

**How is low parental socioeconomic status associated with future smoking and nicotine dependence in offspring? A population-based longitudinal 13-years follow-up**

Key words: Smoking, nicotine dependence, socioeconomic status, SES, population, longitudinal, adolescence, young adulthood

**Aims:** Low socioeconomic status (SES) characterizes smoking and nicotine dependence in adult samples. However, less is known about how parental SES is linked to smoking in offspring and potential mechanisms at work.

**Methods:** A population-based longitudinal study (N = 1,380) from Norway. Participants were followed from mid-teens until late 20s using survey and register data. Data were collected on parental education, parental smoking, educational aspirations and expectations, school grades and school-related conduct problems. Register data monitored education, unemployment and social welfare assistance. By means of multinomial logistic regression analyses, risk factors for smoking and nicotine dependence were identified. Mediation analyses were used to investigate pathways between parental SES and future smoking.

**Results:** Future smokers were recruited from families with low educational levels. Poor school grades, school dropout, low educational aspirations were also predictors. Unemployment and social welfare assistance additionally increased the risk. Parental smoking, no high school exam and welfare assistance were mediators between low parental education and high levels of nicotine dependence in young adulthood.

**Conclusions:** Socialization to smoking reflects a multifaceted socialization process fueled by low parental SES. However, parental influences may be masked behind influences seemingly coming from e.g. schools or peers. Future research should try to capture the multiple sources of SES-related influence at work. Prevention strategies should target adolescents from low SES backgrounds, who orient themselves towards manual working class, and who have problems entering the labor force.

## **Introduction**

For decades, smoking regulations have been increasing, and the reduced prevalence of smoking has to some degree been attributed to the effects of these policies. However, the decline is less pronounced in groups with low education, low occupational rank and low income [1]. Smoking among manual laborers seems to a larger degree to be integrated into their daily working life cycle [2] than for those in the middle classes [3]. Moreover, those in segments of society characterized by low socioeconomic status (SES) more often seem to be “hardcore smokers,” displaying high levels of nicotine dependence [4]. Hence, socioeconomic status, cultural capital, and marginalized positions in the labour market are key issues in tobacco policy.

Even though socioeconomic factors play a major role with regard to smoking in adult samples, less is known about to what degree and how parental socioeconomic status influences smoking habits in their offspring, and recent studies are not in agreement in this respect: A longitudinal study from New Zealand revealed that socioeconomic disadvantage continues to have large impact on smoking patterns throughout adult life [5]. In contrast, a recent study from the UK suggests that SES was of little importance, compared to influence from school and peers [6]. However, we may ask: could parental influence be linked to, or mediated through, subsequent influence seemingly coming from schools and peers?

Early research on the relationship between SES and health centered on the importance of poverty and marginalized groups. However, recent research suggests that SES and health outcomes are associated without clear thresholds: with each decreasing SES level, there is evidence of a gradual increase in morbidity and mortality [7]. A recent study suggested that early life socioeconomic indicators combined with smoking together explained as much as 74 % of the socioeconomic gradient in mortality [8]. Among indicators of SES, studies have found that

education (i.e. high levels of schooling) most consistently predicts health outcomes [for a review, see: 9]. However, other indicators of SES seem to be of importance as well [7] , and a problem with many epidemiological studies is the lack of rich enough information regarding the different dimensions of SES. Hence, in studies of the potential impact of parental SES, the best approach would be to use a variety of SES indicators, including parental education; and to investigate whether there are monotonic associations, or whether primarily parents with particularly low SES, parents belonging to the “working class,” or parents outside the labor force pose special risk for their children.

