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Childhood Cigarette and Alcohol Use: Negative Links with Adjustment

Jeremy Staff¹, Jennifer Maggs², Kelsey Cundiff³, and Rebecca J. Evans-Polce⁴

Jeremy Staff: jus25@psu.edu; Jennifer Maggs: jmaggs@psu.edu; Kelsey Cundiff: kxc399@psu.edu; Rebecca J. Evans-Polce: revanspolce@psu.edu

¹Pennsylvania State University, Department of Sociology, 917 Oswald Tower, University Park, PA 16802

²Pennsylvania State University, Department of Human Development and Family Studies, 119 Health and Human Development Building, University Park PA 16802

³Pennsylvania State University, Department of Sociology, 211 Oswald Tower, University Park, PA 16802

⁴Pennsylvania State University, Methodology Center and Prevention Research Center, 217 Health and Human Development Building, University Park PA 16802

Abstract

Children who initiate cigarette or alcohol use early—during childhood or early adolescence—experience a heightened risk of nicotine and alcohol dependence in later life as well as school failure, crime, injury, and mortality. Using prospective intergenerational data from the Millennium Cohort Study (MCS), we investigate the association between early substance use initiation (cigarettes or alcohol) and age 11 school engagement, academic achievement, and wellbeing. The ongoing MCS tracks the development of a nationally representative sample of children in the United Kingdom (born 2000–2002) from infancy through adolescence. At age 11, MCS children (n=13,221) indicated whether they had ever used cigarettes or alcohol; at age 7 and 11 they reported on school engagement and wellbeing and completed investigator-assessed tests of academic achievement. Using propensity score methods, children who had initiated cigarette or alcohol use by age 11 were matched to abstaining children with similar risks (or propensities) of early substance use, based on numerous early life risk and protective factors assessed from infancy to age 7. We then examined whether early initiators differed from non-initiators in age 11

Address correspondence to: Jeremy Staff, Ph.D., Department of Sociology, Pennsylvania State University, 211 Oswald Tower, University Park, PA 16802. Phone: 814 865-4560. Fax: 814 863-7216. jus25@psu.edu.

Contributors

Drs. Staff and Maggs designed the study. Dr. Staff drafted the initial version of the method, results, and discussion sections, and conducted the analyses. Dr. Maggs reviewed and revised significant portions of the manuscript. Ms. Cundiff assisted with the literature review, drafted the initial version of the introduction, and reviewed the manuscript. Dr. Evans-Polce drafted the initial version of the conclusion and reviewed the manuscript. All authors approved the final manuscript as submitted.

Conflict of Interest

The authors have no conflicts of interest to declare.

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adjustment and achievement. Results show that substance use by age 11 was uncommon (3% cigarettes; 13% alcohol). After matching for propensity for early initiation, school engagement and wellbeing were significantly lower among initiators compared to non-initiators. Academic achievement was not consistently related to early initiation. We conclude that initiation of smoking and drinking in childhood is associated with poorer adjustment.

1. Introduction

Most children do not smoke cigarettes or drink alcohol.^{1–2} Despite low prevalence, long-term developmental and health risks of early substance use are substantial. Early initiation of cigarette or alcohol use—during childhood or early adolescence—has been linked to: nicotine addiction, alcohol misuse and dependence, and use of marijuana and other illicit drugs; fighting, arrest, and deviant peer group affiliation; reduced educational attainment; unintentional injury, and poor health.^{2–14} Given the consensus linking early substance use with negative consequences, the American Academy of Pediatrics recommends standard pediatric health care screening include alcohol and drug use beginning at age 11.¹⁵

The literature is unclear, however, whether these long-term links of early substance use with poor adjustment are due to a process that is set in motion by early use or simply reflect existing differences in childhood risk and protective factors.^{16–19} Children who have a difficult temperament, display conduct problems, are hyperactive or inattentive, dislike school or have poor cognitive functioning, have a family history of substance problems, or are from disadvantaged socioeconomic backgrounds are at elevated risk of using cigarettes and alcohol before they reach adolescence.^{20–28} These early life risk factors call into question whether observed negative effects should be blamed solely on early initiation, unless early childhood risk factors are adequately controlled. Rarely are prospective data available to control for likely spurious risk factors assessed from infancy through childhood, particularly in large, nationally representative samples.^{29–31}

