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ARTICLE

Substance use in rural adolescents: The impact of social capital, anti-social capital, and social capital deprivation

Caroline B. R. Evans, PhD^{a,b}, Katie L. Cotter, PhD^c, Roderick A. Rose, PhD^a, and Paul R. Smokowski, PhD^{a,b}

^aUniversity of North Carolina–Chapel Hill, North Carolina Academic Center for Excellence in Youth Violence Prevention, Chapel Hill, North Carolina, USA; ^bUniversity of Kansas, Lawrence, Kansas, USA; ^cArizona State University, Tucson, Arizona, USA

ABSTRACT

Middle- and high-school substance use is a pressing public health problem in the United States. Despite similar or, in some cases, elevated rates of substance use among rural youth, much of the extant research on adolescent substance use has focused on urban areas. The current study aims to uncover forms of social capital (e.g., ethnic identity), social capital deprivation (e.g., parent-child conflict), and anti-social capital (e.g., delinquent friends) that impact the use of alcohol, cigarettes, and marijuana in a sample of middle- and high-school students from the rural south. It was hypothesized that social capital factors would be associated with decreased substance use while social capital deprivation and anti-social capital factors would be associated with increased substance use. The hypotheses were tested using logistic regression models with generalized estimating equations. The findings indicated that for middle school youth, anti-social capital in the form of aggression and delinquent friends was significantly associated with an increased likelihood of using alcohol, cigarettes, and marijuana. For high school students, anti-social capital in the form of aggression and delinquent friends and social capital deprivation in the form of neighborhood crime were significantly associated with an increased likelihood of using alcohol, cigarettes, and marijuana. Violent behavior was also significantly associated with an increased likelihood of using marijuana. Females reported less substance use in both middle and high school; reports of use increased with age. Implications are discussed. Given the salience of social capital deprivation, substance use programs should emphasize the skills necessary to avoid or disengage from antisocial relationships.

KEYWORDS

Rural; adolescence;
substance use; social capital

Substance use in rural adolescents: The impact of social capital, anti-social capital, and social capital deprivation

Adolescence is a time of upheaval marked by surging hormones, burgeoning autonomy, and intense physical and psychological change. A major goal of this complex, developmental period is identity formation.¹ As youth strive to solidify a sense of self, they often experiment with different political or religious views, styles of dress, sexual behaviors, hobbies, peer groups, or risk-taking behaviors such as substance use. There are many negative consequences at both the individual and community levels associated with adolescent use of alcohol, cigarettes, and marijuana, and a variety of risk factors contribute to this public health problem.² The current study aims to uncover forms of positive social capital, “social capital deprivation” (e.g.,

negative social relationships resulting in a weak social network),³ and anti-social capital (e.g., social capital from deviant sources, such as delinquent friends) that are associated with alcohol, cigarette, and marijuana use in a large sample of rural adolescents from a low-income, racially/ethnically diverse community experiencing high rates of violence.

Given the prevalence of substance use in both high school and middle school, the current research is vital for gaining a more comprehensive understanding of the factors that potentially lead to and prevent substance use. This research is especially important given that rates of substance use increase as youth age. For example, according to the Centers for Disease Control and Prevention’s (CDC) Youth Risk Behavior Surveillance System (YRBSS), in 2013, rates of alcohol use increased over high school with over half of U.S. freshmen (55.6%) and three-fourths (75.6%) of seniors

reporting consumption of at least one alcoholic drink.⁴ Rates for middle school youth also increased over time and in North Carolina, where the current study took place, 12.5% of youth in Grade 6, 27.6% of youth in Grade 7, and 38.6% of youth in Grade 8 reported ever having consumed alcohol.⁴ Further, rural youth might be particularly vulnerable to substance use given the unique stressors present in rural areas.

Adolescent substance use in rural areas

Rural areas expose youth to a host of stressors absent in suburban and urban environments. For example, public transportation is minimal, limiting youths' ability to travel and interact with non-family members, and resulting in geographic isolation and restricted social networks.⁵ There are also limited community resources, which negatively impacts rural youths' mental health. For example, due to financial limitations, stigma associated with receiving mental health treatment, and a lack of providers, it is often difficult for rural youth to receive needed mental health services.⁶ Indeed, in a sample of 4500 rural youth, only 36% of those with a psychiatric diagnosis (e.g., depression) received mental health care in the past 3 months,⁷ a percentage slightly lower than the 41% of youth diagnosed with major depression in the general U.S. population who received mental health treatment in 2014.⁸ The cumulative risk factors present in rural areas partially explain the higher rates of rural adolescent substance use relative to the substance use of suburban and urban youth. For example, one study of 2,017 adolescents in rural, suburban, and urban school districts in upstate New York found that 28.0% of rural youth reported frequent tobacco use, a rate significantly higher than the 17.6% of suburban and 15.4% of urban youth endorsing frequent tobacco use. A similar statistically significant trend was found for frequent alcohol use (rural: 12.3%; suburban: 8.4%; urban: 7.8%) and frequent drug use (rural: 14.4%; suburban: 8.0%; urban: 7.2%).⁹ In middle school (i.e., ages 12 and 13), rural youth were more than twice as likely to abuse alcohol compared to urban youth, and in high school (i.e., ages 16 and 17), 13% of rural youth abused alcohol compared to 10% of their urban counterparts.¹⁰ Further, a report by the National Center on Addiction and Substance Abuse (CASA) confirmed that, compared to urban eighth graders, rural eighth graders were more than twice as likely to have smoked

a cigarette, 29% more likely to have consumed alcohol, and 34% more likely to have smoked marijuana.¹¹ However, other studies have reported no significant differences on substance use between rural and urban adolescents.^{12,13} Despite similar or, in some cases, elevated rates of substance use among rural youth, much of the extant research on adolescent substance use has focused on urban areas.¹² In summation, given the high prevalence rates of adolescent alcohol, cigarette, and marijuana use in rural areas as well as across the United States, a large number of high-school- and middle-school-aged youth are at risk for the negative consequences associated with substance use.