Most importantly for the present study, previous research on how and why parental SES is related to future smoking is scarce, as few studies have examined through which pathways the relation is mediated. There may be at least three explanations of why parental SES is related to the offspring's smoking behavior. First, parental SES may influence offspring's smoking because parents with low SES also have other characteristics that are risk factors for children's smoking. A characteristic of relevance is parental smoking behavior, as parental smoking is overrepresented in low socio-economic classes and has been shown to be consistently associated with offspring smoking initiation, as well as to progression to regular smoking [10, 11] and nicotine dependence [12]. Low parental SES has as well been shown to be correlated with parental alcohol problems, unfavorable upbringing styles and lower parental monitoring and support [13], factors that as well have been shown to predict offspring's smoking [14, 15]. Parental SES may thus be related to offspring's smoking behavior, as parents with low parental SES show characteristics and behavior that promote their children to smoke.

Second, parental SES may influence offspring's smoking through the composition of peer groups: Peers play a role in smoking initiation, and the composition of peer groups may as well

be related to parental SES, as may the degree of instability in the group [16]. Peers' behavior may directly influence smoking behavior. However, peers' influences may be more subtle, and peer imitation may interact with influences from the SES-related cultural context, including friends' school performance and their educational aspirations, which again influence smoking [17].

Third, low parental SES may influence individual characteristics in offspring that are associated with smoking. Low parental SES is e.g. a risk factor for conduct problems, which may be mediated through family stressors, harsh discipline, lack of social support [16]. Moreover, there is increasing evidence that situational-specific conduct problems, such as those limited to the school context, may be of particular importance for health behaviors [18]. One prominent individual characteristic, which may be influenced by parental SES, is of course offspring's own socio-economic status, which is developing gradually through adolescence and young adulthood. Children from low SES families demonstrate poorer school achievement, lower aspirations concerning career and education [19], they attend more often to vocational training in high school, they more often receive social welfare assistance, and unemployment is higher, and such factors are also associated with smoking [20-22].

### **Aims of study**

The study has three aims. First, we investigate several dimensions of parental SES, including education, and their association with onset of daily smoking and the development of nicotine dependence in young adulthood. Second, we examine whether there are monotonic associations between parental SES and future smoking, or whether primarily parents with low SES, parents belonging to the “working class,” or parents outside the labor force pose special risk for their children. Third, we will examine through which pathways parental SES is related to future

smoking status. Thus, we investigate the importance of parental, environmental, and individual factors, such as parental smoking habits and peers' smoking habits. With regard to the adolescents themselves, we highlight the importance of school grades, school-related conduct problems, aspirations and expectations regarding subsequent position in the occupational structure, and of possible problems with becoming established in the labour market. We hypothesize that the impact of parental SES may be mediated through different pathways, such as parental smoking, adolescents' school grades and school-related conduct problems.

## **Methods**

### **Sample**

We used the Young in Norway longitudinal dataset, in which a population-based sample has been followed from their early teens through their late 20s by means of surveys and register data. The details have been described previously [23]. To obtain information about parents' and participants' educational level and the participants' experiences of unemployment and receipt of unemployment support and welfare assistance, the dataset was linked to Statistics Norway's nationwide Historical Event Databases. The study was approved by the Norwegian Data Inspectorate and the Regional Committee for Medical Research Ethics. Active, informed consent for participation was given by all respondents, based on a written and oral description of the project. Further, all participants gave a separate approval to have their survey data linked with registers.

The response rate was 97% at the initial data collection and the cumulative response rate over all data collection periods was 60%. A previous study revealed that attrition was higher in males (OR 1.55; 95% CI 1.38–1.74) and among those with low parental SES (OR 1.06, 95% CI

1.03–1.10) [24]. We use survey data collected at four time points, when the sample participants had a mean age of 13.5 years (T1; SD 0.66), 15.0 years (T2), 20.4 years (T3) and 27.0 years (T4). The sample size was  $N = 1,380$ . As a main aim of the present study was to examine predictors of initiating smoking between T1 and T4, we excluded in all analyses participants who reported to smoke on a daily basis already at T1 (44 persons, 3.2 %). Thus, a sample size of  $N = 1,336$  was used in further analyses.

