



Department of Economics Working Paper

Number 13-12 | April 2013

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Adolescent Risk Perception, Substance Use, and Educational Attainment^{*}

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Abstract

This paper studies whether adolescents who are more aware of the risks on substance use in the early teenage years are later less likely to turn into binge drinkers or smokers. It also examines if reduction in substance use, due to high risk perception among adolescents, consequently improves their educational achievement. This research is important for two reasons. First, enhancing risk perception of substance use is an important strategy to prevent the youth from binge drinking and smoking. Second, adolescent substance use and educational achievement are key predictors of adulthood outcomes. We apply a bivariate probit model to a large representative dataset which codes youth risk perception, substance use, and educational attainment. The analysis shows high risk perception lowers the likelihood of substance use among the high school seniors. The resulting low alcohol use increases the chance of attending college and decreases the probability of dropping out of high school. The reduction in cigarette use caused by high risk perception has a similar effect on such two educational outcomes. It also increases high school graduation by 22 percent. Overall, this study suggests that enhancing recognition on the hazards of substance use is an effective policy intervention to reduce adolescent binge drinking and smoking, as well as improve educational attainment.

Keywords: adolescent risk perception; binge drinking; cigarette smoking; educational attainment

JEL Numbers: I12, I18, J24

^{*} We thank Lee Benham, Sebastian Galiani, Bart Hamilton, Tim McBride, Chuck Moul, Karen Norberg, Bruce Peterson, Bob Pollak, and Ping Wang for helpful comments. We are also grateful to Burhan Biner, Oded Izraeli, M. Najeeb Shafiq, Enrica Di Stefano and other participants at the 2008 Washington University Research Conference and the 2009 Midwest Economics Association Meeting.

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1. Introduction

The high prevalence of adolescent smoking and binge drinking is an important public health concern. A recent national health statistics report shows 24.4 percent of adolescents aged 16-17 smoked cigarettes during the past month in the United States from 1999 to 2004 (Fryar *et al.*, 2009). Because smoking is harmful to adolescent health, brain development, and cognitive abilities (Elders *et al.*, 1994; Jacobsen *et al.*, 2005), it can interrupt learning and result in low classroom performance. Use of cigarettes can further interrupt the normal progress of schooling since access to higher education is in part rationed by past academic performance. The same reasoning applies to adolescent binge drinking (Cook and Moore, 1993). 20.9 percent of 16-17 year olds met the definition of binge drinking with five or more drinks of alcohol in a row on at least 1 day in the past month (Fryar *et al.* 2009). While the current evidence is limited on the detrimental effect of smoking on schooling (Mensh and Kandel, 1988), many studies have shown binge drinking leads to adverse educational achievement including early termination, delay in high school graduation, and reduced chance of college attendance (Mullahy and Sindelar, 1989; Cook and Moore, 1993; Renna, 2007). Yet the size of such an impact is controversial (Dee and Evans, 2003).

Enhancing adolescent risk perception of substance use is crucial to prevent the youth from binge drinking and smoking. A theoretical framework for explaining such a health promotion strategy is the health belief model. It states the combined levels of feelings of personal vulnerability to an illness (“perceived susceptibility”) and feelings concerning the seriousness of contracting an illness (“perceived severity”) provide the energy or force for people to take health-related actions. Besides, the perception of benefits (“perceived benefits”) and “perceived” barriers can offer a preferred path of action (Janz and Becker, 1984; Glanz *et al.*, 2008). When adolescents are more aware of the risks on substance use dependency and severity of substance

use-related health problems, by this theory they will reassess the costs associated with alcohol and tobacco use. Consequently, young people with high level of health risk perception are more likely to refrain from binge drinking and smoking. Over the last several decades, many substance use prevention programs in high schools or local communities have integrated strategies adapted from the health belief model (Ellickson *et al.*, 1993; Wiehe *et al.*, 2005). Such interventions can remarkably change adolescent risk beliefs and attitudes on substance use, through disseminating information on the harmful health consequences of binge drinking and smoking or applying other fear-arousal tactics (Connel *et al.*, 1985; Gottlieb and Baker, 1986).

The “health risk awareness” education has received a lot more attention recently, given that many conventional policies on adolescent substance use and abuse are found to be inefficient (Decicca *et al.*, 2000, 2002). Thus far the literature has examined the effectiveness of different tobacco or alcohol use fear-arousal approaches (Flynn *et al.*, 1992; Botvin *et al.*, 1995; Lynagh *et al.*, 1997), compared them with other social reinforcement or developmental behavioral models (Rundall and Bruvold, 1988), and looked at international evidence (Lynagh *et al.*, 1997; Caria *et al.*, 2011). The results of these studies which focus primarily on the immediate effects are quite mixed. And the lasting effect of enhancing health risk awareness is almost unknown in the literature. In particular, no research has addressed whether high risk perception of alcohol or tobacco use can reduce the chance of forming persistent binge drinking or smoking habits through late adolescence.

This paper contributes to the literature by asking two important research questions: (1) Are adolescents who are more aware of the risks on substance use in the early teenage years less likely to turn into binge drinkers or smokers, as they become high school seniors? (2) Does reduction in substance use, due to high risk perception among adolescents, improve their educational achievement? To answer these questions, we analyze a large panel dataset which

provides unique information of health risk perception of substance use and abuse among very young teenagers. The dataset also codes their binge drinking and smoking habits annually as well as tracks their educational performance through high school. This research is similar to those on adult risk awareness of substance use. Such studies construct measures of individual risk perception either with the perceived probability of getting substance use induced diseases (Viscusi, 1991), or with the knowledge of various health risks due to substance use (Kenkel, 1991). This study applies the latter approach to define adolescent risk perception. While the literature has consistently shown that adults with higher risk awareness are more likely to reduce substance use and abuse, this paper is the first to examine whether increasing risk awareness of substance use among adolescents can have a similar impact.

