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Addict Behav. Author manuscript; available in PMC 2016 November 01.

Published in final edited form as:

Addict Behav. 2015 November ; 50: 222–228. doi:10.1016/j.addbeh.2015.06.014.

The Impact of Early Life Stress on Risk of Tobacco Smoking Initiation by Adolescents

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Abstract

Aims—Our study aimed to examine the association between early life stress and early initiation of alcohol and tobacco use.

Design—This prospective cohort study of women and children belongs to the Ukrainian component of the European Longitudinal Study of Pregnancy and Childhood.

Setting—Dniprodzerzhynsk, a city of some 250,000 inhabitants in south central Ukraine.

Participants—All 4398 women who visited antenatal clinics between December 25, 1992 and July 23, 1994, planned to continue their pregnancy, and were permanent residents of the city were invited to participate. Of the 4398 invitees, 2148 agreed and 1020 of the mother-child pairs were available for complete follow-up until the children were 16 years old.

Measurements—When study children reached ages 3 and 7, their mothers completed questionnaires about their children's exposure to and impact from a standard list of recent stressful life events. From the data on event prevalence and severity, we assigned each child to low,

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medium, or high early life stress. When the children became age 16, they completed questionnaires about their history of smoking and drinking.

Findings—In multivariate analysis that controlled for current level of family income, current family type, current school type, year of child's birth, lifetime smoking and current drinking by mother, and education of mother and father, girls with high stress at age 3 had 2.2 times (95% confidence interval: 1.23-4.08) higher odds than girls with low stress to start smoking early.

Conclusions—Our study may be the first to use a longitudinal study design to examine early life stress as a risk factor for early smoking initiation in adolescence.

Keywords

tobacco use; alcohol drinking; prevention and control; sex differences; male adolescents; female adolescents

1. INTRODUCTION

Most studies to identify risk factors for adolescent tobacco and alcohol use focus on concurrent variables, including social environment, parent and peer influence, availability and accessibility of cigarettes and alcohol, and social reinforcement for use of these drugs (Simantov, Schoen, & Klein, 2000). While some research finds that initiation and experimentation in late childhood predict tobacco and alcohol use (Jackson, 1997), other evidence describes developmental pathways to teenage smoking and drinking that emerge even earlier (Masten, Faden, Zucker, & Spear, 2008). A life course approach uses modeling to uncover the temporal relation between early life exposures and later life outcomes and possible causal pathways including mediating, modifying, and confounding factors (Kuh, Ben-Shlomo, Lynch, Hallqvist, & Power, 2003).

Stress in childhood is a predictor of adult psychopathology, including alcohol and drug addiction. Stressors exert their effect both as mediators of inherited genetic risk for disorders and also as independent risk factors (Anda et al., 2002; Eaves, Prom, & Silberg, 2010). Early life stress (ELS) has been associated with several adverse effects in adults, including abnormalities in electrical brain activity (McFarlane et al., 2005), personality dimensions (Roy, 2002), substance abuse and depression (Anda et al., 2002), and other risk behaviors and diseases (Enoch, 2011; Felitti et al., 1998). The relation between severe stress, such as child abuse and maltreatment, and adult substance abuse and psychopathology is even more prominent (Maniglio, 2011; Simpson & Miller, 2002).

Compared with alcohol use, few reports identify SLE as risk factors for tobacco smoking. McFarlane et al. confirmed a retrospective measure of ELS as a predictor of nicotine dependency in adult smokers (McFarlane et al., 2005). Other retrospective studies have reported an association between adult smoking and different stressors: emotional, physical, and sexual abuse; witnessing violence between parents; divorce of parents; and growing up with a substance-abusing, mentally ill, or incarcerated household member (Anda et al., 1999; Chung et al., 2010; Dube, Cook, & Edwards, 2010; Ford et al., 2011; Mingione, Heffner, Blom, & Anthenelli, 2012; Ramiro, Madrid, & Brown, 2010; Sacco et al., 2007; Simantov et al., 2000; van Loon, Tijhuis, Surtees, & Ormel, 2005). However, we are

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unaware of any published prospective or retrospective studies of ELS as a risk factor for early smoking initiation in adolescence. Our prospective cohort study uses data about stressful events in 3 and 7 year old children to examine the risk of early initiation of alcohol and tobacco use among adolescent boys and girls in a large, middle-income country.