## Measures

We asked participants at T4 about daily smoking (no/yes) and measured nicotine dependence using the Fagerström Test for Nicotine Dependence. Scores on this instrument range from 0 to 10 (Cronbach's alpha = 0.74). The instrument is reported to have satisfactory reliability and validity [25]. In the current study we used a cut-off of four to identify “high-nicotine dependent smokers” (HDS). In all analyses, we categorized respondents into three groups according to their smoking status: those who did not smoke daily (NS), low-nicotine dependent smokers (LDS; Fagerström score < 4) and high-nicotine dependent smokers (HDS; Fagerström score  $\geq 4$ ) [see: 26]. To examine the adequacy of the prevalence estimates of daily smoking, we compared them with national estimates from Statistics Norway (see: <http://www.ssb.no/royk/main.html>). These comparisons showed relatively high agreement, with a slightly higher prevalence rate in our dataset (23% versus 20%) within the relevant age groups.

Using register data we collected information about parental educational level when the respondents were 16 years of age, measured on a four-point scale ranging from “compulsory elementary school only” to “high university level.” For some analyses, parental education was dichotomized into parents with and without tertiary education. Respondents were also asked to

describe their parents' actual work in their own words. Parental SES was coded according to the ISCO manual [27]. A five-level categorization was used, ranging from 5 – "workers" to 1 – "higher administrative professions". A separate question was asked about whether the mother or father was living on social welfare or was unemployed (scored dichotomously). As a proxy of "cultural capital", we asked about the number of books in the home, with options from 1 - "none" to 7 - "more than 1000 books".

Parental smoking was assessed with the question: "Did your father (separate question for mother) smoke during your childhood and adolescence?" Based on this information, a parental smoking index was constructed, with values 0, 1, and 2 for the number of parents who had been daily smokers. Heavy parental drinking was assessed with the question: "Have you ever seen your parents drunk?" at each of the first three data collection waves, with response options ranging from "never" to "a few times a week". The items from all three time points were summed to create a "parental binge drinking" index (values 0 to 12). At T1 and T2, we asked about the best friends' smoking habits and about the degree to which the respondents expected that their best friends would enter higher education. Both areas were summed to create indices with values ranging from 0 (no friends with smoking habits/plans for higher education) to 4 (all friends with such habits/plans).

At T2, participants were asked about their school grades in Norwegian, English and mathematics. We asked whether participants wanted to quit school (no/yes) and about what line of study they had chosen in upper secondary school, with "general studies" and "vocational studies" as response options. To assess occupational aspirations, participants were asked at T2 to complete the open-ended question: "Which job or occupation do you think it is most likely that you will have when you are 40?" A similarly worded question was asked about occupational



expectations. Both questions were categorized on a five-level index based on the SES of the occupation [19]. Using register data we also collected information about whether participants had taken a high school exam, whether they had experienced unemployment and received disability benefits or rehabilitation benefits.

At T1 and T2, items closely approximating the DSM-III-R criteria for conduct disorder [28] were included [29]. Here, we used five different conduct problems related to the school context [18] with questions such as: “Had a violent quarrel with the teacher” and “Been sent out of the classroom”. Answers were on a six-point scale from “never” to “more than 50 times”. Mean scores on the five items across the two time points were calculated, with a range from 0 to 5.

### **Statistical analyses**

To examine predictors of low-nicotine dependent daily smokers (LDS) and high-nicotine dependent smokers (HDS), respectively, multinomial logistic regression analyses were conducted with smoking status as the outcome variable. Each model produced two comparisons: the odds of LDS relative to non-smokers (NS) and the odds of HDS compared with NS. We conducted additional analyses to compare LDS and HDS. Two regression model types were tested. First, to examine how each predictor was related to smoking status, we conducted separate analyses for each predictor, controlling for age, gender, and ethnicity. Second, parental education and all predictors were included simultaneously to examine the combined effect of the predictors on smoking status. Finally, as an important aim of the study was to investigate through which pathways parental education is related to daily smoking and nicotine dependence, we conducted mediation analyses. As one prerequisite for mediation is a significant relationship between the mediator and the outcome variable, only predictors that were significantly related to

LDS or HDS in the multiple regression analyses were included in mediation analyses. We used path analyses and conducted multiple parallel mediator analyses to test the effects of several potential mediators simultaneously [for a detailed description of such analyses, see 30].

