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Abstract

Relative deprivation has been associated with lower social and job satisfaction as well as adverse health outcomes. Using Add Health data, we examine whether a student's relative socioeconomic status (SES) has a direct effect on substance use. We advance the existing literature by addressing selection and simultaneity bias and by focusing on a reference group likely to exert the most influence on the respondents. We find that relative deprivation is positively associated with alcohol consumption, drinking to intoxication, and smoking for adolescent males, but not for females. Alternative variable definitions and robustness checks confirm these findings.

Relative Deprivation and Risky Behaviors

I. Introduction

The principal of relative deprivation posits that individuals are adversely affected when they perceive themselves to be socially or economically deprived relative to their peers. Centuries ago, Adam Smith (1776) noted that departures from a reference group's normative consumption level could lead to shame and social disgrace. More recently, relative socio-economic ranking has been shown to affect levels of happiness, job satisfaction, and health status. Luttmer (2005) observes that people whose neighbors earn more than they do tend to be less happy than people whose neighbors earn about the same. Clark and Oswald (1996) find that job satisfaction has less to do with salary *per se* than with salary relative to that of co-workers. Wilkinson (1996) maintains that an individual's life expectancy is a function of her income relative to that of her society. In a longitudinal study of English Civil Servants, Marmot and colleagues (1997) find that job rank is protective against a wide range of diseases, including coronary heart disease and cancer.

This paper further explores the relationship between relative deprivation and health by studying whether risky behaviors—in particular, substance use—can result from the psychosocial stress associated with relative deprivation. Only a few studies have investigated the effects of relative deprivation on health and health compromising behaviors while simultaneously addressing the potential bias caused by unobserved variables at the community level such as social norms or access to health care. Overall, the findings from this literature are mixed. Mellor and Milyo (2003) find little support for the notion that relative deprivation is detrimental to one's health status. Their conclusions are based on an empirical specification that employs lagged measures of state-level income inequality along with controls for regional fixed

effects in order to explain mortality rates. Using a panel of countries, and controlling for country and year fixed effects, Leigh and Jencks (2007) also fail to find support for detrimental health effects associated with relative deprivation. Eibner and Evans (2005), on the other hand, find a significant relationship between relative deprivation and a variety of health outcomes, including mortality, poor self-reported health status, health-related limitations, higher body mass index, and risky health behaviors. To control for unobserved, time-invariant variables that could spuriously confound the association between relative deprivation and health, their analysis adjusts for group fixed effects defined on the basis of state, race, education, and age categories.[1]

Besides conflicting results, other issues are present with these studies. First, the only study with significant findings (Eibner and Evans, 2005) likely suffers from simultaneity between the outcome variables and the relative deprivation measures, which are based on income. While relative deprivation certainly can affect health status, the analyses cannot dismiss the possibility of reverse causality. Second, it is unclear whether the absence of statistically and/or economically significant results (as in Mellor and Milyo, 2003) is due to the lack of a true relative deprivation effect or the inability to define an appropriate peer group. Third, while one of the studies (Eibner and Evans, 2005) examines the association between relative deprivation and risky behaviors among adults, we are not aware of any research dealing with this association at the adolescent level. Adolescence is a critical stage in the formation of health behaviors, and understanding how relative status affects the actions of adolescents may be valuable for the design of policies and treatments.

To directly address these methodological and empirical gaps in the literature, our study explores whether relative deprivation experienced at school increases a high school student's engagement with three risky and relatively common behaviors: alcohol consumption, drinking to

intoxication, and smoking cigarettes. We analyze data from the first wave of the National Longitudinal Study of Adolescent Health (Add Health) and define relative deprivation as a function of the distance between the adolescent's SES and that of her classmates.[2] Since a perfect measure for a student's SES is difficult to conceptualize and construct, we use a proxy measure based on the schooling completed by her head of household. We mitigate selection bias due to the unobserved characteristics of the relevant community by using school fixed effects. While parents often select their children's school, they are unlikely to select the cohort of their child's peers enrolled in the same grade. Our identification strategy is based on a comparison of students in different grades within the same school. By focusing on adolescents and their heads of household's schooling, we reduce the possibility of simultaneity bias, as an adolescent's risky behaviors will not affect the education of her head of household. Finally, the design of Add Health enables us to construct relative deprivation measures at the grade and school level. The availability of information on all students at each school allows us to form a reference group with a high likelihood of influencing individual behavior: peers in the same grade at the same school.

Overall, we find statistically significant and economically large effects of relative deprivation for males. No statistically significant results, however, are present for females. These findings are reinforced through a series of robustness checks involving alternative variable definitions, empirical specifications, and estimation methods.

II. Conceptual Framework and Empirical Approach

Researchers have underscored the role of psychosocial stress as a mediator of the relationship between relative socioeconomic status (SES) and health.[3] The most specific evidence on the role of social rank in creating stress-induced damage comes from studies of primates. Sapolsky (1993) shows that subordinate baboons present higher levels of stress-

induced damage in the blood (elevated cortisol and bad cholesterol) as well as sub-optimal stress-reactivity patterns. Stress-induced damage is also associated with a higher risk of heart disease and stroke. In a more recent study involving the manipulation of social status among macaques, Tung and colleagues (2012) find that low status primates show high levels of activity in genes that are associated with the production of various immune-related cells, chemical signaling factors, and inflammation (a general immune response that involves tissue swelling and increased immune-cell activity in the affected area). Their study demonstrates a key role for gene regulation in linking the social environment to individual physiology. Among humans, the Whitehall studies (Marmot et al., 1997; Marmot, 2004) show that control over job-related tasks (the degree of decision-making authority and skill discretion) mediates the inverse relationship between job rank and coronary heart disease.

In addition to affecting physical wellbeing, psychosocial stress may lead to deviant behavior. According to social control theory (Elliott et al., 1985; 1989), social strain is a critical cause of weak commitment and attachment to conventional society and its role models. Social strain in this context is defined as the discrepancy between an individual's aspirations (academic and occupational) and perceptions of the opportunities necessary to achieve those goals. Because the distance between normative consumption and the likelihood of achieving it decreases with SES rank, relative deprivation is likely to result in strain. Social control theory also suggests that strain strengthens attachment to deviant peers, especially those who experiment with substance use (Petraitis et al., 1995).

Some of the features of Elliot's social control theory have been captured in economics by Akerlof and Kranton's (2000) model of identity choice. These authors integrate the sociological concepts of identity and social categories into the economic utility function. They argue that

economic choices are based not only on individuals' personal preferences but also on their sense of what is considered socially appropriate behavior. What exactly constitutes "appropriate behavior," however, varies according to social identity—a consideration with far-reaching implications for economic outcomes. Individuals select their identities and make consumption decisions accordingly. In this setting, individuals that feel socially excluded from the dominant group because of their race, ethnicity, or SES (relatively deprived subjects) suffer a loss of identity that can lead them to reject the dominant culture and adopt an oppositional identity. Shunning work, taking drugs, engaging in delinquent or violent acts, and other behavior endorsed by this group may appear to members of the dominant group as poor economic decisions, but can be interpreted in light of Akerlof and Kranton's model as a rational response of the non-dominant group to its perceived exclusion from society.

Along the same lines, Fryer and Torelli (2005) find empirical evidence that Blacks generally exhibit less academic effort than Whites because doing so signals an alignment with a White identity. "Acting White" has a high opportunity cost in terms of peer-group loyalty.

Our relative deprivation hypothesis can be empirically examined by first specifying an implicit function of the following form:

(1) $h = f(y, R, X)$,

where *h* denotes the frequency of a risky behavior, *y* measures SES, *R* captures the degree of relative deprivation, and *X* is a vector of individual and reference group explanatory variables. In constructing *R* we follow the approach of Eibner and Evans (2005), which is based on Yitzhaki (1979). Namely, we assume that each individual compares her SES (y_i) to the corresponding average of her peers with higher SES:

(2) $R_i = [E(y|y > y_i) - y_i] \times Prob(y > y_i)$.

Our empirical construct for relative deprivation (*R*) is therefore simply the product of the amount by which the SES of individual *i*'s peers exceeds her own, and the likelihood of this occurring. Our measure of *R* is consistent with Runciman (1966), who claims that an individual is relatively deprived if she 1) does not possess a given good, 2) sees some other person(s) who possesses that good, 3) desires that good, and 4) believes that it is feasible for her to possess or own the good.[4] We assume that the most relevant reference group for an adolescent is that constituted by her classmates.

The explicit form of Equation (1) is

$$(3)\ h_{ik} = \alpha_0 + \alpha_1 y_i + \alpha_2 y_i^2 + \alpha_3 R_{igs} + X_{ip}\varphi + X_{-igs}\delta + I_s\beta + \varepsilon_{gs} + \varepsilon_i,$$

where the subscript *g* references the individual's grade and *s* represents her school. *h* is the number of days in a given year that the individual engages in risky behavior *k*. As a proxy for the individual's SES (*y*), we use the educational attainment of the adolescent's head of household, including a squared term to capture non-linearities.[5] *R* is the relative deprivation measure as defined above. The set of covariates (*X*) includes a vector of personal characteristics—measured at the individual and family level (X_{ip})—and a vector capturing the average demographic characteristics of the individual's classmates (X_{-igs}). Unlike much previous research, we account for the unobserved heterogeneity of the individual's reference group (her classmates) by including a vector of school fixed effects (I_s).[6] Among a group of schoolmates, grade levels are presumably determined exogenously, conditional on the choice of school. Parents may have some influence on which school their child attends, but they typically do not determine which grade their child will be placed in, as it is usually determined by the child's month and year of birth.[7] By including I_s we hope to control, at least partially, for school-level unobserved heterogeneity that could be correlated with an adolescent's behavioral choices. The

error term is composed of two parts: ε_i represents an idiosyncratic, individual-specific error while ε_{gs} is the random component that is determined at the grade and school level.