We use longitudinal data from the ongoing UK Millennium Cohort Study (MCS), which tracks the development of a nationally representative sample of UK children (born 2000–2002) prospectively from infancy, to document the association of cigarette and alcohol initiation with three key indicators of positive youth development measured at age 11 (school engagement, academic achievement, and wellbeing). We hypothesize that early initiators will differ substantially from children who have not used cigarettes or alcohol, so our first set of analyses assess how a wide range of risk and protective factors measured prospectively from infancy to age 7 distinguish early- and non-initiators of both cigarettes and alcohol. We also predict that early substance use initiation will be negatively associated with adjustment, so our second set of analyses considers whether early cigarette or alcohol initiation is negatively related to age 11 school engagement, academic achievement, and wellbeing, even after adjusting the estimates for early life risk and protective factors using OLS regressions. To increase confidence that these regression results are not biased by the hypothesized early life differences between initiators and non-initiators, we use propensity score methods (PSM) to compare “like with like” individuals.³²

2. Method

2.1. Participants

Nine-month-old children born between September 1, 2000 and January 11, 2002 were selected from a sample of electoral wards from England, Northern Ireland, Scotland, and Wales. MCS investigators oversampled children residing in areas of high child poverty, areas with high concentrations of Indian, Pakistani, Bangladeshi, and Black families, and families residing in Northern Ireland, Scotland, and Wales.³³ At Wave 1, parents of 18,552 nine-month old children participated (approximately 91% of targeted sample).³⁴ Analyses here focus on follow-up parent surveys that occurred when the child was ages 3, 5, 7, and 11 years, along with child surveys at age 7 and during the final year in primary school (modal age 11). By this wave, 13,287 families were retained (81.4% of eligible families who had not emigrated, permanently withdrawn, or died).^{35,36}

Table 1 shows descriptive statistics as well as the percentage of each variable with missing data for 13,221 children. Since our focus is on children in primary school, 66 children who had already transitioned to secondary school when interviewed were excluded. The weighted descriptive statistics were adjusted for the complex sampling design as well as nonrandom sample attrition by age 11. To handle item-missing data, we relied on the “mi” command in Stata 14 to impute 20 datasets using chained regressions.³⁷ We used the “mi estimate” command to combine results across the 20 datasets and adjust standard errors and significance tests.³⁸ The percentage of missing values that were imputed for each variable ranged from 0% (gender) to just over 15% (child’s self-reported school engagement at age 7).

2.2. Measures

Outcome Variables: School Engagement, Academic Achievement, and Wellbeing, Age 11—School engagement is an average of 10 child-reported items ($\alpha = .71$) indicating how well the child likes math, science, English, physical education, and school overall, as well as how often they try their best at school, find school interesting, feel school is a waste of time, get tired at school, and misbehave or cause trouble (last three items were reverse coded). Academic achievement is based on an investigator-assessed³⁹ test of verbal similarities using the British Ability Scales II,⁴⁰ scored as the number of correct identifications of the association between three words (adjusted for age). Finally, wellbeing is an average of the extent to which the child agreed with ten self-reported items ($\alpha = .72$; e.g., satisfied with themselves, able to do things as well as most other people; how often in past 4 weeks they felt happy, got angry, felt sad; negative items reverse coded). Correlations between the three outcome measures ranged from .09 (academic achievement and wellbeing) to .47 (school engagement and wellbeing).

Childhood Cigarette or Alcohol Use—At modal age 11, children completed confidential surveys regarding whether they had *ever* tried a cigarette (even if it was only a single puff) or had an alcoholic drink (more than a few sips). As shown in Table 1, by age 11 approximately 3 percent of children had smoked a cigarette and 13 percent had consumed alcohol.

Early Life Risk and Protective Factors, Infancy to Age 7—Sociodemographic characteristics included gender and child ethnicity, coded as a set of dummy variables for White, Black (Black Caribbean, Black African and Black other), Indian, Pakistani or Bangladeshi, and Other British. Parent interview data (when child was age 7) indicated parent marital status, the highest educational level of either parent (based on national vocational qualifications [NVQ] ranging from no qualifications to NVQ 5 [post-graduate qualifications and diplomas]), and the highest occupational status of either parent (ranging from not working to employment in a managerial or professional occupation).

