer support were associated with more alcohol use, and maternal support was negatively associated with alcohol use. Despite significant variation at the neighborhood level, neighborhood disadvantage was not directly associated with adolescent drinking. **Conclusions:** Our study contributes to a mixed body of literature on social context and adolescent health. Although our research highlights the importance of interpersonal relationships, we found no support for neighborhood influences. We conclude with future directions for research examining the link between adolescent drinking and neighborhood contexts. (*J. Stud. Alcohol Drugs*, 72, 651–659, 2011)

ALCOHOL IS A LEADING CAUSE OF DEATH in the United States and a considerable public health problem affecting adolescents, schools, and communities (Johnson et al., 2006; Mokdad et al., 2004). Youth alcohol use is associated with a variety of poor health, behavioral, and academic outcomes (Barnes et al., 2002; Komro et al., 2008). Although the prevalence of lifetime alcohol use among American adolescents has declined, more than 75% of 12th graders report using alcohol, with 58% of high school seniors reporting drinking enough alcohol to get drunk and about a third reporting at least one episode of heavy episodic drinking (drinking five or more drinks in a row) during their lifetime (Johnson et al., 2006).

Most research has focused on risks for alcohol use associated with family and peer influences. Although intrapersonal and interpersonal factors represent potential points of intervention to reduce youth drinking, focusing on only these two levels can be limiting. As youth mature, they spend increasing amounts of time outside of their homes, interacting with people from diverse settings (Cook et al., 2002). As a result, researchers have acknowledged the need to consider how social contexts may influence youth alcohol use (Chuang et al., 2005; Ennett et al., 1997). Winstanely et al. (2008), for

example, found that alcohol use increased if youth perceived their neighborhoods to be disorganized. Social contexts such as the residential environment may also enable alcohol use indirectly by affecting interpersonal influences, which may influence parenting behavior and the home environment, and by exposing youth to different role models (Chuang et al., 2005). Consequently, research that examines how neighborhood factors may influence alcohol use is necessary to test a socioecological theory and inform multilevel prevention programs. As a contribution to the literature, we examined the relationship between youth alcohol use and several risks (e.g., peer alcohol use) and promotive factors (e.g., maternal support) and tested whether the inclusion of neighborhood disadvantage helps to explain youth alcohol use further.

Multiple influences on youth behavior

We applied a socioecological framework to examine how interactions across environments may shape adolescent drinking (Bronfenbrenner, 1979, 1988; Glanz et al., 2002). A socioecological framework suggests that both the intrapersonal and interpersonal aspects of adolescents' lives are affected by their neighborhood. Although many studies on adolescent alcohol use include intrapersonal and interpersonal risk factors for drinking, few have included promotive factors that help youth counter or overcome these risks (Kadushin et al., 1998) or modeled community-level factors concurrently (Chuang et al., 2005). Consequently, research that examines multiple levels may help us better understand the complex web of influence that affects youth drinking

Received: August 13, 2010. Revision: March 14, 2011.

*This research was supported by National Institute on Alcohol Abuse and Alcoholism Grant 5R03AA017240-02 (principal investigator, Marc A. Zimmerman).

[†]Correspondence may be sent to Allison B. Brenner at the above address or via email at: abbren@umich.edu.

behavior. Rather than focusing on youths' perceptions of their neighborhoods (Winstanley et al., 2008), however, we examined how a census-derived indicator of social disadvantage may be associated with youth alcohol use and its risk and promotive correlates.

Risk and promotive factors for adolescent alcohol use

Family, peer, and neighborhood social environments present youth with a variety of contextual risk factors for alcohol use (Catalano et al., 1996; Mason and Windle, 2001). Catalano et al. (1996) note that adolescents learn patterns of behavior from available socializing agents (e.g., family, peers). These learned behaviors may be prosocial or antisocial depending on the values, norms, and behaviors modeled by the socializing agents. Researchers have found consistent support for the association between family and youth alcohol or other drug (AOD) use (Brook et al., 1990; Hawkins et al., 1992).

Peer substance use is also a risk factor for adolescent alcohol use (Hawkins et al., 1992). Although parental influences remain important, youth interact more frequently with peers as they age (Fuligni and Eccles, 1993). As the influence of peer relationships grows in salience, so does their association with youth behavior. Most research on adolescent alcohol use, however, has focused on risk factors and fails to address the positive forces that promote healthy adolescent development and abstinence from alcohol and drug use (Catalano et al., 2004; Maton and Zimmerman, 1992).

Researchers have started to examine the role of positive influences on youth behavior and development (Ostaszewski and Zimmerman, 2006; Xue et al., 2007). Based on a resiliency framework, they have argued that positive influences or promotive factors may either counteract (negate) or moderate (attenuate) the relationship between risk and adolescent alcohol use (Fergus and Zimmerman, 2005). Promotive factors refer to assets (factors intrinsic to the individual, such as self-esteem) and resources (factors outside the individual, such as social support) that help youth avoid the negative effects of risks (Masten et al., 1990; Rutter, 1993). Promotive factors identified in the research on adolescent AOD use include parental support (Caldwell et al., 2004) and peer support (Ostaszewski and Zimmerman, 2006). Results for peer support, however, have been mixed; this is often attributed to differences in youths' interpersonal assets, norms, and values (Bryant and Zimmerman, 2002; Maton and Zimmerman, 1992; Wills et al., 2004). Furthermore, participation in organized and structured activities that provide youth with opportunities to gain practical, social, and emotional skills has also been found to reduce the risk of AOD use during adolescence (Xue et al., 2007).

Few researchers, however, have examined promotive factors as they relate to neighborhood disadvantage as a risk factor for youth (Dubow et al., 1997; Xue et al., 2007). Xue

et al. (2007) explored the relationship between neighborhood context and the role of promotive factors on youth cigarette use. Involvement in prosocial activities was associated with less cigarette use, particularly among youth who lived in neighborhoods with greater disadvantage. These findings illustrate the importance of considering positive factors as a means to avoid risks that come from living in disadvantaged neighborhoods.