Finally, the findings of this paper are important because they suggest there can be a lifecycle beneficial effect of teenage health risk education on substance use for two reasons. First, the direct adverse impact of binge drinking or smoking on adult earnings is considerable. This is true even when many individual education and health measures are controlled (Hamilton and Hamilton, 1997; Auld, 2005). Increasing youth risk perception can substantially reduce this negative effect, because it can curb addictive substance use in adolescence as shown below thereby reducing adulthood binge drinking and smoking. Second, previous studies also demonstrate that substance use can indirectly reduce the productivity of adult workers through lowering their lifetime educational attainment or on-the-job training accomplishments (Mullahy and Sindelar, 1993; Kenkel and Wang, 1999; Auld, 2005). Such an undesirable effect is also mitigated if adult workers develop high risk perception during adolescence. This is because our analysis indicates reducing substance use through enhancing risk perception among adolescents can improve their educational achievement later on. To summarize, since educational attainment and substance use are critical determinants of adult labor market outcomes, this research

highlights the long term positive effect of early life health promotion.

2. Methods

2.1. Data and Measures

The data for this study come from the National Longitudinal Survey of Youth 1997 (NLSY97), 1997-2003 (wave 1-wave 7). It is a national representative annual survey that followed 8,984 young people born between 1980 and 1984. The base year survey (1997) included rich information on youth characteristics, family background (e.g. family income, parental education), religious preference, risk perception, health behavior, and schooling environment. The subsequent waves asked questions about adolescent alcohol use, cigarette smoking, and test scores. In 2000-2003 the adolescents who participated in this survey reported their educational attainment upon high school graduation.

We define an adolescent to be a binge drinker, if an 11th or 12th grade student in NLSY97 reported having more than five drinks on the same occasion on at least two days in the past month. The teens who smoked on at least one day in the past month are categorized as smokers. The majority of adolescent smokers were frequent cigarette users, since seventy percent of them reported having smoked for more than ten days within the last month. As one unique feature of NLSY97, the randomly sampled 1983 birth cohort was interviewed in 1997 about health risk perception of binge drinking and smoking. Three questions on alcohol use asked the participants if they were aware of the increased risk of developing liver damage, heart disease, or arthritis due to binge drinking. Two other questions in the survey tested whether young people knew smoking can increase the chance of heart disease or HIV infection. We create an indicator of having “high” risk perception of binge drinking for all the respondents who correctly answered at least two questions on alcohol use hazards. A second indicator of “high” risk perception on smoking is made for those who gave the right responses to the two tobacco use questions. There is a large

variation in both variables of high risk perception.

This research examines three measures of adolescent educational attainment: dropping out of high school, high school graduation, and going to college. We construct three corresponding random samples. The first is the college enrollment random sample, where an indicator “Coll” equals 1 if an adolescent in the 12th grade or with a high school degree in the past year (2000, 2001, or 2002) decided to go to college in this year (2001, 2002, or 2003), otherwise it is 0. Note upon year 2000, adolescents of the 1983 birth cohort were old enough to have experienced the onset of substance use, and most of them formed alcohol drinking and smoking habits (Decicca *et al.*, 2002) which influenced their academic performance and incentive to pursue more education. More than ninety percent of the young people born in 1983 had left high school between 2001 and 2003. The second is the high school graduation sample which concentrates on the current 12th grade students between 2000 and 2002. The indicator “HS graduation” is coded as 1 for those who graduated from high school. We assume that binge drinking or smoking during the 12th year discourages high school seniors from graduating in the following year. The third is the high school dropout sample. It consists of the adolescents born in 1983 who were 11th or 12th grade students between 2000 and 2002. The key indicator “Dropping out” equals 1 for those dropping out of high school, otherwise 0. This sample is used to test if reduction in substance use and abuse due to high risk perception decreases the probability of dropping out of high school.

Table 1 reports the weighted descriptive statistics of the dependent variables and the key control variables for all the three samples. The following variables come from wave 1: risk perception, gender, race, ethnicity, religious preference, family income, and parental education. The variables of adolescent religious attendance, substance use, and educational attainment are selected from wave 4 to 7. The overall 8th grade score, the test score of Armed Services

Vocational Aptitude Battery (ASVAB), and the initiation ages of alcohol/tobacco use come from wave 1 to 3. The additional control variables include family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, being late for class frequently, and the schooling environment (teacher-student ratio, fraction of the peers in the teenager’s grade who were engaged in binge drinking/smoking, fraction of the peers who planned to go to college/cut classes).

