Adolescent Alcohol Use: Exploring Rural-Urban Differences

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EXECUTIVE SUMMARY

Introduction

Adolescent alcohol use is a significant public health problem among U.S. adolescents, with 26% of 12-17 year-olds reporting past month drinking in 2010. During the month preceding the 2009 Youth Risk Behavior Survey, , 42% of high school students drank alcohol, 24% engaged in binge drinking, 10% drove after drinking, and 28% rode in a car with a driver who had been drinking. These behaviors pose immediate risks for adolescents including injuries, accidents, physical and sexual assault, and risky sexual and social behavior as well as long term risks including poor academic performance, physical health problems, changes in brain development, dependency and abuse of other substances, increased risk for suicide and homicide, and an increased likelihood of alcohol use disorders in adulthood. Past studies, including our own work, have found that rural adolescents were more likely to use alcohol than urban adolescents. Research suggests that protective factors, such as peer and parental disapproval, may be weaker among youth living in rural areas. This study examines the factors associated with adolescent alcohol use, whether they differ between rural and urban populations, and the extent to which these differences account for rural-urban variations in adolescent alcohol use. This knowledge is crucial to the development of rural-specific prevention strategies, targeted research on rural adolescent alcohol use, and long-term policy interventions.

Methods

Using data from the 2008-2009 National Survey of Drug Use and Health, this study examines alcohol use among rural and urban adolescents between the ages of 12 and 17. We conduct bivariate and multivariate analyses of the prevalence of alcohol use across rural and urban areas and the relationships between alcohol use and potential protective or risk factors including parent relations, peer relations, school relations, and religious involvement.

Findings

Our findings confirm higher rates of binge drinking and driving under the influence among rural youth than among urban youth. Rural residence is associated with increased odds of binge drinking (OR 1.16, $p < .05$) and driving under the influence (OR 1.42, $p < .001$) even when income and protective factors are taken into account. In analyzing the patterns of youth drinking by age group, we observed higher rates of past year alcohol use among rural (10.4%) than urban (9.1%) 12-13 year olds ($p=0.0583$). Evidence indicates that a lower age of first use is associated with an increased risk of problem drinking behaviors and alcohol use disorders in later adolescence and adulthood. This suggests that higher rates of drinking among the youngest adolescents may partially explain rural-urban variations in binge drinking and driving under the influence. We also found that rural youth, their families and peers are less likely to disapprove of youth drinking than urban youth; risk factors that are associated with a greater likelihood of adolescent alcohol use. With the exception of participation in youth activities and attendance at religious services, each of our selected protective factors (including parent disapproval of drinking, parent help with homework, youth likes school, youth disapproves of peers drinking alcohol, friends disapprove of youth drinking alcohol, and religious beliefs influence life decisions) is strongly and significantly associated with decreased odds of binge and driving under the influence.

Discussion and Policy Implications

Rural adolescent alcohol use is a complex social problem. After controlling for a broad range of key risk and protective factors, it is clear that an unexplained rural effect persists with rural adolescents still exhibiting higher alcohol use than their urban counterparts. The reality is that this rural effect may not be explainable through traditional quantitative research methods. Although we were unable to explain fully the cause of higher rural adolescent drinking, we were able to identify rural differences in a number of risk and protective factors that, when viewed together, may help to account for a portion of the differences in rural adolescent alcohol use and suggest opportunities for intervention. One important difference is that rural youth age 12-13 are more likely than urban youth at that age to have used alcohol in the past year. Our findings suggest that adolescents who start drinking at an earlier age are more likely to engage in problem drinking behavior as they get older, leading to a need for interventions that target pre-teens and younger adolescents. Moreover, since we found urban-rural differences in specific protective factors, these may be the most promising for evidence-based, rural-specific prevention strategies targeting parents, schools, and churches. These are the factors that convey and reinforce consistent messages discouraging adolescent alcohol use from an early age.

INTRODUCTION

Adolescent alcohol use has been widely proclaimed as a significant public health problem.[1] During the month preceding the 2010 National Survey on Drug Use and Health, 26% of adolescents under the age of 21 drank alcohol.[2] During the month preceding the 2009 Youth Risk Behavior Survey, 42% of high school students drank alcohol, 24% engaged in binge drinking,[*] 10% drove after drinking, and 28% rode in a car with a driver who had been drinking.[3,4] These behaviors pose immediate risks including injuries, accidents, physical and sexual assault, and risky sexual and social behavior as well as long term risks including poor academic performance, physical health problems, changes in brain development, dependency and abuse of other substances, and increased risk for suicide and homicide.[1,5]

Despite the substantial evidence on prevalence, the problem of adolescent alcohol use is exacerbated by the divide between parental beliefs and attitudes and adolescent drinking behavior and attitudes.[1,6] While 68% of parents believe that most teens try beer occasionally, 63% did not think their own teen had consumed any alcohol. Additionally, parents and adults may view alcohol use as a rite of passage for adolescents.[1] Almost one-third of adolescents believed that their parents would not mind if they had a beer once in a while.[6] Adolescents also perceive the consumption of alcohol to be less risky than other substances; 45% did not see great risk in daily consumption of four to five drinks or more. Only 31% of adolescents disapproved of their peers getting drunk, compared to 42% who disapproved of marijuana use and 65% who disapproved of heroin use. These same adolescents report that beer or other alcoholic beverages are readily available (62%) and nearly 75% report having friends who drink alcohol. Many

[*] This reference from the Centers for Disease Control and Prevention defines binge drinking as five or more drinks for males or four or more drinks for females on one occasion within the past month.

young people perceive benefits to alcohol use, such as improved parties and celebrations and easier socialization.[6]

Rural adolescents are more likely to use alcohol than their peers in urban areas[7,8,9-14] and use is highest among adolescents living in the most remote rural areas.[7,11,14,15] Studies suggest that rural youth are more likely than urban youth to begin drinking at an early age and to engage in binge and heavy drinking and driving while intoxicated.[12,16,17] Higher rural rates of drinking and related risk behavior persist for young adults, ages 18-25.[7]

The research literature has identified a number of factors associated with adolescent alcohol use including: individual characteristics and family environment; socioeconomic status; parental involvement and attitudes toward drinking; peer attitudes toward drinking; school participation and performance; religiosity and religious participation; perceptions of alcohol benefits and harm; participation in risky behaviors; and psychosocial factors.[18-27] While the prevalence of rural adolescent alcohol use is well-established, the influence of these factors on alcohol use is not well understood in rural areas. This paper uses data from the 2008 and 2009 National Survey of Drug Use and Health (NSDUH) to examine the relationship between individual, family, peer, school, and religious factors and alcohol use by adolescents living in urban and rural areas. While this analysis is preliminary, it may suggest protective and risk factors that contribute to alcohol use in rural areas. This knowledge can point the way to the development of rural-specific prevention strategies, targeted research and long-term policy approaches.

BACKGROUND AND APPROACH

Whether or not an adolescent drinks and to what degree he or she drinks is influenced by a complex array of factors including personal characteristics, family characteristics and interactions, the influence of peers, experience in school, religious attendance and beliefs, perceptions of the benefits and risks of alcohol consumption, and participation in other risky behaviors. It is important to view these factors within the context of normative, developmental trajectories of alcohol use in order to understand the patterns of use and the factors that can contribute to problem drinking among adolescents. The typical trajectory of alcohol use for most youth begins in early to mid adolescence.[28-30] Amount consumed and rates of alcohol and binge alcohol use increase with age. This behavior begins to stabilize and decrease in the early 20s and with the assumption of adult responsibilities.[28,31] The challenge is to identify and intervene in the factors that contribute to a trajectory of problem alcohol use (i.e., binge and heavy drinking, driving under the influence, and alcohol abuse and dependency) compared to the "normal" trajectory of alcohol use.

Individual Factors

Age and gender are related to adolescent alcohol use. As adolescents age, they are more likely to begin drinking (if they do not already do so), engage in binge and heavy drinking, and drive under the influence of alcohol.[3,28] For example, the percentage of high school students who binge drink more than doubles between freshman (15.3%) and senior year (33.5 %).[3] Adolescent girls are slightly more likely than boys to have had a drink at some point in their lives and within the past 30 days, but are slightly less likely to have participated in binge drinking within the past 30 days.[3] More than a third of adolescents begin drinking before age 13, with initial alcohol use typically occurring in the 7th and 8th grades.[1] The younger the adolescent and the more often they

drink, the more likely they are to use other substances, engage in problem drinking behaviors, and develop an alcohol use disorder.[3,9,32] Hawkins and colleagues[33] found that young age at first use was associated with alcohol misuse in late adolescence, with positive parenting reducing the risk of early alcohol use and parent drinking and alcohol-using peers raising that risk.

