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Alcohol and tobacco use among maltreated and non-maltreated adolescents in a birth cohort

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Abstract

Aims—This study examines whether child maltreatment experience predicts adolescent tobacco and alcohol use.

Methods—The subjects were participants in the Mater-University Study of Pregnancy (MUSP), a birth cohort of 7223, of whom 5158 (71.4%) were available for analysis at the 14-year follow-up. Child protection history was obtained from the state's child protection agency and confidentially linked. Exposure to reported child maltreatment was the primary predictor variable. The outcome variables were self-reported smoking and alcohol use. Associations were adjusted for potential confounders.

Findings—Reported child maltreatment was associated with early adolescent smoking (OR 1.76, 95% CI 1.32 to 2.34) after adjustment for sociodemographic variables and coexisting alcohol use. Both neglect/emotional abuse (OR 2.03, 95% CI 1.20 to 3.42) and neglect/emotional abuse that included physical abuse (OR 1.85, 95% CI 1.19 to 2.88) were associated with smoking after full adjustment including for coexisting smoking. After full adjustment including coexisting smoking,

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only child neglect/emotional abuse predicted early adolescent alcohol use (OR 1.78, 95% CI 1.06 to 2.97), but not the other types of maltreatment.

Conclusions—Reported child maltreatment predicts early adolescent smoking after adjusting for alcohol use, but does not predict alcohol use after adjustment for smoking. Both smoking and alcohol use are predicted by reported child neglect. Early adolescent smoking is also predicted by multi-type maltreatment that includes physical abuse.

Introduction

The maltreatment of children, including physical abuse, sexual abuse, emotional abuse, and neglect, is a major worldwide public health problem, associated with adverse outcomes that span both physical and psychological health, including mental health problems, drug and alcohol abuse, obesity and risk-taking behaviour and criminality in adulthood (1). Likewise, tobacco and alcohol use are preventable behaviours of considerable global public health significance.

Both smoking and alcohol use show an upward trajectory in adolescence. Smoking is the principal cause of preventable death in Australia, accounting for an estimated 15% of all deaths (2). Most adult smokers become addicted in adolescence (3). A number of cross-sectional studies using retrospective self-report of adverse childhood events, including maltreatment, have reported higher rates of smoking and/or increased markers of nicotine addiction (4–8). A recent self-report study found higher rates of respiratory disease among adults who had been exposed to childhood abuse, with results suggesting cigarette smoking as a potential mediator (9).

Longitudinal studies addressing child maltreatment and smoking are less common. Lewis et al (10) compared adolescents with histories of reported maltreatment with a non-maltreated control group, and found more than three times the odds of self-reported smoking at age 16 among the maltreatment group. Topitzes et al (11) followed an urban, mainly African American cohort to young adulthood, finding a greater than 50% increased likelihood of smoking in young adulthood among those with a history of documented maltreatment.

Alcohol is the most commonly used substance in Australian society, with recent data indicating that 86% of Australian teenagers had used some alcohol by the age of 14 (12), although when this is limited to consumption of a whole glass or more, the rate is substantially lower (13). Harmful alcohol use in late adolescence, including heavy episodic drinking, is an important public health issue, with studies estimating that more than 40% of Australian 15- to 17-year olds drank at a risky level on their last occasion (12). Alcohol consumption is second only to tobacco use as a cause of drug-related hospitalization and death (14). In late adolescence, it is a factor in a number of harms, including trauma due to motor vehicle accidents, violence, unprotected sex, and suicide (14). Furthermore, early adolescent alcohol misuse is associated with persistence into adult harmful and binge drinking (15).

Adverse childhood experiences, including maltreatment, have likewise been associated with harmful alcohol use in adulthood. For example, Anda et al (16) in a large cross sectional

study, found that adults with the highest Adverse Childhood Experiences score (top 12.5%) had 7.2 times the odds of alcoholism when compared to the reference group. A number of studies have confirmed that in adolescence, a history of child maltreatment is an important correlate of heavy episodic (“binge”) drinking (17, 18).

