

Parental smoking status affects substance use by adolescents: A national cross-sectional study conducted in Korea

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Research article

Keywords: parental smoking, adolescent substance use

Posted Date: January 14th, 2020

DOI: <https://doi.org/10.21203/rs.2.20852/v1>

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Abstract

Background: In the present study, we investigated the association between substance use by adolescents and parental smoking status based on data from the 2016 Korean Youth Risk Behavior Web-based Survey, a national school-based survey.

Methods: Data from a nationally representative sample of Korean adolescents aged 12–18 years (n = 65,528) were analyzed, and the risk of substance use according to the parental smoking status was investigated.

Results: We found that smoking by both parents was a greater risk factor for substance use by adolescents than smoking by any one parent. Moreover, maternal smoking was a greater risk for substance use by adolescents than paternal smoking. We also investigated sex differences in the risk of substance use as a result of the parental smoking status. The differences in the substance use status according to the sex of both parents and children were also identified after adjustment for second-hand smoking.

Conclusions: Accurate evaluation of the family smoking environment and whole-family interventions are necessary for preventing and intervening in substance use by adolescents.

Background

Adolescence is a period of vulnerability to various psychological pathologies and comprises several physical and emotional changes. Therefore, globally, the health behavior of adolescents is an important public health issue. Unhealthy behaviors such as smoking, alcohol drinking, and drug use usually start in adolescence [1], and the socioeconomic status, parenting quality, peer group influence, and biological/inherent predisposition toward drug addiction constitute risk factors for the initiation of substance use and its increase among adolescents [2]. In addition, substance use during adolescence exerts a major influence on health in adulthood, mental illness, suicidal behavior, and decreased life expectancy [3]. In this context, substance use by adolescents represents not only an individual health problem but also a social burden, influencing family life, friends, and other members of the society.

Smoking is the most common substance use among young people worldwide. A previous study reported that people who started smoking before the age of 19 years were 2.4 times more likely to become heavy smokers than those who started smoking after the age of 26 years [4]. Considering that > 90% of adult smokers start smoking during adolescence and that an early smoking onset results in poor health outcomes after adolescence [5], smoking by adolescents is a serious and important issue.

Another form of substance use is alcohol drinking. The practice of alcohol drinking among adolescents has increased recently. It can cause adverse changes in the brain structures that regulate risk and reward systems, thereby increasing the risk of developing alcohol addiction [6, 7].

Both early detection of risk factors and intervention are important against substance use; however, adolescents tend to hide or under-report risk behaviors such as substance use. Family influence constitutes a known preventable factor for substance use by adolescents. Adolescents are susceptible to influence of social and environmental factors, and both family history and parental substance use status may motivate substance use in adolescence [8, 9]. A previous study reported that between 5% and 30% of the children in high-income countries live with a parent with substance use problems [10]. However, only a small number of studies have clarified the relationship between substance use by parents and children.

In the present study, large-scale nationally representative data were used to identify the risk of substance use by adolescents according to parental smoking status. We hypothesized that the parental smoking status has effects on the probability of substance use by children and that these effects vary depending on the substance use status of each parent, their sex, and type of substance use.

Materials And Methods

Study population and data source

Data from the 12th Korea Youth Risk Behavior Web-based Survey (KYRBS) were used. KYRBS, a nationwide cross-sectional study and government-approved statistical survey, was performed by the South Korean Ministry of Education, Science and Technology; Ministry of Health and Welfare; and Korea Centers for Disease Control and Prevention using a stratified multistage cluster strategy. KYRBS is a self-report, anonymous, online survey performed on a nationally representative sample of Korean adolescents aged 12–18 years. It comprises 129 questions divided into 15 sections about health-related behaviors as well as mental and physical health. In 12th KYRBS, a total of 67,983 students from 800 middle and high schools were randomly selected, and 65,528 (boys = 33,803 and girls = 31,725) students (96.4% response rate) from 798 schools (99.8% response rate) responded to the survey. The participants were identified by numbers and were guaranteed anonymity. All participants completed an online, self-report questionnaire in a school computer room after the survey had been fully explained. The Institutional Review Board of the Korea Centers for Disease Control and Prevention approved KYRBWS (Statistics Korea, approval No. 11758).