Family and Parental Factors

Both structural and relational family and parental factors have an influence on adolescent alcohol use. Among younger teens, lower family income is slightly associated with higher probability of drinking within the past 12 months. By high school, higher family income is associated with a greater probability of drinking within the past 12 months. Among 9th-12th graders, 50% drank any alcohol during a one-year period when family income was less than $20,000 compared to 59% when family income exceeded $41,000. [20] Adolescents in one-parent families are more likely to drink at all ages and are more likely to engage in other forms of substance use and risky behavior than adolescents from two-parent families.[3,20]

Beyond a family's structural characteristics, parental involvement with their adolescent and their attitude and tolerance of adolescent drinking will influence the likelihood of whether and the degree to which an adolescent drinks. Parental behavior and expectations regarding alcohol use significantly influence their adolescents' decision to use alcohol.[3,23,30,34,35] In a survey of high school students, 80% reported that their parents' expectations mattered somewhat to very much in determining if and how much they drank alcohol.[3] Parental influence regarding alcohol use is highest during early adolescence and declines during later adolescence when peer behavior asserts greater influence, although parental influence does not disappear entirely.[23,30] A positive family environment (i.e., parental monitoring, acceptance, and good communication) moderates the potentially negative impact of peers on adolescent drinking behavior and is

associated with reductions in the number of peers who drink alcohol, less perceived approval of alcohol use from friends, and increased self-efficacy (allowing the adolescent to refuse alcohol).[30] Parental norms that failed to discourage underage drinking led to a greater likelihood of alcohol use and were associated with higher rates of use.[30 3,36]

Peer Factors

Peer influence is another important determinant of whether, how often, how much, and under what conditions an adolescent will drink. As with parental influence, peer influence can either serve as a protective factor [37] or a risk factor.[3] Whether an adolescent perceives that peers disapprove of his drinking and whether an adolescent approves of his peers drinking are related to the likelihood and the degree to which an adolescent will drink. The higher the perceived disapproval, the less likely an adolescent will drink.[34,37,38]

As with family and parental influence, the influence of peers on alcohol use is complex, subject to moderating influences, and may be dependent on the strength of the peer bond. In their study of adolescents' and their friends' health risk behavior, Prinstein et al[39] note that adolescents are influenced by different types of peer behavior and that a substantial percentage of adolescents participating in the study reported at least one friend engaged in deviant behavior (80%) and at least one friend that used illegal substances (86%). At the same time, 97% of participants reported having at least one friend engaged in positive social behavior. Olds and colleagues[40] suggest that the normative beliefs held by an adolescent regarding the perceived acceptability and prevalence of alcohol use among close friends and siblings had the strongest influence on intention to use compared to other same-age peers in one's school and community. Gardner & Shoemaker[35] found that attachment to peers and the conventionality of that attachment (i.e., the extent to which peers respect parents, teachers, and authority figures and

avoid getting in trouble) operate independently and in opposite directions (peer influence is associated with greater substance use but is moderated by the extent to which youth associated with conventional peers).[†] One study suggests that the influence of peers on alcohol and marijuana use is limited to middle school and that the influence of peers moderates with age.[41]

School and Leisure Time Factors

School factors such as academic engagement and perceived support from teachers are linked to adolescent alcohol use. Adolescents who do poorly in school (low grades) are more likely to drink as are those with lower participation in academic and school activities and who hold lower opinions of their teachers.[3,42-44] Students who study more, have better attendance, and who participate in school clubs or activities records also use less alcohol[43,45] For example, in a study of alcohol use among adolescent males,[45] those who participated in school clubs were significantly less likely to binge drink than those who did not participate (44.2% vs. 55.8%).

Teacher interest in students and school bonding are also protective factors against alcohol use, while punitive school policies against student alcohol use may not function as protective factors. Students in schools where students feel that teachers care about them have lower rates of binge drinking than students in schools where students have a greater perception of teacher apathy.[46] In a study involving junior and high school students in 193 US communities, school bonding (as a measure of social control influencing student behavior) is more protective for drunkenness and marijuana use within remote rural communities than in less isolated, more populated communities.[47] School bonding is more protective for girls than boys and reduces the involvement of students already using alcohol, marijuana, and inhalants. In examining the

[†] The authors do not specifically define conventionality but suggest that conventionality is inversely related to delinquent behavior. Instead, they suggest attributes for "conventional peers" that include respect for parents, teachers, and authority figures as well as avoidance of delinquent or criminal behavior that would get the peers in trouble.

relationship between student alcohol use and school policies on alcohol-related offenses, there is no association between binge drinking and harsh punitive policies (e.g., expulsion). School polices may not have the deterrence value normally assumed by school administrators.[46]

Students' leisure time activities can also influence alcohol use. Gibbons et al[43] found that time spent socializing, working, and playing video games were positively related to the amount of alcohol consumed when driving or riding in a car. In a study of rural Pennsylvania high school students, Pendorf[44,48] found that students heavily engaged in social activities outside of school and those who hold part-time jobs are heavier users of alcohol, with both activities providing greater opportunity to use alcohol, greater access to a source of alcohol, and, in the case of part-time employment, funds to purchase it.

Religiosity

Religiosity is a multifaceted concept involving participation in formal religious activities (i.e., attendance at services and participation in organized youth activities); a belief and ethical structure; and establishment and communication of group mores regarding behavior.[49-52] As a result, it is difficult to disentangle the influence of religiosity from the mediating influences of peers and parents. Despite this challenge, studies have found that religiosity is associated with reduced alcohol and drug use among adolescents.[3,36,53,54] In a nationally representative survey of youth living at home,[50] attendance at worship services was negatively associated with alcohol use, reducing the likelihood of drinking by 10%. The literature suggests that the most salient religious factor associated with the decision not to drink or reductions in the amount and frequency of drinking is religious participation.[50,54] In their study of students in the rural Brazo Valley area of Texas, McIntosh et al[52] found that religiosity has less of a protective effect for alcohol and marijuana and more of a protective effect for illicit drug use.

The influence of religiosity on adolescent alcohol use is complex and may operate on different levels. The literature suggests that religiosity moderates drinking behavior through religious teachings (specifically how these teachings are internalized and shape behavior); social bonding and establishment of group norms by congregational leaders, religious youth leaders, and peer groups; the establishment of clear boundaries for adolescents along with the communication of consistent boundary messages through more than one setting; and the provision of structured religious activities that leave less time for adolescents to explore risky behavior.[49,50,54] Studies also suggest that the influence of religiosity may be complicated by the role of peer influence; the likelihood that risk-averse youth may be more likely than risk seekers to be attracted to religious settings; and the possibility that youth who are more active with religious congregations may also have parents who supervise them more closely and are more engaged in their lives.[50,52,54]

Risk Behaviors

Participation in risk behaviors such as stealing, fighting, carrying a hand gun, and other deviant behavior are positively associated with adolescent drinking.[42,55,56] High school students who engage in aggressive or violent behavior are more likely to use alcohol than those who do not (57% vs. 33%).[3] We acknowledge that the association between these risky behaviors and drinking is endogenous, with no causal pattern.

Rural Risk Factors

Several studies have examined the effect of rural residency on adolescent alcohol use and found peers and community characteristics to be influential. Gardner & Shoemaker[35] found that peer influence was associated with greater substance use in rural areas, but was moderated by the extent to which youth associated with peers who respect parents, teachers, and authority figures

and avoid getting in trouble. Wilson & Donnermeyer[57] found a stronger expectation of conventional behavior (e.g., respect for adults, avoidance of delinquency) in rural areas, which may help prevent underage drinking. The social characteristics and structure of rural communities that may have once protected against adolescent alcohol use have been weakened by recent trends including high mobility, age segregation, a loss of community engagement, and few economic opportunities for adolescents.[58]

Many of the factors discussed above are correlated with one another, making it difficult to establish causality. In this study, we initially attempt to measure as many of these factors as addressed by the questions asked in the National Survey of Drug Use and Health (NSDUH) and examine whether these protective and risk factors are more or less prevalent in rural than in urban areas. Next, we examine whether these factors are related to adolescent alcohol use in rural and in urban areas. Based on these results we estimate logistic regression models predicting whether or not an adolescent has engaged in binge drinking in the past 30 days and whether or not they have driven under the influence of alcohol in the past year.

This study examines the factors associated with rural-urban differences in adolescent alcohol use identified in our earlier work. Adolescents are defined as persons aged 12-17. The specific research questions are:

1. What is the association between adolescent alcohol use and parent, peer, and school relations, and religious involvement? Do these associations differ between rural and urban areas?

2. What role do key protective and risk factors play in explaining variations between rural and urban adolescent alcohol use?