[Insert Table 1 here]

2.2. Empirical Approach

To address the two research questions above, we apply the following bivariate probit model (Wooldridge, 2001):

$$EDU_{it+1} = 1[\beta_0 + \beta_1 X_{it} + \beta_2 SU_{it} + \beta_3 Y_t + \varepsilon_{it} > 0] \quad (1)$$

$$SU_{it} = 1[\alpha_0 + \alpha_1 X_{it} + \alpha_2 RP_{i,1997} + \alpha_3 Z_{it} + \alpha_4 Y_t + \varepsilon_{it} > 0] \quad (2)$$

where SU_{it} is an indicator of substance user such as binge drinker or smoker of teenager i in year t , and EDU_{it+1} is an indicator of educational achievement of teenager i in year $t + 1$. Equation (1) describes the determination of teen substance use. X_{it} is a vector of individual, parental, family, and school characteristics as mentioned. $RP_{i,1997}$ is an indicator of high risk perception on binge drinking or smoking at early adolescence in the year 1997. Z_{it} consists of “frequent” religious attendance and an indicator of growing up in a “Catholic family” of adolescent i by year t , and Y_t is the year effect. Equation (2) illustrates the determination of adolescent educational outcomes. The estimation of such two equations will show whether high risk perception and religious participation improve teen educational achievement through reducing substance use. Since NLSY97 oversamples Blacks and Hispanics, the annual panel sampling weights are applied. The regression analysis below also controls for the region effect

with robust standard errors reported on all the estimates.

This empirical framework gives consistent estimates of the causal effect of substance use on educational achievement (β_2), with the following two mild conditions. First, the lagged variable $RP_{i,1997}$ is not correlated with the contemporaneous error ε_{it} . In all the three samples, adolescents had formed risk perception three years prior to the observed educational outcomes upon high school graduation. Thus it is unlikely to directly affect the current decision on continuation of schooling. In addition, the current educational outcome or substance use does not influence past risk perception. As another reason, some substance use questions (especially those about HIV/AIDs) also capture the recently discovered health risks of heavy drinking and smoking (Furber *et al.*, 2007). Such updated knowledge contributes to the formation of risk perception along with the earlier information shock (Kenkel, 1991). Hence the overall variation in substance use risk perception is plausibly independent of youth schooling decision. Besides, a key driving force behind the diffusion of risk health knowledge among teenagers is the community or school level health promotion. This intervention usually does not have an impact on academic performance other than reducing substance use. Then again $RP_{i,1997}$ is uncorrelated with the individual unobserved heterogeneity ε_{it} .

As the second condition, Z_{it} affects youth educational attainment only through curbing binge drinking or smoking. Past studies show the frequency of religious activity (level of religiosity) not only affects adolescent substance use and abuse (Chatters, 2000; Miller *et al.*, 2000; Brown *et al.*, 2001), but also can be excluded from the determination equation of educational outcomes (Williams *et al.*, 2003; Renna, 2007) conditional on a variety of individual, parental, family, and school characteristics. Similar arguments apply to the indicator of growing up in a Catholic family. Such a family is more tolerant of youth binge drinking and smoking. As shown in the literature (Hamilton and Hamilton, 1997), both of the religiosity variables can be used to

improve statistical inference on the estimates of substance use. Other than this purpose, this study does not place much emphasis on the religiosity variables, in comparison with risk perception. As a concern on the Catholic family indicator, Catholic teenagers tend to attend Catholic high schools which can raise the chance of going to college (Evans and Schwab, 1995). However, although about 27 percent of the adolescents in our samples were raised in Catholic families, only a few of them attended Catholic schools. Hence, the effect of living in a Catholic family on youth educational attainment is unlikely to operate through teen attending Catholic schools in this study. Instead, it works through curbing teen substance use. This point is corroborated by the results in Table 7.

3. Results

Table 2 reports the estimation results on the relationship between adolescent risk perception, binge drinking, and college enrollment. Column (1) shows an adolescent in the 12th grade (or with high school degree) who has high risk perception of binge drinking in early adolescence or attends religious activities frequently is significantly less likely to later become a binge drinker. Yet growing up in a Catholic family moderately increases the drinking tendency, conditional on certain religious intensity. Note the results suggest the net effect of religiosity on alcohol use is still negative (reducing alcohol drinking), if a Catholic teenager chooses to frequently participate in religious activities. A student who is female, Black, living in an intact family, or started to drink before age 13 has a higher chance of participating in binge drinking. Binge drinking also significantly reduces the probability of going to college especially among the adolescents with low risk perception. The results are similar when the additional school level variables are controlled as shown in Column (2). To see the magnitude of the binge drinking effect, we convert the point estimates in Column (2) into the marginal effects for a reference student who has the average level of all the characteristics. This student is defined as a White male, growing

up in an intact family with middle-level annual income (\$45,000 to \$70,000), with his father and mother having high school degrees. We find if a reference student engages in binge drinking, the probability of going to college will be 12 percentage points lower than the nondrinkers. It is about twice as large as the effect of moving the student from a family in the highest income category to the lowest, twenty percent larger than the impact of shifting the student's mother from the highest education category to the lowest, and almost twice as much as disrupting an intact family.

[Insert Table 2 here]

Table 3 shows the estimates on the model of risk perception, smoking, and college enrollment. Columns (1) and (2) indicate that high risk perception of smoking or regularly attending religious activities significantly reduces the probability that a high school senior becomes a smoker, similar to the binge drinking case. The effect of growing up in a Catholic family is statistically insignificant. We also find that smoking lowers the chance that a high school graduate goes to college by eighteen percentage points. Students who come from higher income families, have better educated mothers, or have higher initial test scores are more likely to pursue college study. Although the estimated effect of binge drinking or smoking is quite large, it can overstate the true impact if there is any underreporting. The results below are also subject to the same caveat.