Parent substance use was assessed by parent reports as to whether at least one parent was a current smoker (when child was age 7), used alcohol (age 7), or had used an illicit drug in the past year (age 5). Heavy prenatal alcohol exposure (mothers' reports when children were infants of whether during pregnancy they drank 7+ units of alcohol per week or 6+ units per occasion)⁴¹, and infant cigarette smoke exposure (whether someone had smoked tobacco in the same room when the child was an infant) were assessed in infancy.

Child characteristics and behaviors—A dichotomous measure indicated low birthweight (<2.5 kg). Child behavioral risk factors for early substance use onset were measured using parent reports at age 7. Parents used the “Strengths and Difficulties” questionnaire⁴² to describe the degree to which during the past six months their child was hyperactive (i.e., restless, fidgety) or inattentive (an average scale of five items; $\alpha = .79$). Parents also reported whether their child was aggressive (i.e., fought with or bullied other children); had frequent temper tantrums; or was generally disobedient (1=this behavior was “certainly true” of the child; these three items were not averaged due to low reliability). When parent reports were not available at age 7, information from age 5 or 3 was used.

To assess adjustment at age 7, children self-reported their school engagement (i.e., how well they like school, etc.) in a similar measure to the age 11 outcome. Academic achievement was assessed using the British Ability Scales II,⁴⁰ investigator-led tests assessing spatial awareness (via pattern construction) and reading ability. The two scores were adjusted for age, standardized, and then averaged ($r = .32$). Finally, children described their wellbeing using similar measures to those at age 11 (i.e., how often they felt happy, laughed, etc. over the past month).

2.3. Data Analysis

We first used logistic regression models predicting cigarette or alcohol use to identify the relevant early childhood risk and protective factors that distinguish early initiators from non-initiators. Next, we used OLS regressions to test whether smoking or drinking initiation in childhood was negatively associated with school engagement, academic achievement, and wellbeing at age 11 after controlling for sociodemographic characteristics, parent substance use, and child characteristics and behaviors. Finally, as an alternate analytic strategy, we used PSM to match “treated”—in this case children who have previously smoked or drank alcohol—and “untreated” children. Matching helps produce less biased estimates when the treated and untreated respondents in a study are hypothesized to be very different from each other, and when these differences can be captured by a set of observed covariates.^{43,44} More

specifically, using the “teffects” command in Stata 14, each child who had previously smoked a cigarette was matched with a child who had a similar risk (or propensity) to smoke, based on observed covariates measured from infancy to age 7, but did not. A propensity score was first calculated for each child based upon logit estimates of their predicted probability of treatment status (i.e., smoking initiation), and then each treated child was matched to an untreated child who had a similar propensity score (via a one-to-one nearest neighbor matching algorithm). These matched groups were then compared on school engagement, academic achievement and wellbeing outcomes at age 11.

3. Results

Table 2 presents odds ratios and 95% confidence intervals from logistic regression models predicting whether the child had ever smoked a cigarette (column 1) or drunk alcohol (column 2). Childhood cigarette and alcohol use was more likely among boys. Compared to White British children, the risk of cigarette initiation was lower among Black British children, and the risk of alcohol initiation was lower among Indian British children, Pakistani and Bangladeshi British children, and among children with other ethnicities. Children whose parents had more educational qualifications (advanced secondary school diploma and higher) and intermediate level professions were less likely to initiate smoking, and children with married parents were less likely to initiate alcohol use. Parental tobacco, alcohol, and illicit drug use predicted early initiation of smoking and alcohol, as did smoking around the child when he or she was an infant, with one exception: Parent alcohol use in childhood did not predict early smoking. Heavy prenatal alcohol exposure did not predict earlier initiation beyond the associations of parents’ substance use during childhood.