METHODS

Data

The National Survey of Drug Use and Health (NSDUH) is a nationally representative survey conducted annually by the federal Substance Abuse and Mental Health Administration to measure the prevalence and correlates of alcohol, illicit drugs, and tobacco use in the United States.[59] It contains detailed information on substance use, socio-economic and demographic characteristics, risk factors, mental health status, and substance abuse and mental health treatment and covers several topics asked only of respondents aged 12 to 17, including perceived adult attitudes toward drug use and activities, illegal activities, drug use by friends, social support, extracurricular activities, and exposure to prevention and education programs. Data are collected from non-institutionalized U.S. residents age 12 and older. To ensure sufficient sample size for our analysis, we pooled two years of NSDUH data (2008-2009) from the public use files. Each year of the survey samples approximately 68,700 individuals. The public use file available to researchers randomly removes survey data for approximately 13,000 respondents to eliminate the possibility that the data could be analyzed in a way that could identify individual respondents. As the data for these individuals are randomly eliminated, this process should not bias the survey results.[‡] The final public use file, as used for this study, contains approximately

[‡] Access to the full NSDUH analytic file is restricted to analysts directly involved in the NSDUH project. To make the data available to researchers, SAMHSA and other Federal statistical agencies create a public use files (PUF) that contain most of the data from the restricted data sets but modifies the file through a process known as Micro Agglomeration, Substitution, Subsampling, and Calibration (MASSC) and by removing detailed geographic information (i.e., state, county, and detailed rural classification codes) to protect respondents' personal information from disclosure. MASSC is a multi-step process used to modify the restricted data file to create the PUF. Variables with a high potential of personal identification, as well as a high value for analysis, are treated by standard procedures of categorization and top-and-bottom coding (Agglomeration). To introduce a measure of uncertainty about the identity of any individual in the PUF, values for some variables on a sample of records are replaced with data from a different respondent who has similar characteristics (Substitution). To further induce uncertainty about the presence of an individual in a PUF, a sample of records is selected and removed from the data file (Subsampling). Finally, the sampling weights are recalibrated to several estimated totals generated from the restricted data file in order to increase the precision of estimates generated from a PUF, as well as to improve their

55,700 respondents. The NSDUH over-samples younger age groups, providing a combined 35,547 respondents from 2008 and 2009 public use files who are 12-17 years old. Among these adolescents, 22% live in non-metropolitan counties.

Dependent and Independent Variables

Our dependent variables consist of a series of prevalence measures including any alcohol use in the past month, binge drinking in the past month,[§] and driving a vehicle while under the influence of alcohol during the past 12 months. Our key independent variable in this study is rural or urban residence. To aid in identifying urban and rural residence, the NSDUH public use file uses the federal Office of Management and Budget (OMB) metropolitan/nonmetropolitan county designations to classify counties as large metropolitan (i.e., with a population of over one million or more), small metropolitan (i.e. with a population of fewer than one million), and non-metropolitan (i.e., counties that are outside of Metropolitan Statistical Areas) counties.[60] Covariates include factors thought to be associated with adolescent risk behaviors (e.g., household income, age, sex, family intactness and relationships, grades, personal attitudes towards alcohol, perceived parental attitudes, perceived peer attitudes, participation in prevention programs, and religious involvement).

Many of the covariates available in the NSDUH survey data are conceptually clustered. For example, there are four survey questions related to religious involvement and beliefs, three related to peers, and four related to parents. This clustering is addressed in our analytic approach. Also, several behaviors known to be associated with risk behaviors have an endogenous

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consistency with estimates from the restricted file (Calibration). Although it is possible for the two files to yield different results as a result of this process, the differences are likely to be small.[67]

[§] Binge drinking in the past month is defined in the NSDUH as drinking five or more drinks, regardless of gender, on the same occasion at least once in the past thirty days.

relationship with the dependent variables. For example, youth who get poor grades in school, who have carried a handgun, and/or who have been engaged in illegal activities, are also likely to engage in binge drinking, but it is not clear if drinking leads to these activities, or if these activities pre-dispose one to drinking, or if these are simply a group of behaviors common to high risk youth. We investigate many of these behaviors at the bivariate level, but do not use them in our multivariate models, due to the challenges inherent in reciprocal causality.

Statistical Analysis

We conduct bivariate analyses of the prevalence of alcohol use comparing rural to urban areas and the relationships between alcohol use and specific covariates. All frequency differences are evaluated with Rao-Scott chi-square tests of significance. We use multivariate logistic regression analysis to test whether rural-urban differences observed in the bivariate analyses can be explained by rural-urban differences in these covariates. To aid in interpretation, we transformed the regression coefficients into odds ratios with 95% confidence intervals.

Because our independent variables are conceptually clustered into four distinct constructs (parent relations, peer relations, school relations and religion), we conducted confirmatory factor analysis to determine if any resulting factors might simplify our multivariate model and its interpretation. The results of our factor analysis are not presented here, because our factors did not improve on our model. The difference between the observed and expected covariance matrices was large, and we had a bare minimum number of variables for each factor. However, factor analysis helped us select two variables from each construct to enter into our multivariate models.[**]

[**] Before conducting multivariate analysis, we explored the clustered variables using a correlation matrix and confirmatory factor analysis. Because this process did not lead to stable factors, instead of using factors in our

Because the NSDUH uses a complex sampling strategy, SAMHSA assigns person-level weights to each record based on the probability of selection, and adjusts for key socio-demographic characteristics. We use these weights in our analyses as well as strata and primary sampling unit data to permit pooling of survey years. All statistical tests are calculated in SAS version 9.2 with survey procedures that use the Taylor series linearization approach to account for the NSDUH sample design and yield valid standard errors for the weighted data.

FINDINGS

Characteristics of Adolescents by Rural and Urban Residency

Table 1 presents weighted statistics on residency, household characteristics, peer attitudes towards youth drinking, parental interactions, school relations, religious involvement, and risky behaviors for U.S. adolescents ages 12-17. During 2008-09, 16.5% of adolescents lived in a rural area. Consistent with prior research, rural adolescents are more likely to be in lower income families. Nearly one-fifth (19.4%) of rural adolescents live in homes with income below $20,000, versus 14.9% of urban adolescents ($p<0.001$). The prevalence of two-parent households among adolescents (70.3%) was not statistically different between rural and urban areas.

Parent, self, and friend disapproval of youth drinking is strongly related to residency, with lower levels of disapproval in rural areas. For example, rural youth are less likely than urban to report that their parents disapprove of them drinking one or more alcoholic beverages a day (86.6% vs. 89.3%; $p<0.001$). Similarly, rural youth are less likely to disapprove of their peers drinking alcohol (85.0% vs. 86.4%; $p<0.001$), and are less likely to say their friends disapprove of youth drinking (82.1% vs. 84.3%; $p<0.001$). Rural youth in the sample were more

multivariate analysis, we chose variables from each cluster that had the strongest factor loadings and used those variables in our models.

likely to report receiving help from their parents with homework relative to their urban counterparts (77% vs. 74%), and reported fewer arguments ($p<0.001$). The prevalence of risk behaviors does not show a consistent pattern. Rural adolescents are more likely to report that they had ever carried a handgun, but are less likely to have stolen.

While we note that rural youth are more likely than urban youth to have participated in a drug prevention program outside of school, we are cautious about interpreting this finding; since we assume that some youth may be participating as a result of being "caught using." Similarly, we have eliminated "talked with parents about drinking or drugs" from our analysis since parents may initiate such conversations after discovering that their teen is using. Since survey data do not reveal whether the parental conversation or the prevention program preceded or followed the drinking behavior, we cannot include these indicators as protective factors.

Finally, rural adolescents are more likely to attend religious services and agree that religious beliefs are important than urban adolescents. For example, rural adolescents are more likely to agree that religious beliefs influence life decisions (70.4% vs. 64.9%; $p<0.001$) and that friends should share religious beliefs (40.4% vs. 31.6%; $p<0.001$) compared to urban adolescents.

Characteristics Associated with Binge Drinking and Driving Under the Influence

Prior studies have indicated that several risk and protective factors are associated with greater or lesser risk of binge drinking and driving under the influence (DUI) for youth. Our finding that rural youth have higher rates of these risky behaviors than urban youth may be explained by higher rates of risk factors and/or lower rates of protective factors. Table 2 examines how these factors are associated with binge drinking and driving under the influence,

organized into key constructs of individual factors, parent, peer, and school relations, and religion.

Having two parents in the home is associated with lower rates of binge drinking (8.2% vs. 10.0%; $p< .0001$) and lower rates of driving under the influence (2.8% vs. 3.3%; $p< .05$). Adolescents who reported that their parents help with their homework also exhibit lower rates of binge drinking (7.2% vs. 13.1 %; $p< .0001$) and driving under the influence (2.2% vs. 5%; $p< .0001$). The strongest parental influence is observed for those youth who believe that their parents disapprove of their drinking (6.8% vs. 23.6%; $p< .0001$). In combination, these bivariate findings confirm a strong case for parental influence as a protective factor.