We estimate Equation (3) using negative binomial regression because *h* is a count variable that measures the number of times a student engages in a health-compromising behavior in a given year.[8] The coefficient of interest, α_3, is associated with the relative deprivation measure. We are not necessarily producing causal estimates for head of household's education and its square, α_1 and α_2, because our analysis cannot dismiss possible correlation between the education of the head of household and unobservable characteristics of the household that are also associated with substance use. We can, however, identify a causal effect of relative deprivation under the assumption that, conditional on head of household's education, the assignment of peers to grades is exogenously determined by the child's birth year.

In our base model, we estimate an abridged version of Equation (3) that controls for an arguably exogenous set of variables—that is, a set of variables that is unlikely to mediate the relationship between relative deprivation and health behaviors. Later, we test the robustness of these results by estimating a more comprehensive specification that takes advantage of the complexity of the Add Health data. We cluster standard errors at the school-grade level in all models.

Our empirical approach can be distinguished from the most recent literature in several ways. First, we use parental education as a proxy for SES. Beyond being a plausible proxy for permanent income, our use of parental education also limits the possibility of reverse causality. The fact that poor health behaviors may be affecting income and thus relative deprivation is probably one of the main methodological concerns in prior research.

Second, we use a student's classroom as the relevant reference group. Other studies construct reference groups based on geographic categories, such as state or MSAs (Millor and Milyo, 2003), or on observable geographic and demographic characteristics including an individual's state of residence, race, education, and age (Eibner and Evans, 2005). These latter authors, however, recognize that "groups defined using such characteristics do not necessarily constitute the unobservable true reference groups. Yet members of such groups have a high degree of similarity and are likely to contain a high proportion of relevant reference people." Thompson and Hickey (2005) define reference groups as "sets of individuals that people refer to when evaluating their [own] qualities, circumstances, attitudes, values, and behaviors." A common assumption is that reference groups must be easily observable by an individual in order to exert influence. This explains why previous studies have incorporated geographic proximity to define the construct. Still, as noted by Eibner and Evans (2005), the underlying characteristics of the group need not be similar to those of the influenced individual. An African American adolescent is as influenced by her White or Hispanic classmates as she is by her African American classmates. Indeed, the relative deprivation principal is grounded in differences, not similarities.

Third, we focus on a group that has received insufficient attention in the relative deprivation literature: adolescents. Understanding the nature of peer influence in the formation of health behaviors probably matters more at this age than at any other. Moreover, our data set is very large and more recent than that of any of the related studies in the literature.

III. Data

This paper uses data collected from the National Longitudinal Study of Adolescent Health or Add Health (Harris et al., 2009). Add Health is a nationally representative survey that

explores the causes of health-related behaviors among adolescents in grades 7 through 12, along with their social-, economic-, and health-related outcomes as they mature into young adults. Our analysis is based on a subsample of the initial school-based survey (the "In School" interview) that was administered to 90,118 students across 175 schools during the 1994-1995 academic year.

We consider the frequency of three risky behaviors as the dependent variables in Equation (3): alcohol consumption, drinking to intoxication, and smoking cigarettes. These variables were constructed using students' responses to the following questions: "During the past 12 months, how often did you 1) drink beer, wine, or liquor; 2) get drunk; 3) smoke cigarettes?" Seven options were offered as possible answers: i) never, ii) once or twice, iii) once a month or less, iv) two or three days a month, v) once or twice a week, vi) three to five days a week, and vii) nearly every day. We calculated how frequently an adolescent engaged in the aforementioned behaviors by using the midpoint of each response category. Thus, the frequency of each risky behavior ranges from 0 to 338 days per year.

Our key explanatory variables are 1) an adolescent's SES (head of household's education), 2) the square of her SES, and 3) relative deprivation. There are a variety of different ways to measure SES. The literature has used definitions based on income, education, occupation, wealth, self-perceived financial status, and other variables. Some of these alternative measures such as income may better reflect an individual's purchasing power whereas others, like education, are likely to be better indicators of social prestige. Unfortunately, respondents were not asked about their household income during the In-School interview. We therefore used the highest level of schooling completed by the head of the household to proxy for household income.[9]

In constructing SES, we first determined whether the adolescent lived with her father and/or mother (biological, step, foster, or adoptive). We then recorded the schooling level completed by this parent. In Add Health, parental schooling is reported as a categorical variable, so we used the midpoints of these categories to form a continuous measure for number of years of completed schooling.[10] Our approach to recoding education is similar to the one used in the National Health Interview Survey (NHIS), a nationally representative survey that contains information on years of schooling completed by the parents of a cohort of similarly aged children.[11] We assume that the head of household is the father unless a respondent reports not living with him, in which case we use the schooling of the mother instead.

The set of controls in our parsimonious baseline specification includes the following person-level characteristics (X_{ip}): age,[12] race (White, Black, Asian, Native American, and other), ethnicity (Hispanic and Non-Hispanic), an indicator for a domestic birth, and the season in which the interview was conducted (fall, winter, or spring) to adjust for any seasonality of alcohol and/or cigarette use. Family-level characteristics include the household size and indicators for a single-father or single-mother household. The set of classmates' characteristics (X_{-igs}) includes the gender, age, domestic birth, racial, ethnic composition, and number of students enrolled in the particular school grade.

The more comprehensive specification, which we use as a first robustness check, adds a set of indicators for the father and mother being born in the U.S., along with various characteristics of the parents' occupations. These include whether the parents work, whether they work in a white- or blue-collar occupation, [13] and indicators for when the child does not know about the working status of her parents. We also include information on the student's tenure at the current school. Specifically, we adjust for whether the student is in her first year at

the school or has been enrolled for one to three years. Finally, we control for participation in school clubs, levels of popularity, and self-perceived social inclusion.

Our final sample includes 65,598 respondents across 141 schools. From the original 85,627 observations with valid identification numbers, we dropped 6,885 respondents who did not answer at least one of the questions corresponding to alcohol and cigarette use. Of the remaining respondents, 10,526 lacked information on parental education while an additional 2,568 respondents were missing at least one value for a variable of interest. Finally, we eliminated 50 observations corresponding to grades with fewer than five students. In total, 23 percent of the sample (20,029 respondents) was dropped due to missing information.

To assess whether our results are generalizable, we compared our sample of 65,598 individuals with the sample corresponding to the individuals who are missing information on at least one of the key questions (see Appendix Table 1). From this exercise, we discovered that adolescents in the analysis sample are 1) less likely to drink 2) slightly more educated, 3) more likely to live with both parents, 4) more likely to be White, non-Hispanic, and 5) more likely to be U.S.-born than the corresponding sample with missing information. Moreover, they have smaller families, and their parents are more likely to be working for pay and working in a white-collar occupation. These findings suggest that our analysis sample may not be representative of the entire U.S. middle- and high-school populations but rather of a subset of households with relatively higher SES.

IV. Results

A. Descriptive Statistics

Table 1 presents mean values for the variables of interest disaggregated by gender. The average frequency of alcohol use in the past 12 months is 25.2 days for males and 13.9 days for

females while the frequency of drinking to intoxication is 16.0 and 7.1 days, respectively. The gender-specific means are more similar when we consider the frequency of smoking tobacco: 46.2 days for males and 44.5 days for females.[14]

Regarding our key explanatory variables, the heads of households have, on average, completed 13 years of schooling. The average relative deprivation index is 1.6 for males and 1.7 for females. As stated above, this index measures the distance between the years of schooling completed by the respondent's head of household—our SES measure—and the corresponding average for classmates with higher SES weighted by the likelihood that the individual's SES is below that of her peers. The probability of this event occurring equals one for adolescents at the lower end of the SES distribution and decreases in magnitude as the adolescent's SES ranking improves. Table 1 also includes two other measures of relative deprivation that will be used in our robustness checks. The mean standardized measure is the ratio of the core relative-deprivation index and the mean school-grade head of household's education.

At the time of the Add Health survey, the average age of all respondents was 15.[15] The overwhelming majority of the sample—64.8 percent of males and 62.1 percent of females—is White. Fifteen percent of males and 18 percent of females are Black. Just over 6 percent of the sample is Asian, 5 percent is Native American, and less than 9 percent indicates another race. Approximately 14 percent of the sample reports being Hispanic while nearly 90 percent of the students are U.S.-born. The vast majority of students (86 percent) were interviewed in the fall.

On average, students have 260 classmates. The average number of household members is 4. Approximately 78 percent of respondents live in a two-parent household while 4.3 (2.5) percent of adolescent males (females) live in a household headed by a single father and 17.2

(20.2) live in a household headed by a single mother. Approximately 83 percent of parents were born in the U.S.

In the next two sections, we describe the estimation results corresponding to Equation (3). Our first specification includes controls for the variables described above as well as school fixed effects. For the sensitivity analysis (Section 4.4), we expand the set of controls to include parental labor-market characteristics and other factors related to the student's involvement in extra-curricular activities at school. Table 2 presents estimates for alcohol use and drinking to intoxication, and Table 3 presents results for frequency of smoking. For ease of presentation, the estimated school fixed effects are not reported in the tables. In Table 4, we calculate the aggregate effects of one additional year of education on the frequency of substance use for male adolescents.