Turning to the child characteristics and behaviors assessed earlier in life, children who were rated by parents as hyperactive/inattentive were more likely to initiate smoking and drinking by age 11, and children who had frequent temper tantrums at age 7 were more likely to smoke at a young age. Based on child assessments, children scoring higher on academic tests at age 7 were less likely to initiate smoking by age 11, and children who reported more positive well-being and greater school engagement were less likely to initiate drinking by age 11. Low birthweight was not independently related to early substance use. These results show that initiation of smoking or of drinking during childhood is predictable from a wide range of risk and protective factors visible earlier in life. Subsequent analyses focused on documenting associations of early initiation with school engagement, academic achievement, and well-being at age 11, therefore, to take these differential tendencies or propensities into account.

Table 3 presents adjusted estimates and robust standard errors from regression models predicting school engagement, academic achievement, and wellbeing at age 11 as a function of early smoking (Model 1) and early drinking (Model 2). After accounting for sociodemographic characteristics, parent substance use, and child characteristics and behaviors including age 7 assessments of the three outcome variables, early initiation of smoking and drinking were significant predictors of lower school engagement, academic achievement, and well-being. That is, independent of the stability observed in which children who had high levels of school engagement, academic achievement, and wellbeing at

age 7 tended to remain higher on these variables at age 11, children who initiated substance use between ages 7 and 11 evidenced lower adjustment. To assess the magnitude of these differences, for each model we calculated expected values for children who had and had not initiated. Differences in age 11 school engagement and wellbeing between early- and non-initiators ranged from about one-third to one-half of a standard deviation, holding all other variables constant. Differences in academic achievement between early initiators and non-initiators were smaller. For instance, early smokers differed from non-initiators by approximately .14 of a standard deviation (and early drinkers by only .05).

The intergenerational links of parental substance use, marriage, education, and occupational status with child outcomes were mostly small and statistically non-significant, though there were some exceptions. Parental cigarette use was negatively associated with school engagement and wellbeing (as well as exposure to smoke as an infant), whereas parental marriage was positively linked to these outcomes. Academic achievement was also significantly higher among children whose parents were employed in managerial or professional positions, or who had high levels of education. The estimates in Table 3 also show a positive link between parental drug use and children's academic achievement, and a negative link between parental education and children's wellbeing, however, these unexpected findings in the multivariate models were statistically non-significant when they were included as the sole predictors in unlisted models. Parents who rated their children as having frequent temper tantrums or who were hyperactive-inattentive at age 7 had significantly lower school engagement, academic achievement, and wellbeing at age 11. The models also revealed some differences by gender and race/ethnicity. Boys had significantly lower school engagement than girls but higher scores on achievement and wellbeing. Indian children had higher school engagement and academic achievement than White British children. Pakistani and Bangladeshi British children also had higher school engagement but lower achievement scores. Finally, compared to White British children, Black British children had higher achievement and wellbeing.

Table 4 provides estimates (and robust standard errors) of the average effects of cigarette and alcohol use on adjustment outcomes among children who had used these substances using PSM. Even after balancing early- and non-initiators on early life risk factors, childhood cigarette use was negatively associated with school engagement (Model 1) and wellbeing (Model 5) at age 11. Early alcohol use was also negatively associated with these indicators of adjustment (Models 2 and 6, respectively). Magnitudes of the average treatment effects on school engagement and wellbeing were similar to regression-adjusted estimates in Table 3. The links between childhood substance use with academic achievement, however, were smaller and statistically non-significant after matching initiators and non-initiators using PSM. For instance, after finding suitable matches for 213 smokers among the 8,987 never-smokers (Model 3), the average treatment effect of smoking on academic achievement was negative and non-significant. Similarly, after pairing 1,101 drinkers from the pool of 8,015 non-drinkers, the average treatment effect of early onset drinking was negative but not statistically significant (Model 4).

4. Discussion

By using prospective data on children followed from infancy to age 11, we provide insight into pre-adolescent associations of early substance use and adjustment that may increase the risk of long-term personal, social, and economic disadvantages later in adolescence and adulthood, such as illicit drug use, addiction, low educational attainment, poor health and wellbeing, and injury^{2–14}. Even after adjusting and balancing for a variety of early life risk and protective factors, children who smoked cigarettes or drank alcohol reported significantly lower levels of age 11 school engagement and wellbeing (by about one-third to one-half of a standard deviation) using both analytic strategies compared to children who had never used these substances.