The full information maximum likelihood estimator was used to handle missing data. Since respondents were recruited from different schools, standard errors and fit indices were computed, taking into account cluster sampling. For this purpose, potential non-independence of observations due to school clusters was addressed by estimating parameters by maximizing a weighted log-likelihood function, whereas standard error estimations were performed with a sandwich estimator. As recommended in the literature [30], bias corrected bootstrap confidence intervals were estimated in all mediation analyses by using 1,000 bootstrap samples.

## **Results**

In Table 1, we present the prevalence rates of LDS and HDS at T4 (when the sample participants were 27 years of age). There were 16.5 % LDS and 7.7 % fulfilled the criteria for HDS. The percentage of LDS and HDS did not differ significantly between women and men ( $\chi^2[2] = 3.83$ ,  $p = .15$ ). In this sample, 25.4 % reported that one parent had been smoking on a daily basis, whereas 17.7 % reported that both parents had been daily smokers.

Next, we conducted multinomial logistic regression analyses with smoking status (LDS and HDS) as dependent variables. In the first models, predictor variables were introduced one by one, controlling for gender, age, and country of birth. As shown in Table 2, parental education was associated with LDS and HDS in a monotonic manner: higher educational level was associated with lower odds for both LDS and HDS. When using the dichotomized parental education variable, we found as well significant relations to both LDS (OR = 1.69, 95% CI:

1.19-2.42,  $p < .01$ ) and HDS (OR = 1.85, 95% CI: 1.35-2.53,  $p < .01$ ). Low parental occupational status was as well significantly related to higher risk for LDS (OR = 1.18, 95% CI: 1.05-1.32,  $p < .01$ ) and HDS (OR = 1.26, 95% CI: 1.06-1.50,  $p < .05$ ). Moreover, even though offspring of parents who were unemployed or had received disability pension were not significantly more prone to LDS (OR = 1.37, 95% CI: 0.87-2.17,  $p > .05$ ), they showed to have a threefold higher odds for HDS (OR = 3.01, 95% CI: 1.82-4.98,  $p < .001$ ). Likewise showed cultural capital no significant relationship to LDS (OR = 0.89, 95% CI: 0.77-1.03,  $p > .05$ , whereas it was inversely associated with HDS (OR = 0.79, 95% CI: 0.67-0.95,  $p < .05$ ).

Parental smoking was a strong predictor of both outcomes, but weaker for LDS than for HDS (see Table 2). The same pattern was found for friends' smoking. Having friends who were likely to enter higher education was negatively associated with HDS. A host of individual-level variables were also associated with subsequent LDS and HDS: poor school grades, desire to quit school, the choice of vocational studies, low educational aspirations and expectations, school-related conduct problems, and not having completed high school at 21 years of age. Note also that having experienced periods of unemployment was a predictor of both LDS and HDS. To have received social benefits was a particularly strong predictor, although more strongly for HDS (OR = 4.94, 95% CI: 3.02–8.09) than for LDS (OR = 1.93; 95 % CI: 1.40-2.65).

Next, we built a multivariate model in which parental education and all significant predictors were included simultaneously (see Table 2, rightmost columns). In this model, other indicators of parental SES than education were not included, as we primarily were interested in how the relationship between parental education and smoking status changed when including potential mediators. For LDS, school grades, school-related conduct problems, wish to quit school, and lack of completing high school remained significant predictors. Females were more

at risk than males for LDS. For HDS, parental smoking, peers' smoking and having received welfare benefits were predictors.