Peer relations in our analysis are represented by two questions: 1) Do you disapprove of your peers drinking one or more alcoholic beverages a day?; and 2) Would your friends disapprove of you drinking one or more alcoholic beverages per day? Both questions showed a strong association with both binge drinking and driving under the influence, with peer to peer disapproval emerging as another strong protective factor. Rates of binge drinking (6.1% vs. 22.3%; $p<0.001$) and DUI (2.0% vs. 7.7%; $p<0.001$) are lower when friends disapprove of youth drinking than when they approve.

The NSDUH survey asked adolescents if they liked or disliked school. While this is another factor associated with binge drinking and driving under the influence, interpretation is fraught with ambiguity, due to a problem inherent in many of our findings. Drinking may cause poor school performance, and thereby a negative attitude toward school or poor grades may lead to a negative attitude toward school and lead a child to a pattern of anti-social or negative behaviors including drinking. Regardless of how one interprets the causal pathway, poor grades and dislike or hatred of school are associated with higher rates of both binge drinking and driving

under the influence. For example, binge drinking is higher among those with grade D or below compared to those with better grades (Table 2: 18.3% vs. 8.4%; $p<0.001$).

We also investigated four questions related to religious beliefs and religious participation: 1) Did the youth attend religious services 25 or more times in the past year?; 2) Does the youth believe that religious beliefs are important?; 3) Should religious beliefs influence life decisions?; and 4) Should friends share one's religious beliefs? Table 3 illustrates that each of these attitudes or behaviors is associated with lower rates of binge drinking and driving under the influence, and is a potential protective factor.

Prevalence of Alcohol Use by Demographic Factors

Just under one-third of all adolescents reported use of alcohol in the past year; the prevalence does not differ by rural-urban residence (Table 3). However, rural adolescents with household income less than $50,000 are more likely than urban adolescents with similar income to have consumed alcohol (61.3% vs. 58.0%; $p<0.001$). There are no urban-rural differences between boys and girls. However, while urban and rural 16-17 year olds have the same rates of past use at around fifty percent, at earlier ages, rural adolescents are more likely to have used alcohol in the past year than urban adolescents, especially at the ages of 12-13 (10.4% vs. 9.1%, $p=.058$). While this finding exceeds our chosen 0.05 level of significance, it may have implications for urban-rural differences in risky behaviors among older adolescents.

Binge drinking is more common among adolescents living in rural areas. Among rural adolescents, 9.6% report binge drinking in the past 30 days, compared to 8.5% of urban adolescents ($p<0.05$). In both rural and urban areas, binge drinking is positively related to adolescents living in households with relatively high income, though the effect of income is more pronounced among urban adolescents. Among urban adolescents, 7.1% with household

income below $20,000 had engaged in binge drinking compared to 9.1% with household income of $75,000 or more ($p<0.05$). In comparison, 9.4% of low income rural adolescents had engaged in binge drinking compared to 9.9% of those with high incomes (not significant).

The overall proportion of adolescents driving under the influence of alcohol is relatively small at 2.9%. However, like binge drinking, driving under the influence is more common among rural than urban adolescents (3.6% vs. 2.8%; $p<0.01$). With higher amounts of household income, the rate of driving under the influence increases for both rural and urban adolescents, possibly reflecting the link between affluence and vehicle access.

Multivariate Analysis: Binge Drinking and Driving Under the Influence Associations with Risk and Protective Factors, Demographic Factors, and Rural Residence

Observing that rural adolescents are more likely to report binge drinking and driving under the influence than their urban counterparts, and that factors predictive of these drinking behaviors also differ between urban and rural adolescents, we proceed to investigate whether urban-rural differences in drinking behavior are explained, in part, by urban-rural differences in these factors. We conducted a series of logistic regressions to assess the extent to which differences in binge drinking and driving under the influence between rural and urban adolescents are explained by risk and protective factors and whether bivariate rural-urban differences persist (Table 4). For both binge drinking and driving under the influence, we estimated a logit model containing rural residence, age, poverty, parent disapproval of drinking, parent help with homework, youth likes school, youth participates in two or more activities outside school, youth disapproves of peers drinking alcohol, friends disapprove of youth drinking alcohol, youth attended religious services 25 or more times in past year, and religious beliefs influence life decisions.

The results of the logistic regression models show that even when these factors are taken into account, rural adolescents are at greater risk of excessive drinking as well as driving under the influence (Table 4). Not only is rural residence associated with increased odds of binge drinking (OR 1.16, $p < .05$) and driving under the influence (OR 1.42, $p < .001$), but each of our selected protective factors is strongly and significantly associated with decreased odds of those behaviors, with two exceptions. Participating in two or more youth activities does not appear to be protective and is actually a risk factor for driving under the influence. This is supported by past research, which has shown that students engaged in social activities outside of school and who held jobs were more likely to be heavy users of alcohol[48] or to consume alcohol while in a car.[43] The other exception to our protective factors analysis is the association between attending religious services and the two selected drinking indicators. While church attendance appears to significantly protect against binge drinking, its association with driving under the influence is not significant.

LIMITATIONS

The NSDUH relies on self-reported data, which is subject to respondent recall. Because the survey asked about alcohol use, an illegal activity for the age group of interest, the subject's response could have been influenced by any perceived stigma associated with underage drinking as well as concern for revealing their participation. During potentially sensitive portions of the survey interview, respondents used headphones to listen to prerecorded questions and then directly keyed their responses into a computer without interviewers knowing how they were answering. This process may have helped to ensure respondent confidentiality and encourage accurate responses. Due to restricted access to the data, we are unable to examine intra-rural

variation. Our past work indicates that the most remote rural areas have the highest rates of young adult alcohol use and this omission may impair targeted prevention and treatment programs. Finally, the NSDUH does not collect data for institutionalized persons, a small subset of our study population that could have revealed greater insight into adolescent alcohol use. On the other hand, the past month behaviors we have focused on in this study are unlikely to have been experienced by institutionalized youth.

DISCUSSION AND POLICY IMPLICATIONS

Our goal in undertaking this study was to identify those factors in the rural environment that contribute to higher observed rates of drinking and problem drinking behaviors among rural adolescents compared to urban adolescents. Given the complex and interrelated nature of risk and protective factors for adolescent drinking, it is difficult to disentangle the influence of each of these factors on behaviors. Thus, we are not able to conclusively identify the one or two "key" factors associated with higher rates of rural adolescent alcohol use nor are we able to identify factors that explain urban-rural differences. After controlling for our selected set of risk and protective factors, the risk of binge drinking and/or driving under the influence remains greater for youth living in rural areas. We were, however, able to identify rural differences in a number of risk and protective factors that, when viewed together, may help to account for a portion of the urban-rural differences in adolescent alcohol use and suggest opportunities for intervention.

As mentioned in our methods section, our understanding of the causal relationship between protective and risk factors for adolescent alcohol use is imperfect. It is tempting to suggest that there are bad kids and good kids; that the bad ones have all the bad indicators (e.g.,

hate school, do not care what parents think, do not care what peers think, and do not go to church) and that a number of risk behaviors are simply part of this syndrome. In Table 2, we found that carrying a handgun and engaging in theft are two additional negative behaviors linked to the "bad kid" syndrome. We chose to leave those two negative indicators out of our multivariate model because their causal relationship with drinking is reciprocal (endogenous). However, there is a plausible story suggesting a causal relationship for each of the variables shown in Table 4. An adolescent who states that his parent disapproves of drinking demonstrates some concern for what his parent thinks, and is somewhat more likely to act in accordance with the parent's perceived wishes. Parents manifest their concern and strengthen their influence on their children by helping with homework. Youth who like school are more likely to see a pathway to success in life and to see that drinking may divert them from that pathway. Peer influence has been shown in other studies to be the single most influential risk and protective factor, and religious involvement may exert both moral and conventional social norms to avoid illegal or anti-social behaviors.

In a separate analysis, not shown here, we found that these protective factors were associated with decreased odds of problem drinking for both urban and rural youth. We looked for differential effects, on the theory that some factors might exert a stronger influence among rural youth or urban youth. Adding interaction terms to our model did not reveal any significant differential effects, and so those factors are not included in our final model. We are left with the question: What is it about rural residence that contributes to the increased odds of binge drinking and driving under the influence when controlling for numerous factors known to be associated with or predictive of these behaviors?

One clue toward an answer is our finding that rural youth age 12-13 are more likely than urban youth at that age to have used alcohol in the past year. Although the cross-sectional data from the NSDUH cannot support a time series analysis, the literature and our data strongly suggest that children who start drinking at an earlier age are more likely to engage in problem drinking behavior as they get older. If rural children start drinking at an earlier age, this may be another factor explaining higher rates of problem drinking among rural adolescents. The finding that rural adolescents are drinking at a younger age than urban adolescents suggests opportunities to intervene through the application of evidence-based rural-specific prevention strategies targeting pre-teens and younger adolescents. Since we found urban-rural differences in specific protective factors in the domains of parents, peers, school and church, these may be the most promising. Our findings suggest the need for multiple interventions targeting individual risk and protective factors, parent roles, and community wide interventions that convey and reinforce consistent messages discouraging adolescent alcohol use from an early age (see Appendix for specific evidence-based approaches within these domains).