B. Frequency of Alcohol Use and Drinking to Intoxication

Table 2 presents the effects of an individual's SES and the relative-deprivation index on the two measures of alcohol consumption. Columns 1 and 2 correspond to the frequency of alcohol consumption while Columns 3 and 4 correspond to the frequency of drinking to intoxication. The models are run separately for males and females.

The statistically significant effects associated with the person-level controls can be summarized as follows: adolescent males drink more frequently if they are older; non-Black, Native American, or Hispanic; and from a single-parent household. In terms of the primary variables of interest, the education of an adolescent male's head of household and its square have a joint positive (ever increasing) and statistically significant effect on the number of days he consumes alcoholic drinks ($p<0.01$). A one-year increase in the head of household's education increases the adolescent's frequency of alcohol use by approximately half a day for students

whose head of household did not complete high school and by 0.6 to 1.1 days for students whose head of household completed at least high school (see Column (3) of Table 4 for the full estimation of this non-linear effect). The relative deprivation measure has a large positive and statistically significant effect on how frequently adolescent boys drink alcohol ($p<0.01$). Quantitatively, a one-year gap between the education completed by a student's head of household and the education completed by the heads of household of those of his peers with higher SES is associated with 3.3 more days of alcohol consumption during the past year (a 12 percent increase above the mean).[16] Given that the standard deviation of the relative deprivation measure is 1.9, a one standard deviation increase in relative deprivation raises the frequency of alcohol use by 6.3 days per year.

Column 2 of Table 2 presents the results for the female sample. Compared to males, adolescent females also drink more frequently if they are older, born in the U.S., and Native American or Hispanic, but not Asian or African American. In terms of their classmates, they drink more frequently if more of their peers are White or Native American and as their class size increases. If a female belongs to a relatively small and intact family, she consumes less alcohol. While the signs and statistical significance associated with many of the control variables in Column 2 are similar to those in Column 1 (for adolescent males), the coefficient estimates on the key explanatory variables are quite different. Neither the head of household's education nor the relative-deprivation index are statistically significant in explaining alcohol use among females. There is also no joint significance for the head of household's education and its square. The three key measures (head of household's education, education squared, and relative deprivation), however, are jointly significant. While it is difficult to determine which of the effects is dominant, it is noteworthy that they are much smaller in magnitude than those for

males. A one standard deviation increase in relative deprivation increases the frequency of female drinking during the past year by only 0.3 days.

Columns 3 and 4 of Table 2 present estimation results for frequency of drinking to intoxication. Starting with males in Column 3, being older and Native American or Hispanic and living in a non-intact family is associated with a higher frequency of drinking to intoxication. The head of household's education and its square are jointly statistically significant (convex) in explaining how frequently an adolescent male drinks to intoxication. For heads of household who have not completed high school, one more year of completed schooling decreases the frequency of drinking to intoxication by his/her male child. Beyond high school, an additional year of schooling completed by the head of household positively affects how frequently the child drinks to intoxication (the computation is reported in Column (6) of Table 4). This non-linear effect could be due to heterogeneity in the provision and processing of health information (that is, the effectiveness with which information about risks is used in the decision to engage in risky behaviors) and variability in income effects at different education levels. At lower levels of parental education, there is evidence that households are less efficient in producing health (Grossman, 2000). Parents may lack information about the risks associated with alcohol use and/or fail to convey these risks to their children. As the level of education completed by the head of household increases, parents are more likely to help their children internalize the risks associated with alcohol use, and this likely offsets any associated income effects. This trend, however, is reversed at higher levels of education, suggesting that income effects prevail over the efficient production of health at the right tail of the parental education distribution.

The estimated coefficient associated with the relative-deprivation index is statistically significant and has the expected sign. A one-year increase in the relative deprivation gap leads a

male student to drink to intoxication by an additional 2.3 days per year (a 14 percent increase over the mean). In terms of standard deviations, this implies that drinking to intoxication increases by 3.9 days as relative deprivation increases by one standard deviation.

Column 4 in Table 2 presents the drinking-to-intoxication results for adolescent females. The same set of control variables is statistically significant here as in Column 2, with the same signs and very similar magnitudes. Again, none of the SES-related measures are statistically significant individually, but the three measures are jointly significant ($p<0.01$). In terms of magnitude, the non-linear effect of the head of household's education is small. In addition, the relative deprivation effect is much smaller for females than for males, but larger than when analyzing the frequency of any alcohol consumption. A one unit increase in the relative-deprivation index leads to 0.7 more days per year of drinking to intoxication.

C. Frequency of Smoking

Table 3 presents the results when Equation (3) is estimated with frequency of smoking cigarettes as the dependent variable. As before, the models are estimated separately for males and females, and the results are first presented for the most parsimonious specification that uses the control variables reported in Table 1. From Column 1, an adolescent male smokes more often if he is older, White or Native American, U.S.-born, enrolled in a bigger class, and from a single-parent household. In terms of the SES variables, neither an adolescent male's SES nor its square are statistically significant. The relative-deprivation index, however, is large in magnitude and highly significant ($p<0.01$). Specifically, a one-unit increase in the weighted gap between an adolescent male's SES and that of his classmates with a higher SES will result in his smoking almost 6 additional days per year (a 13 percent increase relative to the mean frequency

of smoking). In other words, a one standard deviation increase in the relative-deprivation index translates into 11 more days of smoking in the year (24 percent above the average frequency).

Column 2 presents the results for adolescent females. Unlike the results for males, the estimated effect for an adolescent female's SES suggests a statistically significant non-linear effect ($p<0.01$), which decreases at an increasing rate. One additional year of schooling by the head of household decreases a female student's smoking frequency by 0 to 1 day per year if her head of household is a high school dropout. For students whose head of household has completed at least high school, frequency of cigarette use decreases by 1 to 4 days per year. The coefficient estimate on the relative-deprivation index has the expected sign, but it is small in magnitude and not statistically significant. In terms of the additional controls, frequency of smoking is higher if the adolescent female is older, White or Native American, U.S.-born, enrolled in a class with a greater percentage of White and Native American students, placed in a bigger classroom, from a smaller family, and from a family headed by a single parent. Furthermore, a female student's frequency of smoking increases if her parents are U.S.-born, her mother works in a blue-collar job, and her father works in a blue-collar job or does not work.

To summarize, the results presented in Tables 2 and 3 reveal a positive and statistically significant association between relative deprivation and how frequently adolescent males engage in risky health behaviors. While the estimated coefficients on the relative-deprivation indices have the expected sign for females, they are never statistically significant. For males, there is notable uniformity in the magnitude of the effects over the three outcomes analyzed. A one-unit increase in relative deprivation increases the frequency of alcohol consumption, drinking to intoxication, and smoking by approximately 13 percent.

D. Aggregate effects

Relative deprivation is a function of head of household education. Consequently, a one-year increase in head of household education will affect risky behaviors directly (an effect captured in our model by the linear and quadratic terms for head of household education) and indirectly through a decrease in relative deprivation. Thus, in order to assess the effect of one additional year of head of household's education on the frequency of adolescent substance abuse we need to aggregate these effects.

Referring to Equation (3), the aggregate effect of an additional year of education (y_i) on health behavior h_{ik} is calculated as:

$$(4)\ \frac{dh_{ik}}{dy_i} = \alpha_1 + 2\alpha_2 y_i + \alpha_3 \frac{dR_{igs}}{dy_i}.$$

Because relative deprivation is a non-continuous function of education, we cannot easily compute the derivative on the right-hand side algebraically. Instead, we estimate it numerically using the data joint distribution of head of household education and relative deprivation.[17] Table 4 presents these estimates as well as the direct, indirect, and aggregate effects of one additional year of education on the frequency of drinking (Columns (3) to (5)), drinking to intoxication (Columns (6) to (8)), and smoking (Columns (9) to (11)) for males. Results for females are not reported (due to lack of statistical significance), but are available upon request.

To demonstrate the calculations, a change in head of household education from 11 to 12 years (high school completion) directly increases the drinking frequency of adolescent males by 0.7 days (main and quadratic effects) and indirectly decreases it by 3.1 days when considering only the relative deprivation effect.[18] Overall, household high school completion results in a decrease in the frequency of alcohol consumption of 2.415 days for male children. The effects are quite different at higher points of the household education distribution. The relative deprivation effect of having a parent who did not complete college versus one who did (15 vs. 16

years of education) does not offset the main and quadratic effects, resulting in an aggregate positive effect. In this case a one-year increase in the head of household's education raises alcohol consumption by 0.131 days. Results are similar when analyzing the frequency of drinking to intoxication. To summarize, the relative deprivation effect prevails at lower ranges of the household education distribution, but falls off behind a stronger main and quadratic effect by the point of college graduation.