Factors that impact adolescent substance use

Social capital refers to the benefits obtained from social relationships; these social relationships lead to "productive activity" that facilitate goal achievement.¹⁴ According to social capital theory,^{14,15} prosocial relationships offer four beneficial resources to youth: access to *information* about opportunities, the potential to *influence* socially powerful individuals, *social credentials* (e.g., being socially connected to certain individuals provides access to resources), and *reinforcement* of identity and self-worth.^{16,17} One example of social capital is involvement in and connection to religious and ethnic communities; access to these supportive groups is beneficial to adolescent development. Specifically, social capital in the form of religious orientation and ethnic identity significantly predicted increased self-esteem,¹⁸ suggesting that these social capital factors might also function to protect youth from substance use.

A social network comprised of negative relationships (e.g., parent-child conflict, friend rejection, peer pressure), indicates disengagement from positive social capital, or *social capital deprivation*, leaving youth to affiliate with anti-social individuals.³ Indeed, social capital deprivation in the form of poor parent-child relationships, low levels of parent support, insufficient teacher control (e.g., inability of teachers to break up fights), and weak attachment to school and adult figures were associated with increased adolescent delinquency, aggression, fighting, and use of weapons.^{19,20} Further, social capital deprivation in the form of peer rejection was associated with increased delinquency,²¹ suggesting that rejected youth might seek out a deviant peer group in order to obtain anti-social

capital. Although anti-social, delinquent peers provide social capital in the form of access to *information*, *social credentials*, and *reinforcement* of one's sense of self and also provide a sense of comradery and belonging. For example, belonging to a delinquent peer group is associated with social capital accrual in the form of increased popularity and social standing.²² Drinking is a form of delinquent behavior and friend groups categorized by high levels of drinking often experience strong group cohesion and popularity among their classmates.²³ However, acceptance into a delinquent peer group likely includes engagement in deviant acts, such as delinquency and substance use. In this regard, delinquent friends are a form of social capital because they provide increased social standing and popularity, but they also foster rule breaking behavior; therefore, the term anti-social capital is used because it captures both the positive and negative forms of social capital inherent in delinquent friend relationships. The authors' hypothesis that social capital, social capital deprivation, and anti-social capital are associated with other deviant behaviors, such as adolescent substance use, follows from this research.

Demographic factors associated with adolescent substance use

In addition to weak or absent social capital, certain demographic characteristics place adolescents at increased risk for substance use. There is a linear increase in substance use from early to late adolescence,²⁴ indicating that older adolescents are more likely to use substances compared to younger adolescents. According to a nationally representative sample, compared to females, adolescent males reported higher rates of smokeless tobacco use, heavy alcohol use, and marijuana use, whereas gender differences in cigarette use and 30-day prevalence of alcohol use were small and differed by grade.²⁵ African American adolescents tend to report lower substance use compared to their White counterparts. In addition, Hispanic/Latino adolescents have recently surpassed White youth with regard to marijuana use. Finally, in a review of the literature published between 1970 and 2007 (including 25 studies investigating socioeconomic status [SES] and marijuana, 28 studies investigating SES and alcohol, and 44 studies investigating SES and cigarettes), Hanson and Chen²⁶ found that low SES was associated with greater cigarette use, but

there was no clear association between SES and alcohol or marijuana use.

Social capital factors associated with adolescent substance use

Ethnic identity

Ethnic identity refers to an individual's ethnic self-identification and the degree of connection to his or her ethnicity.^{27,28} A strong ethnic identity indicates that adolescents feel a sense of belonging and membership to their ethnic group and likely seek out opportunities to connect with members of that group. In this regard, ethnic identity could serve as a form of social capital that connects youth to ethnically similar, supportive peers and adults (potentially through prosocial institutions such as community centers). A high ethnic identity is a protective factor associated with decreased adolescent substance use for minority youth²⁹ and Latino/Hispanic males.³⁰ Previous research on the protective nature of ethnic identity focused on urban areas, thus, additional research is needed to ascertain if ethnic identity is associated with decreased substance use in rural areas as well.

Religious orientation

Religious orientation refers to the degree of importance that youth place on religion and participation in socially-supportive religious communities. Adolescents with high religious orientation value religion and likely attend religious services and gatherings. Thus, a high religious orientation exposes youth to the prosocial religious doctrines and socially supportive religious community present at religious events and is thus a means of acquiring social capital. Further, valuing religion is associated with decreased aggression,³¹ a known risk factor for substance use.³² Research supports the assertion that a high religious orientation might also directly decrease adolescent substance use;^{33,34} however, additional research in rural areas is needed.

Social capital deprivation factors associated with adolescent substance use

Negative friend relationships: Peer pressure and friend rejection

Peer pressure is a form of social capital deprivation representing the presence of unstable and negative friend relationships. Research suggests a strong

association between peer pressure and adolescent substance use.³⁵ For instance, in a sample of predominantly urban middle school students, researchers found positive independent associations between peer pressure and adolescent smoking and drinking behaviors.³⁶ Further research is needed to determine if this relationship is present in a rural sample of adolescents.

Friend rejection is another form of social capital deprivation that indicates harmful friendships. Research suggests that rejected youth are more likely to use substances compared to youth not rejected by their peer group.³⁷ In a sample of Chinese adolescents, using a peer nomination procedure, researchers found that social network position was associated with cigarette use such that youth who were rejected by peers were more likely to experiment with smoking.³⁸ Additional research in the rural U.S. is needed to determine if friend rejection has a similar impact on substance use.