The dominant theoretical framework that supports a causal association between childhood maltreatment and misuse of substances, including alcohol and tobacco, is the self-medication hypothesis (19). This theory asserts that people use substances to relieve or dampen overt or concealed psychological distress, and has particular appeal in the context of child maltreatment research because of the known long-term psychological outcomes following child abuse and neglect (1). Early childhood adversity may also affect the development of dopaminergic reward processing systems in the brain, which are frequently the target of drugs of abuse (20).

The majority of studies of child maltreatment as an antecedent of adolescent tobacco and alcohol use have had a cross-sectional design, permitting the possibility of recall bias. This is the first study of the question using a longitudinal, population-based birth cohort, with prospective documentation of reports of different types of child maltreatment. Additionally, independent maternal reports of personal substance use were obtained, which is valuable given the observed intergenerational transfer of alcohol problems (21).

The primary study question was whether reported child maltreatment was associated with alcohol or tobacco use in adolescence. The secondary question was whether specific patterns of types of maltreatment were associated with alcohol and/or tobacco use.

Methods

Data sources

The Mater-University Study of Pregnancy (MUSP) is a longitudinal birth cohort study (22). Between 1981 and 1983, 8556 consecutive pregnant women attending the Mater Misericordiae Mothers’ Hospital for their first prenatal visit were invited to participate (23). The remaining cohort of mothers who delivered live, singleton babies at the study hospital numbered 7223. At their first prenatal clinic, the women completed a questionnaire including topics such as their personal health details and demographic information. The mothers and children were assessed again when the children were aged 3 to 5 days, 6 months, 5 years, and 14 years. The follow-up rate at 5 years was 72.8%, and at 14 years was 71.6% (22).

The child maltreatment data in this study were drawn from the records of the Queensland Department of Families, Youth and Community Care (DFYCC) in September 2000. The data include reports of suspected abuse and neglect that met the threshold for investigating by DFYCC officers. Additionally, the investigation outcome (substantiated or unsubstantiated) was recorded. The child maltreatment data was anonymously linked to the MUSP longitudinal data as described previously (24). The project was approved by the University of Queensland Behavioural and Social Sciences Ethical Review Committee, and the Mater Human Ethics Committee.

For this study, exposure to child maltreatment was categorized according to recorded reports of the study subjects as cases of suspected child abuse and/or neglect. Additionally, the reports were recorded as to the type or types of suspected maltreatment – physical abuse, sexual abuse, emotional abuse, and neglect. After investigation, the outcome was recorded – substantiated (or substantiated “at risk”), unsubstantiated, or “unable to complete”. This study used the reporting of maltreatment as the independent variable, rather than substantiation, because previous research has suggested that substantiation of reports does not differentiate long-term outcomes from those of children subjected to unsubstantiated reports (25). Sensitivity analysis was performed using substantiated maltreatment as the predictor variable.

The study subjects who had been reported as cases of maltreatment were categorized into one of five groups. First were those who had only been reported for physical abuse. Second were those who had only been reported for suspected sexual abuse. The third group was those reported for neglect, with or without emotional abuse. Neglect and emotional abuse were considered together because in addition to sole reporting of emotional abuse being rare, there was a qualitative overlap – failure to provide a child with affection and psychological nurturing (emotional neglect) could be categorized as either neglect or emotional abuse.

The fourth and fifth groups had been reported for more than one maltreatment type, which has been referred to as multi-type maltreatment (26). The fourth group consisted of those reported as cases of both sexual abuse and one or more other types (physical or emotional abuse, or neglect). The final group had been reported for physical abuse as well as neglect or emotional abuse.

This expanded hierarchical scheme reflects the reality of the high overlap of maltreatment types in practice. Similar ordering schemata have been used previously by a number of groups (27). The comparison group was those who had not been reported at all. Reporting could occur up to the age of 18. At the time of DFYCC data collection in September 2000, the youngest study subjects were 16.5 years old. Subjects reported for the first time as suspected maltreatment cases after completing the 14-year follow-up were not excluded from the primary analysis, but a further sensitivity analysis was performed from which these subjects were excluded.