E. Sensitivity Analysis

We performed a series of robustness checks (available upon request from the authors) to determine how sensitive estimates of the core model (those found in Tables 2 and 3) are to changing specifications and variable definitions. We first re-estimated the models using a more comprehensive, but arguably more endogenous set of controls. This set of variables includes parental job characteristics (whether the father and mother work for pay and whether their job is white or blue collar), school tenure (number of years an adolescent has attended her current school), student's involvement in school-based extracurricular activities (for example, arts and sports clubs), and measures of social inclusion (the number of friend nominations received by each student from her peers at school[19] and a student's perception of social inclusion[20]). These latter measures could be mediating the association between relative deprivation and health-compromising behaviors. Empirically, we find that the sequential addition of these measures does not alter the marginal effects of interest in a meaningful way. In fact, the effect sizes for males get slightly larger, but there are no significant changes in the estimated parameters for females (see Appendix Tables 2, 3.1, 3.2, and 3.3 for these sensitivity checks).

We estimated yet another set of models that involved alternative definitions of relative deprivation (R), all of which are based on different functions of the gap between the schooling

completed by the student's head of household and the schooling completed by the heads of household of her peers (see Appendix Tables 4.1, 4.2, and 4.3). We began by using Deaton's (2001) measure of relative deprivation. This measure is simply the ratio of our relative-deprivation index to the mean SES measure corresponding to one's classmates ($\frac{R}{Y_{-igs}}$). Defining relative deprivation in terms of the mean SES for a student's classmates yields a relative-deprivation index that is insensitive to changes in the scale in which SES is expressed. The estimated effects of this alternative relative deprivation measure are still statistically and economically significant in explaining the frequency of alcohol consumption and smoking among males. A one standard deviation increase in this normalized relative-deprivation index increases the frequency of drinking by 7 days and the frequency of smoking by 11.5 days. The estimated effect on how frequently a male drinks to intoxication is similar in magnitude as before but slightly less significant ($p<0.10$). Even with the new relative deprivation measure, the estimated effects on risky behaviors remain non-significant for female students.

As a second alternative for relative deprivation, we redefined R to be $[1 - F(y > y_i)]$, where $F(y)$ is the distribution function of the student's SES. Defining R in this manner allows us to capture the ordinal ranking of the SES distribution across students. The estimated effects of rank on the frequency of alcohol consumption and drinking to intoxication are statistically non-significant for adolescent males. The estimated effect is also non-significant for adolescent females in the case of drinking frequency. There is, however, a negative and marginally significant effect ($p<0.10$) for females when analyzing the frequency of drinking to intoxication. Females who rank lower in the SES distribution of their peers are likely to drink to intoxication more frequently. There is also a strong negative effect of SES rank on how frequently females smoke: a one standard deviation increase in SES rank decreases smoking by 9 days per year. For

males, the estimated coefficient for SES rank on smoking frequency is also marginally significant ($p<0.10$). The magnitude, however, is smaller for males than that for females and smaller than the initial relative-deprivation measure. The key difference between the relative-deprivation measure used in the core model and the measure based on SES rank is that the latter does not adjust for the degree of separation in status. Thus, the originally estimated effects for relative deprivation, at least for alcohol use among males, are more likely due to the degree of separation in status between the respondent and those ranked above him rather than his rank *per se*. For females, however, individual rank may be more relevant than the degree of separation.

Another sensitivity check involved alternative definitions of our SES measure (see Appendix Tables 5.1, 5.2, and 5.3). Instead of substituting unobserved household income with the head of household's completed schooling (father's education if the father was present and mother's if not), we considered the minimum, maximum, and average parental schooling level as well as the mother's and father's completed schooling. The relative-deprivation index continues to be statistically and economically significant for males when the household SES is defined as either the maximum level of parental schooling or the mother's level of schooling. In the former case, the estimated effects of relative deprivation are twice as large as those in the core model. The average level of parental schooling and the father's schooling are statistically significant in explaining the frequency of drinking and the frequency of smoking, but not the frequency of drinking to intoxication. For adolescent females, the estimated coefficients on the new relative-deprivation measures remain non-significant in most cases. The exception to this is when the household's SES is defined as the number of years of schooling completed by the mother. In this case, the relative-deprivation index becomes both statistically and economically significant in explaining all three risky behaviors. These results support previous research suggesting that

parents individually have a greater influence upon children of their gender (Balsa et al., 2009; Morgan et al., 2010).

The negative binomial technique is used to address over-dispersion in our count dependent variables (frequencies of drinking alcohol, drinking to intoxication, and smoking). An abundance of zeroes, however, also appear on the left side of the distribution (ranging from 44% of observations stemming from respondents who never drank alcohol and 68% of observations pertaining to respondents that never drank to intoxication). We considered running zero-inflated negative binomial models to address the relatively high prevalence of zeros, but no satisfactory instruments are available to predict the prevalence of any occurrence without also predicting frequency. Rather than identifying prevalence (zero-inflation) entirely through functional form, we decided to use the standard negative binomial technique for all models.

We also investigated whether Equation (3), which includes a linear and quadratic SES term in addition to a relative deprivation index, fits the data better than a simpler specification that only includes the linear and quadratic SES terms. For this purpose, we compared the two specifications using the Akaike Information Criterion (AIC). The AIC is a "goodness-of-fit" measure that imposes a penalty for increasing the number of estimated parameters in the equation (it discourages over-fitting the data). According to the AIC, the model in Equation (3) fits the data better for males than the alternative that excludes the relative deprivation measure. For females, when assessing the frequency of drinking and smoking, the preferred model is the one that excludes the relative-deprivation measure, which is consistent with our failure to find statistically significant effects of relative deprivation. Equation (3), however, remains the preferred specification for frequency of drinking to intoxication among females.

Finally, our identification strategy would be challenged if household education was not exogenous across grades within schools. A positive correlation would make it hard to distinguish between the relative deprivation measure and the parent's education measure. We assessed this issue by correlating average household education across grades after adjusting for school fixed effects. Specifically, we correlate the average residuals of a regression of household education on school identifiers across grades. Results show that once we condition on schools, there remains no positive correlation in the distribution of household's SES across grades that could potentially confound the measure of relative deprivation with the parent's education measure.[21]

F. Limitations

Our data, measures, and analysis have some limitations that should be mentioned. First, we are not necessarily identifying the direct causal effects of parental education on substance use. Rather, we examine relative deprivation conditional on parental education. Our source of exogenous variation is provided by the assignment of children with similar household backgrounds to different grade cohorts within the same school. These different cohorts provide the needed variation in our SES measure.

Second, our results may not be fully representative of the high school population in the U.S. As noted earlier, we lost about 25 percent of the original sample due to missing values for one or more of the key variables. The analysis sample is more educated, uses substances at a lower frequency, is more likely to be White, and is more likely to live in households with employed parents. Most importantly, the analysis sample exhibits lower scores for relative deprivation than the excluded group of students.

Finally, our results could be biased if students underreport risky behaviors and if the degree of underreporting is correlated with head of household education. If this correlation is negative (that is, if underreporting is more common among students at the lower echelon of the SES distribution), then the estimated effects are probably smaller than the true effects. Even if misreporting of risky behaviors is not significantly related to SES, random measurement error could also bias our estimates towards zero.

5. Discussion and Conclusion

This paper explores the relationships between relative deprivation and engagement in risky behaviors among adolescents enrolled in middle school and high school in the U.S. We use the head of household's completed schooling as a proxy for an adolescent's SES, which forms the basis for our relative-deprivation measure. Unlike much of the existing research on relative deprivation, we address selection bias (the fact that individuals choose to interact with people that are similar to themselves) by incorporating fixed effects at the school level. This allows us to eliminate the effects of social norms, policies, institutional factors, and other unobserved influences from the community that could simultaneously affect the degree of inequality in the community and a student's behavior. Furthermore, the level of disaggregation we achieve is finer than that of most of the literature, which defines the community at the state-, county-, or neighborhood-level. This is a notable contribution because some of the small and/or statistically non-significant effects found in much of the prior literature could be due to broadly defined reference groups. Using data collected from Add Health, we construct our reference group based on an adolescent's most relevant community—her school. Finally, focusing on adolescent behaviors and allowing parental education to serve as our SES indicator reduces and possibly

eliminates the simultaneity bias often found in other studies that relate SES inequality with adult outcomes.

We find that our measure of relative deprivation has a positive, statistically significant, and economically meaningful effect on the three measures of risky behaviors (frequency of any alcohol consumption, drinking to intoxication, and smoking) for males, but not for females. The estimated marginal effects suggest that a male student will drink, possibly to the point of intoxication, 4 to 6 more days per year for every one standard-deviation increase in his relative deprivation. In terms of smoking, the same unit increase in his relative deprivation generates 11 more days of smoking per year.

Our results also show that an additional year of schooling completed by the head of household is associated with a statistically significant increase in the frequency of drinking by adolescent males (the direct effect). Considering that education is a proxy for household income, this relationship suggests the presence of an income effect. Our estimation results also show a significant negative relationship between head of household education and the frequency of drinking to intoxication for males in households with low levels of education. Although these findings are not necessarily causal, the associations could be indicative of two counteracting effects: greater efficiency in the production of health as parental education increases (Grossman, 2000) and more pronounced income effects (given by greater access to financial resources) for adolescents in households with higher parental education. Neither of these relationships, however, is statistically significant for adolescent females. The only significant direct SES effect for females is a lower frequency of cigarette use as head of household education increases. We performed numerous sensitivity checks and confirmed that our results are robust to alternative specifications that alter the sets of controls and the construction of the key variables.