[Insert Table 3 here]

The empirical framework of Equations (1) and (2) is then applied to the other two educational outcomes. We only report the estimates when all the control variables (including those on school environment) are added in the regressions. Column (1) in Table 4 shows high risk perception at early adolescence lowers the chance of becoming a binge drinker later on, and the estimated impacts of frequent religious attendance and growing up in a Catholic family are similar to Table 3. However, the resulting decrease in binge drinking does not significantly enhance the

probability of high school graduation. In contrast, Column (2) indicates high risk perception of smoking reduces the propensity to smoke among the 12th grade students. This increases the chance of high school graduation in the next year by 22 percent when the point estimate of the smoking effect -0.563 is converted into the marginal effect. Table 5 reports the estimates on the model of adolescent risk perception, substance use, and dropping out of high school. Columns (1) and (2) both indicate that binge drinking or smoking among the 11th or 12th grade students with low risk perception of substance use in early adolescence significantly increases the chance of dropping out of high school. Adolescents who come from higher income families, have better educated parents or higher ASVAB scores are statistically less likely to become high school dropouts.

[Insert Table 4 here]

[Insert Table 5 here]

We then conduct four robustness checks. First, the school fixed effects are included to control for the unobserved school level environment which can affect both adolescent substance use and educational attainment. Table 6 only reports the results on risk perception, religiosity, substance use, and educational achievement for brevity. They are similar to Table 2 through 5. Second, we undertake probit regressions on all the educational outcomes by including risk perception and religiosity. None of the risk perception and religiosity variables is statistically significant in any regression, as indicated in Table 7. This falsification exercise corroborates the validity of excluding them from the educational outcome models.

[Insert Table 6 here]

[Insert Table 7 here]

Next we use a two stage least squares method (2SLS) in which substance use is instrumented by adolescent risk perception and religiosity. The estimates are presented in Table 8, which are

consistent with the previous bivariate probit results. Besides, all the Sargan over-identification statistics are insignificant. Finally, a control function approach is applied, due to the concern of applying instrumental variables for binary outcomes (Terza *et al.* 2008; Wooldridge, 2001). Table 9 demonstrates every included residual of the first stage regression is significant in the educational determination equation. It also suggests low substance use due to high risk perception leads to better educational attainment after we address the endogeneity of binge drinking and smoking. In addition, the outcomes of the first stage regression are reported in Table 10 for the college enrollment sample only to save space. The estimates on the other two samples are similar and available upon request.

[Insert Table 8 here]

[Insert Table 9 here]

[Insert Table 10 here]

4. Discussion

This paper studies whether increasing risk perception of substance use among young teenagers can later on reduce the probability of binge drinking and smoking through adolescence. It also examines if such reduction in youth substance use due to high risk perception can improve educational attainment. We apply a bivariate probit model which addresses the relationship between early life risk perception, late adolescence substance use, and educational attainment. The dataset that we use is very suitable for this research, because it codes unique information of health risk perception on binge drinking and smoking for the adolescents born in 1983 as well as a rich set of individual characteristics, family structures, educational achievement, and school environment. We find high risk perception formed in early adolescence is significantly associated with low substance use in the senior year of high school. The resulting decrease in binge drinking consequently increases the chance of going to college and reduces the risk of

dropping out of high school. Less cigarette use due to high risk perception has a similar effect on such two educational outcomes. It also enhances the chance of high school graduation by 22 percent.

Future research can examine if increasing youth risk perception of substance use has a similar impact on other harmful drugs in addition to alcohol or tobacco products. Our framework is readily extended to study whether reducing substance use due to high risk perception can increase the scores of standard tests such as SAT or ACT. Additional analysis may also use our estimates to conduct a cost benefit analysis of disseminating hazardous information on substance use among adolescents. Overall, this study shows that increasing teenager recognition of the hazards of substance use is effective in decreasing binge drinking and smoking, as well as later on improving educational achievement. It is well known these improvements during adolescence are the key predictors of adulthood low substance use, high educational attainment, and thereby better jobs or high earnings. Hence, policy interventions which enhance youth risk perception can have far reaching beneficial effects on adolescents' lifetime outcomes.

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Table 1: Descriptive statistics of the dependent variables and the key control variables