Parent-adolescent conflict

Parent-adolescent conflict is a source of social capital deprivation indicating the absence of a supportive parent-adolescent relationship. Parent-adolescent conflict specifically is also associated with additional negative adolescent outcomes including substance use.^{39,40} For example, a 24-year longitudinal study found that parent-adolescent conflict in youth aged 14 to 16 was associated with delinquent and substance using peers in their early 20s, which had a direct effect on participants' substance use in their 30s. Thus, parent-adolescent conflict appears to be associated with a higher likelihood of later substance use disorders.³⁹ However, this past research does not specifically examine a rural population, indicating the need for further research on how parental-adolescent conflict is associated with substance use in rural areas.

Neighborhood substance use and crime

Neighborhood substance use and crime are indicators of social capital deprivation, denoting the absence of supportive and prosocial neighbors. Indeed, perceptions of neighborhood crime and drug use were associated with increased adolescent tobacco, alcohol, and marijuana use in a sample of urban African American youth.⁴¹ Another study confirmed that the closer youth lived to high crime areas, the more likely it was that they used marijuana.⁴² Further, a study using a nationally representative sample of 10,050 U.S. high school seniors found that, compared to youth who

never saw neighborhood drug sales, those who reported seeing neighborhood drug sales "almost every day" were more likely to report having used more than one illicit drug in the past 30 days.⁴³ Taken together, past research suggests that social capital deprivation in the form of high rates of perceived neighborhood crime and substance use are a risk factor for adolescent substance use. Given the fact that rural residents view their neighborhoods as quite small (less than 0.5 square miles) and often view themselves as emotionally close with their neighbors,⁴⁴ additional research is needed to further understand how neighbor substance use and crime impacts adolescent substance use in a rural context.

Anti-social capital factors associated with adolescent substance use

Delinquent friends

Delinquent peers are anti-social in nature and provide youth with access to anti-social capital in the form of access to *information*, *social credentials*, and *reinforcement* of one's sense of self as well as a feeling of camaraderie and belonging. In order to obtain and maintain access to this anti-social capital, youth might engage in deviant behaviors, such as substance use. It is well documented that delinquency and adolescent substance use often co-occur.^{45,46} Deviant peers fuel and encourage each other's negative behaviors,^{47,48} suggesting that youth embedded in a delinquent, substance using peer group will be more likely to engage in delinquent acts, including substance use. Additional research is needed to uncover whether this relationship is also present in rural areas.

Violent and aggressive behavior

Although violent and aggressive behavior do not directly represent forms of anti-social capital, they can be mechanisms used to acquire anti-social capital and their presence might denote the presence of anti-social capital. Youth might engage in violence and aggression as a means of gaining access to deviant peer groups and the anti-social capital these peer groups provide access to, such as social standing and popularity.²² Further, there is a well-established link between adolescent violence, aggression, and substance use.^{32,49} Violence and aggressive behavior may be a means to work one's way up the hierarchy in an anti-social peer group. Higher levels of aggression

demonstrate more anti-social credibility. Research in rural areas is needed to better understand the relationship between violence, aggression, and substance use in this unique context.

Potential interaction effects

While there are direct relationships between substance use and the aforementioned social capital, social capital deprivation, and anti-social capital factors, research indicates that there are also indirect effects between some of these factors suggesting that interaction effects might be present. For example, in a longitudinal study that tracked urban youth from Grade 5 to Grade 9, researchers found that high levels of proactive aggression in Grade 5 were associated with increased delinquent friends in Grade 8, which was associated with increased substance use in Grade 8. Thus, there is a potential interaction effect between aggression, delinquent friends, and substance use. Further, reactive aggression in Grade 5 was associated with high levels of peer rejection, which was associated with peer delinquency in Grade 8 and increased substance use in Grade 9. Thus, another potential interaction effect exists between aggression, peer rejection, and substance use.⁵⁰ Research in rural areas is needed to ascertain if these relationships extend beyond the urban context.

Hypotheses

Based on past research, it was hypothesized that positive social capital (i.e., religious orientation and ethnic identity) would be associated with a lower likelihood of rural adolescent alcohol, cigarette, and marijuana use. It was further hypothesized that social capital deprivation (i.e., peer pressure, friend rejection, parent-adolescent conflict, neighborhood crime), and anti-social capital (i.e., delinquent friends, violence, aggression) would be associated with a higher likelihood of rural adolescent alcohol, cigarette, and marijuana use.

Method

Current study

The current research was funded by a cooperative agreement between the United States Centers for Disease Control and Prevention and the North Carolina Youth Violence Prevention Center (NC-YVPC). Data

for the current study came from the Rural Adaptation Project (RAP), a 5-year longitudinal panel study of more than 7000 middle and high school students from 26 public middle and 12 public high schools in two rural, low income counties in North Carolina. In 2011, Year 1 of the RAP study, a complete census in County 1 (all middle school students) was included in the sample and each year the new class of students in Grade 6 was added to the sample. Because the second county is much bigger geographically and has a larger student population compared to County 1, it was not feasible to take an entire census from County 2, thus a random sample of 40% of students was used; this made the sample from County 2 roughly the same size as the sample from County 1. Students from both counties were tracked longitudinally as they progressed through middle school and into high school. Data for the current analysis were collected in 2013–2014, Years 3 and 4 of the RAP study; specifically, predictor variables were from Year 3 and substance abuse outcome variables were from Year 4, resulting in a longitudinal analysis.

Procedure

Following approval from the Institutional Review Board of a major research university in the southeastern U.S., a nearly identical data collection procedure was used in both counties. In accordance with school district policies, County 1 adopted the assessment as part of normal school procedures, while County 2 sent a letter home to all caregivers explaining the study. If caregivers from County 2 did not want their child to participate, they sent a letter requesting non-participation and their child was removed from the study roster. In both counties, students filled out assessments in school computer labs, closely monitored by research staff. All participants were informed that participation was voluntary and they could decline participation at any time without negative repercussions. Students assented to participate by reading and electronically signing an assent screen. Confidentiality was maintained by assigning each student a unique identification number and no identifying information was collected. Survey completion took 30 to 45 minutes and students received a \$5 gift card as an incentive.