Our findings have both research and policy implications. From a research perspective, it is important to clearly define the relevant community, analyze multiple behaviors, conduct gender-specific analyses, address simultaneous influences, and control for community-level fixed effects. As evidenced in the prior literature, the relative standing of an individual in her peer group appears to affect not only her attitudes such as happiness, isolation, or job satisfaction, but also her behavior (for example, her use of substances). Theoretically, this behavior can be explained by a reaction to psychosocial stress, as articulated by sociologists in Social Control Theory (Elliott et al., 1985; 1989), by such biologists as Sapolsky (1993), and by economists Akerlof and Kranton (2000) and Fryer and Torelli (2005). We hope that future research continues to explore these alternative economic, sociological, and biological pathways.

Another interesting finding from our research is that adolescent males seem to react more to relative deprivation than adolescent females, at least in terms of substance use. One possible explanation is that males are more likely than females to demonstrate externalizing behaviors (aggressive or disruptive activities) as a reaction to stress (Leadbeater et al., 1999). Alternatively, and as suggested by our sensitivity analysis, females could be more responsive to maternal than paternal education. More research with adolescent samples is needed to better understand these gender differences.

The policy implications of this study are also important, yet the best course of action is not immediately apparent. Policy options could include school-based programs to support low-SES students and redistribute resources in a way that address their needs. This could be achieved by tailoring psychological services and tutoring to low-SES students as well as developing educational and school-related activities that promote social integration of the students and their families. Such solutions could be counterproductive, however, by drawing

attention to an individual's SES and thereby increasing the relative deprivation effect. Moreover, if relative deprivation is a proxy for social rank, then it may be difficult or impossible to effectively address the underlying disparities, and SES adjustments might simply cause another personal attribute (such as intelligence, athletic ability) to become the key factor in the relative deprivation equation. Given these concerns associated with resource redistribution and augmented social services, traditional sanctions and price policies may be the most effective approach for discouraging smoking and drinking among the young since they don't overly discriminate based on SES and could therefore have a more pronounced effect for lower income groups. [22] Thus, while it may be possible eventually to incorporate these research findings into policy prescriptions, there are still too many ambiguities and unanswered questions surrounding the mechanisms in question to strongly advocate for a particular strategy.

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Table 1: Descriptive Statistics

	Males		Females	
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**
	(1)	(2)	(3)	(4)
Dependent variables				
Frequency of drinking alcohol in past 12 months[a]	25.232	64.299	13.871	39.707
Frequency of drinking to intoxication in past 12 months[a]	15.965	53.918	7.096	29.571
Frequency of smoking cigarettes in past 12 months[a]	46.239	107.200	44.525	105.451
SES and relative deprivation measures				
Head of household education[b]	13.800	3.548	13.506	3.434
Relative deprivation[c]	1.628	1.854	1.684	1.817
Mean standardized relative deprivation[c]	0.120	0.138	0.126	0.137
Head of household's education, grade percentile rank	0.366	0.263	0.348	0.259
Individual characteristics				
Age	15.187	1.663	14.998	1.658
Race				
White	0.670	0.470	0.655	0.475
Black	0.150	0.357	0.185	0.388
Asian	0.068	0.252	0.062	0.241
Native American	0.050	0.219	0.055	0.228
Other race/ethnicity	0.087	0.282	0.083	0.276
Hispanic ethnicity	0.145	0.352	0.141	0.349
U.S.-born	0.893	0.309	0.905	0.293
Season of interview				
Fall	0.858	0.349	0.855	0.352
Spring	0.089	0.284	0.087	0.282
Winter	0.053	0.224	0.057	0.232
Grade-level characteristics				
Number of students in grade	263.565	138.948	261.728	139.841
Basic household characteristics				
Household size	4.265	1.126	4.317	1.120
Single father household	0.043	0.203	0.025	0.156
Single mother household	0.173	0.379	0.203	0.402
Two-parent household	0.783	0.412	0.772	0.419
Number of observations (N)	31,635		33,963	

Source: Add Health, In-School Survey.

Notes: a. Figures are expressed in terms of days. b. Figures are expressed in terms of years. c. Relative deprivation measure is based on the head of household's education.

Table 2: Effect of Relative Deprivation on Frequency of Alcohol Use

	Drinking Frequency		Frequency Drinking to Intoxication	
	Males	**Females**	**Males**	**Females**
Explanatory Variables	(1)	(2)	(3)	(4)
Head of household's education[a]	0.021	-0.992	-2.077	-0.213
	(1.551)	(1.163)	(1.678)	(0.959)
Head of household's education squared[b]	0.028	0.031	0.088**	0.011
	(0.041)	(0.030)	(0.044)	(0.026)
Relative deprivation[c]	3.327***	0.311	2.297**	0.708
	(0.998)	(0.741)	(0.999)	(0.609)
Age	5.928***	3.261***	4.594***	2.298***
	(0.686)	(0.532)	(0.664)	(0.444)
Black	-3.765*	-1.982*	-2.306	-1.793**
	(2.013)	(1.047)	(1.767)	(0.877)
Asian	-0.251	-4.239***	3.308	-2.379**
	(2.234)	(1.612)	(2.098)	(1.198)
Native American	13.563***	4.641***	10.512***	1.979**
	(2.160)	(1.045)	(2.202)	(0.863)
Other race	4.092**	2.523**	3.998**	1.507*
	(1.852)	(1.137)	(1.709)	(0.814)
Hispanic ethnicity	5.469***	3.851***	4.944***	2.716***
	(1.731)	(1.012)	(1.576)	(0.848)
U.S.-born	0.477	4.052***	1.759	2.653***
	(1.511)	(1.055)	(1.377)	(0.832)
Interviewed in spring	-34.312***	8.380	-19.850**	4.224
	(9.389)	(7.991)	(9.755)	(6.509)
Interviewed in winter	27.376***	17.277***	27.321***	13.334***
	(5.445)	(5.333)	(5.703)	(4.579)
Grade-level % male	0.097	2.239	-3.644	-3.968
	(13.891)	(8.801)	(11.391)	(6.831)
Grade-level age	1.078	0.626	0.463	-0.175
	(0.954)	(0.639)	(0.872)	(0.508)
Grade-level % Black	-69.298***	-50.554***	-52.642***	-50.469***
	(19.803)	(10.565)	(17.697)	(10.282)
Grade-level % Asian	36.338	-13.704	32.044	-2.889
	(27.397)	(16.888)	(24.001)	(12.854)
Grade-level % Native American	36.258	55.905***	41.423	37.235**
	(31.676)	(20.195)	(26.589)	(17.461)
Grade-level % other race	-60.460**	-18.970	-42.018	-11.522
	(30.686)	(18.107)	(32.247)	(14.394)
Grade-level % Hispanic	30.824	-10.156	21.151	-17.507
	(21.733)	(16.247)	(20.706)	(13.052)
Grade-level % U.S.-born	21.119	11.022	15.018	3.931
	(22.187)	(12.749)	(20.348)	(10.625)
Number of students in grade	0.020	0.037***	0.010	0.023***
	(0.014)	(0.008)	(0.012)	(0.007)
Household size	-0.743**	-0.979***	-0.432	-0.353*
	(0.365)	(0.246)	(0.337)	(0.198)
Single father household	6.508***	5.263***	7.673***	4.284***
	(1.917)	(1.455)	(1.995)	(1.092)

Single mother household	5.172***	3.838***	5.961***	2.778***
	(1.160)	(0.649)	(1.215)	(0.535)
N	31,635	33,963	31,635	33,963
Joint significance a, b: Prob>χ^2	0.005	0.438	0.000	0.543
Joint significance a, b, c: Prob>χ^2	0.000	0.000	0.000	0.000

Note: The marginal effects from the negative binomial regression are reported with standard errors in parentheses. Each model includes a constant and school fixed effects. All schooling and grade levels are expressed in years. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Table 3: Effect of Relative Deprivation on Smoking Frequency

	Males	**Females**
Explanatory Variables	(1)	(2)
Head of household's education[a]	3.091	3.575
	(3.192)	(4.021)
Head of household's education squared[b]	-0.088	-0.189*
	(0.083)	(0.109)
Relative deprivation[c]	5.964***	2.655
	(1.920)	(2.436)
Age	13.504***	13.728***
	(1.307)	(1.832)
Black	-45.976***	-67.998***
	(4.241)	(4.859)
Asian	5.631	-6.825
	(4.536)	(5.633)
Native American	26.928***	17.351***
	(3.687)	(4.063)
Other race	1.395	3.214
	(3.494)	(4.426)
Hispanic ethnicity	-2.134	-3.038
	(2.890)	(3.350)
U.S.-born	5.659*	16.073***
	(3.042)	(3.727)
Interviewed in spring	-94.898***	-103.521***
	(36.722)	(30.749)
Interviewed in winter	36.940**	22.046
	(17.941)	(21.922)
Grade-level % male	17.002	-17.838
	(27.990)	(33.968)
Grade-level age	-0.926	2.307
	(1.818)	(2.171)
Grade-level % Black	-96.812**	-150.086***
	(38.891)	(47.506)
Grade-level % Asian	-34.961	-18.678
	(53.789)	(57.175)
Grade-level % Native American	125.728*	194.916**
	(64.658)	(76.576)
Grade-level % other race	1.066	-131.991*
	(53.742)	(75.094)
Grade-level % Hispanic	51.337	42.818
	(41.138)	(66.778)
Grade-level % U.S.-born	27.742	-30.300
	(47.489)	(57.672)
Grade-level number of students	0.077***	0.198***
	(0.030)	(0.038)
Household size	-0.754	-2.329***
	(0.704)	(0.797)
Single father household	18.221***	29.141***