Finally, we conducted multiple mediator analyses to examine potential pathways from parental education to smoking. To simplify analyses, the dichotomized parental education variable was used. We conducted two sets of path analysis. In the first, we examined potential mediators of the relationship between parental education and LDS versus nonsmoking (i.e. HDS were excluded from the analyses). For this purpose, all variables which predicted LDS in the multiple analyses in Table 2 were included simultaneously in path analyses while controlling for age, gender, and ethnicity. As shown in Figure 1A, all four potential mediator variables were both significantly related to parental education and LDS. When testing indirect effects by means of bootstrapping, poor school grades, a wish to quit school and lack of high school exam and conduct problems were all shown to be significant mediators ( $p < .05$ ). Moreover, parental education did not longer predict LDS in the multiple mediator model (OR = 1.15,  $p > .05$ ). In the second path analysis, the four variables significantly predicting HDS were simultaneous included in the mediator multiple mediator model for HDS. As depicted in Figure 1B, parental education significantly predicted parental smoking, lack of final high school exam, and receiving welfare benefits ( $p < .05$ ), but not peer smoking ( $p > .05$ ). Tests of indirect effects, moreover, showed the first three variables to be significant mediators, whereas peer smoking was not. As for LDS, parental education did not longer predict HDS in the multiple mediator model (OR = 1.21,  $p > .05$ ).

## **Discussion**

In this population-based study, we used longitudinal data to explore how parental socioeconomic factors may be linked to participants' daily smoking and nicotine dependence in young adulthood. The association of parental SES, and particular parental education, with smoking status was mediated through several factors: For LDS, school factors were of particular importance, as poor school grades, lack of motivation to continue in high school, no high school graduation, and conduct problems related to the school context all mediated the relationship between parental education and LDS. Concerning HDS, variables from several domains functioned as mediators. Here, parental smoking, receiving welfare benefits, and no high school graduation were mediators. Many of the same factors predicted daily smoking with low and high level of nicotine dependence. However, the associations were typically stronger for high-nicotine-dependent smoking. New in the study is the documentation of the multitude of socioeconomic and sociocultural influences and the complex mechanisms that are at work.

The study had several strengths: We used population-based, longitudinal data covering a 13-years' time span from the participants' mid-teens to their late 20s. Rich survey-based self-reports combined with high-quality data from registers provided a unique data set. There are also limitations: First, although we had favorable response rates, attrition was higher among participants with a low socioeconomic background and smokers are overrepresented among those who dropped out of the study. Second, we used a self-report measure of nicotine dependence, and even though this measure has proved to have good psychometric properties [25], other self-report measures or personal interviews [26] may better have captured more severe nicotine dependence-related psychiatric symptomatology. Saliva samples measuring cotinine (the principal metabolite of nicotine) would also have increased the validity of the data, even if the Fagerström test is reported to correlate highly ( $r = 0.70$ ) with such measures [31]. Third, even

if we collected much information about the participants' lives, we lack information about characteristics such as psychiatric disorders [32] or genetic influences from parents [14] which may be important confounders of the relationship between parental SES and smoking behavior.

### **A variety of SES-related direct and indirect influences, no clear thresholds**

The study indicates that the prospective relationship between parents' SES and smoking status reflects the fact that parents have other characteristics than low SES, which are predictors of smoking. In our study, parental smoking was such a variable. It was associated with subsequent smoking in offspring, and functions as mediator for the relationship between parental education and HDS. However, our study also revealed that parents' socioeconomic status may influence their children towards future smoking through a variety of school-related variables, such as poor school grades, lack of motivation to continue in school, and eventually not getting a high school exam. All these variables showed to be mediators of LDS, HDS, or both. Among individual offspring characteristics that are of particular importance for the development of nicotine-dependent smoking, the receipt of welfare assistance seems to be a key variable. The relationships between parental education and smoking diminished into non-significance when introducing all mediators, thereby further underscoring the importance of these factors in explaining the association between parental SES and offspring's smoking.

Thus, our study suggests that we witness a complex socialization process, where parental SES position is linked to participants' subsequent smoking status through different mechanisms. Hence, one or a few indicators of socioeconomic status – which are often used in such studies - are unlikely to capture the multiple sources of influences that seem to be at work here. Rather, we will suggest that the socialization to smoking and nicotine dependence is a multifaceted

process, fueled by the family-based socioeconomic position. The emerging smoking habits are often embedded in the family, which – by means of subtle socialization processes – influences the formation of the broader cultural peer- and school-related milieu of the future smokers.