Participants

The final analytic sample consisted of 7,081 youth, about half ($n = 3,581$) were female. The racial/ethnic

composition reflected the diversity of the surrounding community and 30% ($n = 2,151$) identified as Caucasian, 26% ($n = 1,821$) as African American, 24% ($n = 1,671$) as American Indian, 11% ($n = 787$) as mixed race/other, and 8% ($n = 537$) as Latino/Hispanic. Data were analyzed by middle school ($n = 2,141$) and high school ($n = 4,940$), about 88% ($n = 6,250$) of the sample received free/reduced price lunch, and the majority of students (92%; $n = 6,539$) resided in a 2-parent household.

Measures

The School Success Profile (SSP) is a 195-item online, youth self-report with 22 scales that measure perceptions and attitudes about school, friends, family, neighborhood, self, and health and well-being.⁵¹ Since its creation in 1993, the SSP has been administered to tens of thousands of students and has well-documented reliability and validity.⁵² The RAP project used a modified version of the SSP, the School Success Profile Plus (SSP+), which included 17 of the original SSP scales plus 12 additional scales. The current study used 4 of the original SSP scales included on the SSP+ and 4 of the additional scales. The measures for the current study come from Year 4 of the RAP study.

Substance use

Substance use was assessed with three questions asking participants: “How many times in your lifetime have you: Drunk more than a sip of alcohol (beer, wine, or liquor)? Smoked cigarettes? Smoked marijuana (pot, weed)?” Each item was rated on 7-point Likert scale (*0 Times, 1–2 Times, 3–5 Times, 6–9 Times, 10–19 Times, 20–39 Times, 40 or More Times*). Because there were few responses at the non-zero values, these items were recoded to *0 times, 1–5 times, 6–19 times, and 20 or more times*. Given the small number of participants who endorsed *6–19 times* and *20 or more times*, the authors elected to examine the issue of substance use as a yes/no question and the substance use items were subsequently recoded to binary to record whether a youth ever used a substance (*1 = one or more times*) or not (*0 = zero times*), such that binary logistic regression could be used.

Demographic variables and covariates

Demographic variables included gender, age, and race. Race was coded as three dichotomous variables

including Hispanic/Latino, African American, and American Indian (Caucasian, Asian, and participants reporting Pacific Islander, Hawaiian Native, other or mixed were the reference group). Receipt of free/reduced price lunch was used as a proxy for socioeconomic status and family structure was dichotomized as 2-parent household or another type of family situation. In addition to these demographic variables, the internalizing symptoms scale from the Youth Self Report was included in the model to control for mental health concerns (i.e., depression and anxiety).

Social capital factors

Religious orientation. The importance of religion in participants’ lives was assessed with the three-item religious orientation scale.⁵¹ Example items included: “My religious faith gives me strength” and “My religious faith influences the decisions I make.” Each item was rated on a 3-point Likert scale (*Not Like Me, A Little Like Me, or A Lot Like Me*) and the Cronbach’s alpha reliability was 0.93 in the current sample.

Ethnic identity. The strength of participants’ ethnic identity was assessed with Phinney’s five-item Multi-group Ethnic Identity Measure (MEIM).⁵³ Example items included, “I have a strong sense of belonging to my own ethnic group,” and “I feel a strong attachment towards my ethnic group.” Each item was rated on a 5-point Likert scale (*Strongly Disagree, Disagree, Neither Agree or Disagree, Agree, and Strongly Agree*) and Cronbach’s alpha reliability was 0.95 in the current sample.

Social capital deprivation factors

Peer pressure. The degree to which participants felt their friends negatively pressured them was assessed with a five-item scale.⁵¹ Example items included: “I let my friends talk me into doing things I really don’t want to do” and “I tend to go along with the crowd.” Each item was rated on a 3-point Likert Scale (*Not Like Me, A Little Like Me, or A Lot Like Me*) and Cronbach’s alpha reliability was .83 in the current sample.

Friend rejection. The degree to which participants felt rejected by their friends through teasing, being picked on, and being treated disrespectfully was measured

with the three-item friend rejection scale.⁵¹ Example items included: “I am made fun of by my friends” and “I wish my friends would show me more respect.” Each item was rated on a 3-point Likert scale (*Not Like Me, A Little Like Me, or A Lot Like Me*) and the Cronbach’s alpha reliability was .80 in the current sample.

Parent-adolescent conflict. Parent-adolescent conflict was measured using 10 of the 20 items from the Conflict Behavior Questionnaire (CBQ).⁵⁴ This scale assessed the degree of conflict in the parent-adolescent relationship. Example items included: “At least three times a week, my parent(s) and I get angry at each other” and “My parent(s) put me down.” The responses for each item were *True* or *False* and the Cronbach’s alpha reliability was .85 in the current sample.

Neighborhood crime. Neighborhood crime was measured using three items that assessed the degree to which neighbors encouraged youth to break the law in the past 30 days.⁵¹ Example items included: “Someone tried to get you to break the law” and “Someone tried to sell you illegal drugs.” Each item was rated on a 3-point Likert scale (*Never, Once or Twice, More than Twice*) and Cronbach’s alpha reliability was .85 in the current sample.

Anti-social capital factors

Delinquent friends. The nine-item Delinquent Friends subscale measured the degree to which participants’ friends engaged in delinquent activities.⁵¹ Example items included: “I have friends who get in trouble with the police” and “I have friends who use drugs.” Each item was rated on a 3-point Likert Scale (*Not Like Me, A Little Like Me, or A Lot Like Me*) and the Cronbach’s alpha reliability was .92 in the current sample.