Outcome measures

The subjects were asked how many cigarettes they had smoked in the last week: 50 or more, 30–49, 20–29, 10–19, 1–9, or nil. Two categories for analysis were generated from this: “Any smoking” versus no smoking in the last week; and “Heavy smoking”, classified as 10 or more per week, versus no smoking.

To ascertain alcohol use, the adolescent subjects were asked at the 14-year follow-up, “How often do you drink alcohol?” (Daily; a few times a week; a few times a month; a few times a year; rarely; and never). The following question was “how much do you drink on those occasions?” (Seven or more glasses; three or four glasses; one or two glasses; less than one glass; never drink).

Two alcohol use outcomes were analyzed: “Any drinking”, i.e. subjects reported having ever consumed a full glass of alcohol; and “heavy drinking”, i.e. ever drinking 5 or more drinks in a session, or 3 or more in a session at least monthly. These were the preferred cutoffs in the study by Alati et al (28) that used the same questionnaire.

Potential confounders

Potential confounding variables were selected to adjust for any observed associations between reported maltreatment and adolescent smoking and alcohol use. They were selected on the basis of previously published associations with both the predictor variable (child maltreatment) and the outcomes (alcohol and tobacco use). The variables were: Family income, maternal marital status, race, and education; maternal tobacco and alcohol use; and subject gender and age at questionnaire completion (29).

Maternal alcohol use at the 14-year follow-up was included due to the association between parental alcohol misuse and child abuse and neglect (30). Furthermore, genetic studies add biological plausibility to the observed intergenerational transmission of alcohol misuse disorders (31). Similarly, maternal smoking at the 14-year follow-up was used to adjust both the adolescent smoking and alcohol outcomes (32). Socioeconomic status, youth age, race and gender are all recognized correlates of both alcohol misuse and maltreatment exposure (17). In this study, measures of socioeconomic status included family income (at 14-year follow-up), and maternal marital status and education level (at first prenatal visit).

An additional adjusted analysis was performed for each outcome variable: The youths’ self-reported use of alcohol (ever had a full glass) and tobacco (any cigarettes in the last week) were used to adjust for the tobacco and alcohol outcomes, respectively. While each is an important outcome in its own right, there remained potential for each to confound or mediate the other’s observed associations with child maltreatment.

Statistical analysis

Multivariable logistic regression was performed using Stata 12 (StataCorp, Texas). In each analysis, the primary predictor variable was exposure to any reported child maltreatment, with further analysis according to the type or types of maltreatment categorized as outlined above. The reference group was the no smoking or no alcohol group, as appropriate. Outcomes were reported on an unadjusted basis, and then adjusted for the potential confounding variables as outlined above, followed by a final adjustment for use of the other substance (i.e. tobacco or alcohol). Multiple imputation was used to account for missing values of the adjusting covariates.

Results

Cohort characteristics

Of the cohort of 7223 mother-child pairs, 5200 (72%) participated in the 14-year follow up (mother or child questionnaire), of which 5172 completed the youth questionnaire. The number of youth subjects who completed the either the alcohol or smoking questions, or

both, was 5158 (Figure 1). The median age of subjects at completion of the youth questionnaire was 13.9 years (interquartile range 13.7 to 14.2 years).

Table 1 shows the rates of completion of the 14-year alcohol and smoking questions according to relevant sociodemographic variables, and maternal substance use. The completion rates were stratified along socioeconomic and demographic lines, with higher loss to follow up of those whose mothers were socioeconomically disadvantaged, and of mothers whose children had been reported as cases of suspected maltreatment. The youth of these disadvantaged mothers, and of mothers who smoked or used alcohol heavily, were also more likely to have been reported as maltreatment cases (Table 1).

Maltreatment characteristics

Of the birth cohort of 7214 for whom maltreatment data are available, 789 (10.9%) had been reported at least once to the DFYCC as a case of suspected maltreatment. Of the 5158 subjects remaining for analysis, 426 (8.3%) had been reported to DFYCC. Thus, children exposed to reported maltreatment were preferentially lost to follow-up, as were those exposed to other forms of social disadvantage. Most of the children had been reported for more than one maltreatment type. For example, among those reported as suspected sexual abuse cases, 63% had been reported for one or more other type; for physical abuse reports, this proportion was 83%. In the neglect/emotional abuse group, 68% had been reported for neglect only, 24% had been reported for both neglect and emotional abuse, and emotional abuse as a single maltreatment type was rare (7%).