Previous studies have also found that education-related variables are of particular importance when it comes to health outcomes [for a review, see: 9]. However, the possible mechanisms linking education and the various health outcomes are not well understood. There may be a direct effect, i.e. education increases knowledge resulting in behavior in favor of good health. However, there are also potential indirect effects [for a review, see: 33], such as more smooth ways into the labor market, the affordability of health-improving goods (better food, gym membership), less stress, work environments where the well-educated are also exposed to healthier peers. Our study gave some support for importance of such indirect effects: we found that periods of unemployment and in particular receiving welfare benefits were strong predictors of nicotine dependence. However, we also found that low level of education in parents was a factor behind this association, as this variable was linked to nicotine dependence via as well a lack of high school education as with receiving welfare benefits as mediators. Hence, one may argue that the well-known association between parental and offspring smoking to some degree may reflect characteristics of their common socioeconomic environment, as well as to well-documented genetic influence [34]. Our findings as well suggest that not only education *per se* but a much broader array of SES-related sociocultural influences in both parents, peers and the participants themselves seem to be involved in the socialization process to smoking and nicotine dependence.

### **Policy consequences**

Tax and price policies, smoke-free legislation and de-normalization of smoking have been cornerstones of contemporary tobacco policy, and Norway is rated among the countries that have most successfully implemented such tools. Less attention has been paid to unintended consequences of these policies. Increased stigmatization of smokers may be one such unintended consequence [35]. Several have argued that the tough tobacco policy may result in resistance to perceived pressure from health authorities. Further, such resistance may be interpreted within a broader context, in which most types of prevention have problems reaching those with the poorest educational, economic and social resources. Our findings may support such concerns: low parental educational level, little so-called cultural capital in the parental home, friendships with peers who do not have plans for further education and poor school grades were all early indicators of risk for future smoking and nicotine dependence. However, there also seems to be a distinct working-class dimension at play, as those orienting themselves toward manual occupations were more likely to become smokers. Moreover, among those who experience periods of unemployment and receive welfare assistance the risk of subsequent smoking and nicotine dependence increased radically, a finding that may be associated with a lack of perceived control in the daily life and emotional isolation among unemployed.

## **Conclusions**

We have identified a variety of socioeconomic influences, in parents as well as the participants themselves, in the trajectory to smoking initiation and nicotine dependence. Some participants were at increased risk already from early on and these are situated in social marginal segments of society. Scholars in tobacco research theorize about possible “endgame scenarios”; i.e. novel and radical approaches to finally combat tobacco. A more modest step would be to target risk groups



such as those identified in this paper. This could be done through not only hard control, but also by harm-reduction approaches and in trying to form alliances with vulnerable groups rather than instigating resistance.

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**Table 1. Prevalence of daily low-nicotine dependent smoking and high-nicotine dependent smoking among women and men at the fourth data collection wave (mean age 27 years)**

	Women	Men	Total
	n (%)	n (%)	n (%)
Nonsmoking	569 (75.8)	485 (77.8)	1054 (76.7)
Low-dependent smoking	124 (16.5)	81 (13.0)	205 (14.9)
High-dependent smoking	58 (7.7)	57 (9.1)	115 (8.4)

**Table 2 Multinomial logistic regression: Dependent variables low-nicotine-dependent smoking (LDS) and high-nicotine dependent smoking (HDS) at age 27. No tobacco use as reference group**