Parental Interventions: The first level of prevention activities should target parents as our study indicates that rural adolescents report that their parents are less likely to disapprove of adolescent drinking than urban adolescents. As discussed earlier in this paper, previous studies have documented the importance of parental influence and disapproval in discouraging adolescent drinking and that parental influence is highest in early adolescence and moderates with the increasing age of the adolescent (when peer influence grows in importance). These realities suggest the need for prevention strategies providing parents with the knowledge and skills to address alcohol use in the pre-teen years, and to discourage adolescent drinking.

School Interventions: Our findings also indicate that rural adolescents are more likely to indicate that they do not like or hate school or to have a grade average of D or lower. The literature describes the important role that schools play in discouraging adolescent alcohol use by providing a stable, supportive environment where students feel that teachers and staff care about them and that they are important. The literature also indicates that students that are successful in school are less likely to drink. *Church and Faith-Based Interventions:* Our findings indicate that rural adolescents are more likely to participate in organized religious services and activities as well as to report that religious beliefs are very important to them and that those beliefs influence their life decisions. These findings suggest another opportunity for prevention activities to reach the subset of rural adolescents participating in formal religious activities. These programs can also reinforce parental and school norms against alcohol use.[61,62]

Peer and Youth Attitude Interventions: Based on our findings, it is clear that rural adolescents and their peers are less disapproving of adolescent alcohol use than their urban counterparts. The reasons for this are complex, but it is likely that rural adolescent and peer attitudes regarding alcohol use are influenced by lower levels of parental disapproval of adolescent alcohol use and the higher tolerance for alcohol use in rural communities. The prevention programs, such as those promoted through SAMHSA, target adolescent attitudes towards alcohol use and provide youth with the skills, resources, and resiliency to refrain from or at least delay and moderate alcohol use and problem drinking behavior. Other prevention interventions engage rural adolescents in changing their peers' attitudes toward alcohol use by engaging in education through a variety of media including murals and posters. Finally, it is clear that rural adolescents have relatively easy access to alcohol. Small area studies suggest that rural families may have greater tolerance for adolescent alcohol use, by allowing its consumption

at family events[63]and by purchasing alcohol on behalf of adolescents.[64] An overall community level strategy focused on reducing problematic alcohol use and reducing access to alcohol can be an important complement to prevention activities to change adolescent, parent, and community norms regarding alcohol.

CONCLUSION

Rural adolescent alcohol use is a complex social problem. After controlling for a broad range of key risk and preventive factors, it is clear that an unexplained rural effect persists with rural adolescents exhibiting higher problem alcohol use than their urban counterparts. The reality is that this rural effect may not be explainable through traditional quantitative research methods. To fully understand the interaction between these risk and protective factors and rural residence will likely require intensive qualitative research that is beyond the scope of this study. We have identified a variety of risk and protective factors that exhibit a rural-urban difference. Although we have not been able to explain fully the urban-rural differences in adolescent alcohol use, these key risk and prevention factors provide an opportunity to engage rural communities, parents, schools, and adolescents in evidence-based prevention activities designed to reduce this significant social problem.

APPENDIX: EVIDENCE-BASED PREVENTION PROGRAMS

Parental Interventions *Source:* Substance Abuse and Mental Health Services Administration's National Registry of Evidence-Based Programs and Practices (NREPP)[65]	**Active Parenting of Teens: Families in Action** is a school- and community-based intervention for middle school-aged youth designed to increase protective factors that prevent and reduce alcohol, tobacco, and other drug use; irresponsible sexual behavior; and violence. It includes a parent and teen component (http://www.activeparenting.com/).
	Creating Lasting Family Connections is a family-focused program designed to build the resiliency of youth aged 9 to 17 years and reduce the frequency of their alcohol and drug use. The program is designed to be implemented through community organizations such as churches, schools, recreation centers, and court-referred settings. The program emphasizes early intervention services for parents and youth and follow-up case management services for families (http://myresilientfuturesnetwork.com/).
	Family Matters is a family-directed program to prevent adolescents 12 to 14 years of age from using tobacco and alcohol. The intervention is designed to influence population-level prevalence and can be implemented with large numbers of geographically dispersed families. The program encourages communication among family members and focuses on general family characteristics (e.g., supervision and communication skills) and substance-specific characteristics (e.g., family rules for tobacco and alcohol use and media/peer influences) (http://familymatters.sph.unc.edu/index.htm).
	Guiding Good Choices is a drug use prevention program that provides parents of children in grades 4 through 8 (9 to 14 years old) with the knowledge and skills needed to guide their children through early adolescence. It seeks to strengthen and clarify family expectations for behavior, enhance the conditions that promote bonding within the family, and teach skills that allow children to resist drug use successfully (http://www.channing-bete.com/prevention-programs/guiding-good-choices/guiding-good-choices.html).
	Keep a Clear Mind is a take-home drug education program for elementary school students ages 9-11 and their parents. The program consists of four weekly lessons based on a social skills training model: Alcohol, Tobacco, Marijuana, and Tools to Avoid Drug Use. Each lesson introduces the topic for the week and is followed by a sequence of five activities to be completed at home with a parent (http://www.keepaclearmind.com/).
	Project Northland is an intervention involving students, peers, parents, and community in programs designed to delay the age at which adolescents begin drinking, reduce alcohol use among those already drinking, and limit the number of alcohol-related problems among young drinkers. It is administered to adolescents in grades 6-8 on a weekly basis with a specific theme for each grade level that is incorporated into the parent, peer, and community components (http://www.hazelden.org/web/go/projectnorthland).
	Start Taking Alcohol Risks Seriously (STARS) for Families is a health promotion program to prevent or reduce alcohol use among middle school youth ages 11 to 14 years. It is founded on the Multi-Component Motivational Stages prevention model. The program has components for youth, parents, and families (http://www.childtrends.org/lifecourse/programs/stars.htm).

	The Strengthening Families Program: For Parents and Youth 10-14 is a family skills training intervention to enhance school success and reduce youth substance use and aggression among 10- to 14-year-olds (http://www.extension.iastate.edu/sfp/).
School Interventions Source: NREPP[65]	**Caring School Community** is a universal elementary school (K-6) improvement program aimed at promoting positive youth development. It is designed to create a caring school environment characterized by kind and supportive relationships and collaboration among students, staff, and parents (http://www.devstu.org/caring-school-community).
	Positive Action is designed to improve academic achievement; school attendance; and problem behaviors such as substance use, violence, suspensions, disruptive behaviors, dropping out, and sexual behavior. It is also designed to improve parent-child bonding, family cohesion, and family conflict (http://www.positiveaction.net).
	Project SUCCESS (Schools Using Coordinated Community Efforts to Strengthen Students) is designed to prevent and reduce substance use among students 12 to 18 years of age. The program was developed for students attending alternative high schools at high risk for substance use and abuse due to poor academic performance, truancy, discipline problems, negative attitudes toward school, and parental substance abuse. The program has also been used in regular middle and high schools for a broader range of high-risk students (http://www.sascorp.org/success.html).
Church and Faith-Based Intervention Sources: Ransdell L, & Rehling S. Church-Based Health Promotion: a Review of the Current Literature. [62] Barry A. et al. Faith-Based Prevention Model: a Rural African-American Case Study. [61]	**Faith-based Prevention Model: A Rural African American Case Study**: This study describes a prevention model targeting elementary, middle, and high school student's view of risk factors: accessibility to alcohol, tobacco, and drugs; academic achievement; self-concept; peer behavior; and parent-child interactions as implemented in a rural Florida African American church. The study found that the program positively impacted each risk factor for boys and girls and that boys were more responsive to the intervention in every area but parent-child interaction time. The intervention was based on characteristics of successful faith-based interventions: utilizing an established prevention model; assessing the needs of the community; forming prevention committees; involving church members and pastors; and assigning roles to the volunteers and prevention committee members.