Variables

General characteristics

The general characteristics of the participants included age, sex, residential area (i.e., metropolitan cities, small and medium cities, and rural areas), family economic status (i.e., high, middle high, average, middle low, and low), paternal and maternal educational levels (i.e., college and higher, high school, middle school and below, and unknown), and academic achievement (i.e., high, middle high, average, middle low, and low).

Parental smoking status

The parental smoking status of the participants was classified into 4 categories: (1) nonsmoking, (2) paternal smoking, (3) maternal smoking, and (4) parental smoking. We also assessed the second-hand smoke exposure at home over the last 7 days regardless of parental smoking status.

Current alcohol drinking and smoking status

Substance use by the participants including alcohol drinking and smoking statuses were assessed. Their alcohol drinking status included lifetime alcohol drinking, current alcohol drinking, alcohol drinking days, and alcohol drinking volume. Similarly, their smoking status included lifetime smoking experience, current smoking, smoking days, and smoking volume. Detailed current alcohol drinking and smoking statuses were assessed for the last 30 days. Lifetime drug use by the participants was also analyzed.

Statistical analysis

Univariate analysis was conducted to estimate the proportion of smoking by each parent. One-way analysis of variance and Pearson's chi-square test were performed to estimate the general characteristics and second-hand smoke exposure of the 4 groups. The risk of substance use among adolescents according to the parental smoking status was determined using age, urbanity, academic achievement, parental educational level and socioeconomic status (SES) as factors for between-group comparisons. Binary variables such as lifetime alcohol drinking, current alcohol drinking, lifetime smoking experience, current smoking, and lifetime drug use were analyzed using logistic regression. Continuous variables, including the number of days spent drinking alcohol and smoking and the volumes of alcohol drinking and smoking, were analyzed using linear regression. Finally, to verify whether there was an effect of second-hand smoke, analyses were adjusted for second-hand smoking at home.

Results

Demographic variables

Table 1 presents the demographic characteristics of each group according to the parental smoking status. A total of 1,646,394 adolescents living with their parents were included, among which 1,481,156 were in the parental nonsmoking group, 1,108,934 were in the paternal smoking group, 13,738 were in the maternal smoking group, and 42,566 were in the parental smoking group. Significant differences were found among these groups in terms of sex, age, educational level, urbanity, academic achievement, parental educational level, and SES (all $p < 0.001$).

Substance use by adolescents

Table 2 shows the results of logistic regression and multiple linear regression regarding the effects of the parental smoking status on substance use by adolescents. Following adjustment for age, urbanity, educational level, parental educational level, SES, and differences in demographic variables, maternal smoking had higher risks of lifetime alcohol drinking and current alcohol drinking among adolescents than paternal smoking, whereas parental smoking had higher risks than maternal/paternal smoking.

Regardless of the parental smoking status, girls were at a higher risk of alcohol drinking than boys [Lifetime alcohol drinking (girls): paternal smoking OR = 1.30, 95% CI = 1.29–1.31; maternal smoking OR = 1.58, 95% CI = 1.50–1.66; parental smoking OR = 2.42, 95% CI = 2.35–2.49. Current alcohol drinking (girls): paternal smoking OR = 1.26, 95% CI = 1.25–1.28; maternal smoking OR = 1.99, 95% CI = 1.87–2.12; parental alcohol drinking OR = 2.63, 95% CI = 2.54–2.72]. Girls also presented differences in alcohol drinking severity compared with boys, particularly those whose both parents smoked (girls: alcohol drinking days $\beta = .06$, $p < .001$; volume $\beta = .09$, $p < .001$).