Alcohol and smoking characteristics

Of the available cohort, 16.1% (830 of 5153) reported having consumed at least a whole glass of alcohol, with 4.8% reporting heavy drinking. Similarly, 11.7% (602 of 5154) reported smoking at least one cigarette in the last week, including 259 (5.0%) who smoked 10 or more in the week. Consumption of at least a whole glass of alcohol was strongly associated with youth smoking in the previous week: Subjects reporting one had 10.1 times the odds of reporting the other ($p < 0.001$). Of the 1099 subjects reporting either alcohol use or smoking, 497 (45.2%) reported alcohol use alone, 268 (24.4%) smoking alone, and 333 (30.3%) reported having used both.

Child maltreatment and alcohol use

Occurrence of any reported maltreatment was associated with increased odds of having ever consumed at least a whole glass of alcohol (OR 1.62, 95% CI 1.27 to 2.06)(Table 2). The association remained significant after adjustment for maternal and demographic factors, but not once youth smoking was added to the adjustment. Of the maltreatment categories, only the neglect/emotional abuse group had increased odds of any alcohol use that persisted after adjustment for all covariates including smoking (OR 1.78, 95% CI 1.06 to 2.97)(Table 2). On assessing heavy alcohol use, the association with reported maltreatment was strong prior to adjustment (OR 2.55, 95% CI 1.80 to 3.61)(Table 2), and remained significant after adjustment for maternal and demographic variables. However, no significant association remained after concurrent youth smoking was added to the adjustment. After adjustment for

sociodemographic variables and youth smoking, only neglect/emotional abuse was associated with heavy alcohol use (OR 2.63, 95% CI 1.31 to 5.26)(Table 2).

Smoking

The occurrence of any report of child maltreatment was associated with having smoked any cigarettes in the previous week (OR 2.63, 95% CI 2.07 to 3.35), which was maintained after adjustment for maternal and demographic covariates and youth alcohol use (OR 1.76, 95% CI 1.32 to 2.34)(Table 3). When compared with the non-maltreated peers, all the maltreatment subgroups except sexual abuse alone had increased odds of smoking; after adjustment for potential confounders including youth alcohol use, both neglect/emotional abuse alone (OR 2.03, 95% CI 1.20 to 3.42) and neglect/emotional abuse with physical abuse (OR 1.85, 95% CI 1.19 to 2.88) were associated with youth smoking (Table 3).

Similarly, any reported maltreatment was associated with heavy smoking after adjustment, including for alcohol use (OR 3.76, 95%CI 2.75 to 5.15)(Table 3). Of the subgroups, all except singular sexual abuse were associated with heavy smoking before adjustment. After full adjustment including for youth alcohol use, both neglect/emotional abuse alone (OR 2.16, 95% CI 1.09 to 4.31) and neglect/emotional abuse with physical abuse (OR 2.97, 95%CI 1.68 to 5.23) retained significant associations (Table 3).

Sensitivity analyses

Two sensitivity analyses were performed. First, the analysis was repeated using only substantiated cases of maltreatment as the predictor variable. The second sensitivity analysis excluded maltreatment cases that had been reported after the young person completed the 14-year questionnaire. The associations between any maltreatment and the smoking and alcohol outcomes were similar to those seen in the original analysis after full adjustment (data shown in online supplement).

Discussion

This study found that independently reported child maltreatment is robustly associated with adolescent tobacco and alcohol use in a large, prospective birth cohort. The present study supports previous findings of increased odds of smoking, after accounting for sociodemographic variables, among previously maltreated youth and young adults (4–7, 10, 11). In relation to alcohol use, the present study demonstrated an association with reported child maltreatment after adjustment for maternal and sociodemographic factors that was in keeping with previous studies such as Shin et al (33), but did not persist once additional adjustment was made for youth smoking.

The distinguishing feature of this study is that to our knowledge, no other large birth cohort study has been able to assess the associations between child maltreatment and adolescent smoking and alcohol use while defining the exposure to different types of maltreatment prospectively and independently.