The non-experimental design precludes conclusions that childhood cigarette or alcohol use has a *causal* negative effect on school engagement and wellbeing. Since randomly assigning some children to use these substances would, clearly, be unethical, we used PSM to rule out multiple sources of selection effects in this context because early initiators are very different from children who have not used cigarettes or alcohol (as shown in Table 2). In small samples, it is often difficult to find a non-user who is comparable on prior risk factors to the very small numbers of early initiators (here, 3% for cigarettes and 13% for alcohol). The large, nationally representative MCS sample allowed us to find suitable matches for these children on a wide range of prior risk and protective factors assessed earlier in life. Nonetheless, our findings indicate associational rather than causal links between childhood substance use, school engagement, and wellbeing.

Though early initiation still had a negative association with school engagement and wellbeing in the analyses using PSM, the relatively small differences in academic achievement observed in the OLS analyses were reduced by more than one-half (to statistical non-significance) after matching in the propensity score methods. This suggests that at least part of the reason why early substance use initiation is linked to low educational attainment in adulthood is not because early initiators suffer immediate declines in cognitive ability after limited use,⁴⁵ but rather because they may disengage from school at an early age (shown here) and may also affiliate with more deviant peers.¹⁴ This in turn increases the risk of escalating to heavier and more frequent use,^{6, 14} which predicts lower longer-term educational attainment.⁴⁶

Gender was a consistent predictor of early substance use initiation and youth development. Boys were more likely than girls to have smoked cigarettes or drunk alcohol by age 11 and also had lower levels of school engagement. In contrast, achievement and wellbeing were higher among boys. In unlisted analyses, we considered whether effects of substance use varied by gender. We re-estimated models separately by gender and then assessed the equality of the estimates using z-tests.⁴⁷ With respect to wellbeing, the negative links with smoking and drinking were significantly stronger for girls. However, early smoking and drinking effects did not vary by gender for school engagement or achievement, and only four of the control variables (out of 102 comparisons) varied by gender. Thus, the short-term links between early substance use, school engagement, and wellbeing do not appear to operate substantially differently for girls and boys.

Our key measures of substance use are based on whether the child had previously tried a cigarette or had more than a few sips of an alcoholic drink. For some children, this may have been a single occasion of experimentation with cigarettes and alcohol. For others, it may have encompassed more frequent use. Though MCS children did not indicate the number of cigarettes previously smoked, children did report if they had ever consumed more than 5 drinks in one setting (approximately 0.5% had done so⁴⁸). In supplemental OLS regression and propensity models (not listed but available upon request), we found that children who reported having 5 or more drinks at a time had significantly lower school engagement and wellbeing at age 11. As future waves of MCS data are collected, and the number of youth who drink and smoke increases, we can assess the process by which early initiators escalate to more frequent and high-intensity use, as well as the mechanisms underlying links between early substance use patterns and youth adjustment, such as deviant peer affiliations and further school disengagement.⁴⁹

4.1. Limitations

We acknowledge at least three important limitations of the current study. First, although we controlled for numerous risk and protective factors measured earlier in childhood, including lagged measures of our age 11 outcome variables assessed 4 years prior, there may be some genetic, developmental, or social factors that we missed that may potentially confound the relationship seen between early initiation and the deleterious outcomes. Second, survey reports of problem behaviors can be subject to social desirability bias. Children, for instance, may underreport previously used cigarettes or alcohol, though concerns regarding this bias are alleviated somewhat by the fact that the child surveys were confidential and completed in a booklet in a separate room away from parents and interviewers. Furthermore, the fact that risk and protective factors were associated with substance use in ways consistent with previous literature on adolescents and adults suggests convergent validity. Finally, though we took steps to control for potential spurious factors, we recognize that childhood substance use may have a bidirectional association with school engagement and wellbeing. As future waves of MCS data are collected across adolescence, we will be able to more confidently assess the direction of the associations.