Table 2 presents the risk of smoking. Current smoking followed a similar trend as current alcohol drinking, although the patterns of smoking experience differed according to the sex of children. Although no significant difference was found in the risks caused by maternal smoking and parental smoking in boys, parental smoking increased the risk of current smoking by approximately 5 times, whereas maternal smoking did not significantly affect girls (Boys: maternal smoking OR = 1.58, 95% CI = 1.47–1.70; parental smoking OR = 1.62, 95% CI = 1.55–1.69. Girls: maternal smoking OR = .76, $p = .002$; parental smoking OR = 4.72, 95% CI = 4.49–4.97). Regarding smoking severity, a higher risk was determined for boys whose both parents smoked and for girls whose mothers smoked (Boys: smoking days $\beta = .06$, $p < .001$; volume $\beta = .04$, $p < .001$ for parental smoking. Girls: smoking days $\beta = .07$, $p < .001$; volume $\beta = .05$, $p < .001$ for maternal smoking). On the other hand, the results revealed an opposite pattern for illegal drug use by adolescents, with maternal smoking constituting a significant risk factor for boys and parental smoking for girls.

Table 3 presents the results obtained after additional adjustment for second-hand smoking at home. The overall odds ratio reduced, suggesting that second-hand smoking at home makes adolescents more prone to substance use. The results revealed again that maternal smoking is associated with a greater risk of substance use by adolescents than paternal smoking and that parental smoking is associated with a greater risk than maternal/paternal smoking in terms of lifetime alcohol drinking and current alcohol drinking, particularly among girls [Lifetime alcohol drinking (girls): paternal smoking OR = 1.12, 95% CI = 1.11–1.13; maternal smoking OR = 1.27, 95% CI = 1.20–1.34; parental smoking OR = 1.85, 95% CI = 1.79–1.90. Current alcohol drinking (girls): paternal smoking OR = 1.01, 95% CI = 1.00–1.02; maternal smoking OR = 1.43, 95% CI = 1.34–1.52; parental smoking OR = 1.77, 95% CI = 1.71–1.83]. Regarding alcohol drinking severity, the risk was higher among girls and for adolescents whose both parents smoked (girls: alcohol drinking days $\beta = .03$, $p < .001$; volume $\beta = .06$, $p < .001$ for parental smoking).

Similar results were found for smoking risk after adjusting for second-hand smoking at home, with the risk of lifetime smoking experience and current smoking among girls whose both parents smoked being the highest [Lifetime smoking experience (girls whose both parents smoked) OR = 2.76, 95% CI = 2.66–2.87. Current smoking (girls whose both parents smoked) OR = 2.49, 95% CI = 2.35–2.63]. Regarding smoking severity, following adjustment for second-hand smoking at home, odds ratio reduced but the patterns remained similar to those presented in Table 2, indicating that parental smoking in boys and maternal smoking in girls were the greatest risk factors, [Boys: smoking days $\beta = .05$, $p < .001$; volume $\beta =$

.02, $p < .001$ for parental smoking. Girls: smoking days $\beta = .06$, $p < .001$; volume $\beta = .04$, $p < .001$ for maternal smoking]. Maternal smoking was found to constitute a significant risk factor for the lifetime use of illegal drugs in boys (OR = 1.45, 95% CI = 1.20–1.75).

Discussion

In the present study, we analyzed data from 12th KYRBS to examine the influence of the parental smoking status on the risk of tobacco, alcohol, and illegal drug use by adolescents. The effects of parental smoking or maternal/paternal smoking as well as of maternal smoking and paternal smoking were analyzed separately. Sex differences in the risk of substance use as a result of parental smoking were also determined. Additionally, the unique effect of parental smoking on substance use by adolescents was determined by analyzing the onset age, current use, as well as amount and frequency of substance use.