2. METHODS

2.1. Study setting and population

The present analysis uses data from the Ukrainian component (described previously (Hryhorczuk et al., 2009)) of the European Longitudinal Study of Pregnancy and Childhood, a prospective cohort study of women and their children to identify environmental features affecting children's health and development (Golding, Pembrey, & Jones, 2001). In Dniprodzerzhynsk, a city of some 250,000 inhabitants in south central Ukraine, we invited all pregnant women who between December 25, 1992 and July 23, 1994 visited antenatal clinics, planned to continue their pregnancy, and were permanent residents of the city. All antenatal clinics in city were visited by the study team (Little, Monaghan, Gladen, Shkyryak-Nyzhnyk, & Wilcox, 1999). Of the 4398 women who met these study eligibility criteria, 2148 (49%) women agreed to participate. No information was recorded about reasons why some pregnant women were unwilling to participate. With a very high abortion rate then, some women might have been unsure about their intention to keep the pregnancy (Little et al., 1999). Furthermore, the study personnel had limited resources to track participants for long periods and to record attempts to locate drop-outs. Therefore, only 1020 (47%) of the enrolled 2148 woman-child pairs were available for complete follow-up until the study children were 16 years old. (In case of twin births, both children were eligible to participate.) Informed consent was obtained from the children's parents, and assent was obtained from every child at ages 7 and 16. The study received Institutional Review Board ethical approval from the University of Illinois in Chicago and the Ukraine Institute of Pediatrics, Obstetrics and Gynecology in Kyiv at each stage of data collection.

2.2. Data collection

Data about outcomes, exposures, and potential confounders were obtained from participants' self-completed questionnaires distributed by local primary health care facility staff. Mothers provided answers about their smoking and drinking, their marital status and attitude to pregnancy in the baseline questionnaire. The year of child birth was recorded during the delivery (delivery questionnaire). Mothers answered questions about their children's exposure to and impact from SLE at ages 3 and 7 (see Appendix). Education of mother and father was also recorded when the child was 7. When study children became age 16, they answered questions about their history of smoking tobacco and drinking alcohol. At the same time mothers gave answers to the questions about their smoking and drinking. A US four dollar voucher for mobile phone use was given to the adolescents to participate in the study. No financial incentives were given to the mothers or the young children at any stage of data collection.

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2.3. Outcome measures

For this paper, we used two study outcomes – age at initiation of smoking and of drinking which were determined from answers to questions asked of the 16 year old study children. The questions were, “When (if ever) did you FIRST do each of the following things (smoke your first cigarette)?” and “When (if ever) did you FIRST do each of the following things? (drink beer (at least one glass), drink cocktail (at least one glass), drink wine (at least one glass), drink spirits (at least one glass)?”. These questions came from the European Survey Project on Alcohol and Other Drugs (ESPAD) questionnaire (Hibell B., 2007), whose test-retest reproducibility and high internal consistency have been shown previously (Hibell B., 2000; Molinaro, Siciliano, Curzio, Denoth, & Mariani, 2012). For smoking, children were divided a priori into those who started smoking at or before age 13 and those who started after age 13 or never. For drinking, children were divided into those who started drinking at or before age 12 and those who started after age 12 or never. These two ages came from estimates of the average age of smoking and drinking onset in Eastern Europe (Andreeva, Krasovsky, & Semenova, 2007; Oh et al., 2010).