There are some novel aspects of our findings that require discussion. First, in addition to adjusting for sociodemographic variables, we adjusted youth smoking for concurrent youth

alcohol use, and *vice versa*. This resulted in amelioration of the association between child maltreatment and alcohol use, but not the association between child maltreatment and adolescent smoking. It is known that adolescent alcohol and tobacco use frequently co-exist (34), and that tobacco use commences at a slightly younger mean age than alcohol use (13). Therefore, the young age of the adolescents in this study may have contributed to the relative strength of association between reported maltreatment and smoking. Interestingly, smoking appears to be more strongly associated than alcohol with problems in adult adjustment (35). Our study suggests that early onset of tobacco use may be a mediator of the early onset of alcohol use in maltreated children – a possibility for further investigation in other large longitudinal cohorts.

Second, our results suggest that child neglect and emotional abuse have been relatively under-appreciated as antecedents of adolescent smoking and alcohol use, with most of the previous literature focusing on the importance of physical and sexual abuse. In this study, the neglect/emotional abuse group had more than double the odds of heavy alcohol use when compared to non-maltreated peers, which persisted after additional adjustment for coexistent youth smoking. In relation to smoking, the neglect/emotional abuse had similarly high odds of any or heavy smoking. Alati et al (28) found that the combination of frequent partner changes coupled with low parenting control was associated with heavy alcohol use in adolescence. Our finding that of the types of maltreatment, neglect (+/- emotional abuse) was the strongest predictor of heavy adolescent alcohol use, adds weight to the suggestion of other researchers that limited parental supervision, permitting association with other like-minded peers, may be a key determinant of early alcohol initiation, and alcohol use in adolescence (36).

Third, the present study found that the subjects reported as cases of sexual abuse did not have higher odds of alcohol or tobacco use after adjustment, in contrast to the findings of survey-based recall studies (7, 8). This may be due in part to misallocation related to this study's use of government agency data. An Australian cross sectional self-report study of child sexual abuse suggested a lifetime incidence of approximately 15% in boys and 30% in girls (37), whereas among our longitudinally followed-up cohort only 2.3% had been reported as suspected cases of sexual abuse. On the other hand, one might expect that our cohort who had been reported as suspected cases of sexual abuse could be the most severe cases, and therefore more likely to have adverse outcomes.

The study of the neurobiology of the links between early life adverse events and later problem behaviours lends biological plausibility to a causal association between child maltreatment and adolescent substance use (16). Some of the brain changes observed following early life stress include abnormalities of the hypothalamic-pituitary-adrenocortical (HPA) axis (16). These neurobiological hypotheses fit well with the observations that use of substances such as tobacco may be a strategy of self-medication, to help manage stress and tension (38).

There are a number of limitations to the present study. First, no information was available about the extent of drinking by the subjects' fathers. Thus, this potential source of confounding could not be tested. Neither did the study have access to genetic analysis to

further investigate any possible interactions between the subjects' genetics and their maltreatment histories, as has been recently studied in relation to the MAOA gene (31).

The loss to follow-up in this study requires addressing. While the overall follow-up rate was not unusual for a large birth cohort, there was preferential attrition of socioeconomically disadvantaged subjects, and of those whose children were reported as suspected cases of maltreatment (Table 1). This is a limitation of the present study, although studies of loss to follow up in ours and other cohorts suggest that those lost to follow up broadly have the poorer outcomes that would be expected given their baseline characteristics (39). Therefore, we have some confidence that the magnitude of associations found in this study would likely be similar, if not greater, if the whole birth cohort was available.

Finally, the use of government agency data to define the exposure to child maltreatment, while prospective and objective, has some potential disadvantages. There is a risk of misallocation due to under-reporting, as exemplified by sexual abuse as discussed above. Misallocation of this type would tend to result in underestimation of the association with smoking or alcohol use. Consequently, the small absolute numbers of followed up subjects in some maltreatment categories confers a risk of loss of power and under-recognition of true associations. Therefore, our findings are likely to be conservative estimates of the true association between child maltreatment and early adolescent onset of alcohol and tobacco use.