The results showed that smoking by both parents constitutes a significant risk factor for substance use by adolescents compared with smoking by one parent or no smoking by both parents. First, the smoking behavior of both parents increased the smoking rate and degree among adolescents. Evidence clearly shows that parental smoking is a risk factor for smoking by adolescents. Loureiro et al. reported that parental smoking increased the smoking rate among both boys and girls [11], whereas Powell and Chaloupka found that the smoking rate of adolescents increased significantly even when only one parent smoked [12]. Importantly, the results from the present study showed that parental smoking increased smoking risk in children more than maternal/paternal smoking. This suggests that smoking by adolescents is affected not only by the parental smoking status but also by the number of smokers at home.

The identified risk remained significant even when the analysis was adjusted for the effect of second-hand smoking at home. As reported in previous studies, parental attitudes and educational policies toward smoking have a marked impact on adolescent smoking, indicating that parental smoking serves as a role model for adolescent smoking [3, 13, 14]. Okuda et al. showed that adolescents whose both parents smoke show a stronger tendency to smoke and a greater difficulty to quit than those whose only one or no parent smokes [15]. Therefore, parental smoking is more dangerous than maternal/paternal smoking because it increases second-hand exposure to smoking at home, thus allowing children to develop a positive attitude toward smoking.

In the present study, we found that parental smoking affected children of both sexes differently and that the sex of the smoking parent constitutes a different risk factor for the smoking behavior of children. Parental smoking constitutes a significant risk factor for the smoking rate among girls and for the degree of smoking among boys. Maternal smoking produced unique results compared with parental smoking or paternal smoking because it affected the smoking rate of boys and girls differently, significantly increasing the rate of current smoking among boys but decreasing it among girls. Interestingly, girls whose mothers smoked had a higher smoking degree than others.

Previous studies have referred to the differential effects of parental smoking according to the sex of the smoking parent and children. In fact, several studies have found that the effects of both parental and peer smoking on adolescents vary with their sex [12, 13, 16] and that the effects of parental smoking vary with the sex of the smoking parent [11, 17]. According to Loureiro et al., parents of the same sex as their children act as a stronger role model for smoking [11], with smoking fathers increasing the smoking rate among boys and smoking mothers increasing this rate among girls. On the other hand, Resen pointed out that irrespective of the sex of children, maternal smoking constitutes a greater risk factor than paternal smoking [17]. Therefore, the available evidence is not fully consistent, suggesting that the effects of parental smoking on the onset and duration of smoking by adolescents are a result of a complex interplay between the sex of parents and that of children [18, 19]. In addition, previous studies conducted in Korea have shown that the school environment and mental health issues such as depression have a significant impact on smoking by adolescents [20–22]. Therefore, further longitudinal studies are needed to closely observe such causal relationships.

Regarding the use of alcohol, the results showed that parental smoking increased the rate and degree of alcohol drinking by adolescents compared with parental nonsmoking or maternal/paternal smoking even after the adjustment for second-hand smoking at home. Currently, there are only few evidences regarding the relationship between parental smoking and alcohol drinking by adolescents, although it is well known that smoking and alcohol drinking are closely related [23]. Some studies have found evidence on a relationship between parental substance use other than alcohol drinking, such as tobacco use, and alcohol drinking by children [24, 25]. Based on large-scale surveys on Korean adolescents, the present study provides convincing evidence that parental smoking can promote alcohol drinking by adolescents and that parental smoking constitutes a higher risk for smoking by adolescents than maternal/paternal smoking.

We also examined the effects exerted by maternal smoking on substance use other than nicotine use by adolescents. We found that while maternal smoking constitutes a risk factor for alcohol drinking behavior in children, paternal smoking exerts a relatively smaller effect. These results are consistent with those of a study by Capaldi et al., who found that among the parental use of various substances, the most robust predictor of alcohol drinking by adolescents is maternal smoking [23]. We also revealed that maternal smoking markedly increased the use of illegal substances by boys. Previous studies have reported that a favorable attitude of parents toward the use of various substances, including nicotine, constitutes a risk factor for the use of illegal substances by adolescents [26]. Smoking and alcohol drinking or other substance use by mothers can greatly increase the risk of use of illegal drugs, including marijuana, by adolescents [27, 28].