	Predictors included individually				All predictors included simultaneously				
	LDS		HDS		LDS		HDS		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
<i>Parental characteristics</i>									
Parental socioeconomic status	<i>reference group: 4+ years higher education</i>				<i>reference group: 4+ years higher education</i>				
Less than high school education	2.55*	1.03–6.34	4.09**	1.54–10.89	1.16	0.42–3.17	1.37	0.45–4.16	
Completed senior high school	2.43*	1.11–5.29	2.76*	1.06–7.17	1.54	0.66–3.56	1.57	0.59–4.16	
Higher education – 4 years or less	1.65	0.82–3.32	1.85	0.63–5.41	1.48	0.71–3.05	1.71	0.55–5.28	
Parents not living together	1.14	0.75–1.75	1.96**	1.24–3.08	0.83	0.53–1.30	1.09	0.62–1.91	
Parental smoking	1.44*** <sup>a</sup>	1.21–1.71	1.88***	1.47–2.40	1.18	1.00–1.41	1.40*	1.05–1.88	
Parental alcohol intoxication	1.08*	1.02–1.15	1.16***	1.09–1.24	0.99	0.93–1.06	1.04	0.95–1.13	
<i>Friends</i>									
Friends' smoking (T1 and T2)	1.44*** <sup>b</sup>	1.23–1.69	2.03***	1.68–2.47	1.08 <sup>b</sup>	0.92–1.28	1.69***	1.35–2.11	
Evaluation of whether friends enter higher education	0.92	0.71–1.20	0.74*	0.58–0.95	1.09	0.83–1.42	0.89	0.70–1.19	
<i>Individual variables</i>									
School grades (T2)	0.44***	0.34–0.56	0.41***	0.30–0.56	0.71*	0.52–0.96	0.93	0.63–1.37	
Wish to quit school	2.71***	1.86–3.93	1.86**	1.19–2.90	1.68** <sup>a</sup>	1.08–2.62	1.01	0.63–1.62	
Line of study at school (general versus occupational)	1.99***	1.47–2.68	2.28**	1.35–3.85	1.19	0.80–1.69	1.22	0.71–2.10	
Educational aspirations	1.76*	1.03–3.02	2.21**	1.20–4.07	1.61	0.80–3.27	0.75	0.32–1.74	
Educational expectations	1.66	.97–2.87	2.61**	1.39–4.88	0.69	0.32–1.46	1.49	0.63–3.52	
School-related conduct problems (T1 and T2)	1.09***	1.06–1.13	1.09***	1.06–1.13	1.07*** <sup>a</sup>	1.04–1.11	1.02	0.99–1.06	
Not finished senior high school by age 21	2.51***	1.79–3.51	3.42***	2.24–5.22	1.57*	1.06–2.31	1.68*	1.05–2.69	
Received benefits	1.93*** <sup>b</sup>	1.40–2.65	4.94***	3.02–8.09	1.08 <sup>a</sup>	0.71–1.66	2.27**	1.30–3.98	
Being unemployed	1.34 <sup>a</sup>	0.98–1.85	2.58***	1.62–4.11	1.04	0.69–1.57	1.50	0.88–2.57	
Gender	1.25	0.91–1.72	.82	0.48–1.42	1.68**	1.20–2.35	0.91	0.48–1.74	
Age	0.71**	0.56–0.89	.74	0.51–1.07	0.67**	0.52–0.85	0.64	0.41–1.00	
Birth country	1.06	0.44–2.54	1.15	0.38–3.51	1.11	0.47–2.63	1.15	0.37–3.63	

Note. All analyses were controlled for gender, age, and country of birth; OR = Odds ratio; 95% CI = 95% confidence interval of OR; \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ . <sup>a</sup>difference between smoking without addiction and smoking with addiction,  $p < 0.05$ ; <sup>b</sup>difference between smoking without addiction and smoking with addiction,  $p < 0.01$ ; <sup>c</sup>difference between smoking without addiction and smoking with addiction,  $p < 0.001$ . <sup>d</sup>The measure ranges from 1 (higher administrative positions) to 5 (workers)