Neighborhood factors

Neighborhood-level theories suggest that youth are particularly vulnerable to the effects of living in poor neighborhoods (Cicchetti and Rogosch, 2002; Leventhal and Brooks-Gunn, 2003). Social disorganization theory posits that neighborhoods with few economic and social resources (i.e., disadvantaged neighborhoods) lack community social control, which deters deviant and criminal behavior and further social and economic breakdown (Sampson and Groves, 1989; Shaw and McKay, 1969). It has been applied to research on adolescent delinquency, risk behavior, and AOD use (Ennett et al., 1997; Lambert et al., 2004; Leventhal and Brooks-Gunn, 2000; Sampson et al., 1997). Living in poor neighborhoods has been linked to a variety of youth risk behaviors (Ennett et al., 1997; Jencks and Mayer, 1990).

Neighborhoods may influence youth alcohol use through indirect pathways. Youth who live in disadvantaged neighborhoods may have more access to alcohol (Allison et al., 1999; Hawkins et al., 1992), which has been found to increase alcohol use (LaVeist and Wallace, 2000). Neighborhoods may also exert indirect influences on adolescent drinking through parents (Chuang et al., 2005; Ennett et al., 1997). Parents who live in disadvantaged neighborhoods are more likely to have poor mental health, coping, and parenting behaviors (Chuang et al., 2005; Leventhal and Brooks-Gunn, 2000), which may damage their ability to offer support, monitoring, and discipline. These parents may also be more likely to model AOD use behavior for their children.

Racial differences in risk for alcohol use

Although etiological studies lend strong support for the relationship between family and peer risk factors and adolescent AOD use, most of these studies were conducted with predominantly White samples (Lambert et al., 2004). Family and peer influences explain less variance in AOD use for African American youth compared with White youth (Lambert et al., 2004). Our study contributes to this research by studying a sample of predominantly African American youth who live in a small, economically depressed midwestern city.

African Americans are disproportionately represented in segregated and disadvantaged communities (Wallace and Muroff, 2002) and are more likely than non-African American families to live in communities fraught with crime and

violence (Jencks and Mayer, 1990). The greater presence of African American youth in disadvantaged neighborhoods may, therefore, contribute to racial differences in the risk and promotive factors for alcohol use. This highlights the importance of testing a socioecological model and including neighborhood-level factors in studies of African American youth.

Current study

Relatively few researchers have examined structural and economic neighborhood influences on adolescent drinking. Our research used a multilevel analytic strategy to account for the nesting of neighborhood effects. This multilevel analysis allowed us to study the net effects of individual, interpersonal, and neighborhood indicators of adolescent alcohol use, as well as to examine how these relationships may vary across neighborhoods. First, we explored the relationship between individual risk factors, including peer and parental substance use, and adolescent alcohol use in the 12th grade, controlling for demographic variables and earlier drinking behavior. Second, we examined the counteracting effects of social support and prosocial involvement on youth alcohol use. Finally, we explored a multilevel model that examines the effects of neighborhood disadvantage, as well as the individual risk and promotive factors. We tested whether disadvantage is directly associated with alcohol use within a neighborhood and expected neighborhoods to have a direct influence on adolescent drinking while accounting for individual-level risk and promotive factors.

Method

Design and sample

Data from a longitudinal study of 850 youth were used for this study. Data collection began in 1994 and is ongoing. Eligible students included ninth graders enrolled in one of four public high schools in an urban city in Michigan who had an eighth-grade grade-point average of 3.0 or below on entering high school. Youth who were diagnosed by the schools with emotional or developmental impairments were excluded from the study sample. Youth self-identified as African American (80%), White (17%), or biracial (3%). Males and females were equally represented. This study was approved by the institutional review board at the University of Michigan.

Data were collected during structured face-to-face interviews conducted in school or in community locations. Data were collected annually, beginning with ninth grade (Wave 1), and the current study uses data from the first and last year of high school. The interview portion of the study included most of the psychosocial variables in the data. A self-administered questionnaire given to youth at the end

TABLE 1. Sample means and standard deviations for predictors included in the final model ($N = 711$)^a

Variable	<i>M</i> (<i>SD</i>)/%	Range	Cronbach's α
Outcome			
Wave 4 alcohol use ^b	0.00 (2.66)	-1.7–11.89	.78
Wave 1 alcohol use ^b	-0.04 (2.50)	-1.39–15.42	.76
Demographics			
Black	82%		N.A.
Male	48%		N.A.
Socioeconomic status	39.97 (9.77)	29.28–64.38	N.A.
Maternal education	4.35 (1.88)	1–9	N.A.
Risk factors			
Caregiver alcohol use ^b	1.30 (0.49)	1–4.25	.83
Caregiver drug use ^b	1.05 (0.17)	1–2.89	.63
Peer alcohol use ^b	2.15 (0.99)	1–5	.84
Peer drug use ^b	1.76 (0.72)	1–5	.80
Protective factors			
Maternal support ^b	3.99 (0.96)	1–5	.91
Peer support ^b	3.29 (0.98)	1–5	.90
Prosocial participation			
School activities	9.12 (8.72)	5.01–114.94	N.A.
Church activities	8.25 (9.00)	2.2–145.7	N.A.
Neighborhood			
Disadvantage (<i>z</i> scored) ^b	-0.12 (1.08)	-2.29–2.24	.88

Notes: N.A. = not applicable. ^a*n* based on imputed data used in multilevel analyses; ^bscale composed of several items.

of the interview assessed substance use and other sensitive questions. The individual-level data were linked to 1990 census data based on geocoded home address information.