Several potential causes may underlie the negative effects exerted by maternal smoking on substance use by children. First, mothers may have a greater contribution to the attitude of children toward substance use than fathers. Usually, mothers spend more time with their children and tend to develop a more intimate relationship with them than fathers [29, 30]. Consequently, maternal attitudes may have a greater impact on a child's attitude and value formation [31]. Accordingly, it is assumed that maternal

smoking is more likely to lead children to form a permissive attitude toward substance use than paternal smoking.

Second, maternal smoking may lead children to develop antisocial attitudes. Substance use by adolescents is closely related to antisociality [32]. In Asia, including in Korea, smoking by females is considered contrary to social customs because it is considered a masculine trait [33, 34]. Therefore, smoking mothers may serve as antisocial role models within Asian cultures, potentially leading to more antisocial behavior (including due to substance use) by adolescents.

The present study has several limitations. First, it was conducted through an online questionnaire, thus reflecting self-reported smoking behavior only. Because the smoking behavior of adolescents can be masked by various reasons, the reliability of self-reported smoking is relatively limited. Therefore, further studies using an objective evaluation of smoking, such as physiological indicators, are required. Second, there may have been confounding variables that were not accounted for. In the present study, the general characteristics of adolescent smokers whose parents were also smokers were easy to determine based on the panel data. However, other psychosocial factors affecting parent–child relationships, such as adolescents’ perceived parental attitudes toward substance use and parenting characteristics, were difficult to assess. We suggest the construction of a sophisticated model aiming at a more accurate evaluation of these characteristics in subsequent studies. Finally, the present study was based on cross-sectional panel data; therefore, it was difficult to perform a longitudinal observation due to the nature of data. Future studies may provide a causal understanding of the parent–child interaction or sex differences of parent and children on adolescents’ smoking behavior through longitudinal observations.

Conclusion

We used large-scale survey data and confirmed that parental smoking has a significant impact on substance use by adolescents. We found that smoking by both parents constitutes a greater risk factor for substance use by adolescents than smoking by only one parent. Moreover, maternal smoking comprises a greater risk than paternal smoking as determined by the analysis of substance use status according to the sex of parents and children after adjusting for second-hand smoking at home, which may have a significant effect on the initiation and maintenance of smoking habit. This suggests that not only the presence of smokers at home but also their number and sex are critical for substance use by adolescents. The accurate evaluation of the family smoking environment and whole-family interventions are necessary to prevent and intervene early against substance use by adolescents.

Declarations

Acknowledgements

We gratefully acknowledged the participation of the individuals involved in the study as well as the valuable and helpful comments of the editors and reviewers on this paper.

Funding

The authors did not receive any funding for this paper.

Availability of data and material

The datasets used and analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

Study conception and design: JL, YK. Statistical expertise, analysis and interpretation of data: JL, YK. Manuscript preparation, supervision, and critical revision of the paper: SM, MHK, KHC, SC, JSA. All authors read and approved the final manuscript.