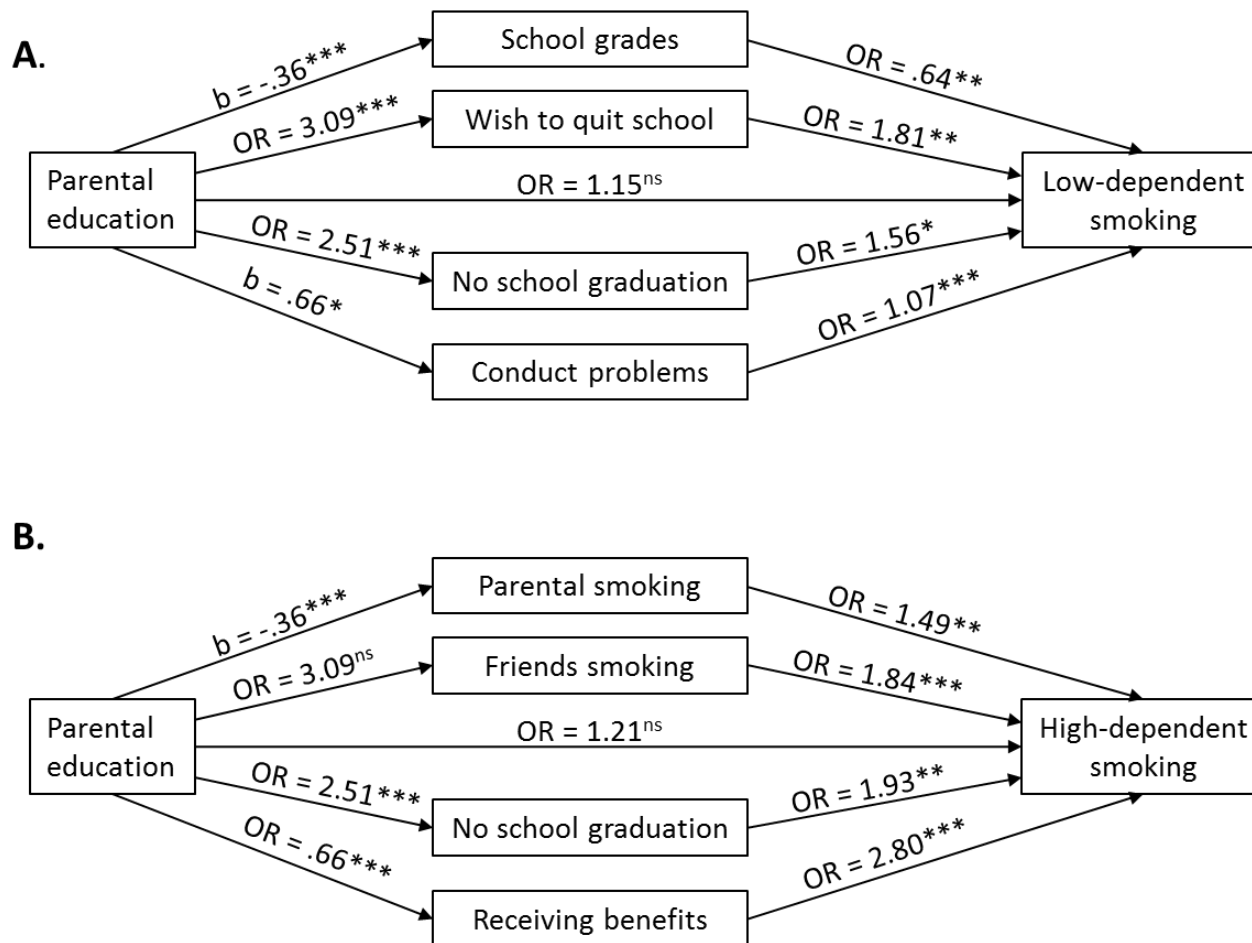


Figure 1 A and B. Multiple mediation model predicting non-dependent smoking (A.) and dependent smoking (B.).

The outcome and all mediator variables are controlled for gender, age, and ethnicity.

Tests of indirect effects by using bootstrapping showed school grades, wish to quit school, and no school graduation, and conduct problems to be significant mediators in Model A. ( $p < .05$ ). In Model B., parental smoking, no school graduation, and receiving benefits were significant mediators ( $p < .05$ ), whereas friends' smoking was not ( $p > .05$ ).

\* $p < .05$ , \*\* $p < .01$ , \*\*\* $p < .001$ , <sup>ns</sup> $p > .05$ ; OR = odds ratio; b = unstandardized regression coefficient.