Peer and Youth Attitude Intervention Source: Johnson D. *Policing a Rural Plague: Meth is Ravaging the Midwest - Why it's so Hard to Stop*.[66]	**Mendocino County Asset Building Coalition's (ABC) Rural Murals Project** engages rural middle and high school students in rural Mendocino County, California in the development of murals that highlight community values and traditions and provide an alcohol and drug prevention message. Youth art teams direct the development of the murals and are provided with supplies, stipends, snacks, and access to various team building programs. The project focuses on the perception and reality of adolescent alcohol and drug use. The Rural Murals Project is part of ABC's programming which focuses on changing community culture that accepts youth alcohol and drug use. Other activities include a Drug Free Communities Support Program grant and a Sober Truth On Prevention (STOP) of Underage Drinking Program grant. The goal of ABC's STOP grant is to produce changes in school culture, community culture, and family culture that reduce underage alcohol use (http://www.ruralmurals.org/).
Community Intervention	**Community Trials Intervention to Reduce High-Risk Drinking** is a multi-component, community-based program designed to alter the alcohol use patterns and related problems of people of all ages. The program incorporates a set of environmental interventions that assist communities in (1) using zoning and municipal regulations to restrict alcohol access through alcohol outlet density control; (2) enhancing responsible beverage service by training, testing, and assisting beverage servers and retailers in the development of policies and procedures to reduce intoxication and driving after drinking; (3) increasing law enforcement and sobriety checkpoints to raise actual and perceived risk of arrest for driving after drinking; (4) reducing youth access to alcohol by training alcohol retailers to avoid selling to minors and those who provide alcohol to minors; and (5) forming the coalitions needed to implement and support the interventions that address each of these prevention components. The program aims to help communities reduce alcohol-related accidents and incidents of violence and the injuries that result from them. The program typically is implemented over several years, gradually phasing in various environmental strategies; however, the period of implementation may vary depending on local conditions and goals (http://www.pire.org/communitytrials/index.htm).

REFERENCES

1. U.S. Department of Health and Human Services. *The Surgeon General's Call to Action to Prevent and Reduce Underage Drinking*. Washington, DC: U.S. DHHS, Office of the Surgeon General; 2007.

2. Center for Behavioral Statistics and Quality. *Results From the 2010 National Survey on Drug Use and Health: Summary of National Findings*. Washington, D.C.: US DHHS: Substance Abuse and Mental Health Services Administration; September 2011.

3. The National Center on Addiction and Substance Abuse at Columbia University. *Adolescent Substance Use: America's #1 Public Health Problem*. New York, NY: CASA; June 2011.

4. Eaton DK, Kann L, Kinchen S, et al. Youth Risk Behavior Surveillance --- United States, 2009. *MMWR Morb Mortal Wkly Rep*. 2010; 59(SS05): 1-142.

5. Centers for Disease Control and Prevention. *Underage Drinking*. (Fact Sheet). Atlanta, GA: CDC; 2010. http://www.cdc.gov/alcohol/fact-sheets/underage-drinking.htm

6. MetLife Foundation. *2010 Partnership Attitude Tracking Study: Teens and Parents*. New York, NY: The Partnership at DrugFree.org; April 2011.

7. Lambert D, Gale JA, Hartley D. Substance Abuse by Youth and Young Adults in Rural America. *J Rural Health*. 2008; 24(3): 221-8.

8. Gfroerer JC, Larson SL, Colliver JD. Drug Use Patterns and Trends in Rural Communities. *J Rural Health*. 2007; 23 Suppl: 10-5.

9. Lasser J, Schmidt E, Diep J, Huebel A. Underage Rural Drinking: Survey Data and Implications for Educators. *The Rural Educator*. 2010; 38-46.

10. Van Gundy K. *Reports on Rural America: Substance Abuse in Rural and Small Town America*. Durham, NH: University of New Hampshire, Carsey Institute; 2006.

11. Swaim RC, Stanley LR. Rurality, Region, Ethnic Community Make-Up and Alcohol Use Among Rural Youth. *J Rural Health*. 2011; 27(1): 91-102.

12. Cronk CE, Sarvela PD. Alcohol, Tobacco, and Other Drug Use Among Rural/Small Town and Urban Youth: A Secondary Analysis of the Monitoring the Future Data Set. *Am J Public Health*. 1997; 87(5): 760.

13. Pruitt LR . The Forgotten Fifth: Rural Youth and Substance Abuse. *Stanford Law Pol Rev*. 2009; 20(2): 359-404.

14. Donnermeyer JF, Scheer SD. An Analysis of Substance Use Among Adolescents From Smaller Places. *J Rural Health*. 2001; 17(2): 105-113.

15. Swaim R, Beauvais F, Edwards RW, Oetting ER. Adolescent Drug Use in Three Small Rural Communities in the Rocky Mountain Region. *J Drug Educ*. 1986; 16(1): 57-73.

16. Sarvela PD, Pape DJ, Odulana J, Bajracharya SM. Drinking, Drug Use, and Driving Among Rural Midwestern Youth. *J Sch Health*. 1990; 60(5): 215-9.

17. The National Center on Addiction and Substance Abuse at Columbia University; *No Place to Hide: Substance Abuse in Mid-Size Cities and Rural America*. New York: 2000.

18. Rountree PW, Clayton RR. A Contextual Model of Adolescent Alcohol Use Across the Rural-Urban Continuum. *Subst Use Misuse*. 1999; 34(4-5): 495-519.

19. Oetting ER, Edwards RW, Kelly K, et al. Risk and Protective Factors for Drug Use Among Rural American Youth. In: *NIDA Research Monograph 168*. 1997:90-130.

20. Blum RW, Beuhring T, Shew ML, et al. The Effects of Race/Ethnicity, Income, and Family Structure on Adolescent Risk Behaviors. *Am J Public Health*. 2000; 90(12): 1879-84.

21. Power TG, Stewart CD, Hughes SO, Arbona C. Predicting Patterns of Adolescent Alcohol Use: a Longitudinal Study. *J Stud Alcohol*. 2005; 66(1): 74-81.

22. Fisher LB , Miles IW, Austin SB, Camargo CA Jr, Colditz GA. Predictors of Initiation of Alcohol Use Among US Adolescents: Findings From a Prospective Cohort Study. *Arch Pediatr Adolesc Med*. 2007; 161(10): 959-66.

23. Nash SG, McQueen A, Bray JH. Pathways to Adolescent Alcohol Use: Family Environment, Peer Influence, and Parental Expectations. *J Adolesc Health*. 2005; 37(1): 19-28.

24. Patrick ME, Schulenberg JE. Alcohol Use and Heavy Episodic Drinking Prevalence and Predictors Among National Samples of American Eighth- and Tenth-Grade Students. *J Stud Alcohol Drugs*. 2010; 71(1): 41-5.

25. McBroom JR. Correlates of Alcohol and Marijuana Use Among Junior High School Students. *Youth Soc*. 1994; 26(1): 54.

26. Stewart Fahs PS, Smith BE, Serdar Atav A, et al. Integrative Research Review of Risk Behaviors Among Adolescents in Rural, Suburban, and Urban Areas. *J Adolesc Health*. 1999; 24(4): 230-243.

27. Eaton DK, Forthofer MS, Zapata LB, et al. Factors Related to Alcohol Use Among 6th Through 10th Graders: The Sarasota County Demonstration Project. *J Sch Health*. 2004; 74(3): 95-104.

28. Masten AS , Faden VB, Zucker RA, Spear LP. Underage Drinking: A Developmental Framework. *Pediatrics*. 2008; 121 Suppl 4: S235-51.

29. Maggs JL, Schulenberg JE. Trajectories of Alcohol Use During the Transition to Adulthood. *Alcohol Research & Health*. 2004; 28(4): 195-201.

30. Sieving RE, Maruyama G, Williams CL, Perry CL . Pathways to Adolescent Alcohol Use: Potential Mechanisms of Parent Influence. *J Res Adolesc*. 2000; 10(4): 489-514.

31. Bachman JG, O'Malley PM, Schulenberg JE, et al. *The Decline of Substance Use in Young Adulthood: Changes in Social Activities, Roles, and Beliefs*. Mahwah, NJ: Lawrence Erlbaum Associates; 2002.

32. DeWit DJ, Adlaf EM, Offord DR, Ogborne AC. Age at First Alcohol Use: A Risk Factor for the Development of Alcohol Disorders. *Am J Psychiatry*. 2000; 157(5): 745-50.

33. Hawkins JD, Graham JW, Maguin E, et al. Exploring the Effects of Age of Alcohol Use Initiation and Psychosocial Risk Factors on Subsequent Alcohol Misuse. *J Stud Alcohol*. 1997; 58(3): 280-90.

34. Ouellette JA, Gerrard M, Gibbons FX, Reis-Bergan M. Parents, Peers, and Prototypes: Antecedents of Adolescent Alcohol Expectancies, Alcohol Consumption, and Alcohol-Related Life Problems in Rural Youth. *Psychol Addict Behav*. 1999; 13(3): 183-197.

35. Gardner L , Shoemaker DJ. Social Bonding and Delinquency: A Comparative Anlaysis. *Sociol Q*. 1989; 30(3): 481-499.

36. Bahr SJ, Hoffmann JP, Yang X. Parental and Peer Influences on the Risk of Adolescent Drug Use. *J Prim Prev*. 2005; 26(6): 529-51.

37. Atkins LA , Oman RF, Vesely SK, Aspy CB, McLeroy K. Adolescent Tobacco Use: the Protective Effects of Developmental Assets. *Am J Health Promot*. 2002; 16(4): 198-205.

38. Oman RF, Vesely S, Aspy CB, et al. The Potential Protective Effect of Youth Assets on Adolescent Alcohol and Drug Use. *Am J Public Health*. 2004; 94(8): 1425-30.