| Variables | College Enrollment | | High School Graduation | | Dropping out | |
|--|--------------------|-------|------------------------|-------|--------------|-------|
| | Mean | S.D. | Mean | S.D. | Mean | S.D. |
| Binge drinker | 0.19 | 0.39 | 0.18 | 0.38 | 0.16 | 0.36 |
| Smoker | 0.33 | 0.47 | 0.28 | 0.45 | 0.27 | 0.44 |
| College enrollment | 0.42 | 0.49 | — | — | — | — |
| High school graduation | — | — | 0.87 | 0.33 | — | — |
| High school dropout | — | — | — | — | 0.06 | 0.23 |
| High risk perception of drinking | 0.63 | 0.48 | 0.63 | 0.48 | 0.63 | 0.48 |
| High risk perception of smoking | 0.09 | 0.27 | 0.09 | 0.29 | 0.10 | 0.30 |
| Frequent religious attendance | 0.40 | 0.49 | 0.44 | 0.50 | 0.44 | 0.50 |
| Catholic family | 0.26 | 0.44 | 0.27 | 0.44 | 0.25 | 0.43 |
| Female | 0.48 | 0.50 | 0.49 | 0.50 | 0.48 | 0.50 |
| Black | 0.16 | 0.36 | 0.15 | 0.35 | 0.15 | 0.36 |
| Hispanic | 0.13 | 0.34 | 0.12 | 0.33 | 0.12 | 0.33 |
| Born abroad | 0.05 | 0.21 | 0.04 | 0.21 | 0.05 | 0.21 |
| Intact family | 0.57 | 0.50 | 0.60 | 0.49 | 0.59 | 0.49 |
| Family income \$20 to \$45 k | 0.23 | 0.42 | 0.23 | 0.42 | 0.23 | 0.42 |
| Family income \$45 to \$70 k | 0.23 | 0.42 | 0.23 | 0.42 | 0.22 | 0.42 |
| Family income >\$70 k | 0.20 | 0.40 | 0.23 | 0.42 | 0.22 | 0.41 |
| Mother years of education=12 | 0.34 | 0.47 | 0.31 | 0.46 | 0.31 | 0.46 |
| Mother years of education>12 | 0.42 | 0.49 | 0.48 | 0.50 | 0.46 | 0.50 |
| Father years of education=12 | 0.24 | 0.43 | 0.22 | 0.42 | 0.22 | 0.41 |
| Father years of education>12 | 0.30 | 0.46 | 0.35 | 0.48 | 0.34 | 0.47 |
| ASVAB score | 54.70 | 27.95 | 57.65 | 28.10 | 54.33 | 28.56 |
| Overall 8 th grade score> most Bs | 0.41 | 0.49 | 0.46 | 0.50 | 0.44 | 0.49 |
| Drinking initiation age<13 | 0.20 | 0.40 | 0.18 | 0.38 | 0.18 | 0.38 |
| Smoking initiation age<13 | 0.22 | 0.41 | 0.18 | 0.38 | 0.19 | 0.39 |
| Number of Observations | 1786 | 1786 | 1205 | 1205 | 1813 | 1813 |

Table 2: Adolescent risk perception, binge drinking, and college enrollment

| Variables | (1) | | (2) | |
|---|------------------|------------------|-------------------|-------------------|
| | Coll | Binge Drinker | Coll | Binge Drinker |
| Binge drinker | | | | |
| | -0.723(0.106)*** | | -0.586 (0.177)*** | |
| High risk perception of drinking | | -0.176(0.046)*** | | -0.167 (0.044)*** |
| Frequent religious attendance | | -0.437(0.041)*** | | -0.445(0.043)*** |
| Catholic family | | 0.259(0.154)* | | 0.275(0.149)* |
| Female | 0.161(0.095)* | -0.254(0.042)*** | 0.168(0.100)* | -0.258(0.051)*** |
| Black | 0.060(0.046) | -0.581(0.114)*** | 0.076(0.071) | -0.533(0.119)*** |
| Hispanic | -0.053(0.087) | -0.151(0.201) | -0.024(0.085) | -0.132(0.216) |
| Born abroad | -0.185(0.071)*** | 0.121(0.176) | -0.210(0.080)*** | 0.114(0.182) |
| Intact family | 0.224(0.042)*** | -0.118(0.055)** | 0.217(0.075)*** | -0.128(0.061)** |
| Family income \$20 to \$45 k | 0.094(0.111) | -0.054(0.099) | 0.109(0.119) | -0.056(0.106) |
| Family income \$45 to \$70 k | 0.096(0.061) | 0.012(0.059) | 0.111(0.069)* | 0.039(0.070) |
| Family income >\$70 k | 0.201(0.081)** | 0.075(0.129) | 0.199(0.075)** | 0.093(0.135) |
| Mother years of education=12 | 0.084(0.062) | 0.179(0.114) | 0.082(0.045)* | 0.171(0.117) |
| Mother years of education>12 | 0.376(0.083)*** | 0.227(0.111)** | 0.351(0.087)*** | 0.190(0.117)* |
| Father years of education=12 | -0.092(0.181) | -0.066(0.199) | -0.118(0.198) | -0.102(0.219) |
| Father years of education>12 | 0.201(0.143) | -0.238(0.213) | 0.170(0.185) | -0.300(0.214) |
| ASVAB score | 0.007(0.001)*** | 0.000(0.002) | 0.007(0.001)*** | -0.001(0.002) |
| Overall 8 th grade score > most Bs | 0.428(0.085)*** | 0.241(0.092)** | 0.430(0.091)*** | 0.242(0.091)*** |
| Drinking initiation age<13 | -0.040(0.051) | 0.380(0.088)*** | -0.054(0.028)* | 0.368(0.077)*** |
| Intercept | -1.058(0.168) | -1.000(0.132)*** | -1.537(0.092)*** | -1.435(0.188)*** |
| Number of observations | 1786 | 1786 | 1786 | 1786 |

Note: 1. The specification in column (1) also controls for family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently. The one in column (2) further controls for the schooling environment (a high teacher-student ratio, fraction of the peers in the teen's grade who were engaged in binge drinking/smoking, fraction of the peers who planned to go to college/cut classes).