Aggression. Aggressive behavior was measured using the modified 12-item aggression scale from the Youth Self Report (YSR).⁵⁵ Example items included: “I am mean to others” and “I break rules at home, school, or elsewhere.” Each item was rated on a 3-point Likert scale (*Not Like Me, A Little Like Me, and A Lot Like Me*) and Cronbach’s alpha reliability was .90 in the current sample.

Violence. Ten items were used to assess violent behavior.⁵⁶ Example items included: “I beat somebody up” and “I used a weapon in a fight.” Each item was assessed on a 4-point Likert scale (*Never, Once, Sometimes, Often*) and Cronbach’s alpha reliability was .88 in the current sample.

Data analysis

Univariates and bivariate by school level

Table 1 reports the means and standard deviations or counts and proportions for youth demographics, psychosocial, and social/antisocial capital variables. Univariate statistics for the whole sample spanning level are presented, as are bivariate statistics comparing middle and high school students on these characteristics. For continuous variables, the difference between high school and middle school characteristics is reported and tested using a *t*-test; for binary variables, the odds (HS:MS) ratio is reported and tested using a chi-square test.

Regression models

To test the hypotheses regarding the association between substance use and social or anti-social capital, the authors estimated regression models of whether youth had tried alcohol, cigarettes, and marijuana. Models were estimated separately for middle school and high school students. Binary logistic regression was used to examine the association between the probability of substances use and demographics (X_D), social capital (X_{SC}), social capital deprivation (X_{SCD}), and anti-social capital (X_{ASC}):

$$\ln \left\{ \frac{P(y = 1 | x)}{1 - P(y = 1 | x)} \right\} = X_D \beta_D + X_{SC} \beta_{SC} + X_{ASC} \beta_{ASC} + X_{ASD} \beta_{ASD}$$

As is the standard, coefficients were transformed to odds ratios ($OR = \exp[\beta]$).

Generalized estimating equations

Because youth are clustered according to school, generalized estimating equations (GEE) were used to adjust for correlations within schools. GEE is an alternative to multilevel modeling where substantive interest is on the average associations in the population and cluster-level factors are not relevant. Prior to selecting GEE, intraclass correlations were estimated

Table 1. Youth characteristics overall and by school level.

	All Youth (N = 7081)		Middle School (n = 2141)		High School (n = 4940)		OR (HS/MS)	Chi-square	p Value
	Proportion	N	Mean or Proportion	N	Mean or Proportion	N			
Used alcohol	.38	2725	.26	554	.44	2170	2.248	203.049	.000***
Used cigarettes	.22	1560	.14	293	.26	1267	2.178	200.173	.000***
Used marijuana	.21	1490	.11	235	.25	1255	2.768	176.918	.000***
African American/Black	.26	1821	.27	568	.25	1253	.942	1.006	.316
Latino/Latina	.08	537	.08	161	.08	376	1.014	.020	.887
American Indian	.24	1671	.19	406	.26	1265	1.474	37.926	.000***
Free or reduced price lunch	.88	6250	.85	1825	.90	4425	1.504	25.215	.000***
Gender (1 = Girls)	.51	3581	.50	1061	.51	2520	1.063	1.404	.236
From 2-parent home	.92	6539	.89	1914	.94	4625	1.766	32.893	.000***
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Diff (HS-MS)	t Value	p Value
Age (years)	3.54	1.10	2.84	.71	3.84	1.10	.995	38.227	.000***
Ethnic identity scale	2.27	.88	2.30	0.92	2.25	0.86	-.051	-2.174	.030*
Religion	1.31	.59	1.37	0.61	1.28	0.59	-.092	-5.835	.000***
Aggression (externalizing behavior)	.33	.36	.30	.36	.34	.36	.031	2.890	.004**
Violent behavior	.29	.46	.32	.47	.28	.45	-.039	-2.678	.009**
Parent-child conflict	2.32	2.73	1.80	2.35	2.54	2.84	.747	10.237	.000***
Peer pressure	.25	.38	.31	.41	.22	.36	-.090	-8.119	.000***
Peer rejection	.24	.43	.30	.46	.21	.41	-.082	-5.963	.000***
Delinquent friends	.42	.48	.32	.41	.47	.50	.147	10.520	.000***
Neighborhood crime	.21	.46	.11	.30	.26	.51	.151	11.392	.000***
Internalizing	.42	.52	.39	.50	.43	.52	.040	2.488	.014*

Note. * <.05; ** <.01; *** <.001.

for each outcome, using the variance of the logistic distribution ($\frac{\pi^2}{3}$) as an estimate of within-cluster variance, finding that in all cases, the ICC was less than .01. In GEE, parameter estimates are consistent estimates of the population-average association between each variable and the probability of substance use, and robust standard errors, inflated to account for within-school correlation, are estimated. Two different correlation structures were tested—exchangeable and independent. An exchangeable structure has a correlation matrix with a fixed non-zero correlation between students in the same school. An independent structure is effectively no different from a model without clustering (correlations between students = 0), except that robust standard errors are estimated. To compare the fit of models with different predictors and correlational structures, the quasi-likelihood information criterion (QIC) was used.

Interactions

Three potential interactions, informed by the literature review, were tested. Externalizing was interacted with delinquent friends and peer rejection; and parent-child conflict was interacted with delinquent friends. Prior to taking the product of these variables, they were recentered at their means.

Fitting procedure

The reported results consist of models that contain all of the proposed demographics, psychosocial factors, social capital, and antisocial capital, and (where applicable) interactions. However, a fitting procedure tested different specifications to determine the best fitting (a) set of predictors and interactions and (b) correlational structure.