5. Conclusions

Substance use initiation by the last year of primary school in a large, nationally representative sample is relatively low, with 3% having smoked and 13% having consumed alcohol. As the MCS children move into adolescence, more will initiate tobacco and alcohol use. The present findings indicate these very early initiators show substantial differences dating back to infancy and childhood and continuing with less positive adjustment by age 11 years. Among those whose frequency and intensity of use escalates, it will become increasingly likely that negative consequences in these and related domains of development will ensue.⁵⁰

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Highlights

- Childhood substance use carries long-term developmental and health risks
- Links of childhood alcohol and cigarette use with adjustment may be spurious
- 3% smoked and 13% drank alcohol by age 11 in large nationally representative sample
- Early initiators and non-users differ on wide range of early childhood risk factors
- Early initiation predicts low age 11 school engagement, wellbeing beyond early risk

Table 1

Weighted Descriptive Statistics

	Mean or %	SE	% imputed
Early Life Risk and Protective Factors: Matching variables			
<u>Sociodemographic characteristics</u>			
Male gender	51.6%	.005	0.0%
Child ethnicity			<1%
White	84.5%	.014	
Indian	2.0%	.003	
Pakistani and Bangladeshi	5.0%	.010	
Black	3.5%	.006	
Other	5.0%	.004	
Parent married	54.6%	.009	1.3%
Parent highest education level			2.2%
No qualifications	10.0%	.006	
NVQ1	6.0%	.003	
NVQ2	24.7%	.007	
NVQ3	15.8%	.005	
NVQ4	32.6%	.008	
NVQ5	10.9%	.005	
Parent highest occupational status			1.3%
Not working	23.6%	.008	
Semi-routine or routine	14.2%	.005	
Low supervisory or technical	5.7%	.003	
Small employer or self-employed	9.0%	.003	
Intermediate level	10.0%	.004	
Managerial/professional job	37.4%	.010	
<u>Parent substance use</u>			
Parent smoked	53.4%	.007	<1%
Parent drank	85.8%	.011	2.5%
Parent used illicit drug	10.1%	.004	6.3%
No smoking near infant	84.7%	.006	3.7%
Heavy prenatal alcohol exposure	2.2%	.002	3.8%
<u>Child characteristics and behaviors</u>			
Low birthweight (<2.5 kg)	7.2%	.003	3.8%
Child behaviors, parent reported, age 7			
Hyperactive/inattentive	.702	.007	2.1%
Frequent temper tantrums	14.6%	.004	2.2%
Disobedient	4.4%	.003	2.3%
Aggressive	1.7%	.002	2.2%
Adjustment, age 7			
School engagement, child reported	1.86	.004	15.6%

	Mean or %	SE	% imputed
Academic achievement, investigator assessed	-.033	.017	9.5%
Wellbeing, child reported	2.29	.004	15.2%
Childhood substance use initiation: Treatment variables			
Ever smoked by age 11	3.2%	.002	3.9%
Ever drank alcohol by age 11	13.4%	.005	4.8%
Adjustment, age 11: Outcome variables			
School engagement, child-reported	2.81	.005	2.6%
Academic achievement, investigator-assessed	58.23	.253	2.2%
Wellbeing, child-reported	3.73	.006	2.6%

Note. Sample size = 13,221. Descriptive statistics based upon 20 imputed datasets.

Logistic Regression Models Predicting Childhood Smoking and Drinking by Early Life Risk and Protective Factors