2.4. Exposure measures

When the study children reached ages 3 and 7, their mothers reported whether they had had any SLE in the past 1.5-2 years. The SLE list (see Appendix) included 15 events for 3 year olds and 18 events for 7 year olds. For each event a child had, such as being hospitalized, the mother rated the event's impact by describing the child as being “very upset”, “quite upset”, “a bit upset”, or “not upset”. The exposure measures came from the Avon Longitudinal Study of Parents and Children (http://www.bristol.ac.uk/alspac/sci-com/quests/ accessed on July, 20; 2012). Using these data on SLE prevalence and severity, we calculated an “ELS score” of 0–60 points for 3 year olds and of 0–72 points for 7 year olds. We assigned the children's ELS scores to three equal groups representing low, medium, and high stress. For children aged 3 the groups were 0-2, 3-6, and 7-60 points, while for children aged 7 the groups were 0-3, 4-7, and 8-72 points. We used the method used by the Avon Longitudinal Study of Parents and Children to score mothers’ ratings of event severity: 1 for not upset, 2 for a bit upset, 3 for quite upset, and 4 for very upset (Enoch et al., 2010). For example, if a child had three of 15 possible events and was “very upset” each time, this child received an ELS score of 12 (3 times 4) points. Because the ELS score anticipated transforming ordinal data to interval data, which is not always appropriate, we approached the data with a principal components of categorical data analysis (Iakunchykova et al., 2013). However, since the score generated by optimal scaling revealed associations very similar to those of the initial score, we retained the original score here.

2.5. Potential confounders

Based on knowledge about the factors associated with tobacco smoking, alcohol use, and ELS (Griesbach, Amos, & Currie, 2003; Ledoux, Miller, Choquet, & Plant, 2002), we chose eight potential confounders that can be controlled for in multivariate analysis. Measures of three of these variables were available from the 16 year old study children: current level of family income; current family type; and current school type. The other five variables were available from study mothers: year of child's birth from delivery questionnaire; lifetime

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smoking and current drinking by mother from baseline and 16 years follow-up; and mother's and father's education from 7 years follow-up.

2.6. Statistical analysis

Our initial analysis examined the relation between the three levels of ELS and the two study outcomes of first age of smoking and first age of drinking. This was done separately for male and female children using the $\chi 2$ independence test. Next we used the odds ratio, with a 95% confidence interval, to assess the relation between exposures, confounders, and outcomes in both bivariate and multivariate analyses. Bivariate logistic regression was used to examine the relation between the eight above-mentioned potential confounders and the study outcomes. We included the exposure variable and the potential confounders one by one into multivariate logistic regression models with only one confounding variable in each model to observe the attenuation effect attributable to each variable. Finally, we conducted multivariate binary logistic regression analysis, controlling for potential confounders selected on the basis of the results of (a) the previous step in this analysis and (b) prior evidence from relevant research. All modeling was done separately for boys and girls because gender might modify the effect of ELS and other variables on substance use onset (Widom et al., 2006).

2.7. Attrition

The group that was lost to study follow-up, which included 1128 (53%) of the 2148 mother-child pairs, comprised mainly individuals who could not be located. No statistically significant differences were found between study participants who did and did not complete the study. We examined group differences in level of child's early life stress at 3 and 7 years old, gender of a child, smoking and alcohol use by parents during pregnancy, marital status of women during pregnancy, attitude to pregnancy by mother/father, and education of mother/father. Although smoking during pregnancy occurred in 12.7% of women lost to follow-up versus 10.7% of women who completed, the difference was small ($p=0.065$).

Of the 1020 woman-child pairs with complete study follow-up, some had missing data for some exposures or outcomes (see Table 1). There were 898 participants with available ELS score at 3 years old, 840 participants with available ELS score at 7 years old, 948 participants with available data about age of smoking onset, and 975 participants with available data about age of drinking onset. Only study participants with complete data on both study exposures and outcomes were included in the final multivariate regression model.