False discovery rate adjustment

To account for testing three outcomes at each level of schooling, a false discovery rate adjustment was implemented.⁵⁷ The p values for each covariate in each of the three models were ordered from smallest to largest, with each assigned rank r_k , with $k = \{1, \dots, 3\}$. Covariate j in model k was significant if $p_{jk} < (r_k/3) \times .05$. Tables 2 and 3 show the original p value but an asterisk appears next to the p values that meet this criterion.

Missing values

The range of missingness on each variable in the analysis ranged from 3 for age to 1,366 for alcohol use. An imputation model consisting of the analysis variables as well as several dozen additional variables (auxiliary) was conducted using multiple imputation for chained equations (MICE) in R. Fifteen data sets were imputed, and the analysis was conducted in SAS on each of these 15 sets. The findings were then summarized using Rubin's rules for inference.⁵⁸

Table 2. Regression results, middle school significance indicators adjusted for Benjamini FDR.

Predictor	Alcohol				Cigarettes				Marijuana			
	Odds Ratio	CI Low	CI High	Sig ¹	Odds Ratio	CI Low	CI High	Sig ¹	Odds Ratio	CI Low	CI High	Sig ¹
Intercept	.12	.048	0.279	*	.04	.013	.137	*	.01	.004	.037	*
African American/Black	1.01	.771	1.321		.63	.447	.882	*	.91	.582	1.427	
Latino/Latina	1.04	.654	1.642		.42	.183	.972		1.11	.542	2.253	
American Indian	1.17	.865	1.578		1.14	.763	1.710		1.08	.683	1.724	
Free or reduced price lunch	1.36	.943	1.966		1.14	.763	1.698		2.04	1.072	3.869	
Gender (1 = Girls)	.72	.554	.941	*	.62	.454	.860	*	.78	.568	1.065	
Age (years)	1.13	.947	1.348		1.35	1.106	1.646	*	1.40	1.050	1.863	*
Ethnic identity scale	1.03	.915	1.168		.99	.830	1.182		.89	.693	1.145	
Religion	.81	.655	.995		.86	.644	1.161		.88	.590	1.307	
From 2-parent home	1.33	.933	1.903		1.17	.728	1.889		1.68	.873	3.251	
Aggression (externalizing behavior)	2.01	1.203	3.372	*	2.04	1.155	3.618	*	3.13	1.594	6.140	*
Violent behavior	1.22	.895	1.652		1.24	.892	1.715		1.37	.992	1.893	
Parent-child conflict	1.03	.970	1.096		1.07	.985	1.160		1.04	.958	1.122	
Peer pressure	.96	.676	1.362		1.23	.801	1.899		.81	.509	1.286	
Peer rejection	.81	.588	1.118		.83	.512	1.355		.97	.621	1.513	
Delinquent friends	2.04	1.449	2.870	*	1.95	1.388	2.753	*	1.87	1.281	2.715	*
Neighborhood crime	1.45	.941	2.222		1.77	1.110	2.837		1.93	1.065	3.494	
Internalizing	.92	.650	1.296		.80	.528	1.208		.73	.497	1.070	
QIC for model fit	2295.62				1545.09				1305.79			

¹Significance has been adjusted for false discovery using Benjamini-Hochberg method; confidence intervals that do not include OR = 1.0 may not be significant. **p* < .05; ***p* < .01; ****p* < .001.

Results

Youth characteristics by schooling level

Relative to middle school students, high school students were more likely to be American Indian; receive free or reduced price lunch; and to come from 2-parent homes (Table 1). In addition to being older,

they were more aggressive, had higher parent-adolescent conflict, reported greater delinquency among their friends and more neighborhood crime, and they reported higher internalizing symptoms. They reported lower ethnic identity and religious identification scores, reported less violent behavior, less peer pressure, and less peer rejection.

Table 3. Regression results, high school significance indicators adjusted for Benjamini FDR.

Predictor	Alcohol				Cigarettes				Marijuana			
	Odds Ratio	CI Low	CI High	Sig ¹	Odds Ratio	CI Low	CI High	Sig ¹	Odds Ratio	CI Low	CI High	Sig ¹
Intercept	.31	.189	.499	*	.19	.105	.342	*	.11	.062	.181	*
African American/Black	.70	.568	.858	*	.59	.461	.744	*	.97	.773	1.209	
Latino/Latina	.86	.655	1.126		.65	.438	.963		.82	.564	1.193	
American Indian	1.12	.916	1.376		1.10	.866	1.407		1.40	1.119	1.761	*
Free or reduced price lunch	1.19	.955	1.478		1.32	1.010	1.738		1.94	1.411	2.656	*
Gender (1 = Girls)	.88	.745	1.046		.67	.561	.810	*	.71	.578	.866	*
Age (years)	1.15	1.055	1.244	*	1.18	1.088	1.287	*	1.12	1.037	1.211	*
Ethnic identity scale	.96	.845	1.081		.87	.762	.982		.94	.840	1.041	
Religion	.92	.753	1.120		.92	.771	1.105		.83	.676	1.008	
From 2-parent home	.94	.749	1.173		.78	.547	1.103		.73	.567	.949	
Aggression (externalizing behavior)	2.22	1.569	3.136	*	1.84	1.267	2.675	*	1.58	1.089	2.307	*
Violent behavior	1.26	.970	1.639		1.28	1.007	1.614		1.66	1.330	2.075	*
Parent-child conflict	1.02	.989	1.058		1.02	.981	1.057		1.03	.995	1.069	
Peer pressure	.95	.730	1.229		1.00	.750	1.342		.85	.617	1.178	
Peer rejection	1.02	.793	1.302		1.03	.777	1.359		1.05	.753	1.470	
Delinquent friends	1.72	1.455	2.036	*	1.42	1.174	1.707	*	2.06	1.654	2.562	*
Neighborhood crime	1.71	1.401	2.086	*	1.59	1.320	1.904	*	1.76	1.453	2.125	*
Internalizing	.88	.718	1.075		.97	.770	1.217		.96	.718	1.296	
Interaction: Externalizing by delinquent friends	.67	.432	1.027						.79	.515	1.204	
Interaction: Parent-child conflict by delinquent friends	.98	.931	1.040						.95	.899	.997	
Interaction: Externalizing by peer rejection	.82	.511	1.325						.99	.593	1.648	
QIC for model fit	6247.77				5136.33				4910.34			

¹Significance has been adjusted for false discovery using Benjamini-Hochberg method; confidence intervals that do not include OR = 1.0 may not be significant. **p* < .05; ***p* < .01; ****p* < .001.