Ethics approval and consent to participate

The KYRBWS was approved by the Institutional Review Board of the Korea Centers for Disease Control and Prevention. (Statistics Korea, approval No. 11758). All methods in the study were carried out with relevant guidelines and regulations.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

Abbreviations

KYRBS (Korea Youth Risk Behavior Web-based Survey)

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Tables

Table 1 Demographic variables

Characteristics	Parental nonsmoking (n = 1,481,156)	Paternal smoking (n = 108,934)	Maternal smoking (n = 13,738)	Parental smoking (n = 42,566)	p-value
Female sex (n, %)	700,206 (47.3)	540,665 (48.8)	6,498 (47.3)	21,677 (50.9)	<.001†
Age [years; M (SD)]	15.08 (1.74)	15.02 (1.73)	15.44 (1.71)	15.21 (1.70)	<.001†
Educated [M (SD)]	9.62 (1.69)	9.57 (1.69)	9.95 (1.63)	9.76 (1.68)	<.001†
Urbanity (n, %)					<.001†
Metropolitan cites	654,014 (44.2)	476,170 (42.9)	5,441 (39.6)	16,421 (38.6)	
Small and medium cites	753,636 (50.9)	567,587 (51.2)	7,259 (52.8)	22,875 (53.7)	
Rural areas	73,505 (5.0)	65,176 (5.9)	1,037 (7.5)	3,271 (7.7)	
Paternal educational level (n, %)					<.001†
College and higher	888,226 (60.0)	548,377 (49.5)	4,196 (30.5)	13,080 (30.7)	
High school	364,371 (24.6)	345,515 (31.2)	5,231 (38.1)	17,987 (42.3)	
Middle school and below	26,492 (1.8)	20,842 (1.9)	638 (4.6)	2,828 (6.6)	
Unknown	202,067 (13.6)	194,199 (17.5)	3,671 (26.7)	8,671 (20.4)	
Maternal educational level (n, %)					<.001†
College and higher	782,489 (52.8)	489,715 (44.2)	2,978 (21.7)	10,509 (24.7)	
High school	474,065 (32.0)	418,471 (37.7)	6,594 (48.0)	21,631 (50.8)	
Middle school and below	22,626 (1.5)	17,695 (1.6)	812 (5.9)	2,108 (5.0)	
Unknown	201,976 (13.6)	183,052 (16.5)	3,354 (24.4)	8,319 (19.5)	
Academic achievement					<.001†
High	224,616 (15.2)	129,720 (11.7)	922 (6.7)	3,711 (8.7)	
Middle high	404,759 (27.3)	274,423 (24.7)	2,621 (19.1)	8,477 (19.9)	
Average	433,247 (29.3)	326,435 (29.4)	4,461 (32.5)	10,441 (24.5)	
Middle low	305,463 (20.6)	266,761 (24.1)	3,511 (25.6)	11,959 (28.1)	
Low	113,070 (7.6)	111,595 (10.1)	2,223 (16.2)	7,978 (18.7)	
Family economic status					<.001†
High	171,223 (11.6)	94,622 (8.5)	1,183 (8.6)	2,229 (5.2)	
Middle high	473,344 (32.0)	309,285 (27.9)	3,041 (22.1)	7,929 (18.6)	
Average	687,342 (46.4)	558,474 (50.4)	6,646 (48.4)	20,449 (48.0)	
Middle low	128,256 (8.7)	125,955 (11.4)	2,366 (17.2)	9,257 (21.7)	
Low	20,991 (1.4)	20,598 (1.9)	501 (3.6)	2,704 (6.4)	
Second-hand smoking at home [days; M, (SD)]	.26 (.99)	1.69 (2.29)	2.18 (2.69)	3.17 (2.83)	<.001†

Data are presented as mean (M) and standard deviation (SD) or numbers and percentages; † Statistical significance in group comparisons of all possible combinations. The figures reflect the weight of the population.