Table 2

	Ever smoked by age 11		Ever drank by age 11	
	OR	95% CI	OR	95% CI
Sociodemographic characteristics				
Male gender	1.70 ***	[1.32, 2.18]	1.47 ***	[1.31, 1.66]
Ethnicity (vs White)				
Indian	.97	[.41, 2.28]	.21 ***	[.09, .49]
Pakistani and Bangladeshi	.68	[.36, 1.28]	.13 ***	[.07, .24]
Black	.47 *	[.22, .99]	.90	[.63, 1.30]
Other	.64	[.35, 1.20]	.60 **	[.43, .83]
Parent married	.79	[.60, 1.05]	.85 *	[.74, .97]
Parent highest education level (vs no qualifications)				
NVQ1	.83	[.49, 1.41]	1.08	[.76, 1.54]
NVQ2	.95	[.66, 1.37]	1.24	[.97, 1.60]
NVQ3	.54 *	[.33, .88]	1.18	[.90, 1.54]
NVQ4	.56 **	[.37, .86]	1.07	[.82, 1.39]
NVQ5	.46 *	[.24, .88]	1.17	[.86, 1.59]
Parent highest occupational status (vs not employed)				
Semi-routine or routine	.78	[.55, 1.09]	1.05	[.86, 1.27]
Low supervisory or technical	.61	[.35, 1.06]	1.12	[.84, 1.48]
Small employer or self-employed	.67	[.40, 1.12]	1.21	[.94, 1.56]
Intermediate level	.58 *	[.35, .95]	1.02	[.80, 1.30]
Managerial/professional job	.75	[.51, 1.09]	.99	[.81, 1.22]
Parent substance use				
Parent smoked	2.06 ***	[1.52, 2.79]	1.31 ***	[1.16, 1.47]
Parent drank	1.15	[.79, 1.65]	1.55 **	[1.18, 2.04]
Parent used illicit drug	1.98 ***	[1.46, 2.69]	1.33 ***	[1.12, 1.59]
No smoking near infant	.67 **	[.51, .87]	.80 **	[.68, .95]

	Ever smoked by age 11		Ever drank by age 11	
	OR	95% CI	OR	95% CI
Heavy prenatal alcohol exposure	1.42	[.81, 2.48]	1.29	[.92, 1.79]
<u>Child characteristics and behaviors</u>				
Low birthweight (<2.5 kg)	1.38	[.94, 2.03]	.99	[.79, 1.25]
Child behaviors, parent reported, age 7				
Hyperactive/inattentive	1.73 ***	[1.37, 2.17]	1.46 ***	[1.30, 1.65]
Frequent temper tantrums	1.43 *	[1.08, 1.90]	1.04	[.87, 1.24]
Disobedient	1.03	[.66, 1.59]	.92	[.68, 1.24]
Aggressive	.50	[.24, 1.06]	.81	[.48, 1.35]
Adjustment, age 7				
School engagement, child-reported	1.04	[.71, 1.52]	.81 *	[.66, .99]
Wellbeing, child-reported	.70	[.45, 1.08]	.64 ***	[.51, .79]
Academic achievement, investigator-assessed	.74 ***	[.64, .85]	1.00	[.94, 1.06]

Note. Estimates adjusted for the clustering of respondents in the 398 primary sample units. Estimates for stratum design dummy variables not shown. Sample size=13,221.

* $p < .05$,

** $p < .01$,

*** $p < .001$

Table 3

OLS Regression Models Predicting Age 11 School Engagement, Academic Achievement, and Wellbeing by Childhood Substance Use Initiation, Controlling for Early Life Risk and Protective Factors

	School engagement			Academic achievement			Wellbeing		
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	
<u>Childhood substance use initiation</u>	Est	SE	Est	SE	Est	SE	Est	SE	
Ever smoked by age 11	-.17 ***	(.02)	-1.44 *	(.62)	-.19 ***	(.03)			
Ever drank alcohol by age 11			-.15 ***	(.01)	-.54 *	(.26)	-.13 ***	(.01)	
<u>Sociodemographic characteristics</u>									
Male gender	-.05 ***	(.01)	1.38 ***	(.16)	.03 ***	(.01)	.03 ***	(.01)	
Ethnicity (vs White)									
Indian	.09 ***	(.02)	.08 ***	(.02)	3.13 ***	(.97)	.04 *	(.02)	
Pakistani and Bangladeshi	.08 ***	(.02)	.07 ***	(.02)	-1.96 **	(.69)	.02	(.02)	
Black	.03	(.02)	.03	(.02)	1.86 **	(.68)	.05 *	(.02)	
Other	.05 **	(.02)	.05 **	(.02)	1.40 ***	(.43)	.04 *	(.02)	
Parent married	.02 ***	(.01)	.02 **	(.01)	.24	(.20)	.02 *	(.01)	
Parent highest education level (vs no qualifications)									
NVQ1	-.02	(.02)	-.02	(.02)	1.19 *	(.51)	-.04	(.02)	
NVQ2	-.01	(.01)	.00	(.01)	1.62 ***	(.39)	-.04 *	(.02)	
NVQ3	-.01	(.01)	.00	(.01)	2.70 ***	(.39)	-.04 *	(.02)	
NVQ4	-.01	(.01)	-.01	(.01)	3.43 ***	(.38)	-.05 **	(.02)	
NVQ5	.00	(.01)	.01	(.02)	4.12 ***	(.43)	-.07 ***	(.02)	
Parent highest occupational status (vs not working)									
Semi-routine or routine	.01	(.01)	.02	(.01)	-.23	(.29)	.02	(.01)	
Low supervisory or technical	.02	(.01)	.03	(.01)	.30	(.44)	.01	(.02)	
Small employer or self-employed	.00	(.01)	.00	(.01)	.65 *	(.33)	.00	(.02)	
Intermediate level	.02	(.01)	.02	(.01)	.39	(.32)	.02	(.01)	
Managerial/professional job	.01	(.01)	.02	(.01)	1.06 ***	(.29)	.02	(.01)	
Parent substance use									