Middle school substance use

The best fitting correlation structures for all middle school models were independent. In terms of middle school alcohol use, all else equal, compared to males, females were 28% less likely to report using alcohol (Table 2). Every one-unit increase in self-reported aggression or delinquent friends was associated with more than twice the odds of using alcohol.

In terms of cigarette use, compared to White middle school youth, African American youth were 37% less likely to report smoking. Compared to males, females were 38% less likely to report smoking. A one-year increase in age was associated with a 35% increase in the odds of reporting cigarette use. Each one unit increase in aggression (which ranged from 0 to 2) was associated with a two-fold increase in the odds of using cigarettes, and a one-unit increase in delinquent friends (range 0 to 2) nearly a two-fold increase in the odds.

In terms of marijuana use, every one-year increase in age was associated with a 40% increase in the odds of reporting marijuana use. Each one-unit increase in self-reported aggression was associated with a three-fold increase in the odds of using marijuana. A one-unit increase in delinquent friends was associated with nearly twice the odds of using marijuana.

High school substance use

The best fitting models for alcohol and marijuana were exchangeable with interactions; for cigarettes, it was independent with no interactions. Compared to White students, African American students were 30% less likely to report alcohol use (Table 3). Every one-year increase in age was associated with 15% higher odds of alcohol use. Each one-unit increase in aggression was associated with more than double the odds of using alcohol. A similar trend was found for delinquent friends and neighborhood crime (which ranged from 0 to 2): for every one-unit increase in delinquent friends or neighborhood crime, the odds of reporting alcohol use was 72% higher and 71% higher, respectively.

Compared to White students, the odds of African American students using cigarettes were 41% lower. The odds of girls using cigarettes was only 2/3 that of boys. Every one-year increase in age significantly increased the odds of reporting cigarette use by 18%. Aggression was positively and significantly associated

with cigarette use: every one-unit increase in aggression was associated with 84% higher odds of using cigarettes. Similarly, for delinquent friends and neighborhood crime, a one-unit increase was associated with 42% and 59% higher odds of cigarette use, respectively.

Compared to White students, American Indian students were 40% more likely to report marijuana use. Compared to boys, girls were 29% less likely to use marijuana. Compared to youth not receiving free or reduced price lunch, those receiving free or reduced price lunch had nearly twice the odds of reporting marijuana use. Every one-year increase in age was associated with 12% higher odds of marijuana use. Every one-unit increase in aggression, for youth with delinquent friends and peer rejection at the mean, was associated with 58% higher odds of using marijuana; a one-unit increase in violent behavior (which ranged from 0 to 3) was associated with 66% higher odds of using marijuana. A similar trend was found for delinquent friends and neighborhood crime: for every one-unit increase in delinquent friends for youth with externalizing and parent-adolescent conflict at the mean, the odds of reporting marijuana use was more than doubled, and for every one unit increase in neighborhood crime the odds of reporting marijuana use was 76% higher.

Discussion

The current study examined if and how social capital, social capital deprivation, and anti-social capital factors were associated with substance use in a large sample of rural middle school and high school students. It was hypothesized that social capital (ethnic identity, religious orientation) would be associated with decreased substance use while social capital deprivation (negative peer relationships, parent-adolescent conflict, neighborhood crime) and anti-social capital (delinquent friends, aggression, violence) would be associated with increased substance use. These hypotheses were partially supported.

Contrary to the authors' hypothesis, positive social capital indicators were not associated with substance use in middle school or high school. Consequently, the protective effects of positive social capital, at least in the form of religion and ethnic identity, were trivial compared to the power of anti-social processes. It is possible that social capital measured in other ways

(e.g., parent involvement, engagement in prosocial extracurricular activities) might have had more of an impact on decreasing the likelihood of substance use. Further, given the link between substance use and popularity,^{59,60} substance use might be seen as positive by some youth and could in and of itself be viewed as a form of social capital used to gain and maintain popularity. Indeed, popularity at age 13 led to significant increases in substance use one year later.⁵⁹ Perhaps social acceptability of substance use by the peer group results in popularity and social status, thus popular youth use substance use as a way of gaining and maintaining status.⁶⁰ If youth view substance use as positive, it follows that forms of social capital, such as ethnic identity and religious orientation, would not be sufficiently strong enough to deter youth from using substances. Finally, this current finding is opposite to findings in urban areas where ethnic identity^{29,30} and religious orientation³⁴ protected against substance use. Perhaps the unique stressors present in a rural environment overpowered the protective nature of ethnic identity and religious orientation.