3. THEORY

In addiction research, stress refers to processes that include perception, appraisal, and response to harmful, threatening, or challenging events or stimuli (Sinha, 2008). This definition leads to separate consideration of stimuli and the neural processes in emotional and motivational brain systems that are associated with chronic stress. Stimuli, or stressors, can be measured in epidemiologic research prospectively or retrospectively. For research purposes, ELS can be divided into childhood maltreatment and stressful life events (SLE), with some overlap between the two categories (Enoch, 2011). Compared to childhood

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maltreatment, SLE is more common in the general population, is less severe, and affects not only children but also other family members. Our study of ELS focused on SLE, most of which are negative.

Stressors in childhood influence the risk for adult alcohol and drug dependence regardless of genetic factors (Anda et al., 2002; Eaves et al., 2010; Verona & Sachs-Ericsson, 2005). Experiencing maltreatment and other SLE in the first few years of life is associated with onset of problem drinking in adolescence and alcohol dependence in early adulthood (Dube et al., 2006; Rothman et al., 2008). The degree of risk for adult alcohol use and drug dependence tends to be correlated with the severity of childhood maltreatment and the number of childhood SLE (Enoch et al., 2010; Jaffee et al., 2007).

Maltreatment under age 5 is associated with more psychopathology in adulthood, including anxiety and depression, than maltreatment at later ages is (Kaplow & Widom, 2007). Thus, it is necessary to account for age when SLE are experienced.

The effect of adverse childhood experiences is moderated by gender. Although evidence of a relation between childhood maltreatment and alcohol use disorders or drug dependence exists for women, few studies have found it in men (Simpson & Miller, 2002; Widom et al., 2006). Jaffee et al. confirmed that boys, but not girls, with high intelligence and parents with few symptoms of antisocial personality were more likely to be resilient to maltreatment (Jaffee et al., 2007). Also, abuse accounted for the relation between parental externalizing behavior and offspring externalizing behavior in female, but not male, participants (Verona & Sachs-Ericsson, 2005). However, the Virginia Adult Twin Study reported that men with experience of childhood maltreatment before age 15 were 1.7 times more likely than men not exposed to maltreatment to be diagnosed with alcohol use disorder (Young-Wolff et al., 2011). Therefore, we decided to do separate analyses for boys and girls to clarify the situation in a Ukrainian population.

4. RESULTS

Of the 1020 study children who were followed until age 16, 33% (160/478) of the boys and 24% (113/470) of the girls started smoking by age 13; 25% (125/478) of the boys and 25% (122/470) of the girls started drinking by age 12 (see Table 1).

In the 898 children aged 3, 265 (29.5%) were hospitalized and 228 (25.4%) were taken into care by someone else (see Table 2). Only 35 (3.9% of 898) children acquired a new mother/father, and two (.2% of 898) experienced sexual abuse. In the 840 children aged 7, 698 (83.1%) started school, and 278 (33.1%) had a pet die. Only 30 3.6% of 840) were separated from their mother, and three (.4% of 840) experienced sexual abuse. Median ELS scores were 4 (range: 0-31) points for both boys and girls at age 3, and they were 5 points for boys and 4 points for girls (range: 0-48) at age 7.

At 3 years old, children were most often “very” or “quite” upset with separation from mother (53%), shock/fright (49%), pet death (48%), being hospitalized (39%), and being taken into care by someone else (36%).

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At 7-years-old, children were most often “very” or “quite” upset with pet death (71%), shock/fright (60%), death of family member (58%), separation from someone (49%), separation from mother (47%), and being beaten by someone (42%).

In bivariate analysis of girls at age 3, those with high ELS had 2.2 (95% confidence interval: 1.27-3.74) times higher odds than those with low ELS to start smoking by age 13 (see Table 3). Compared with boys with low life stress at age 7, boys with medium or high life stress were more likely to start drinking by age 12, although the difference was not statistically significant. In multivariate analysis that controlled for current level of family income, current family type, current school type, year of child's birth, lifetime smoking and current drinking by mother, and education of mother and father, the above-mentioned association between high ELS and smoking initiation in girls (n=417) was confirmed (OR = 2.24, 95% CI = 1.23-4.08) (see Table 4).