	School engagement		Academic achievement		Wellbeing	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Parent smoked	-.03 *** (.01)	-.03 *** (.01)	-.27 (.20)	-.27 (.20)	-.02 * (.01)	-.02 * (.01)
Parent drank	-.01 (.01)	.00 (.01)	.19 (.31)	.21 (.31)	.01 (.01)	.01 (.01)
Parent used illicit drug	-.01 (.01)	-.01 (.01)	.68 * (.30)	.66 * (.29)	-.01 (.01)	-.01 (.01)
No smoking near infant	.03 ** (.01)	.02 ** (.01)	.22 (.27)	.24 (.27)	.01 (.01)	.01 (.01)
Heavy prenatal alcohol exposure	-.01 (.02)	-.01 (.02)	1.00 (.62)	1.00 (.62)	.02 (.03)	.02 (.03)
<u>Child characteristics and behaviors</u>						
Low birthweight (<2.5 kg)	.02 (.01)	.02 (.01)	.31 (.33)	.29 (.33)	.00 (.02)	.00 (.01)
Adjustment, parent-reported, age 7						
Hyperactive/inattentive	-.07 *** (.01)	-.07 *** (.01)	-.91 *** (.20)	-.91 *** (.20)	-.09 *** (.01)	-.08 *** (.01)
Frequent temper tantrums	-.03 ** (.01)	-.04 *** (.01)	-1.10 *** (.28)	-1.12 *** (.28)	-.04 ** (.01)	-.04 ** (.01)
Disobedient	.00 (.02)	-.01 (.02)	.18 (.52)	.17 (.52)	-.02 (.02)	-.02 (.02)
Aggressive	.07 ** (.03)	.07 ** (.03)	-1.36 (.87)	-1.34 (.87)	.00 (.04)	.01 (.04)
Adjustment, age 7						
School engagement, child-reported	.21 *** (.01)	.21 *** (.01)	1.01 ** (.33)	.99 ** (.33)	.08 *** (.02)	.07 *** (.02)
Wellbeing, child-reported	.10 *** (.01)	.09 *** (.01)	-.99 ** (.33)	-1.00 *** (.33)	.15 *** (.01)	.15 *** (.01)
Academic achievement	.02 *** (.00)	.02 *** (.00)	2.93 *** (.12)	2.95 *** (.12)	.03 *** (.00)	.03 *** (.00)
Constant	2.25 *** (.04)	2.27 *** (.04)	55.38 *** (1.10)	55.40 *** (1.11)	3.29 *** (.04)	3.30 *** (.04)

Note. Estimates adjusted for clustering and stratum design. N=13,221; SE=Robust Standard Errors;

* $p < .05$,

** $p < .01$,

*** $p < .001$.

Average Effect of Childhood Smoking and Drinking among Children Who Initiated (Using Propensity Score Methods)

Table 4

	School engagement		Academic achievement		Wellbeing	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Childhood substance use initiation						
Ever smoked by age 11	-.18 (.03) ***		-.53 (.89)		-.22 (.04) ***	
Ever drank alcohol by age 11		-.13 (.02) ***		-.13 (.41)		-.13 (.02) ***
N	9,287	9,202	9,200	9,116	9,286	9,202

Note. Robust standard errors are shown in parentheses;

* $p < .05$,

** $p < .01$,

*** $p < .001$.