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 3: Adolescent risk perception, smoking, and college enrollment

| Variables | (1) | | (2) | |
|---|------------------|------------------|-------------------|------------------|
| | Coll | Smoker | Coll | Smoker |
| Smoker | -0.667(0.115)*** | | -0.637 (0.104)*** | |
| High risk perception of smoking | | -0.306(0.096)*** | | -0.281(0.096)*** |
| Frequent religious attendance | | -0.383(0.041)*** | | -0.368(0.037)*** |
| Catholic family | | -0.034(0.130) | | -0.023(0.121) |
| Female | 0.235(0.095)** | 0.097(0.052)* | 0.239(0.100)** | 0.061(0.055) |
| Black | -0.004(0.038) | -0.613(0.064)*** | -0.037(0.061) | -0.603(0.065)*** |
| Hispanic | -0.105(0.094) | -0.282(0.203) | -0.091(0.090) | -0.270(0.205) |
| Born abroad | -0.150(0.089)* | 0.182(0.146) | -0.175(0.104)* | 0.217(0.140) |
| Intact family | 0.164(0.077)** | -0.337(0.243) | 0.129(0.101) | -0.323(0.213) |
| Family income \$20 to \$45 k | 0.072(0.153) | -0.117(0.120) | 0.073(0.163) | -0.107(0.118) |
| Family income \$45 to \$70 k | 0.127(0.077) | 0.094(0.167) | 0.136(0.085) | 0.100(0.166) |
| Family income >\$70 k | 0.167(0.063)*** | -0.061(0.135) | 0.158(0.075)** | -0.056(0.129) |
| Mother years of education=12 | 0.097(0.055)* | 0.145(0.185) | 0.103(0.040)*** | 0.121(0.171) |
| Mother years of education>12 | 0.393(0.051)*** | 0.180(0.195) | 0.370(0.053)*** | 0.138(0.188) |
| Father years of education=12 | -0.071(0.217) | 0.001(0.119) | -0.112(0.231) | 0.009(0.109) |
| Father years of education>12 | 0.224(0.164) | -0.138(0.188) | 0.173(0.195) | -0.124(0.163) |
| ASVAB score | 0.008(0.001)*** | -0.000(0.002) | 0.007(0.001)*** | 0.000(0.002) |
| Overall 8 th grade score > most Bs | 0.346(0.074)*** | -0.194(0.099)* | 0.351(0.079)*** | -0.174(0.101)* |
| Smoking initiation age<13 | -0.160(0.124) | 0.516(0.094)*** | -0.145(0.126) | 0.462(0.097)*** |
| Intercept | -0.949(0.104)*** | -0.255(0.349) | -1.294(0.156)*** | -0.849(0.311)*** |
| Number of observations | 1786 | 1786 | 1786 | 1786 |

Note: 1. The specification in column (1) also controls for family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently. The one in column (2) further controls for the schooling environment (a high teacher-student ratio, fraction of the peers in the teen's grade who were engaged in binge drinking/smoking, fraction of the peers who planned to go to college/cut classes).

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 4: Adolescent risk perception, substance use, and high school graduation

| Variables | (1) | | (2) | |
|---|-----------------|------------------|-----------------|------------------|
| | HS Graduation | Binge Drinker | HS Graduation | Smoker |
| Binge Drinker | -0.248(0.523) | | | |
| High risk perception of drinking | | -0.178(0.019)*** | | |
| Smoker | | | -0.563(0.315)* | |
| High risk perception of smoking | | | | -0.270(0.125)** |
| Frequent religious attendance | | -0.427(0.047)*** | | -0.374(0.047)*** |
| Catholic family | | 0.339(0.096)*** | | 0.056(0.090) |
| Female | 0.146(0.097)* | -0.133(0.069)* | 0.161(0.055)** | 0.111(0.085) |
| Black | -0.080(0.131) | -0.491(0.207)** | -0.268(0.155)* | -0.746(0.147)*** |
| Hispanic | 0.072(0.099) | -0.188(0.158) | -0.007(0.075) | -0.267(0.174) |
| Born abroad | -0.052(0.307) | 0.208(0.212) | -0.015(0.202) | 0.392(0.222)* |
| Intact family | 0.247(0.146)* | 0.019(0.088) | 0.193(0.157) | -0.198(0.177) |
| Family income \$20 to \$45 k | 0.073(0.199) | -0.049(0.133) | 0.047(0.238) | -0.002(0.181) |
| Family income \$45 to \$70 k | 0.317(0.124) | 0.193(0.163) | 0.356(0.168)** | 0.288(0.084)*** |
| Family income >\$70 k | 0.408(0.236)* | 0.235(0.193) | 0.415(0.277) | 0.074(0.129) |
| Mother years of education=12 | 0.018(0.130) | 0.149(0.214) | 0.021(0.124) | -0.045(0.234) |
| Mother years of education>12 | 0.099(0.248) | 0.195(0.208) | 0.109(0.233) | -0.004(0.208) |
| Father years of education=12 | 0.067(0.127) | -0.094(0.317) | -0.009(0.128) | 0.053(0.191) |
| Father years of education>12 | 0.020(0.178) | -0.271(0.242) | -0.078(0.149) | -0.189(0.221) |
| ASVAB score | 0.005(0.002)** | -0.001(0.003) | 0.004(0.002)** | 0.001(0.002) |
| Overall 8 th grade score > most Bs | 0.597(0.163)*** | 0.143(0.072)** | 0.564(0.147)*** | -0.225(0.097)** |
| Drinking initiation age<13 | 0.193(0.219) | 0.459(0.165)*** | | |
| Smoking initiation age<13 | | | 0.191(0.275) | 0.549(0.113)*** |
| Intercept | 0.440(0.308) | -1.569(0.269)*** | 0.820(0.257)*** | -1.279(0.254)*** |
| Number of observations | 1205 | 1205 | 1205 | 1205 |

Note: 1. The specifications in column (1) and (2) also control for family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, being late for class frequently, and the schooling environment (a high teacher-student ratio, fraction of the peers in the teen's grade who were engaged in binge drinking/smoking, fraction of the peers who planned to go to college/cut classes).