Conclusion

This study has found, in a large birth cohort, that exposure to maltreatment in childhood is independently associated with adolescent smoking after adjustment for a wide range of potential confounders and mediators, including concurrent alcohol use. Of the types of maltreatment, childhood neglect was most consistently associated with the early onset of both smoking and alcohol use, and heavy smoking and alcohol use, in young adolescents. The addition of these adverse outcomes of child maltreatment to the others documented in similarly rigorous, long term cohort studies lend further impetus to the allocation of resources to protect children from abuse and neglect, develop strategies to boost resilience among those unfortunately exposed, and address substance use behaviours in abused and neglected adolescents.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Figure 1.
Flow of subjects through MUSP study

Table 1

Rates of completion of youth questionnaire (including smoking and/or alcohol questions) at 14-year follow-up.

Characteristic	N	Questionnaire completion (%)	Reported maltreatment (%)
<i>Variables available for cohort from birth (N=7214)</i>			
<i>Maltreatment notification</i>			
No notifications	6425	73.7	χ^2, p 133.3, <0.001
Any notification	789	54.0	0 100.0
<i>Type of notified maltreatment (exclusive categories)</i>			
Physical abuse only	59	62.7	100.0
Sexual abuse only	67	74.6	100.0
Neglect and/or emotional abuse	185	51.4	100.0
Sexual abuse + 1 or more other	192	43.8	N/A
Physical abuse + neglect or emotional	281	56.9	100.0
<i>Gender</i>			
Male	3755	71.1	10.1
Female	3459	71.9	5.37, 0.020 11.8
<i>Race</i>			
White	6250	73.2	10.7
Aboriginal-Islander	444	52.9	24.08, <0.001 17.6
Asian	307	61.9	7.8
Other/not specified	213	74.2	9.4
<i>Marital status in pregnancy</i>			
Married	5380	76.1	7.99
Single	735	59.3	201.9, <0.001 21.1
Living together	843	57.3	18.0
Separated-divorced-widowed	193	53.9	23.8
<i>Maternal education status in pregnancy</i>			
Incomplete high school	1304	66.2	19.1
		27.96, <0.001	132.8, <0.001

Characteristic	N	Questionnaire completion (%)	Reported maltreatment (%)
Completed high school	4601	72.0	10.0
Post high school	1256	75.4	5.4
<i>Family income (annual) at 14-year follow-up (N=5172)</i>			
≤20799	1057	99.1	4.23, <0.040
>=20800	3983	99.6	15.1
			83.7, <0.001
<i>Maternal alcohol use at 14-year follow-up (N=5172)</i>			
Nil	949	98.8	2.04, 0.564
Light (up to 0.5 glasses per day)	3009	99.3	9.2
Moderate (up to 1 glass per day)	633	99.2	8.2
Heavy (more than 1 glass per day)	579	99.3	5.7
			10.4
<i>Maternal smoking at 14-year follow-up (N=5172)</i>			
Nil	3570	99.3	2.14, 0.343
Light to moderate (1–19 per day)	768	99.2	6.0
Heavy (20 or more per day)	834	98.8	11.2
			15.7
			93.2, <0.001

Table 2

Odds ratios any alcohol use (i.e. ever drunk a full glass of alcohol), and heavy alcohol use (5 or more drinks in a session or 3 or more at least monthly) at 14-year follow-up