The current study focused on a subsample of 711 African American ($n = 583$, 82%) and White ($n = 128$) youth who had nonmissing data for Wave 1 and Wave 4 of the dependent variable (alcohol use). Youth averaged age 14.5 years ($SD = 0.66$) in Wave 1 and age 17.8 years ($SD = 0.64$) in Wave 4. Slightly more than half of the sample was female (52%).

Measures

The measures included in our analysis are described below, and the descriptive statistics for these measures are displayed in Table 1.

Dependent variable. Youth alcohol use was measured with three items: frequency of alcohol use in the past month (categorical response for past month drinking from 1 = 0 to 7 = ≥ 40 times), frequency of heavy episodic drinking (five or more drinks in a row) during the past 2 weeks (categorical response from 1 = none to 6 = ≥ 10 times), and drinking enough alcohol to feel high (categorical responses from 1 = never to 5 = on all occasions). Responses to the three alcohol use items were standardized to a common scale and then summed for each participant to form a composite measure for Wave 1 and Wave 4 alcohol use, respectively.

Demographic factors. Youth's sex and self-identified race were included as control variables. Both measures were assessed during the first wave of data collection. Age was cal-

culated by subtracting birth month and year from the survey date.

Family socioeconomic status was also assessed in Wave 1 and is assigned based on the highest occupational prestige score for either parent using codes developed by the National Opinion Research Center and then standardized to facilitate interpretation (Nakao and Treas, 1990). The score is assigned based on 20 occupational classifications, ranging from private household work (scored as 29.28) to professional (scored 64.38). The mean prestige score in our sample corresponds to blue-collar occupations.

Maternal education was assessed in the first wave of data collection. Mother's highest education level was entered into the analysis as a continuous variable and was originally assessed based on a seven-level interval response format. Higher values denote more education. The mean education level in our sample corresponds roughly to an average vocational/training school education.

Risk factors. Caregiver alcohol use was assessed based on who youth had identified as the most important person in raising them (Rachal et al., 1975). Caregiver alcohol use includes three items (drinking beer or wine in the past month, drinking distilled spirits in the past month, and drinking to get drunk over the past 2 weeks) that were assessed on a 5-point scale (1 = *never* to 5 = *very often*). These items were averaged to create a composite measure, which ranges from 1 (*low alcohol use*) to 5 (*highest use*).

Caregiver drug use was also assessed by a composite measure created from an average of three questions, including the frequency of smoking marijuana in the past year, getting high or stoned on drugs, and being arrested for having or using drugs. This measure was adapted from the alcohol use measure and to our knowledge has not been used previously. Like caregiver alcohol use, the response of each indicator, as well as the final drug use scale, ranges from 1 to 5. A higher score corresponds to greater drug use.

Peer alcohol use was measured by a composite scale of three items that assess how many of the youth's friends consume beer and wine at least one time per month, consume distilled spirits at least once per month, and consume alcohol at school (Doljanac and Zimmerman, 1998; Stacy et al., 1992). The items were originally measured on a scale of 1 = *none* to 5 = *all* and then averaged to form the composite measure.

Peer drug use was assessed by five items that characterize the number of the respondents' friends who smoke marijuana at least once per month, have used cocaine, have used drugs at school, have been arrested for selling drugs, and have been arrested for having drugs (Stacy et al., 1992). These items were averaged to create a composite measure ranging from 1 = *none* to 5 = *all*.

Promotive factors. Mother's support was measured by five items adapted from Procidano and Heller (1983). Items include the degree to which the adolescent's mother gives

emotional and instrumental support and the closeness of the mother-youth relationship. Participants responded using a 5-point scale (1 = *not true* to 5 = *very true*). A composite score was created by taking the average of the five items.

Peer support included five items assessing the same types of emotional and instrumental support as maternal support. These items were averaged to create a composite measure (Procidano and Heller, 1983). A higher value on both measures corresponds to greater levels of support.

Adolescents were asked to list all school and church activities in which they participated. Participation was assessed by three items for school and church involvement and included months of involvement in the last year, frequency of participation (measured on a scale of 1 = *hardly ever* to 4 = *most of the time*), and a dichotomous measure of whether the youth held a leadership position. These questions were asked for each activity reported. Students who did not participate were given scores of 0 for months of involvement and frequency of involvement and -1 for leadership position. Summary scores for each activity were standardized, transformed to positive numbers (with +1 as the minimum score), and then added (Xue et al., 2007).

Neighborhood factors. The neighborhood-level disadvantage variable was created from 1990 census data using individual geocoded data. Neighborhood was conceptualized at the census block group level ($n = 143$) to ensure adequate power for the analysis (Sampson et al., 1997). Census block group data were used to create a standardized neighborhood economic disadvantage score through a principal axis factor analysis with a varimax rotation (Sampson et al., 1997; Xue et al., 2007). This composite score ($\alpha = .88$) had a one-factor solution that explained 69.4% of the variance and included the following indicators: families in the census block group with annual incomes less than \$15,000, families on public assistance, families who are single-headed households with a child less than 18 years of age, families in which an adult in the house was unemployed, and families with a head of household with less than a high school education. A higher value of disadvantage denotes more neighborhood disadvantage.

Data analytic strategy

Only participants with nonmissing Wave 1 and Wave 4 alcohol use were included in the analysis ($N = 711$). Participants who had missing values for some of the independent variables were retained, and their missing data were imputed using the expectation maximization algorithm (West et al., 2006). We conducted an attrition analysis comparing participants with missing ($n = 35$) and complete ($N = 711$) data to ensure that the imputation did not result in a biased analysis.

To account for the nested structure of the data, we used a multilevel analysis using Hierarchical Linear and Nonlinear Modeling software (HLM 6) (Raudenbush et al., 2004).

HLM accounts for the intragroup correlation and partitions the variance and covariance between and within groups (Raudenbush and Bryk, 2002). Participants who live in the same block groups may be more similar than participants in different block groups; this shared experience may increase intragroup correlation for alcohol use.