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 5: Adolescent risk perception, substance use, and dropping out of high school

| Variables | (1) | | (2) | |
|---|------------------|------------------|------------------|------------------|
| | Dropping out | Binge Drinker | Dropping out | Smoker |
| Binge Drinker | 0.714(0.368)* | | | |
| High risk perception of drinking | | -0.178(0.019)*** | | |
| Smoker | | | 0.763(0.300)** | |
| High risk perception of smoking | | | | -0.173(0.054)*** |
| Frequent religious attendance | | -0.316(0.068)*** | | -0.384(0.082)*** |
| Catholic family | | 0.226(0.065)*** | | -0.023(0.085) |
| Female | -0.181(0.094)* | -0.154(0.065)** | -0.244(0.110)** | 0.122(0.080) |
| Black | -0.137(0.124) | -0.502(0.194)** | 0.017(0.160) | -0.597(0.185)*** |
| Hispanic | -0.414(0.092)*** | -0.152(0.043)** | -0.355(0.077)*** | -0.266(0.182) |
| Born abroad | -0.261(0.236) | 0.122(0.168) | -0.233(0.181) | 0.216(0.179) |
| Intact family | -0.061(0.245) | 0.066(0.044) | 0.034(0.249) | -0.023(0.168) |
| Family income \$20 to \$45 k | 0.159(0.168) | 0.015(0.138) | 0.158(0.192) | 0.206(0.086)** |
| Family income \$45 to \$70 k | -0.271(0.213) | 0.123(0.125) | -0.361(0.220)* | 0.422(0.050)*** |
| Family income >\$70 k | -0.295(0.045)*** | 0.275(0.108)** | -0.334(0.072)*** | 0.291(0.131)** |
| Mother years of education=12 | -0.282(0.220) | -0.013(0.139) | -0.320(0.201) | -0.154(0.136) |
| Mother years of education>12 | -0.556(0.228)** | 0.082(0.166) | -0.572(0.221)** | -0.020(0.166) |
| Father years of education=12 | -0.783(0.234)*** | -0.034(0.312) | -0.779(0.280)*** | 0.015(0.091) |
| Father years of education>12 | -0.365(0.117)*** | -0.168(0.209) | -0.349(0.119)*** | -0.204(0.119)* |
| ASVAB score | -0.006(0.003)** | 0.000(0.002) | -0.006(0.003)** | -0.001(0.002) |
| Overall 8 th grade score > most Bs | -0.583(0.141)*** | 0.079(0.053) | -0.511(0.073)*** | -0.314(0.059)*** |
| Drinking initiation age<13 | -0.152(0.176) | 0.480(0.114)*** | | |
| Smoking initiation age<13 | | | 0.124(0.143) | 0.634(0.116)*** |
| Intercept | -0.596(0.327)* | -2.045(0.211)*** | -1.033(0.441) | -1.123(0.153)*** |
| Number of observations | 1813 | 1813 | 1813 | 1813 |

Note: 1. The specifications in column (1) and (2) also control for family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, being late for class frequently, and the schooling environment (a high teacher-student ratio, fraction of the peers in the teen's grade who were engaged in binge drinking/smoking, fraction of the peers who planned to go to college/cut classes).

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 6: Risk perception, substance use, and educational attainment: controlling for school fixed effects

| Variables | (1) | | (2) | | (3) | |
|----------------------------------|----------------------|----------------------|--------------------|----------------------|--------------------|----------------------|
| | Coll | Binge Drinker | HS Graduation | Binge Drinker | Dropping Out | Binge Drinker |
| Binge Drinker | -0.596 (0.155)*** | | -0.273 (0.346) | | 0.849 (0.359)** | |
| High risk perception of drinking | | -0.167 (0.087)* | | -0.149 (0.053)*** | | -0.158 (0.048)*** |
| Frequent religious attendance | | -0.498 (0.102)*** | | -0.482 (0.113)*** | | -0.317 (0.059)*** |
| Catholic family | | 0.335 (0.151)** | | 0.465 (0.118)*** | | 0.296 (0.075)*** |
| Variables | (4) | | (5) | | (6) | |
| | Coll | Smoker | HS Graduation | Smoker | Dropping Out | Smoker |
| Smoker | -0.535 (0.210)** | | -0.666 (0.405)* | | 0.901 (0.491)* | |
| High risk perception of smoking | | -0.271 (0.122)** | | -0.342 (0.132)*** | | -0.186 (0.147) |
| Frequent religious attendance | | -0.348 (0.064)*** | | -0.453 (0.051)*** | | -0.437 (0.086)*** |
| Catholic family | | -0.059 (0.131) | | 0.018 (0.146) | | -0.052 (0.097) |

Note: 1. All the specifications also control for school fixed effects, gender, race, ethnicity, family income, parental education, test scores, the initiation ages of alcohol/tobacco use, family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently.
 2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 7: Educational attainment determination including risk perception and religiosity: probit models

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|----------------------------------|-------------------|----------------------|-------------------|----------------------|--------------------|---------------------|
| | Coll | Coll | HS Graduation | HS Graduation | Dropping Out | Dropping Out |
| Binge Drinker | -0.165 (0.107) | | -0.153 (0.124) | | 0.258 (0.125)** | |
| Smoker | | -0.388 (0.091)*** | | -0.744 (0.172)*** | | 0.630 (0.120)*** |
| High risk perception of drinking | 0.125 (0.081) | | 0.017 (0.117) | | -0.030 (0.112) | |
| High risk perception of smoking | | 0.099 (0.133) | | -0.125 (0.136) | | 0.203 (0.169) |
| Frequent religious attendance | 0.123 (0.080) | 0.100 (0.080) | 0.105 (0.081) | 0.017 (0.093) | -0.230 (0.152) | -0.189 (0.116) |
| Catholic family | 0.103 (0.097) | 0.079 (0.097) | 0.121 (0.156) | 0.025 (0.037) | -0.029 (0.271) | 0.058 (0.149) |