	(3.124)	(4.518)
Single mother household	16.592***	18.516***
	(2.236)	(2.243)
N	31,635	33,963
Joint significance a, b: Prob>χ^2	0.505	0.000
Joint significance a, b, c: Prob>χ^2	0.000	0.000

Note: The marginal effects from the negative binomial regression are reported with standard errors in parentheses. Each model also includes a constant and school fixed effects. All schooling and grade levels are expressed in years. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Table 4: Aggregate Effects of Household Education on Males' Frequency of Substance Use

Coefficients \ Outcomes	Drinking Frequency			Frequency Drinking to Intoxication			Smoking Frequency		
Household educ. (α_1)	0.021			-2.077			0 (NS)		
Household educ. squared (α_2)	0.028			0.088			0 (NS)		
Relative deprivation (α_3)	3.327			2.297			5.964		
Head of household education	Relative deprivation	Main and quadratic effects of education (α_1+2α_2y)	Relative deprivation effect (α_3*dRd/dy)	Aggregate effect	Main and quadratic effects of education (α_1+2α_2y)	Relative deprivation effect (α_3*dRd/dy)	Aggregate effect	Main and quadratic effects of education (α_1+2α_2y)	Relative deprivation effect (α_3*dRd/dy)	Aggregate effect
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
5	7.737									
6	6.828	0.357	-3.021	-2.664	-1.021	-2.086	-3.107	0.000	-5.416	-5.416
7	5.924	0.413	-3.009	-2.596	-0.845	-2.078	-2.923	0.000	-5.395	-5.395
8	4.734	0.469	-3.957	-3.488	-0.669	-2.732	-3.401	0.000	-7.094	-7.094
9	3.817	0.525	-3.052	-2.527	-0.493	-2.107	-2.600	0.000	-5.471	-5.471
10	3.135	0.581	-2.268	-1.687	-0.317	-1.566	-1.883	0.000	-4.066	-4.066
11	2.490	0.637	-2.147	-1.510	-0.141	-1.483	-1.624	0.000	-3.849	-3.849
12	**1.556**	**0.693**	**-3.108**	**-2.415**	0.035	**-2.145**	**-2.110**	**0.000**	-5.571	**-5.571**
13	1.459	0.749	-0.322	0.427	0.211	-0.222	-0.011	0.000	-0.577	-0.577
14	1.044	0.805	-1.383	-0.578	0.387	-0.955	-0.568	0.000	-2.479	-2.479
15	0.787	0.861	-0.854	0.007	0.563	-0.590	-0.027	0.000	-1.532	-1.532
16	**0.550**	**0.917**	**-0.786**	**0.131**	0.739	**-0.543**	**0.196**	**0.000**	-1.409	**-1.409**
17	0.374	0.973	-0.587	0.386	0.915	-0.405	0.510	0.000	-1.053	-1.053
18	0.219	1.029	-0.515	0.514	1.091	-0.355	0.736	0.000	-0.923	-0.923
19	0.052	1.085	-0.555	0.530	1.267	-0.383	0.884	0.000	-0.995	-0.995
20	0.000	1.141	-0.174	0.967	1.443	-0.120	1.323	0.000	-0.312	-0.312

NS: not statistically significant

Appendix 1
Appendix Tables

Appendix Table 1: Comparison of Core Sample with Sample of Dropped Observations

	Core Sample	Dropped Sample		Difference
	(N=65,598)	N	Mean	t-test significance
Frequency of drinking alcohol in past 12 months	19.350	14,227	23.317	***
Frequency of drinking to intoxication in past 12 months	11.373	13,746	16.570	***
Frequency of smoking cigarettes in past 12 months	45.352	14,416	44.884	
Head of household's education	13.648	7,338	12.584	***
Relative deprivation[3]	1.657	7,292	1.930	***
Male	0.482	19,495	0.562	***
Age	15.089	19,669	14.711	***
Black	0.168	20,029	0.268	***
Asian	0.065	20,029	0.086	***
Native American	0.053	20,029	0.061	***
Other race	0.085	20,029	0.133	***
Hispanic ethnicity	0.143	20,029	0.262	***
U.S.-born	0.899	20,029	0.794	***
Interviewed in spring	0.088	20,029	0.088	
Interviewed in winter	0.055	20,029	0.035	***
Grade size	262.614	20,029	258.853	***
Household size	4.292	17,145	4.380	***
Single father household	0.034	20,029	0.033	
Single mother household	0.189	20,029	0.172	***

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 2: Descriptive Statistics for Variables Used in the Sensitivity Checks

	Males		Females	
	Mean	Standard Deviation	Mean	Standard Deviation
Parental characteristics				
Parents' place of birth				
Father is U.S.-born[a]	0.685	0.465	0.660	0.474
Mother is U.S.-born[b]	0.793	0.405	0.816	0.388
Father's job characteristics[a]				
Father works for pay	0.778	0.416	0.741	0.438
Father is not working	0.042	0.200	0.043	0.202
Unknown if father works for pay	0.364	0.481	0.316	0.465
Father is white-collar worker	0.017	0.131	0.023	0.149
Unknown if father is white-collar worker	0.077	0.267	0.096	0.295
Mother's job characteristics[b]				
Mother works for pay	0.758	0.428	0.761	0.426
Unknown if mother works for pay	0.218	0.413	0.226	0.418
Mother is not working	0.548	0.498	0.535	0.499
Mother is white-collar worker	0.035	0.183	0.040	0.196
Unknown if mother is white-collar worker	0.075	0.264	0.083	0.276
Individual's school characteristics				
Tenure				
First year at current school	0.276	0.447	0.273	0.445
1-3 years at current school	0.784	0.412	0.788	0.409
Extracurricular school activities				
Arts club	0.187	0.390	0.339	0.473
Sports club	0.626	0.484	0.517	0.500
Other clubs	0.359	0.480	0.530	0.499
Social inclusion				
Number of friend nominations	4.144	3.677	4.576	3.555
Perception of social inclusion	3.674	0.887	3.592	0.891

Notes: a.Only for fathers living with the respondent. b.Only for mothers living with the respondent.

Appendix Table 3.1: Effects of Relative Deprivation on Drinking Frequency—Alternative Sets of Controls

	Males			Females		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	-0.849	-0.248	0.546	-1.814	-1.832	-1.583
	(1.562)	(1.581)	(1.687)	(1.249)	(1.202)	(1.182)
Head of household's education squared	0.052	0.038	0.022	0.040	0.045	0.043
	(0.041)	(0.041)	(0.044)	(0.033)	(0.032)	(0.031)
Relative deprivation	2.789***	3.121***	3.559***	-0.587	-0.485	-0.386
	(1.026)	(1.045)	(1.112)	(0.805)	(0.791)	(0.775)
Father is U.S.-born	---	2.892	2.619	---	1.701	2.176*
		(1.799)	(1.872)		(1.179)	(1.160)
Father works for pay	---	-3.935	-2.081	---	-0.254	1.153
		(3.364)	(3.278)		(2.179)	(2.161)
Father is not working	---	0.565	0.584	---	2.533	2.908
		(3.113)	(3.161)		(1.821)	(1.894)
Father is white-collar worker	---	-0.539	-0.777	---	-0.891	-0.645
		(1.234)	(1.250)		(0.674)	(0.691)
Unknown if father works for pay	---	4.559	5.437	---	-5.451**	-4.189
		(4.932)	(4.857)		(2.605)	(2.747)
Unknown if father is white-collar worker	---	2.755	2.221	---	-0.618	-0.703
		(2.019)	(2.060)		(1.021)	(1.123)
Mother is U.S.-born	---	1.292	1.894	---	1.480	2.064*
		(1.913)	(1.929)		(1.094)	(1.096)
Mother works for pay	---	-0.716	0.329	---	1.408	1.046
		(2.244)	(2.288)		(1.155)	(1.182)
Mother is not working	---	0.648	1.866	---	-0.510	-1.267
		(2.121)	(2.177)		(1.197)	(1.225)
Mother is white-collar worker	---	0.358	0.629	---	-1.399*	-1.661**
		(1.347)	(1.379)		(0.762)	(0.821)
Unknown if mother works for pay	---	1.748	1.701	---	2.640	2.161
		(2.924)	(2.999)		(1.645)	(1.697)
Unknown if mother is white-collar worker	---	-3.840	-4.076*	---	-0.194	-0.418
		(2.345)	(2.451)		(1.126)	(1.210)
First year at current school	---	1.891	2.020	---	1.607**	1.844**
		(1.372)	(1.423)		(0.789)	(0.836)
1-3 years at current school	---	-3.106**	-3.422**	---	0.481	0.011
		(1.381)	(1.400)		(0.804)	(0.815)
Arts club	---	---	-3.926***	---	---	-4.510***
			(1.398)			(0.664)
Sports club	---	---	0.808	---	---	1.619***
			(1.035)			(0.625)
Other clubs	---	---	-1.375	---	---	-3.291***

			(1.092)			(0.640)
Number of friend nominations	---	---	0.817***	---	---	0.382***
			(0.127)			(0.092)
Perception of social inclusion	---	---	-5.712***	---	---	-3.633***
			(0.600)			(0.346)
Other controls (age, race/ethnicity, place of birth, season of interview, grade-level characteristics, household size, family structure)	yes	yes	yes	yes	yes	yes
Number of observations	26,128	6,128	26,128	28,529	8,529	28,529