Table 2 Substance use by adolescents

Variable	Total		Boys		Girls	
	OR (95% CI) <i>βR (g)</i>	<i>p</i> -value	OR (95% CI) <i>β (t)</i>	<i>p</i> -value	OR (95% CI) <i>βR (g)</i>	<i>p</i> -value
Lifetime alcohol drinking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.24 (1.23-1.25)	<.001	1.22 (1.21-1.22)	<.001	1.30 (1.29-1.31)	<.001
Maternal smoking	1.44 (1.39-1.49)	<.001	1.35 (1.28-1.42)	<.001	1.58 (1.50-1.66)	<.001
Parental smoking	1.87 (1.83-1.91)	<.001	1.51 (1.46-1.55)	<.001	2.42 (2.35-2.49)	<.001
Current alcohol drinking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.22 (1.21-1.23)	<.001	1.21 (1.20-1.22)	<.001	1.26 (1.25-1.28)	<.001
Maternal smoking	1.37 (1.31-1.43)	<.001	1.01 (.94-1.07)	.890	1.99 (1.87-2.12)	<.001
Parental smoking	2.01 (1.96-2.05)	<.001	1.59 (1.53-1.64)	<.001	2.63 (2.54-2.72)	<.001
Drinking days						
Paternal smoking	.02 (9.21)	<.001	.02 (8.06)	<.001	.02 (7.76)	<.001
Maternal smoking	.02 (10.31)	<.001	.02 (11.20)	<.001	.02 (5.57)	<.001
Parental smoking	.02 (14.20)	<.001	.001 (2.98)	.003	.06 (22.65)	<.001
Drinking volume						
Paternal smoking	.02 (14.52)	<.001	.02 (8.90)	<.001	.05 (18.54)	<.001
Maternal smoking	.02 (13.14)	<.001	.02 (11.09)	<.001	.03 (10.21)	<.001
Parental smoking	.05 (28.91)	<.001	.03 (14.36)	<.001	.09 (34.74)	<.001
Lifetime smoking experience						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.17 (1.16-1.18)	<.001	1.22 (1.21-1.23)	<.001	1.21 (1.19-1.22)	<.001
Maternal smoking	1.21 (1.15-1.26)	<.001	1.14 (1.08-1.21)	<.001	1.60 (1.47-1.74)	<.001
Parental smoking	2.08 (2.03-2.13)	<.001	1.56 (1.51-1.61)	<.001	4.00 (3.86-4.15)	<.001
Current smoking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.18 (1.11-1.13)	<.001	1.17 (1.16-1.19)	<.001	1.09 (1.06-1.12)	<.001
Maternal smoking	1.30 (1.22-1.39)	<.001	1.58 (1.47-1.70)	<.001	.76 (.64-.90)	.002
Parental smoking	2.21 (2.14-2.28)	<.001	1.62 (1.55-1.69)	<.001	4.72 (4.49-4.97)	<.001
Smoking days						
Paternal smoking	.04 (14.91)	<.001	.04 (14.73)	<.001	.04 (6.01)	<.001
Maternal smoking	-.01 (-3.13)	.002	-.02 (-7.99)	<.001	.07 (11.59)	<.001
Parental smoking	.04 (16.17)	<.001	.06 (21.10)	<.001	.06 (8.48)	<.001
Smoking volume						
Paternal smoking	-.01 (-1.70)	.088	.00 (.26)	.795	-.03 (-4.49)	<.001
Maternal smoking	-.02 (-5.86)	<.001	-.03 (-9.70)	<.001	.05 (8.28)	<.001
Parental smoking	.02 (8.67)	<.001	.04 (14.78)	<.001	.00 (.23)	.816
Lifetime drug use						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	.80 (.77-.83)	<.001	.83 (.80-.87)	<.001	.76 (.71-.80)	<.001
Maternal smoking	1.53 (1.29-1.81)	<.001	2.38 (1.98-2.87)	<.001	.41 (.25-.66)	<.001
Parental smoking	1.58 (1.43-1.74)	<.001	.79 (.65-.95)	.012	2.45 (2.17-2.77)	<.001

Models adjusted for age, urbanity, academic achievement, paternal educational level, maternal educational level, and socioeconomic status.