5. DISCUSSION

This study fills an important gap in the literature regarding the effect of ELS on the initiation of substance use by adolescents. Using a life course approach to disease causation and a longitudinal study in a Ukrainian city, we observed that ELS increases the risk of early initiation of cigarette smoking by adolescent girls, but not by boys.

5.1. Explanations for and implications of the study findings

The explanations of the gender differences that were found in this study's exposure-outcome relations should be clarified. Female smoking may be less socially acceptable than male smoking, especially among adolescents. In Ukraine 34% of boys and 25% of girls aged 15-16 years old currently smoked in 2011 (Hibell B., 2011), and 67% of men and 20% of women did so in 2005 (Andreeva & Krasovsky, 2007). The lower prevalence of smoking in women because of the ”cultural prohibition” in most low and medium resource countries has been emphasized in a recent, revised model of the tobacco epidemic (Thun, Peto, Boreham, & Lopez, 2012). Not only does smoking by men get more social approval in many countries, it can even become normative for young men. When concurrent factors including social environment and norms come into play (Simantov et al., 2000), the impact of early life course factors may become less obvious as the variation in smoking behavior caused by stress becomes obscured when a majority of men smoke. Because in Ukraine smoking by women is less acceptable than smoking by men (Andreeva, 2011), it is not part of normative behavior and early life factors may play a causal role in adolescence. Young women may be more likely than young men to use smoking as a coping mechanism for problems, including the long-term emotional wounds of adverse childhood experiences.

However, although studies from developed countries have reported that adverse childhood experiences predict adolescent alcohol use (Dube et al., 2006), we did not observe such a relation in our study. According to Masten et al., “Alcohol use typically becomes acceptable and common sometime during the end of the second decade or the beginning of the third decade of life in drinking societies” (Masten et al., 2008). It is possible that alcohol use initiation is already normative in adolescence in Ukraine (Hibell B., 2011). If so, ELS

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factors may be less influential during adolescence in Ukraine than elsewhere, and researchers may not be able to measure their effects quantitatively.

The conditions that young children experience have extensive effects on health throughout life. Therefore, failure to account for them may distort the relation between adult risk factors and outcomes (Gilman & Loucks, 2012). Our study provides valuable information about early life, or distal, predictors of tobacco use that should be taken into account during assessment of the impact of concurrent, or proximate, factors.

Another source of the discrepancies between our results and those from other studies may be the differences in exposure measures. Many studies have assessed ELS through information about adverse childhood experiences, including severe stressors such as emotional, physical, and sexual abuse; violence between parents; divorce of parents; and presence of a substance-abusing, mentally ill, or criminal household member (Anda et al., 2002; Dube et al., 2006; Mingione et al., 2012). Our exposure measure included a range of stressors, including mild ones such as death of a pet, entering kindergarten/school, moving of family, and birth of a brother/sister. Severe stressors such as sexual abuse were unlikely to influence the association with our study outcomes because they were rarely reported.

The identification of ELS as a risk factor for smoking initiation among girls resembles associations between ELS and illicit drug use that are deeply grounded in the developmental approach to addiction prevention and treatment (Dube et al., 2003; Masten et al., 2008; Zucker, Donovan, Masten, Mattson, & Moss, 2008). Just as illicit drugs function as faulty coping mechanisms in persons with disorders resulting from early developmental factors, tobacco use in a population where it is considered socially unacceptable may acquire a similar functional role. Overall, our findings are quite plausible in terms of the mechanisms by which ELS can lead to addiction. Described in neurophysiologic studies, these mechanisms include permanent neurohormonal and hypothalamic-pituitary-adrenal axis changes, morphological changes in the brain, and gene expression changes in the mesolimbic dopamine reward pathway (Enoch, 2011).

Although stress-free childhood may be unattainable, both public and private policies can decrease the frequency and severity of SLE. Child beating, child hospitalization, and family member death are examples of events that can be reduced by collective action to promote nonviolence, provide mental health care, vaccinate universally, and control alcohol and tobacco use. The timely detection and mitigation of the consequences of ELS can keep children on a low-risk developmental path and may prevent early smoking initiation (Zucker et al., 2008).