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 3.2: Effects of Relative Deprivation on Frequency Drinking to Intoxication — Alternative Sets of Controls

	Males			Females		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	-2.220	-1.755	-1.614	-0.867	-1.257	-1.069
	(1.659)	(1.687)	(1.841)	(1.114)	(1.082)	(1.118)
Head of household's education squared	0.093**	0.081*	0.081*	0.020	0.034	0.031
	(0.044)	(0.045)	(0.049)	(0.030)	(0.029)	(0.030)
Relative deprivation	2.335**	2.520**	2.682**	0.050	0.031	0.068
	(1.020)	(1.036)	(1.122)	(0.695)	(0.690)	(0.703)
Father is U.S.-born	---	2.725	3.218*	---	2.540***	2.948***
		(1.857)	(1.932)		(0.908)	(0.956)
Father works for pay	---	-4.971*	-2.984	---	-3.137*	-1.723
		(2.962)	(2.953)		(1.775)	(1.766)
Father is not working	---	0.797	0.616	---	0.994	1.201
		(2.612)	(2.795)		(1.339)	(1.522)
Father is a white-collar worker	---	0.452	0.388	---	-0.260	0.004
		(1.238)	(1.256)		(0.627)	(0.670)
Unknown if father works for pay	---	2.218	3.194	---	-5.604**	-3.689
		(4.598)	(4.434)		(2.178)	(2.404)
Unknown if father is white-collar worker	---	1.373	0.790	---	0.499	0.064
		(1.765)	(1.850)		(0.870)	(1.005)
Mother is U.S.-born	---	-0.275	-0.456	---	1.874**	2.581***
		(1.892)	(1.978)		(0.845)	(0.898)
Mother works for pay	---	-1.436	-0.275	---	1.249	0.983
		(1.902)	(1.937)		(0.963)	(0.986)
Mother is not working	---	-0.219	0.816	---	0.018	-0.713
		(1.962)	(2.055)		(1.094)	(1.111)
Mother is a white-collar worker	---	-0.711	-0.511	---	-0.927	-1.232*
		(1.312)	(1.371)		(0.663)	(0.723)
Unknown if mother works for pay	---	-0.466	-1.838	---	0.196	-0.624
		(2.935)	(2.823)		(1.276)	(1.307)
Unknown if mother is white-collar worker	---	0.525	0.973	---	-0.060	-0.240
		(2.329)	(2.549)		(0.869)	(0.941)
First year at current school	---	0.725	0.984	---	0.533	1.023
		(1.401)	(1.452)		(0.724)	(0.779)
1-3 years at current school	---	-3.436***	-3.712***	---	0.604	0.402
		(1.273)	(1.286)		(0.668)	(0.660)
Arts club	---	---	-1.641	---	---	-3.126***
			(1.456)			(0.555)
Sports club	---	---	0.149	---	---	1.284***
			(0.976)			(0.498)

Other clubs	---	---	-1.244	---	---	-2.594***
			(1.009)			(0.572)
Number of friend nominations	---	---	0.470***	---	---	0.301***
			(0.120)			(0.081)
Perception of social inclusion	---	---	-4.858***	---	---	-2.806***
			(0.587)			(0.337)
Other controls (age, race/ethnicity, place of birth, season of interview, grade-level characteristics, household size, family structure)	yes	yes	yes	yes	yes	yes
Number of observations	26,128	26,128	26,128	28,529	8,529	28,529

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 3.3: Effects of Relative Deprivation on Smoking Frequency—Alternative Sets of Controls

	Males			Females		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	-1.685	-2.763	1.640	0.538	1.070	4.023
	(3.054)	(3.148)	(3.280)	(4.475)	(4.314)	(4.543)
Head of household's education squared	0.041	0.080	-0.013	-0.121	-0.114	-0.173
	(0.080)	(0.082)	(0.086)	(0.122)	(0.117)	(0.124)
Relative deprivation	3.294*	3.152*	5.863***	-0.170	0.426	1.744
	(1.843)	(1.908)	(1.987)	(2.615)	(2.573)	(2.661)
Father is U.S.-born	---	5.507	4.708	---	3.185	2.461
		(3.688)	(3.790)		(4.460)	(4.609)
Father works for pay	---	2.383	3.724	---	-8.941	4.887
		(6.149)	(6.246)		(8.727)	(9.541)
Father is not working	---	5.311	2.416	---	9.516	18.609**
		(5.730)	(5.559)		(7.375)	(8.589)
Father is a white-collar worker	---	-2.910	-1.936	---	-7.420***	-4.983*
		(2.306)	(2.433)		(2.443)	(2.627)
Unknown if father works for pay	---	16.740**	18.987**	---	-8.469	-1.437
		(7.961)	(8.035)		(11.273)	(12.523)
Unknown if father is white-collar worker	---	1.760	0.511	---	2.951	0.780
		(3.396)	(3.641)		(3.822)	(4.134)
Mother is U.S.-born	---	12.156***	11.860***	---	14.823***	17.767***
		(3.649)	(4.011)		(3.744)	(4.145)
Mother works for pay	---	-1.167	0.089	---	9.159**	6.074
		(3.758)	(3.742)		(4.337)	(4.395)
Mother is not working	---	-7.435*	-5.160	---	-2.342	-6.816
		(3.901)	(4.034)		(4.606)	(4.626)
Mother is a white-collar worker	---	-3.437	-0.805	---	-7.320***	-4.319
		(2.975)	(3.232)		(2.702)	(2.962)
Unknown if mother works for pay	---	1.410	1.436	---	17.511***	15.106**
		(5.289)	(5.676)		(6.103)	(6.354)
Unknown if mother is white-collar worker	---	-3.061	-2.261	---	-0.375	-0.004
		(3.977)	(4.319)		(4.621)	(4.789)
First year at current school	---	2.766	2.655	---	9.275***	8.768**
		(2.785)	(2.844)		(3.267)	(3.524)
1-3 years at current school	---	4.532*	1.217	---	2.740	-0.633
		(2.698)	(2.714)		(2.933)	(3.261)
Arts club	---	---	-5.881**	---	---	-13.521***
			(2.788)			(2.658)
Sports club	---	---	-21.013***	---	---	-10.615***
			(2.058)			(2.199)
Other clubs	---	---	-10.194***	---	---	-18.439***

			(2.416)			(2.493)
Number of friend nominations	---	---	0.917***	---	---	0.672*
			(0.286)			(0.344)
Perception of social inclusion	---	---	-12.778***	---	---	-18.712***
			(1.105)			(1.500)
Other controls (age, race/ethnicity, place of birth, season of interview, grade-level characteristics, household size, family structure)	yes	yes	yes	yes	yes	yes
Number of observations	26,128	26,128	26,128	28,529	28,529	28,529

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 4.1: Effects of Relative Deprivation on Drinking Frequency—Alternative Measures of Relative Deprivation

	Males			Females		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	0.021	0.793	-4.948***	-0.992	-1.303	-1.377***
	(1.551)	(2.352)	(0.679)	(1.163)	(1.638)	(0.376)
Head of household's education squared	0.028	0.004	0.142***	0.031	0.038	0.050***
	(0.041)	(0.061)	(0.026)	(0.030)	(0.043)	(0.015)
Relative deprivation	3.327***	---	---	0.311	---	---
	(0.998)			(0.741)		
Relative deprivation mean standardized	---	49.242**	---	---	1.242	---
		(20.285)			(13.796)	
Head of household schooling, percentile rank	---	---	3.331	---	---	-3.927*
			(4.007)			(2.338)

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 4.2: Effects of Relative Deprivation on Frequency Drinking to Intoxication —Alternative Measures of Relative Deprivation

	Males			Females		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	-2.077	-1.876	-5.533***	-0.213	-0.298	-1.206***
	(1.678)	(2.273)	(0.738)	(0.959)	(1.407)	(0.341)
Head of household's education squared	0.088**	0.081	0.167***	0.011	0.012	0.041***
	(0.044)	(0.059)	(0.027)	(0.026)	(0.037)	(0.014)
Relative deprivation	2.297**	---	---	0.708	---	---
	(0.999)			(0.609)		
Rel. deprivation mean standardized	---	31.343*	---	---	8.205	---
		(18.710)			(11.775)	
Percentile Rank	---	---	2.702	---	---	-2.419
			(3.669)			(1.913)

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 4.3: Effects of Relative Deprivation on Smoking Frequency—Alternative Measures of Relative Deprivation

		Males			Females	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Head of household's education	3.091	3.900	-5.417***	3.575	1.838	0.338
	(3.192)	(4.396)	(1.221)	(4.021)	(5.680)	(1.308)
Head of household's education squared	-0.088	-0.115	0.152***	-0.189*	-0.148	-0.023
	(0.083)	(0.114)	(0.044)	(0.109)	(0.152)	(0.053)
Relative deprivation	5.964***	---	---	2.655	---	---
	(1.920)			(2.436)		
Relative deprivation mean standardized	---	82.764**	---	---	18.543	---
		(35.482)			(45.573)	
Percentile Rank	---	---	-12.489*	---	---	-34.217***
			(6.913)			(7.727)

* Significant at 10%. ** Significant at 5%. *** Significant at 1%.