39. Prinstein MJ, Boergers J, Spirito A. Adolescents' and Their Friends' Health-Risk Behavior: Factors That Alter or Add to Peer Influence. *J Pediatr Psychol*. 2001; 26(5): 287-98.

40. Olds RS, Thombs DL, Tomasek JR. Relations Between Normative Beliefs and Initiation Intentions Toward Cigarette, Alcohol and Marijuana. *J Adolesc Health*. 2005; 37(1): 75.

41. Duan L, Chou CP, Andreeva VA, Pentz MA. Trajectories of Peer Social Influences As Long-Term Predictors of Drug Use From Early Through Late Adolescence. *J Youth Adolesc*. 2009; 38(3): 454-65.

42. Bloch LP, Crockett LJ, Vicary JR. Antecedents of Rural Adolescent Alcohol Use: a Risk Factor Approach. *J Drug Educ*. 1991; 21(4): 361-77.

43. Gibbons S , Wylie ML, Echterling L. Situational Factors Reltaed to Rural Adolescent Alcohol Use. *Int J Addict*. 1986; 21(11): 1183-1195.

44. O'Malley PM. Maturing Out of Problematic Alcohol Use. *Alcohol Res Health*. 2004; 28(4): 202-204. http://pubs.niaaa.nih.gov/publications/arh284/202-204.pdf

45. Leaver-Dunn D, Turner L, Newman BM. Influence of Sports' Programs and Club Activities on Alcohol Use Intentions and Behaviors Among Adolescent Males. *Journal of Alcohol and Drug Education*. 2007; 51(3): 57-72.

46. Guilamo-Ramos V, Jaccard J, Turrisi R, Johansson M. Parental and School Correlates of Binge Drinking Among Middle School Students. *Am J Public Health*. 2005; 95(5): 894-9.

47. Shears J, Edwards RW, Stanley LR. School Bonding and Substance Use in Rural Communities. *Soc Work Res*. 2006; 30(1): 6-18.

48. Pendorf JE. Leisure Time Use and Academic Correlates of Alcohol Abuse Among High School Students. *J Alcohol Drug Educ*. 1992; 37(2): 103-110.

49. Rew L, Wong YJ. A Systematic Review of Associations Among Religiosity/Spirituality and Adolescent Health Attitudes and Behaviors. *J Adolesc Health*. 2006; 38(4): 433-442.

50. Sinha JW, Cnaan RA, Gelles RJ. Adolescent Risk Behaviors and Religion: Findings From a National Study. *J Adolesc*. 2007; 30(2): 231-49.

51. Knight JR , Sherritt L, Harris SK, et al. Alcohol Use and Religiousness/Spirituality Among Adolescents. *South Med J*. 2007; 100(4): 349-55.

52. Mcintosh WA, Fitch SD, Wilson JB, Nybero KL. The Effect of Mainstream Religious Social Controls on Adolescent Drug Use in Rural Areas. *Rev Relig Res*. 1981; 23(1): 54.

53. Substance Abuse and Mental Health Services Administration. *The NSDUH Report: Underage Drinking in Rural Areas*. Rockville, MD: Office of Applied Studies, SAMHSA; August 2004.

54. Mason WA, Windle M. A Longitudinal Study of the Effects of Religiosity on Adolescent Alcohol Use and Alcohol-Related Problems. *J Adolesc Res*. 2002; 17(4): 346-363.

55. Atav S, Spencer G. Health Risk Behaviors Among Adolescents Attending Rural, Suburban, and Urban Schools: a Comparative Study. *Fam Community Health*. 2002; 25(2): 53-64.

56. Wintemute GJ. Association Between Firearm Ownership, Firearm-Related Risk and Risk Reduction Behaviours and Alcohol-Related Risk Behaviours. *Inj Prev*. 2011.

57. Wilson JM , Donnermeyer JF. Urbanity, Rurality, and Adolescent Substance Use. *Crim Justice Rev*. 2006; 31(4): 337-356.

58. Salamon S . From Hometown to Nontown: Rural Community Effects of Suburbanization. *Rural Sociology*. 2003; 68(1): 1-24.

59. Office of Applied Studies. *National Survey on Drug Use and Health, 2009*. (ICPSR 29621). Ann Arbor, MI: Inter-university Consortium for Political and Social Research; 2010.

60. Substance Abuse and Mental Health Services Administration. *The NSDUH Report: Illicit Drug Use, by Race/Ethnicity, in Metropolitan and Non-Metropolitan Counties: 2004 and 2005*. Rockville, MD: Office of Applied Studies, SAMHSA; July 2007.

61. Barry A, Southerland M, Harris G. Faith-Based Prevention Model: a Rural African-American Case Study. *American Journal Of Health Studies*. 2006; 21(3): 148-157.

62. Ransdell L, Rehling S. Church-Based Health Promotion: a Review of the Current Literature. *American Journal of Health Behavior*. 1996; 20(4): 195-207.

63. Meyer MG, Toborg MA, Denham SA, Mande MJ. Cultural Perspectives Concerning Adolescent Use of Tobacco and Alcohol in the Appalachian Mountain Region. *J Rural Health*. 2008; 24(1): 67-74. 18257873

64. Pettigrew J, Miller-Day M, Krieger J, Hecht ML. The Rural Context of Illicit Substance Offers: A Study of Appalachian Rural Adolescents. *Journal of Adolescent Research*. 2012.

65. Substance Abuse and Mental Health Services Administration. *National Registry of Evidence-Based Programs and Practices (NREPP)*. [Web Page]. 2012, May 24. Available at: http://nrepp.samhsa.gov.

66. Johnson D . Policing a Rural Plague: Meth Is Ravaging the Midwest - Why It's So Hard to Stop. *Newsweek*. 2004; 143(10): 41.

67. Substance Abuse and Mental Health Services Administration. *The NSDUH Report: Accessing Data From the National Survey on Drug Use and Health*. Rockville, MD: Office of Applied Studies, SAMHSA; September 2004.

TABLES

Table 1. Characteristics of Adolescents by Residence, 2008-09

Characteristics	Rural (n=7,903)	Urban (n=27,644)
Weighted percent	16.5%	83.5%
Total household income ***		
Less than $20,000	19.4	14.9
$20,000-$49,000	36.2	29.6
$50,000-$74,999	20.2	17.9
$75,000 or more	24.3	37.6
Age		
12-13 years old	32.2	30.7
14-15 years old	34.1	34.4
16-17 years old	33.6	34.9
Male	51.6	51.0
Two parents in household	70.2	70.3
Parents disapprove of youth drinking ***	86.6	89.3
Parents help with homework always/sometimes ***	76.8	73.8
More than 10 arguments with parents *	23.3	24.9
Youth disapproves of peers drinking 1+ alcohol beverage/day **	85.0	86.4
Friends disapprove of youth drinking 1+ alcohol beverage/day***	82.1	84.3
Grade average of D or lower	6.6	5.9
Youth did not like or hated school**	20.3	18.2
Participated in two or more youth activities*	84.1	85.1
Youth participated in drug prevention program outside of school **	12.4	11.0
Attendance at religious services 25+ times in past year **	32.8	30.3
Religious beliefs are very important ***	76.3	72.3
Religious beliefs influence life decisions ***	70.4	64.9
Friends should share religious beliefs ***	40.4	31.6
Youth carried handgun 1+ times ***	4.6	3.3
Youth stole or tried to steal 1+ times ***	3.9	5.1

Residence differences significant at $p \leq .05$*; $p \leq .01$ **; $p \leq .001$***.
Statistics are weighted to population level using weights provided with the NSDUH. Sample size is unweighted.