In terms of social capital deprivation factors, our hypothesis was partially supported. High rates of neighborhood crime were significantly associated with an increased likelihood of using cigarettes and marijuana for both middle-school- and high-school-aged youth and for using alcohol for high-school-aged youth. This finding is in line with past research conducted in urban areas,^{41,42} suggesting that crime-filled neighborhoods negatively impact adolescent substance use regardless of whether they are urban or rural. It is important to note that perceptions of rural neighborhoods differ slightly from urban neighborhoods. Past qualitative research suggests that rural residents view their neighborhoods as quite small (less than .5 square miles) and considered the houses near them as part of their neighborhood. Further, rural residents reported feeling emotionally close to their neighbors.⁴⁴ This suggests that the individuals who lived in close proximity to current participants constituted their neighbors and given the physical and emotional closeness present in small, rural neighborhoods, neighbors might have considerable influence on youth, especially with regard to substance use. The current measure of neighborhood crime included two items about whether neighbors had attempted to sell participants drugs or offered them alcohol. Thus, neighborhoods with high levels of crime were characterized in the

current study as having high rates of substance use. Adolescents are quite impressionable and being surrounded by adults and/or adolescents using and offering drugs and alcohol normalizes this behavior and sends the message to youth that using substances is acceptable. Further, neighbors who offer youth drugs and alcohol are not acting as prosocial mentors and likely do not encourage or support youth in their own prosocial endeavors. Being embedded in a substance-using and crime-filled neighborhood might limit youths interactions with prosocial peers and adults, thus hindering their ability to acquire positive social capital and resist negative behaviors, such as substance use. Indeed, living in crime-filled neighborhoods may facilitate the development of anti-social capital through easy access to alcohol and drugs and negative role models.

Counter to the authors' hypothesis, past research conducted in urban areas,³⁶ and past research not specifically conducted in rural areas,^{39,40} social capital deprivation in the form of negative peer relationships and parent-adolescent conflict were not significantly associated with an increased likelihood of using alcohol, cigarettes, or marijuana. The current findings indicated that social environment (neighborhood crime) and anti-social capital factors (i.e., delinquent friends, aggression, and violence) had more of an impact on drug use than individual negative relationships or positive social capital (i.e., religion and ethnic identity). This could potentially have implications for intervention and prevention efforts. In addition to targeting the surrounding community, adolescent substance use programming should also attempt to encourage youth to replace relationships characterized by anti-social capital with prosocial peers. Due to the importance of relationships for adolescents, adolescents will likely be reluctant to disengage with friends who engage in negative, risk-taking behavior even if they are aware of the consequences of this behavior. Thus, prevention and intervention programming can provide opportunities and teach the skills necessary to develop healthy relationships with peers.

In support of the authors' hypothesis and research conducted in urban areas,⁴⁵ anti-social capital in the form of delinquent friends was significantly associated with an increased likelihood of alcohol, cigarette, and marijuana use for both middle-school- and high-school-aged youth. It is well documented that delinquent behavior and substance use often co-occur^{45,46} and that

adolescents often mimic the behavior of their friends. Thus, youth who spend time with friends who are engaging in delinquency and substance use also engage in these behaviors.⁴⁸ The current findings confirm this past research and extend it to a sample of middle-school and high-school-aged youth from a violent and low income, rural county. Although high school students are clearly older and more mature than middle school students, they are not immune to the negative influence of their friends, highlighting that throughout adolescence, friend behavior is influential and can lead to negative behaviors, such as substance use. This influence can be understood in light of the concept of “social mimicry.”⁶¹ Youth mimic their friends’ delinquent behavior in order to gain access to valuable social resources, like the high social status, power, and privilege that accompanies delinquent behavior.⁶¹ Engaging in substance use might be necessary to gain acceptance into a delinquent peer group that has access to this social power. The current finding highlights the importance of intervening immediately when youth begin to spend time with a delinquent peer group.

Also in line with the authors’ hypothesis and past research,^{32,49} aggression was associated with an increased likelihood of using alcohol, cigarettes, and marijuana for both middle-school- and high-school-aged youth. It is possible that youth begin to spend time with anti-social peers who gradually inculcate them into a deviant way of life by introducing them to aggressive and delinquent behaviors and then moving onto more severe forms of anti-social behavior, including substance use. Conversely, it is possible that using substances increases aggressive behavior. A review of the literature on substance use and aggression indicates that both pathways are plausible. Substance use changes the brain structure of adolescents, decreasing inhibition, which often increases aggression. However, childhood aggression has also been found to increase later substance use.⁶² Additional research in rural areas is needed to investigate the temporal order of aggressive behavior and substance use.

In partial support of the authors’ hypothesis, high rates of violent behavior were associated with a significantly higher likelihood of reporting marijuana use for high school students only. It is interesting that violent behavior did not significantly impact middle school substance use or high school alcohol and cigarette use. Violent behavior, as measured in the current study, was more severe than aggressive behavior and included many items assessing physical assault. It is possible that

high school students engaged in this more serious form of anti-social behavior to a greater degree than middle school students. Further, violent behavior indicates a serious form of deviance that might indicate a general pattern of rule breaking behavior. Marijuana is illegal in North Carolina, thus, it is possible that violent high school students were intent upon breaking the law and thus engaged in illegal drug use.

Limitations

The results of the current study must be considered in conjunction with the limitations of the study. The fact that the participants of the current study completed assessments in school computer labs introduces the possibility of the influence of social desirability. Although researchers emphasized the confidential nature of the survey and made efforts to provide a comfortable and private environment, students may have under-reported their substance use behaviors. In addition, given the unique rural, ethnically diverse context in which the current study took place, results of the study should be cautiously generalized to other communities. Caution was taken so as not to interpret these associations as causal effects and in the authors’ descriptions, avoiding language that might give that impression.

Conclusions

The purpose of the current study was to apply a social capital framework to adolescent substance use in a large, ethnically diverse sample of rural youth. Overall, in partial support of the authors’ hypotheses, results suggested that certain anti-social capital (delinquent friends, aggression, and violence), and social capital deprivation factors (neighborhood crime) were associated with substance use for rural adolescents while positive social capital factors (ethnic identity, religion) provided negligible protection. The results of the current study provide potential guidance for intervention and prevention programming. That is, given the salience of social capital deprivation, substance use programs can target the identification of negative peer relationships and emphasize the skills necessary to avoid or disengage from antisocial relationships.

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