A fully unconditional model (FUM) was first examined to determine whether youth alcohol use varied between neighborhoods. The FUM does not contain any individual-level factors and simply partitions the variance in the outcome between and within census block groups. The intraclass correlation coefficient, a measure of the ratio of between to within group variance in the outcome, was calculated from the FUM to determine the proportion of variance in the outcome that is a result of between-neighborhood factors. After determining that a proportion of the variance in Wave 4 alcohol use was attributed to neighborhood-level factors, we created three models for this analysis. First, in an individual level (Level 1) risk model, we examined the relationships between youth and family demographics, caregiver and peer risk factors, and Wave 4 alcohol use, controlling for baseline drinking behavior (i.e., change in alcohol use from Wave 1 to Wave 4). Then, to test whether the promotive factors are inversely related to alcohol use, a second individual-level model was run that added social support and participation in prosocial activities to Model 1 (see Equation 1).

$$Y_{ij} = \hat{a}_{0j} + \hat{a}_{1-5,j}(\text{Demographics}) + \hat{a}_{6-9,j}(\text{Risk factors}) + \hat{a}_{10-13,j}(\text{Promotive factors}) + r_{ij} \quad (1)$$

Finally, we ran a neighborhood-level (Level 2) model to examine whether alcohol use varied by neighborhood disadvantage (see Equation 2 for Level 2 model). We modeled disadvantage on the intercept to examine the direct effect of socioeconomic disadvantage on youth alcohol use. We included random effects of the intercept because we hypothesized that the relationship between disadvantage and alcohol use would vary across neighborhoods. Dichotomous variables remain uncentered in all of our models and are interpreted similarly to simple regression models. The remaining variables are centered on the sample's grand mean for that variable and are interpreted in relation to the sample average across neighborhoods.

$$\hat{a}_{0j} = \hat{a}_{00} + \hat{a}_{0j}\text{Disadvantage} + i_{0j} \quad (2)$$

Results

Attrition analysis

Participants dropped from the analysis ($n = 35$) were more likely to be male (62%) than those who remained in the analysis, $\chi^2(1) = 10.23, p < .01$. We found no differences in attrition by age, race, Wave 1 alcohol use, socioeconomic status, caregiver education, caregiver and peer substance use, social support, or prosocial activity participation.

TABLE 2. Regression parameter estimates from hierarchical linear multi-level regression analysis using robust standard errors^a

Variable	Model 1 β (SE)	Model 2 β (SE)	Model 3 β (SE)
Intercept	.58 (.22)*	.43 (.23)	.44 (.24)
Disadvantage			.03 (.09)
Wave 1 alcohol use	.14 (.05)*	.14 (.05)*	.14 (.05)*
Male	.43 (.17)*	.53 (.17)*	.53 (.17)*
Black	-.93 (.24)*	-.80 (.25)*	-.82 (.26)*
Mother's education	-.02 (.04)	-.04 (.04)	-.03 (.04)
Socioeconomic status	-.00 (.01)	-.00 (.01)	-.00 (.01)
Age	-.16 (.15)	-.12 (.15)	-.12 (.14)
Friends' alcohol use	.99 (.15)*	.98 (.15)*	.98 (.15)*
Friends' drug use	.27 (.21)	.29 (.21)	.30 (.21)
Caregiver alcohol use	.00 (.21)	-.03 (.20)	-.03 (.20)
Caregiver drug use	.44 (.66)	.42 (.64)	.41 (.64)
Maternal support		-.20 (.09)*	-.20 (.09)*
Peer support		.20 (.09)*	.20 (.09)*
School activities		.01 (.01)	.01 (.01)
Church activities		-.00 (.00)	-.01 (.00)
Model fit, χ^2 (df)	184.91* (148)	182.02* (148)	182.35* (147)

^aAll fixed effects reported using robust standard errors.

* $p \leq .05$

The results for the multilevel analysis are presented in three parts: (a) the individual risk model; (b) the individual risk and promotive model, which includes resources; and (c) the neighborhood disadvantage model with the variables in the previous models. In both analyses, Wave 1 alcohol use was included as a baseline measure, and the results were thus interpreted as the change in alcohol use during high school. The multilevel results are presented in Table 2.

Partitioning the variance within and between neighborhoods

First, we examined a FUM to determine whether the variance in Wave 4 alcohol use between neighborhoods is significant. The results from the FUM indicated that the between-neighborhood variance is significant, $\tau = .266$, $\chi^2(148) = 195.06, p < .01$, suggesting neighborhood differences in youth alcohol use. Approximately 3.7% of the variance in Wave 4 alcohol use is explained by neighborhood differences.

Model 1: Individual-level risk model

In the individual risk model, we explored the relationship between individual, peer, and family risk factors and youth alcohol use. Model 1 (Table 2) displays the individual-level risk model. Wave 1 alcohol use, which was included in the model as a control for baseline drinking behavior, was predictive of Wave 4 alcohol use in the expected direction. Youth who reported more alcohol use at baseline also reported more use 3 years later ($\beta = .14, SE = .05, p < .01$).

Participants who were White used more alcohol than their Black ($\beta = -.93$) peers. Male youth ($\beta = .43$) used more alco-

hol than their female peers. Age, socioeconomic status, and mother's education were not related to adolescent alcohol use at Wave 4. Peer alcohol use was the only risk factor associated with the change in alcohol use. Youth who reported more alcohol-using friends had greater increases in alcohol use during high school ($\beta = .99$, $SE = .15$, $p < .01$).

Model 2: Individual-level risk and promotive model

The second model (Table 2, Model 2) includes the demographic and risk factors examined in the previous model, as well as several promotive factors. When social support and prosocial activities are entered into the model as promotive factors, we found that youth with higher levels of perceived peer support reported greater alcohol use over time ($\beta = .20$, $SE = .09$, $p < .05$). Conversely, youth with higher levels of perceived maternal support reported less alcohol use over time ($\beta = -.20$, $SE = .09$, $p < .05$). Prosocial involvement was not associated with alcohol use.