5.2. Study strengths and limitations

There are many strengths of the study including its relatively understudied location, large sample size, and prospective nature. The information about early life stressors of children was reported by mothers when their children were 3 and 7 years old. This limits the recall bias which threatens the validity of those studies of ELS which use retrospective reports. Moreover, our measure of stress included several factors – such as being separated from parents, being sexually abused, and others – that are known to increase the risk of drug

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addiction (Sinha, 2008). Another strength of this study is the use of a reliable tool to measure adolescent tobacco smoking and alcohol use. Loss to follow-up is a study limitation. If the study risk factors and poor outcomes were less prevalent in participants lost to follow-up than in participants who completed the study, our results would overestimate the association between risk factors and children's tobacco use at age 16. However, since the prevalence of ELS and related risk factors in mother-child pairs lost to follow-up did not differ significantly compared to those mothers who remained in the study, this seems unlikely.

Other potential study weaknesses are the uncertainty about the basic psychometric properties of measures of ELS and the use of surrogate reports on the frequency and severity of stress events in children (Grant, Compas, Thurm, McMahon, & Gipson, 2004). Our study questionnaire did not ask about the number of instances of each type of SLE, and mothers had to rate each event's impact regardless of the number of instances of it. Although not all psychometric properties of our instrument are known, a recent paper confirms its good internal consistency. Two dimensions of stress could be clearly distinguished: overall stress and security related to child's attachment to mother and new experiences (Iakunchykova et al., 2013). Another approach to ELS data could consider the number of life event experiences without accounting for mother's rating of their severity. After counting the number of instances of SLE for each child at 3 and 7 years old, we conducted a reanalysis of the data using the original study methods. Since the results from the reanalysis remained unchanged, we decided to keep the first analysis because it includes more valuable information gathered during the study. Also, we found no evidence of an association between specific individual stressors and the outcome measures in our exploration of the data. Perhaps it is the combination of different stressors that influences one's behavior.

5.3. Conclusions

Our study is the first report of which we are aware that uses prospective methods to examine ELS as a risk factor for early smoking initiation in adolescence. Our evidence is based on data from a middle-income country in the context of the tobacco epidemic in Eastern Europe. This study opens up the potential for investigation into the type of ELS that best predicts substance use onset.

ACKNOWLEDGEMENTS

We are grateful to the families who took part in the study, the medical personnel for help in recruiting them, and the whole European Longitudinal Study of Pregnancy and Childhood team in Ukraine, which includes computer and laboratory technicians, interviewers, clerical workers, and research scientists.

6. FUNDING

This work was supported in part by the Fogarty International Center of the United States National Institutes of Health (Award Number D43TW000653).

Appendix

List of items in early life stress inventory at 3 and 7 years old

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(URL:http://www.bristol.ac.uk/alspac/researchers/resources-available/data-details/questionnaires/. Accessed: 2012-10-14. (Archived by WebCite® at http://www.webcitation.org/6BPEMVlll))

*Not included in the 3 year old child questionnaire

1. Child was taken into care by someone else.
2. Pet died.
3. Child's family moved.
4. Child had shock/fright.
5. Child was beaten by someone.
6. Child was sexually abused.
7. Child was separated from the mother.
8. Child was separated from the father.
9. Child acquired a new mother/father.
10. Child had a new sister/brother.
11. Child was hospitalized.
12. Child was looked after by a new person.
13. Child was separated from someone.
14. Child started attending a new kindergarten/school.
15. Something else happened to child.
16. The family member died.*
17. The child started to visit school.*
18. The child has lost the best friend.*