Appendix Table 5.1: Effects of Relative Deprivation on Drinking Frequency - Alternative Measures of Household Education

	Males					Females				
	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[1]	Father's education[2]	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[a]	Father's education[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Specified household education	0.021	-1.832	0.121	-2.969	-3.598	-0.992	1.385	0.135	2.721	-3.835***
	(1.551)	(2.246)	(2.213)	(2.257)	(2.209)	(1.163)	(1.729)	(1.696)	(1.691)	(1.426)
Specified household education squared	0.028	0.267*	0.203	0.408***	0.379**	0.031	-0.146	-0.013	-0.196*	0.255***
	(0.041)	(0.157)	(0.147)	(0.155)	(0.152)	(0.030)	(0.118)	(0.106)	(0.112)	(0.096)
Relative deprivation	3.327***	4.871***	6.283***	4.155**	3.978**	0.311	1.694	0.920	3.124**	-1.254
	(0.998)	(1.777)	(1.741)	(1.735)	(1.816)	(0.741)	(1.337)	(1.297)	(1.376)	(1.163)
N	31,635	31,635	31,635	29,201	25,005	33,963	33,963	33,963	32,182	25,322

* Significant at 10%. ** Significant at 5%. *** Significant at 1%. a. Only if mother is present in the household. b. Only if father is present in the household.

Appendix Table 5.2: Effects of Relative Deprivation on Frequency Drinking to Intoxication - Alternative Measures of Household Education

	Males					Females				
	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[1]	Father's education[2]	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[a]	Father's education[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Specified household education	-2.077	-5.587**	-3.556	-4.112*	-8.370***	-0.213	2.041	0.334	0.948	-2.011
	(1.678)	(2.458)	(2.399)	(2.394)	(2.209)	(0.959)	(1.408)	(1.318)	(1.393)	(1.335)
Specified household education squared	0.088**	0.553***	0.465***	0.488***	0.698***	0.011	-0.155	-0.003	-0.041	0.145
	(0.044)	(0.170)	(0.159)	(0.164)	(0.152)	(0.026)	(0.098)	(0.085)	(0.092)	(0.091)
Relative deprivation	2.297**	2.860	4.433**	3.506*	0.998	0.708	2.310**	1.140	2.137*	-0.085
	(0.999)	(1.807)	(1.728)	(1.799)	(1.722)	(0.609)	(1.099)	(1.016)	(1.158)	(0.999)
N	31,635	31,635	31,635	29,201	25,005	33,963	33,963	33,963	32,182	25,322

* Significant at 10%. ** Significant at 5%. *** Significant at 1%. a. Only if mother is present in the household. b. Only if father is present in the household.

Appendix Table 5.3: Effects of Relative Deprivation on Smoking Frequency - Alternative Measures of Household Education

	Males					Females				
	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[1]	Father's education[2]	Head of household's education (core model)	Average parental education	Maximum parental education	Mother's education[a]	Father's education[b]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Specified household education	3.091	4.994	8.466*	6.032	0.099	3.575	18.181***	12.989**	16.190***	1.465
	(3.192)	(4.850)	(4.544)	(4.862)	(4.610)	(4.021)	(6.494)	(5.810)	(6.073)	(5.091)
Specified household education squared	-0.088	-0.392	-0.527*	-0.335	-0.070	-0.189*	-1.890***	-1.369***	-1.370***	-0.581*
	(0.083)	(0.318)	(0.281)	(0.320)	(0.295)	(0.109)	(0.457)	(0.382)	(0.407)	(0.350)
Relative deprivation	5.964***	11.517***	12.664***	12.297***	8.350**	2.655	12.895***	7.412*	15.860***	2.780
	(1.920)	(3.829)	(3.586)	(3.817)	(3.501)	(2.436)	(4.923)	(4.222)	(4.908)	(3.910)
N	31,635	31,635	31,635	29,201	25,005	33,963	33,963	33,963	32,182	25,322

Notes: a.Only if mother is present in the household. b. Only if father is present in the household. * Significant at 10%. ** Significant at 5%. *** Significant at 1%.

1. See Mellor and Milyo (2003) and Eibner and Evans (2005) for thorough reviews of the Income Inequality Hypothesis and prior studies that associate relative deprivation with health.

2. In this paper, the term "classmates" refers to all students that belong to the same grade and school as the student of reference.

3. Psychosocial stress refers to acute or chronic events of a psychological or social nature that challenge the homeostatic state of biological systems. Psychosocial stressors include exposure to adverse environments and life experiences, relative position in a social hierarchy, stigma and discrimination, loss of job, disease, family violence, deprivation, child abuse, adverse social environments or situations, and detrimental parental behaviors.

4. In this context, a 'good' refers to any tangible product or service. In our model, a good could also include a particular SES.

5. Add Health does not contain income data for the majority of respondents. In fact, such information is missing for approximately 80 percent of the sample. To assess the strength of the association between household income and education, we regress the logarithm of household income on the head of household's education for the relatively small subsample of observations that have non-missing data for both measures. The estimated effect is positive and statistically significant ($p<0.001$) and the R^2 is 0.13 for this bivariate regression. One additional year of education increases income by 8 percent when no controls are added to the regression and by 5 percent (standard error of 0.003) when adjusting for school fixed effects and individual characteristics.

6. The inclusion of school fixed effects is an attempt to address and correct for possible selection bias. The addition of such indicators presumably controls for a large number of confounders that determine a student's selection into a particular school. It does not, however, entirely eliminate the possibility that the effect of relative deprivation on risky behaviors may be influenced by unobservable grade-level characteristics within a school that might also be correlated with our primary explanatory variables. While we identify an average effect of SES and relative deprivation across the various school grades, we cannot isolate an individual grade-level effect.

7. Exceptions to this occur when a child fails a grade and is held back or when she is allowed to skip a grade due to exceptional performance. A recent trend has emerged whereby parents are voluntarily holding back their kindergarten-age children—especially their sons—so that they are more mentally and physically mature relative to their peers. As the data were collected in the mid 1990's and the average age of our respondents is 15, we are less concerned with this recent phenomenon.

8. Alternatively, count data models can be estimated with Poisson regression. We chose to use negative binomial over Poisson because of over dispersion in our dependent variables.

9. It should be noted that in the Add Health data, the respondent reports parental schooling levels. Adolescents with low social or financial status may be unaware of or misreport their parents' schooling. Moreover, social and financial status can be defined along a series of dimensions such as race/ethnicity, innate ability, physical attractiveness, and athletic prowess. Finally, a child's perception of her SES may not be perfectly or completely aligned with that of her parents.

10. Specifically, we assigned 5 years to parents who completed 8 or fewer years of schooling, 10.5 years to parents who completed the eighth grade but did not graduate from high school, 11.5 years to parents who completed a GED, 12 years to parents who graduated from high school, 13.5 years to parents who attended a business, trade, or vocational school after high school, 14 years to parents who completed some college, 16 years to parents who graduated from a college or university, and 20 years to parents who acquired professional training beyond college. If a child indicated that her parent never went to school or did not know whether he/she did, we coded these observations as "completion of eight or less years of schooling," the lowest category in Add Health.

11. The NHIS is an annual household survey that solicits information about health conditions and other socio-economic characteristics for both adults and children residing in each sampled household. Unfortunately, the NHIS is not well suited for our analysis of relative deprivation because it is not administered at the school level and lacks information on a child's classmates.

12. An individual's age is adjusted for the months it would take to mature to that of her classmates. This allows us to consider the relative maturity of the student within a grade.

13. White-collar workers include those in professional, managerial, or technical occupations or those who work in an office or in sales. Blue-collar workers include those who work in restaurants, personal services, security, construction, transportation, factories, farms, or fisheries or those who are

craft-persons or mechanics. Also included in this classification are parents who are in the military. Parents who are classified as homemakers, disabled, retired, or on welfare as well as those who do not work are deemed to be "not working."

14. Underreporting of risky behaviors may be correlated with parental income. Even if misreporting is not related to SES, measurement error could also influence our regression estimates (towards zero).

15. The In-School survey was administered between October 1994 and April 1995.

16. Note that this one-year gap in the relative deprivation measure would refer to a real one-year difference in the head of household's education if we were referring to the more relatively deprived male in the respective grade. For a student whose SES is at the median of the SES distribution, however, a one-year gap in the relative deprivation measure is equivalent to a difference of two years in the head of household's education (because, as mentioned above, the relative-deprivation index is calculated as the difference between a student's SES and the average SES of students with higher SES in her grade multiplied by the probability of having students with higher SES in her grade).

17. We estimated a local polynomial smooth of the conditional expectation of relative deprivation on head of household education and computed the change in this smooth for each additional household year of education.

18. An increase from 11 to 12 years in the head of household's education decreases relative deprivation by 0.934 points (from 2.490 to 1.556). Given a coefficient of 3.327, the relative deprivation effect of one more year of education on drinking frequency is -3.1 days.

19. Students were asked to report up to five best male friends and up to five best female friends within a roster of school-based peers provided by the interviewers.

20. To measure this, we constructed an index that averaged a student's responses to whether she felt 1) close to people at school, 2) part of the school, and 3) socially accepted. Each answer ranged from 1 to 5, where 1 indicates that the respondent strongly disagreed with the statement and 5 indicates that she strongly agreed.

21. The correlation coefficients for household education between grade 9 and grades 10, 11, and 12 are -0.361, -0.005, and -0.171. The coefficients are -0.229 and -0.320 for the correlations between grade 10 and grades 11 and 12, and -0.014 for the correlation between grades 11 and 12.

22. We thank a referee for raising this point.