Note: 1. All the specifications also control for ethnicity, family income, parental education, test scores, the initiation ages of alcohol/tobacco use, family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently.
 2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 8: Risk perception, substance use, and educational attainment: two stage least squares (2SLS)

| Variables | (1) | | (2) | | (3) | |
|----------------------------------|---------------------|----------------------|----------------------|----------------------|---------------------|----------------------|
| | Coll | Binge Drinker | HS Graduation | Binge Drinker | Dropping Out | Binge Drinker |
| Binge Drinker | -0.263 (0.126)** | | -0.090 (0.027)*** | | 0.245 (0.088)** | |
| High risk perception of drinking | | -0.033 (0.008)** | | -0.043 (0.011)** | | -0.035 (0.004)*** |
| Frequent religious attendance | | -0.099 (0.007)*** | | -0.090 (0.011)*** | | -0.058 (0.006)*** |
| Catholic family | | 0.074 (0.042) | | 0.087 (0.024)** | | 0.053 (0.020)* |
| Sargan Overid Test | P-value=0.142 | | P-value=0.652 | | P-value=0.582 | |
| Variables | (4) | | (5) | | (6) | |
| | Coll | Smoker | HS Graduation | Smoker | Dropping Out | Smoker |
| Smoker | -0.330 (0.166)** | | -0.157 (0.052)*** | | 0.215 (0.075)*** | |
| High risk perception of smoking | | -0.079 (0.015)** | | -0.067 (0.039)* | | -0.044 (0.015)* |
| Frequent religious attendance | | -0.109 (0.018)** | | -0.121 (0.022)*** | | -0.112 (0.026)** |
| Catholic family | | -0.008 (0.043) | | 0.008 (0.042) | | -0.010 (0.024) |
| Sargan Overid Test | P-value=0.297 | | P-value=0.255 | | P-value=0.741 | |

Note: 1. All the specifications also control for ethnicity, family income, parental education, test scores, the initiation ages of alcohol/tobacco use, family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently.

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 9: Risk perception, substance use, and educational attainment: control function approach

| Variables | (1) | (2) | (3) | (4) | (5) | (6) |
|-------------------------------|---------------------|---------------------|--------------------|----------------------|--------------------|--------------------|
| | Coll | Coll | HS Graduation | HS Graduation | Dropping Out | Dropping Out |
| Binge Drinker | -0.323 (0.162)** | | -0.230 (0.131)* | | 0.245 (0.136)* | |
| Smoker | | -0.400 (0.170)** | | -0.339 (0.114)*** | | 0.215 (0.088)** |
| Residual from the First stage | 0.269 (0.164)* | 0.297 (0.172)* | 0.223 (0.136)* | 0.195 (0.113)* | -0.239 (0.137)* | -0.142 (0.086)* |

Note: 1. All the specifications also control for ethnicity, family income, parental education, test scores, the initiation ages of alcohol/tobacco use, family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently.

2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.

Table 10: Risk perception, substance use, and educational attainment: first stage regressions in 2SLS

| Variables | (1) | (2) |
|-----------------------------------|------------------|------------------|
| | Binge Drinker | Smoker |
| High risk perception of drinking | -0.033(0.008)** | |
| High risk perception of smoking | | -0.079(0.015)** |
| Frequent religious attendance | -0.099(0.007)*** | -0.109(0.018)*** |
| Catholic family | 0.074(0.042) | -0.008(0.043) |
| Female | -0.063(0.012)** | 0.035(0.024) |
| Black | -0.103(0.020)** | -0.197(0.036)** |
| Hispanic | -0.041(0.055) | -0.095(0.060) |
| Born abroad | 0.038(0.045) | 0.115(0.011)*** |
| Intact family | -0.026(0.013) | -0.086(0.070) |
| Family income \$20 to \$45 k | -0.020(0.020) | -0.026(0.030) |
| Family income \$45 to \$70 k | -0.006(0.013) | 0.045(0.055) |
| Family income >\$70 k | 0.013(0.037) | 0.001(0.046) |
| Mother years of education=12 | 0.044(0.025) | 0.035(0.063) |
| Mother years of education>12 | 0.055(0.019)* | 0.038(0.076) |
| Father years of education=12 | -0.020(0.055) | 0.023(0.048) |
| Father years of education>12 | -0.066(0.053) | -0.041(0.045) |
| ASVAB score | -0.000(0.001) | 0.000(0.001) |
| Overall 8th grade score > most Bs | 0.064(0.022)* | -0.067(0.023)* |
| Drinking initiation age<13 | 0.106(0.027)** | |
| Smoking initiation age<13 | | 0.182(0.015)*** |
| Intercept | 0.128(0.033)** | 0.265(0.197) |
| Number of observations | 1786 | 1786 |

Note: 1. The specifications in column (1) and (2) also control for family income missing, parental education missing, grade in 1997, schooling motivation in 1997, occasionally damaging property, having problems limiting school or work, being absent from school frequently, and being late for class frequently.
 2. *** means statistically significant at 1%; ** significant at 5%; * significant at 10%.