Model 3: Multi-level model of individual risk and protection

Neighborhood disadvantage was added to the full model (Model 3), and the results were almost identical to those in Model 2. The change in alcohol use was not associated with neighborhood disadvantage once the individual-level covariates were included in the model. Final inspection of our model suggests that there is unexplained neighborhood variance in adolescent alcohol use, even though neighborhood disadvantage is not associated with Wave 4 alcohol use (Table 2).

Given the complexity of the multilevel model, we conducted three additional analyses. First, we ran the multilevel model after removing nonsignificant risk and promotive factors to increase parsimony and statistical power. These changes did not alter the results (data not shown). Second, given that neighborhood disadvantage may be a distal correlate of alcohol use, interpersonal factors could mediate the relationship between neighborhood disadvantage and alcohol use. Nevertheless, we found no support for these indirect effects (data not shown). Finally, to determine whether our individual- and neighborhood-level predictors are cross-sectionally associated with adolescent alcohol use, we removed the Wave 1 alcohol use covariate from the model but found no differences between this model and our original model.

Discussion

We found mixed results in support of a socioecological model of risk and promotion for adolescent alcohol use. Risk and promotive factors were associated with youth alcohol use. Although we found that youth alcohol use varied by neighborhoods, we did not find support for a direct effect of

neighborhood context on alcohol use as would be expected from neighborhood disorganization theory. These results are consistent with the body of research demonstrating that neighborhood socioeconomic factors may not influence youth health and behavior consistently (Harding, 2003; Pinderhughes et al., 2001). Allison et al. (1999), for example, found a strong relationship between parental and adolescent substance use, as well as an association between neighborhood drug presence and peer use, but they did not find an association between neighborhood factors and youth AOD use. Others have found similarly limited effects of neighborhood disadvantage for several youth outcomes, including violence (Paschall and Hubbard, 1998), delinquency (Wikström and Loeber, 2000), and first sexual experience (Upchurch et al., 1999). Wikström and Loeber (2000), for example, found that neighborhood context did not matter for the highest-risk youth, but disadvantage was associated with higher rates of juvenile offending for moderate-risk youth (Wikström and Loeber, 2000). Similarly, it may be possible that, for youth who drink very little, neighborhood disadvantage has no effect. In our sample, and consistent with much of the research on adolescent alcohol use, African American youth drink less than White youth (Bachman et al., 1991). It is possible that for these youth, disadvantage does not influence their drinking behavior, and thus the level of individual risk for using alcohol may moderate the association between neighborhood disadvantage and alcohol use. Taken together, these findings suggest that neighborhood effects may not be uniform and may depend on individual characteristics and baseline risk, which are not specifically addressed in social disorganization models.

Although our neighborhood disadvantage measure was similar to those used by other researchers (Morenoff et al., 2007; Sampson et al., 1997), it may not adequately capture the most influential contextual aspects for adolescent alcohol use. Indicators of neighborhood disadvantage, including poverty and unemployment, for instance, may have a greater influence on adults than on youth because they may be more representative of adults' socioeconomic status. Youth, however, spend time at school or at friends' homes outside their neighborhoods and may be less affected by their neighborhood. This interpretation is consistent with a socioecological perspective, which identifies the multiple contextual influences in which youth function.

Another neighborhood indicator that may have greater effects on youth alcohol use than disadvantage is access to alcohol. Data on the number and location of alcohol outlets within a neighborhood may be useful in determining whether access to alcohol is an important factor in adolescent drinking. Researchers have proposed that youth living in disadvantaged neighborhoods have more access to alcohol (Allison et al., 1999; Hawkins et al., 1992), and research indicates that average distance to alcohol outlets at the neighborhood level is an important contributor to

alcohol-related outcomes (Scribner et al., 2000). Thus, disadvantage may have an indirect effect on youth alcohol use through the number of outlets in the neighborhood or only in neighborhoods where more outlets are found (Popova et al., 2009). Studies that examine the direct effects of outlet density and its interaction with disadvantage may provide useful insights into the role that neighborhoods may play in adolescent alcohol use.

A census-based measure of neighborhood overlooks social processes and specific types of deprivation in an area that are conceptualized in social disorganization theory (Ennett et al., 1997; Sampson et al., 1997). Factors including segregation, violence, the physical environment, and social capital may be crucial to understanding how neighborhoods influence adolescent drinking behavior. In a review of neighborhoods and health, Diez Roux (2001) argued that youth may be more affected by community AOD use, gang presence, crime, and community resources than more abstract measures of disadvantage. Seidman et al. (1998) provide some support for this interpretation in a study of antisocial behavior. They clustered neighborhoods on measures of poverty, violence, noise, drug use, and social cohesion and identified four distinct neighborhood profiles. They found that neighborhoods that were poor but had high levels of social cohesion had fewer youth with antisocial behavior than poor neighborhoods that lacked social cohesion. These results suggest that social factors may be more influential for youth than disadvantage. Upchurch et al. (1999) also demonstrated that the conceptualization of neighborhood may influence findings. They found that adolescents' self-reported neighborhood experience was related to delayed sexual experiences but that an objective measure of neighborhood disadvantage was not related. These results suggest that research that incorporates both objective and subjective measures of neighborhood influence may be necessary to fully understand neighborhood effects on adolescent development.

The lack of neighborhood findings may also be attributed to the participants' developmental stage. Neighborhood disadvantage may have a greater effect on younger children because they typically spend more time in their home neighborhood than older youth, who interact more with friends from other communities and may live and attend school in different neighborhoods. Longitudinal research that examines the association between neighborhood context and alcohol use may clarify these developmental effects.