Table 2. Characteristics of Adolescents by Alcohol Use, 2008-09

Characteristics	Binge Drinking in Past 30 Days (n=3,324)	Sig.	Driving Under the Influence in Past Year (n=1,150)	Sig.
Alcohol use (weighted percent)	8.7		2.9	
Rural use	9.6	0.0251	3.6	0.0014
Urban use	8.5		2.8	
Total household income				
Less than $20,000	7.6	0.0559	2.1	0.0001
$20,000-$49,000	8.9		2.5	
$50,000-$74,999	8.4		3.1	
$75,000 or more	9.1		3.5	
Age				
12-13 years old	1.6	0.0001	0.1	<.0001
14-15 years old	6.6		1.2	
16-17 years old	17.1		7.1	
Sex				
Male	9.2	0.0014	2.9	0.9994
Female	8.2		2.9	
Two parents in household				
Yes	8.2	<.0001	2.8	0.0310
No	10.0		3.3	
Parents disapprove of youth drinking				
Yes	6.8	<.0001	2.3	<.0001
No	23.6		7.6	
Parents help with homework always/sometimes				
Yes	7.2	<.0001	2.2	<.0001
No	13.1		5.0	
Arguments with parents				
Fewer than 10 in past year	7.3	<.0001	2.2	<.0001
More than 10 arguments	12.9		5.1	
Youth disapproves of peers drinking 1+ alcohol beverage/day				
Yes	6.2	<.0001	2.0	<.0001
No	24.5		8.6	
Friends disapprove of youth drinking 1+ alcohol beverage/day				
Yes	6.1	<.0001	2.0	<.0001
No	22.3		7.7	
Grade average				
A,B or C	8.4	<.0001	2.9	<.0001
D or lower	18.3		5.5	
Youth feels about school				
Likes school at lot / kind of liked	7.3	<.0001	2.3	<.0001
Did not like school / hated school	16.1		6.0	

Characteristics	Binge Drinking in Past 30 Days (n=3,324)	Sig.	Driving Under the Influence in Past Year (n=1,150)	Sig.
Participated in youth activities				
Two or more activities	8.0	<.0001	2.8	0.0062
One or no activities	12.2		3.5	
Drug prevention program outside of school				
Youth participated	8.3	0.5	2.9	0.4735
Did not participate	8.8		3.1	
Attendance at religious services				
25+ times in year	5.3	<.0001	2.1	<.0001
Less than 25 times	10.2		3.3	
Religious beliefs are very important				
Agrees	7.0	<.0001	2.2	<.0001
Disagrees	13.5		4.8	
Religious beliefs influence life decisions				
Agrees				
Disagrees	6.1	<.0001	1.9	<.0001
	13.7		4.9	
Friends should share religious beliefs				
Agrees	5.8	<.0001	1.8	<.0001
Disagrees	10.1		3.5	
Youth carrying handgun				
Did not carry handgun	8. 2	<.0001	2.6	<.0001
Carried gun 1+ times	22.8		10.9	
Youth stealing				
Did not steal	7.6	<.0001	2.4	<.0001
Stole or tried to steal 1+ times	29.4		13.3	

Note: Statistics are weighted to population level using weights provided with the NSDUH. Sample size is unweighted.

Table 3. Adolescent Alcohol Use by Residence, 2008-09

Variables	Any Past Year Use			Binge Drinking in Past 30 Days			Driving Under the Influence in Past Year		
	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.
Alcohol use	31.0%	30.6%		9.6%	8.5%	p ≤ .001	3.6%	2.8%	p ≤ .001
Total household income									
Less than $20,000	30.3	27.1	p ≤ .001	9.4	7.1	p ≤ .001	2.9	1.9	p ≤ .001
$20,000-$49,000	31.0	30.9		9.8	8.7		3.6	2.3	
$50,000-$74,999	29.9	31.3		9.0	8.3		3.8	2.9	
$75,000 or more	32.5	31.4		9.9	9.1		4.2	3.4	
Age									
12-13 years old	10.4	9.1	0.0583	2.0	1.5		0.3	0.1	
14-15 years old	31.6	29.8		7.5	6.4		1.5	1.2	
16-17 years old	50.1	50.3		18.9	16.7		9.1	6.7	
Sex									
Male	30.3	30.0		9.9	9.1		3.7	2.8	
Female	31.8	31.3		9.2	8.0		3.6	2.8	
Two parents in household									
Yes	29.6	29.0		8.7	8.0		3.4	2.6	
No	34.4	34.3		11.6	9.7		4.2	3.1	
Parents disapprove of youth drinking									
Yes	27.1	27.8	p ≤ .001	7.4	6.7		2.8	2.2	
No	56.2	54.4		23.9	23.5		8.8	7.3	
Parents help with homework always/sometimes									
Yes	28.5	27.3	p ≤ .001	7.8	7.1		2.9	2.1	
No	39.3	39.9		15.5	12.7		6.1	4.8	
Arguments with parents									
Fewer than 10 in past year	26.9	27.0		8.1	7.2		2.8	2.1	
More than 10 arguments	44.6	41.5		14.4	12.7		6.2	4.9	

Variables	Any Past Year Use			Binge Drinking in Past 30 Days			Driving Under the Influence in Past Year		
	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.
Youth disapproves of peers drinking 1+ alcohol beverage/day									
Yes	26.5	26.3		6.6	6.1		2.3	2.0	
No	56.6	58.4		26.5	24.1		11.5	8.0	
Friends disapprove of youth drinking 1+ alcohol beverage/day									
Yes	26.3	26.2		7.0	6.0		2.5	1.9	
No	52.7	54.5		21.6	22.4		9.0	7.4	
Grade average									
A,B or C	31.0	30.8		9.1	8.2		3.4	2.8	
D or lower	49.5	47.4		19.1	18.1		7.7	5.1	
Youth feels about school									
Likes school at lot / kind of liked	29.0	28.7	0.0715	8.1	7.1		2.9	2.2	
Did not like school / hated school	43.2	43.4		17.0	15.9		7.2	5.8	
Participated in youth activities									
Two or more activities	30.5	29.8		9.0	7.9		3.4	2.7	
One or no activities	32.9	35.1		11.8	12.2		4.6	3.3	
Drug prevention program outside of school									
Youth participated	27.5	27.8		7.6	8.5		4.1	2.9	
Did not participate	31.5	31.0		9.9	8.5		3.6	2.8	
Attendance at religious services									
25+ times in year	24.3	24.5		5.5	5.3		2.3	2.0	
Less than 25 times	34.3	33.3		11.6	9.9		4.3	3.1	
Religious beliefs are very important									
Agrees	27.5	26.5	$p \leq .001$	7.9	6.8	$p \leq .01$	2.5	2.1	
Disagrees	42.3	41.4		15.1	13.2		7.2	4.4	

Variables	Any Past Year Use			Binge Drinking in Past 30 Days			Driving Under the Influence in Past Year		
	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.	Rural (n=7,903)	Urban (n=27,644)	Sig.
Religious beliefs influence life decisions									
Agrees	26.2	24.5	$p \leq .001$	7.2	5.9	$p \leq .01$	2.4	1.8	
Disagrees	42.3	41.9		15.3	13.4		6.5	4.7	
Friends should share religious beliefs									
Agrees	23.6	22.8	$p \leq .001$	6.5	5.6	$p \leq .01$	2.2	1.7	
Disagrees	36.0	34.2		11.6	9.9		4.6	3.3	
Youth carrying handgun									
Did not carry handgun	30.2	29.8		9.1	8.0		3.3	2.5	
Carried gun 1+ times	47.3	53.2		19.3	23.7		10.5	11.1	
Youth stealing									
Did not steal	29.5	28.6	$p \leq .01$	8.6	7.4		3.0	2.3	
Stole or tried to steal 1+ times	68.2	66.7		34.7	28.6		20.3	12.2	

Note: Statistics are weighted to population level using weights provided with the NSDUH. Sample size is unweighted.

Table 4. Logistic Regression Predicting Probability of Adolescent Alcohol Use, 2008-09

Control Variables	Binge Drinking in the Past 30 Days O.R. (95% C.I.)	Driving Under the Influence in the Past Year O.R. (95% C.I.)
Residence		
Rural	1.16 * (1.02, 1.33)	1.42 *** (1.20, 1.68)
Urban	1.0	1.0
Age (included as an ordinal variable)	2.88 *** (2.60, 3.20)	5.73 *** (4.80, 6.85)
Poverty		
Below 100% of FPL	0.77 *** (0.66, 0.89)	0.59 *** (0.46, 0.75)
Above 100% of FPL	1.0	1.0
Parents disapprove of youth drinking		
Yes	0.47 *** (0.40, 0.54)	0.66 *** (0.52, 0.82)
No	1.0	1.0
Parents help with homework always/sometimes		
Yes	0.74 *** (0.64, 0.84)	0.65 *** (0.54, 0.77)
No	1.0	1.0
Youth liked school a lot or kind of liked school		
Yes	0.57*** (0.50, 0.66)	0.53*** (0.44, 0.63)
No	1.0	1.0
Participated in two or more youth activities (i.e., school, community, church/faith, or other activities)		
Yes	1.10 (0.92, 1.31)	1.39** (1.10, 1.76)
No	1.0	1.0
Youth disapproves of peers drinking 1+ alcohol beverage per day		
Yes	0.45 *** (0.38, 0.55)	0.49*** (0.37, 0.64)
No	1.0	1.0
Friends disapprove of youth drinking 1+ alcohol beverage per day		
Yes	0.60 *** (0.51, 0.70)	0.66 ** (0.51, 0.86)
No	1.0	1.0
Attended religious services 25+ times in past year		
Agrees	0.69 *** (0.59, 0.80)	0.93 (0.73, 1.19)
Disagrees	1.0	1.0
Religious beliefs influence life decisions		
Agrees	0.68 *** (0.59, 0.78)	0.58 *** (0.48, 0.70)
Disagrees	1.0	1.0

Differences significant at $p \leq .05$*; $p \leq .01$ **; $p \leq .001$***.

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