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Table 1

Descriptive characteristics of the study children and parents, n = 1020, by sex

Characteristic	Value	Boys (n=517)	Girls (n=503)
Started smoking at age 13 or younger (missing = 72)	Yes	160 (33.5%)	113 (24%)
	No	318 (66.5%)	357 (76%)
Started drinking at age of 12 or younger (missing = 45)	Yes	125 (25.4%)	122 (25.3%)
	No	367 (74.6%)	361 (74.7%)
Year of child's birth (missing = 0)	1993	70 (13.5%)	70 (13.9%)
	1994	393 (76.0%)	391 (77.7%)
	1995	54 (10.4%)	42 (8.3%)
Family structure at age 16 (missing = 6)	Traditional	300 (58.0%)	279 (55.6%)
	Single mother	127 (24.6%)	138 (27.5%)
	Reconstructed with a step-father	63 (12.2%)	60 (12.0%)
	Other	27 (5.2%)	25 (5.0%)
Type of school child attends at age 16 (missing = 12)	Secondary school	261 (51.1%)	298 (60.0%)
	Gymnasium[1]	72 (14.1%)	87 (17.5%)
	Vocational school[2] or college[3]	178 (34.8%)	112 (22.5%)
Current level of family income at child age 16 (missing = 3)	No money for food or clothes	79 (15.8%)	97 (20.1%)
	No money for household devices	110 (22.0%)	90 (18.7%)
	Need to borrow for bigger purchases, such as television or refrigerator	135 (27.1%)	111 (23.0%)
	Need to save for flat or car	99 (19.8%)	78 (16.2%)
	Enough for everything	76 (15.2%)	106 (22.0%)
Education of mother (missing = 189)	Secondary or less[4]	84 (20.2%)	72 (17.3%)
	Secondary professional[5]	205 (49.4%)	218 (52.4%)
	Higher or higher incomplete[6]	126 (30.4%)	126 (30.3%)
Education of father (missing =185)	Secondary or less[4]	75 (19.9%)	53 (14.8%)
	Secondary professional[5]	200 (53.2%)	186 (51.8%)
	Higher or higher incomplete[6]	101 (26.9%)	120 (33.4%)
Drinking by mother during last month before the survey (missing = 94)	Never	172 (36.6%)	153 (33.6%)
	1-2 times	210 (44.7%)	211 (46.3%)
	3-5 times	61 (13.0%)	62 (13.6%)
	6 times and more	27 (5.7%)	30 (6.6%)
Lifetime smoking by mother (missing = 193)	Never smoked	294 (70.5%)	284 (69.3%)
	Current smoker, but quit during pregnancy	84 (20.1%)	82 (20.0%)
	Current smoker, did not quit during pregnancy	39 (9.4%)	44 (10.7%)

[1] Gymnasium – an institution offering secondary education but with some additional courses.

[2] Vocational school – a trade school in which one learns special professional skills.

[3] College - an institution with mainly vocational courses, with a possibility to obtain bachelor degree.

[4] Secondary or less – completed secondary school (11 classes or less).

[5] Secondary professional – completed vocational school

[6] Higher or higher incomplete – graduated from college and received a degree similar to bachelor or master.

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Table 2

Stressful life events experienced by 898 children at age 18 months-3 years and 840 children age 5-7 years, by sex