A final interpretation of our lack of support for social disorganization theory is that neighborhood effects may not be as influential as family and peers on youth drinking. Consistent with previous research (Hawkins et al., 1992), we found that youth who report more alcohol-using friends also use more alcohol. These results support Catalano et al.'s (1996) suggestions that youth learn patterns of behavior from their socializing agents. Yet, we did not find parental AOD to be related to their child's use. Youth in our sample

were older and may be less influenced by parental behaviors than younger adolescents. Youth may also spend more time outside of the house with adults other than their primary caregiver, thereby diminishing the influence of caregiver behaviors. It is also possible that caregiver use was not viewed by respondents as problematic. Research on adolescent alcohol use that takes developmental issues into account is necessary to more accurately examine neighborhood effects.

Youth in our sample who reported greater peer support drank more alcohol. This result is contradictory to past research that reveals beneficial effects of social support on well-being (Thoits, 1995) but consistent with much of the research that examines peer support and adolescent behavioral outcomes (Wills et al., 2004). Support from AOD-using friends may increase risk for AOD use because of the negative influences of peer role models. Dishion et al. (1999) found that deviant peer groups provide adolescents with a context that promotes further delinquency through late adolescence and into adulthood. Future investigations that examine the relationship between peer support and adolescent alcohol use within specific levels of substance-using friends may be particularly useful.

Researchers have reported beneficial effects of prosocial involvement for youth (Mahoney et al., 2006; Xue et al., 2007). We did not, however, find evidence of a direct relationship between prosocial participation and alcohol use. Future research that examines the promotive effects of prosocial involvement may benefit from a more detailed analysis of the issue. The type of prosocial involvement may have differential effects on adolescent outcomes. Researchers have reported increased alcohol use for youth involved in sports versus other activities (Eccles and Barber, 1999). A one-size-fits-all approach may not be sufficient in characterizing youth involvement, and future research could consider specific types of involvement within categories of school, church, and community involvement.

Study strengths and limitations

Several limitations of this study should be noted. The self-reported nature of several study measures may suggest some response bias. Researchers have reported, however, that self-reported data on alcohol use is highly accurate under conditions of confidentiality and privacy (Del Boca and Darkes, 2003). The portion of the survey that contains questions on substance use was answered privately using a paper-and-pencil format after the interview. Thus, our data collection approach helped to mitigate some measurement bias because we maintained confidentiality and anonymity. Our sampling strategy of youth with grade-point averages below 3.0 limited the range of youth in the study, thereby limiting our generalizability; but these may be the youth at the greatest risk for AOD use. Finally, our models explained relatively little variance, which suggests that factors outside

those we studied may be more relevant for youth alcohol use. The fact that our models explained so little variation in alcohol use may be because we controlled for earlier use, leaving little variation in 12th-grade alcohol use left to explain.

These limitations notwithstanding, our study makes several significant contributions to the literature on youth alcohol use. Using a multilevel analysis helped to tease out the effects of intrapersonal and interpersonal factors from contextual factors associated with neighborhood disadvantage. In addition, by using a multilevel analysis, we were able to examine whether individual and interpersonal factors vary between neighborhoods based on the degree of disadvantage. Another contribution of this study is that we examined changes in alcohol use by controlling for baseline alcohol use. By doing so, we are conducting a more conservative test of our hypotheses. Most previous research on neighborhood effects used cross-sectional designs and did not account for baseline alcohol use.

Although researchers have extensively examined the relationship between the peer, family, and school context and adolescent alcohol use, few researchers include positive assets and resources for youth (Anthony, 2008; Leventhal and Brooks-Gunn, 2000). Disadvantaged neighborhoods are not void of resources. Youth from disadvantaged neighborhoods may still have access to a variety of positive influences, including youth programs, churches, and social organizations (Jencks and Mayer, 1990). Additional research that examines community resources and how they may help youth overcome the risks of living in disadvantaged neighborhoods would be informative. Our research contributes to a growing body of literature that connects socioecological theories to individual behavioral outcomes. These connections will better enable researchers to understand how neighborhood context shapes behavior in adolescence and sets a developmental trajectory into adulthood.