	Unadjusted OR (95% CI) (n=5153)		Adjusted OR ¹ (95% CI) (n=5153)		Adjusted OR ² (95% CI) (n=5153)	
	Any alcohol					
	1.00	<i>p</i> value	1.00	<i>p</i> value	1.00	<i>p</i> value
No reported maltreatment	1.00					
Any reported maltreatment	1.62 (1.27, 2.06)	<0.001	1.42 (1.10, 1.83)	0.007	1.13 (0.85, 1.50)	0.413
Physical abuse only	1.09 (0.45, 2.63)	0.845	1.11 (0.45, 2.71)	0.822	0.79 (0.30, 2.12)	0.641
Sexual abuse only	0.61 (0.24, 1.53)	0.291	0.52 (0.20, 1.33)	0.171	0.44 (0.16, 1.21)	0.112
Neglect/emotional abuse	2.91 (1.89, 4.46)	<0.001	2.38 (1.52, 3.74)	<0.001	1.78 (1.06, 2.97)	0.028
Sexual + 1 or more other	1.60 (0.95, 2.68)	0.077	1.40 (0.82, 2.40)	0.216	1.24 (0.68, 2.25)	0.486
Physical + neglect/emotional	1.48 (1.01, 2.19)	0.045	1.33 (0.89, 1.99)	0.169	1.05 (0.67, 1.65)	0.819
	Heavy alcohol					
	1.00	<i>p</i> value	1.00	<i>p</i> value	1.00	<i>p</i> value
No reported maltreatment	1.00					
Any reported maltreatment	2.55 (1.80, 3.61)	<0.001	1.95 (1.34, 2.84)	<0.001	1.36 (0.89, 2.09)	0.890
Physical abuse only	0.65 (0.09, 4.76)	0.669	0.61 (0.08, 4.58)	0.634	0.34 (0.04, 2.80)	0.318
Sexual abuse only	0.86 (0.21, 3.58)	0.838	0.67 (0.16, 2.85)	0.590	0.56 (0.12, 2.69)	0.472
Neglect/emotional abuse	5.63 (3.27, 9.69)	<0.001	3.82 (2.13, 6.84)	<0.001	2.63 (1.31, 5.26)	0.006
Sexual + 1 or more other	1.79 (0.77, 4.18)	0.178	1.34 (0.56, 3.24)	0.510	1.00 (0.37, 2.70)	0.999
Physical + neglect/emotional	2.48 (1.45, 4.26)	0.001	1.98 (1.11, 3.50)	0.019	1.37 (0.71, 2.63)	0.349

¹ Adjusted for: Family income, maternal alcohol use and maternal smoking (14y follow-up); maternal education and marital status (prenatal); and race, age, and gender.

² Additional adjustment for youth smoking (14y follow-up).

Table 3

Odds ratios (OR) for any smoking in last week, and heavy smoking (≥ 10 in week) at 14-year follow-up

	Unadjusted OR (95% CI) (n=5154)	Adjusted OR ¹ (95% CI) (n=5154)	Adjusted OR ² (95% CI) (n=5154)
Any smoking			
No reported maltreatment	1.00	1.00	1.00
Any reported maltreatment	2.63 (2.07, 3.35)	1.86 (1.43, 2.41)	1.76 (1.32, 2.34)
Physical abuse only	2.41 (1.09, 5.32)	2.09 (0.92, 4.70)	2.28 (0.95, 5.51)
Sexual abuse only	1.61 (0.75, 3.44)	0.222	1.40 (0.58, 3.36)
Neglect/emotional abuse	3.89 (2.50, 6.06)	<0.001	2.03 (1.20, 3.42)
Sexual + 1 or more other	2.30 (1.36, 3.91)	0.002	1.29 (0.69, 2.42)
Physical + neglect/emotional	2.54 (1.74, 3.71)	<0.001	1.85 (1.19, 2.88)
Heavy smoking			
No reported maltreatment	1.00	1.00	1.00
Any reported maltreatment	3.76 (2.75, 5.15)	2.43 (1.73, 3.41)	2.36 (1.61, 3.47)
Physical abuse only	3.00 (1.04, 8.65)	0.041	3.10 (0.94, 10.27)
Sexual abuse only	2.00 (0.71, 5.64)	0.189	1.81 (0.52, 6.27)
Neglect/emotional abuse	4.85 (2.72, 8.66)	<0.001	2.16 (1.09, 4.31)
Sexual + 1 or more other	3.50 (1.82, 6.74)	<0.001	1.75 (0.78, 3.92)
Physical + neglect/emotional	4.10 (2.59, 6.50)	<0.001	2.97 (1.68, 5.23)

¹ Adjusted for: Family income, maternal alcohol use and maternal smoking (14y follow-up); maternal education and marital status (prenatal); and race, age, and gender.

² Additional adjustment for any youth alcohol use (14y follow-up).