Type of stressful life event, from more common to less common	***Boys, age* 3 *(n=453)***	***Girls, age 3 (n=445)***	***Boys, age 7 (n=415)***	***Girls, age 7 (n=425)***
Child was hospitalized	143 (31.6%)	122 (27.4%)	113 (27.2%)	93 (21.9%)
Child was taken into care by someone else	118 (26%)	110 (24.7%)	52 (12.5%)	47 (11.1%)
Pet died	96 (21.2%)	86 (19.3%)	140 (33.7%)	138 (32.5%)
Child's family moved	110 (24.3%)	103 (23.1%)	65 (15.7%)	83 (19.5%)
Child had shock/fright	100 (22.1%)	97 (21.8%)	54 (13.0%)	49 (11.5%)
Child was beaten by someone	95 (21.0%)	80 (18.0%)	108 (26.0%)	60 (14.1%)
Child was separated from the father	77 (17.0%)	92 (20.7%)	92 (22.2%)	100 (23.5%)
Child started attending a new kindergarten/school	85 (18.8%)	95 (21.3%)	53 (12.8%)	53 (12.5%)
Child was looked after by a new person	68 (15.0%)	67 (15.1%)	20 (4.8%)	24 (5.6%)
A family member died	NA	NA	109 (26.3%)	100 (23.5%)
The child started to visit school	NA	NA	353 (85.1%)	345 (81.2%)
The child has lost the best friend	NA	NA	23 (5.5%)	23 (5.4%)
Child was separated from someone	40 (8.8%)	42 (9.4%)	30 (7.2%)	36 (8.5%)
Child was separated from the mother	34 (7.5%)	45 (10.1%)	13 (3.1%)	17 (4.0%)
Child had a new sister/brother	31 (6.8%)	42 (9.4%)	39 (9.4%)	46 (10.8%)
Something else happened to child	30 (6.6%)	24 (5.4%)	3 (0.7%)	6 (1.4%)
Child acquired a new mother/father	17 (3.8%)	18 (4.0%)	30 (7.2%)	28 (6.6%)
Child was sexually abused	0	2 (0.4%)	1 (0.2%)	2 (0.5%)
Missing answers	64	58	102	78
Low early life stress score	180 (39.7%)	174 (39.1%)	143 (34.5%)	166 (39.1%)
Medium early life stress score	154 (34.0%)	148 (33.3%)	137 (33.0%)	144 (33.9%)
High early life stress score	119 (26.3%)	123 (27.6%)	135 (32.5%)	115 (27.1%)

NA – not applicable

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Table 3

Association of ELS with early smoking and drinking initiation by study adolescents, bivariate binary logistic regression, odds ratios and 95% confidence intervals.

	Smoking by age 13		**Drinking by age 12**	
	Boys	**Girls**	**Boys**	**Girls**
Early life stress at 3 years old				
Low	1.00	1.00	1.00	1.00
Medium	0.81 (0.50-1.30)	1.18 (0.68-2.05)	0.65 (0.39-1.10)	0.92 (0.55-1.54)
High	1.05 (0.64-1.74)	**2.18 (1.27-3.74)**	1.13 (0.67-1.90)	1.13 (0.67-1.91)
	(missing=182)		(missing=158)	
Early life stress at 7 years old				
Low	1.00	1.00	1.00	1.00
Medium	0.85 (0.51-1.41)	0.84 (0.48-1.46)	1.42 (0.81-2.49)	1.16 (0.70-1.92)
High	0.89 (0.53-1.48)	1.15 (0.66-2.01)	1.54 (0.88-2.70)	0.63 (0.35-1.13)
	(missing=235)		(missing=210)	

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Table 4

Association of early life stress with early smoking and drinking initiation by study adolescents, multivariate binary logistic regression, odds ratios and 95% confidence intervals, adjusted for confounding variables.

	Smoking by age 13		**Drinking by age 12**	
	Boys	**Girls**	**Boys**	**Girls**
Early life stress at 3 years old				
Low	1.00	1.00	1.00	1.00
Medium	0.74 (0.44-1.24)	1.36 (0.75-2.47)	0.56 (0.32-0.98)	0.92 (0.53-1.61)
High	0.96 (0.55-1.68)	**2.24(1.23-4.08)**	0.92 (0.51-1.65)	1.40 (0.78-2.50)
Early life stress at 7 years old				
Low	1.00	1.00	1.00	1.00
Medium	0.90 (0.52-1.56)	0.87 (0.47-1.59)	1.24 (0.68-2.26)	1.19 (0.69-2.07)
High	0.81 (0.46-1.43)	1.25 (0.67-2.33)	1.18 (0.64-2.17)	0.74 (0.38-1.44)

List of confounders: current level of family income, current family type, current school type, year of child's birth, lifetime smoking and current drinking by mother, and education of mother and father.