References

- Allison, K. W., Crawford, I., Leone, P. E., Trickett, E., Perez-Febles, A., Burton, L. M., & Le Blanc, R. (1999). Adolescent substance use: Preliminary examinations of school and neighborhood context. *American Journal of Community Psychology*, 27, 111–141.
- Anthony, E. K. (2008). Cluster profiles of youths living in urban poverty: Factors affecting risk and resilience. *Social Work Research*, 32, 6–17.
- Bachman, J. G., Wallace, J. M., Jr., O'Malley, P. M., Johnston, L. D., Kurth, C. L., & Neighbors, H. W. (1991). Racial/ethnic differences in smoking, drinking, and illicit drug use among American high school seniors, 1976–89. *American Journal of Public Health*, 81, 372–377.
- Barnes, G. M., Welte, J. W., & Hoffman, J. H. (2002). Relationship of alcohol use to delinquency and illicit drug use in adolescents: Gender, age, and racial/ethnic differences. *Journal of Drug Issues*, 32, 153–178.
- Bronfenbrenner, U. (1979). *The ecology of human development*. Cambridge, MA: Harvard University Press.
- Bronfenbrenner, U. (1988). Interacting systems in human development: Research paradigms, present and future. In N. Bolger, A. Caspi, G. Downey, & M. Morehouse (Eds.), *Persons in context: Developmental processes* (pp. 25–49). New York, NY: Cambridge University Press.
- Brook, J. S., Brook, D. W., Gordon, A. S., Whiteman, M., & Cohen, P. (1990). The psychosocial etiology of adolescent drug use: A family interactional approach. *Genetic, Social, and General Psychology Monographs*, 116, 111–267.
- Bryant, A. L., & Zimmerman, M. A. (2002). Examining the effects of academic beliefs and behaviors on changes in substance use among urban adolescents. *Journal of Educational Psychology*, 94, 621–637.
- Caldwell, C. H., Sellers, R. M., Bernat, D. H., & Zimmerman, M. A. (2004). Racial identity, parental support, and alcohol use in a sample of academically at-risk African American high school students. *American Journal of Community Psychology*, 34, 71–82.
- Catalano, R. F., Berglund, M. L., Ryan, J. A. M., Lonczak, H. S., & Hawkins, J. D. (2004). Positive youth development in the United States: Research findings on evaluations of positive youth development programs. *Annals of the American Academy of Political and Social Science*, 591, 98–124.
- Catalano, R. F., Kosterman, R., Hawkins, J. D., Newcomb, M. D., & Abbott, R. D. (1996). Modeling the etiology of adolescent substance use: A test of the social developmental model. *Journal of Drug Issues*, 26, 429–455.
- Chuang, Y.-C., Ennett, S. T., Bauman, K. E., & Foshee, V. A. (2005). Neighborhood influences on adolescent cigarette and alcohol use: Mediating effects through parent and peer behaviors. *Journal of Health and Social Behavior*, 46, 187–204.
- Cicchetti, D., & Rogosch, F. A. (2002). A developmental psychopathology perspective on adolescence. *Journal of Consulting and Clinical Psychology*, 70, 6–20.
- Cook, T. D., Herman, M. R., Phillips, M., & Settersten, R. A., Jr. (2002). Some ways in which neighborhoods, nuclear families, friendship groups, and schools jointly affect changes in early adolescent development. *Child Development*, 73, 1283–1309.
- Del Boca, F. K., & Darkes, J. (2003). The validity of self-reports of alcohol consumption: State of the science and challenges for research. *Addiction*, 98, 1–12.
- Diez Roux, A. V. (2001). Investigating neighborhood and area effects on health. *American Journal of Public Health*, 91, 1783–1789.
- Dishion, T. J., McCord, J., & Poulin, F. (1999). When interventions harm. Peer groups and problem behavior. *American Psychologist*, 54, 755–764.
- Doljanac, R. F., & Zimmerman, M. A. (1998). Psychosocial factors and high-risk sexual behavior: Race differences among urban adolescents. *Journal of Behavioral Medicine*, 21, 451–467.
- Dubow, E. F., Edwards, S., & Ippolito, M. F. (1997). Life stressors, neighborhood disadvantage, and resources: A focus on inner-city children's adjustment. *Journal of Clinical Child Psychology*, 26, 130–144.
- Eccles, J. S., & Barber, B. L. (1999). Student council, volunteering, basketball, or marching band: What kind of extracurricular involvement matters? *Journal of Adolescent Research*, 14, 10–43.
- Ennett, S. T., Flewelling, R. L., Lindrooth, R. C., & Norton, E. C. (1997). School and neighborhood characteristics associated with school rates of alcohol, cigarette, and marijuana use. *Journal of Health and Social Behavior*, 38, 55–71.
- Fergus, S., & Zimmerman, M. A. (2005). Adolescent resilience: A framework for understanding healthy development in the face of risk. *Annual Review of Public Health*, 26, 399–419.
- Fuligni, A. J., & Eccles, J. S. (1993). Perceived parent-child relationships and early adolescents' orientation toward peers. *Developmental Psychology*, 29, 622–632.
- Glanz, K., Rimer, B., & Lewis, F. (Eds.). (2002). *Health behavior and health education: Theory, research and practice* (3rd ed.). San Francisco, CA: John Wiley and Sons.
- Harding, D. J. (2003). Counterfactual models of neighborhood effects: The effect of neighborhood poverty on dropping out and teenage pregnancy. *American Journal of Sociology*, 109, 676–719.
- Hawkins, J. D., Catalano, R. F., & Miller, J. Y. (1992). Risk and protective

- factors for alcohol and other drug problems in adolescence and early adulthood: Implications for substance abuse prevention. *Psychological Bulletin*, 112, 64–105.
- Jencks, C., & Mayer, S. E. (1990). *The social consequences of growing up in a poor neighborhood*. Washington, DC: National Academy Press.
- Johnson, L., O'Malley, P. M., Bachman, J. G., & Schulenberg, J. (2006). *Monitoring the future national results on adolescent drug use: Overview of key findings, 2005*. Bethesda, MD: National Institute on Drug Abuse.
- Kadushin, C., Reber, E., Saxe, L., & Livert, D. (1998). The substance use system: Social and neighborhood environments associated with substance use and misuse. *Substance Use & Misuse*, 33, 1681–1710.
- Komro, K. A., Perry, C. L., Veblen-Mortenson, S., Farbaksh, K., Toomey, T. L., Stigler, M. H., . . . Williams, C. L. (2008). Outcomes from a randomized controlled trial of a multi-component alcohol use preventive intervention for urban youth: Project Northland Chicago. *Addiction*, 103, 606–618.
- Lambert, S. F., Brown, T. L., Phillips, C. M., & Jalongo, N. S. (2004). The relationship between perceptions of neighborhood characteristics and substance use among urban African American adolescents. *American Journal of Community Psychology*, 34, 205–218.
- LaVeist, T. A., & Wallace, J. M., Jr. (2000). Health risk and inequitable distribution of liquor stores in African American neighborhood. *Social Science & Medicine*, 51, 613–617.
- Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence on child and adolescent outcomes. *Psychological Bulletin*, 126, 309–337.
- Leventhal, T., & Brooks-Gunn, J. (2003). Children and youth in neighborhood contexts. *Current Directions in Psychological Science*, 12, 27–31.
- Mahoney, J. L., Harris, A. L., & Eccles, J. S. (2006). Organized activity participation, positive youth development, and the over-scheduling hypothesis. *Social Policy Report*, 20, 3–31.
- Mason, W. A., & Windle, M. (2001). Family, religious, school and peer influences on adolescent alcohol use: A longitudinal study. *Journal of Studies on Alcohol*, 62, 44–53.
- Masten, A. S., Best, K. M., & Garmezy, N. (1990). Resilience and development: Contributions from the study of children who overcome adversity. *Development and Psychopathology*, 2, 425–444.
- Maton, K. I., & Zimmerman, M. A. (1992). Psychological predictors of substance abuse among urban black male adolescents. *Drugs and Society*, 6, 79–114.
- Mokdad, A. H., Marks, J. S., Stroup, D. F., & Gerberding, J. L. (2004). Actual causes of death in the United States, 2000. *Journal of the American Medical Association*, 291, 1238–1245.
- Morenoff, J. D., House, J. S., Hansen, B. B., Williams, D. R., Kaplan, G. A., & Hunte, H. E. (2007). Understanding social disparities in hypertension prevalence, awareness, treatment, and control: The role of neighborhood context. *Social Science & Medicine*, 65, 1853–1866.
- Nakao, K., & Treas, J. (1990). *Computing 1989 occupational prestige scores*. Chicago, IL: National Opinion Research Center.
- Ostaszewski, K., & Zimmerman, M. A. (2006). The effects of cumulative risks and promotive factors on urban adolescent alcohol and other drug use: A longitudinal study of resiliency. *American Journal of Community Psychology*, 38, 237–249.
- Paschall, M. J., & Hubbard, M. L. (1998). Effects of neighborhood and family stressors on African American male adolescents' self-worth and propensity for violent behavior. *Journal of Consulting and Clinical Psychology*, 66, 825–831.
- Pinderhughes, E. E., Nix, R., Foster, E. M., Jones, D., & The Conduct Problems Prevention Research Group. (2001). Parenting in context: Impact of neighborhood poverty, residential stability, public services, social networks, and danger on parental behaviors. *Journal of Marriage and Family*, 63, 941–953.
- Popova, S., Giesbrecht, N., Bekmuradov, D., & Patra, J. (2009). Hours and days of sale and density of alcohol outlets: Impacts on alcohol consumption and damage: A systematic review. *Alcohol and Alcoholism*, 44, 500–516.
- Procidano, M. E., & Heller, K. (1983). Measures of perceived social support from friends and from family: Three validation studies. *American Journal of Community Psychology*, 11, 1–24.
- Rachal, J., Williams, J., Brehm, M., Cavanaugh, B., Moore, R., & Eckerman, W. (1975). *A national study of adolescent drinking behavior, attitudes, and correlates: Final report for National Institute on Alcohol Abuse and Alcoholism*. Springfield, VA: National Technical Information Service.
- Raudenbush, S., & Bryk, A. (2002). *Hierarchical linear models: Applications and data analysis methods* (2nd ed.). Thousand Oaks, CA: Sage.
- Raudenbush, S., Bryk, A., & Congdon, R. (2004). *HLM 6 for Windows (Version 6)*. Lincolnwood, IL: Scientific International Software, Inc.
- Rutter, M. (1993). Resilience: Some conceptual considerations. *Journal of Adolescent Health*, 14, 626–631, 690–696.
- Sampson, R. J., & Groves, W. B. (1989). Community structure and crime: Testing social-disorganization theory. *American Journal of Sociology*, 94, 774–802.
- Sampson, R. J., Raudenbush, S. W., & Earls, F. (1997). Neighborhoods and violent crime: A multilevel study of collective efficacy. *Science*, 277, 918–924.
- Scribner, R. A., Cohen, D. A., & Fisher, W. (2000). Evidence of a structural effect for alcohol outlet density: A multilevel analysis. *Alcoholism: Clinical and Experimental Research*, 24, 188–195.
- Seidman, E., Yoshikawa, H., Roberts, A., Chesir-Teran, D., Allen, L., Friedman, J. L., & Aber, J. L. (1998). Structural and experiential neighborhood contexts, developmental stage, and antisocial behavior among urban adolescents in poverty. *Development and Psychopathology*, 10, 259–281.
- Shaw, C., & McKay, H. (1969). *Juvenile delinquency and urban areas* (2nd ed.). Chicago, IL: University of Chicago Press.
- Stacy, A. W., Newcomb, M. D., & Bentler, P. M. (1992). Interactive and higher-order effects of social influences on drug use. *Journal of Health and Social Behavior*, 33, 226–241.
- Thoits, P. A. (1995). Stress, coping, and social support processes: Where are we? What next? *Journal of Health and Social Behavior*, 35, 53–79.
- Upchurch, D. M., Aneshensel, C. S., Sucoff, C. A., & Levy-Storms, L. (1999). Neighborhood and family contexts of adolescent sexual activity. *Journal of Marriage and Family*, 61, 920–933.
- Wallace, J. M., & Muroff, J. R. (2002). Preventing substance abuse among African American children and youth: Race differences in risk factor exposure and vulnerability. *The Journal of Primary Prevention*, 22, 235–261.
- West, B. T., Welch, K. B., & Galecki, A. T. (2006). *Linear mixed models*. Boca Raton, FL: Taylor & Francis.
- Wikström, P.-O. H., & Loeber, R. (2000). Do disadvantaged neighborhoods cause well-adjusted children to become adolescent delinquents? A study of male juvenile serious offending, individual risk and protective factors, and neighborhood context. *Criminology*, 38, 1109–1142.
- Wills, T. A., Resko, J. A., Ainette, M. G., & Mendoza, D. (2004). Role of parent support and peer support in adolescent substance use: A test of mediated effects. *Psychology of Addictive Behaviors*, 18, 122–134.
- Winstanley, E. L., Steinwachs, D. M., Ensminger, M. E., Latkin, C. A., Stitzer, M. L., & Olsen, Y. (2008). The association of self-reported neighborhood disorganization and social capital with adolescent alcohol and drug use, dependence, and access to treatment. *Drug and Alcohol Dependence*, 92, 173–182.
- Xue, Y., Zimmerman, M. A., & Caldwell, C. H. (2007). Neighborhood residence and cigarette smoking among urban youths: The protective role of prosocial activities. *American Journal of Public Health*, 97, 1865–1872.