Table 3 Substance use by adolescents adjusted for second-hand smoking at home

Variable	Total		Boys		Girls	
	OR (95% CI) <i>βR (9)</i>	<i>p</i> -value	OR (95% CI) <i>βR (9)</i>	<i>p</i> -value	OR (95% CI) <i>βR (9)</i>	<i>p</i> -value
Lifetime alcohol drinking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.10 (1.09-1.10)	<.001	1.08 (1.07-1.09)	<.001	1.12 (1.11-1.13)	<.001
Maternal smoking	1.23 (1.18-1.27)	<.001	1.20 (1.14-1.26)	<.001	1.27 (1.20-1.34)	<.001
Parental smoking	1.47 (1.44-1.50)	<.001	1.20 (1.16-1.23)	<.001	1.85 (1.79-1.90)	<.001
Current alcohol drinking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	.99 (.98-1.00)	.004	.99 (.98-1.00)	.050	1.01 (1.00-1.02)	.129
Maternal smoking	1.04 (1.00-1.09)	.064	.82 (.77-.87)	<.001	1.43 (1.34-1.52)	<.001
Parental smoking	1.35 (1.32-1.39)	<.001	1.07 (1.03-1.11)	<.001	1.77 (1.71-1.83)	<.001
Alcohol drinking days						
Paternal smoking	-.02 (-13.10)	<.001	-.02 (-7.56)	<.001	-.03 (-8.75)	<.001
Maternal smoking	.01 (6.41)	<.001	.02 (8.46)	<.001	.01 (2.64)	.008
Parental smoking	.00 (-.56)	.575	-.01 (8.46)	<.001	.03 (10.62)	<.001
Alcohol drinking volume						
Paternal smoking	-.01 (-5.88)	<.001	-.01 (-3.87)	<.001	.00 (-.16)	.875
Maternal smoking	.02 (9.63)	<.001	.02 (8.85)	<.001	.02 (7.04)	<.001
Parental smoking	.03 (15.32)	<.001	.01 (6.77)	<.001	.06 (21.34)	<.001
Lifetime smoking experience						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	1.01 (1.00-1.02)	.027	1.05 (1.04-1.06)	<.001	.97 (.95-.99)	.001
Maternal smoking	.99 (.95-1.04)	.736	.98 (.93-1.04)	.535	1.15 (1.01-1.25)	.001
Parental smoking	1.56 (1.52-1.60)	<.001	1.16 (1.13-1.20)	<.001	2.76 (2.66-2.87)	<.001
Current smoking						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	.87 (.86-.88)	<.001	.93 (.92-.95)	<.001	.74 (.71-.76)	<.001
Maternal smoking	.93 (.88-1.00)	.037	1.28 (1.19-1.37)	<.001	.42 (.35-.49)	<.001
Parental smoking	1.39 (1.35-1.44)	<.001	1.05 (1.00-1.09)	.042	2.49 (2.35-2.63)	<.001
Smoking days						
Paternal smoking	.02 (7.35)	<.001	.02 (7.37)	<.001	.02 (2.18)	.029
Maternal smoking	.01 (-4.21)	<.001	-.02 (-8.84)	<.001	.06 (10.27)	<.001
Parental smoking	.03 (10.05)	<.001	.05 (17.00)	<.001	.02 (3.12)	.002
Smoking volume						
Paternal smoking	-.04 (-15.45)	<.001	-.04 (-13.05)	<.001	-.06 (-9.69)	<.001
Maternal smoking	-.02 (-7.96)	<.001	-.03 (-11.38)	<.001	.04 (6.45)	<.001
Parental smoking	-.01 (-2.55)	.011	.02 (7.33)	<.001	-.05 (-6.87)	<.001
Lifetime drug use						
Parental nonsmoking	1.00		1.00		1.00	
Paternal smoking	.42 (.40-.44)	<.001	.52 (.50-.55)	<.001	.28 (.26-.30)	<.001
Maternal smoking	.66 (.56-.79)	<.001	1.45 (1.20-1.75)	<.001	.10 (.06-.16)	<.001
Parental smoking	.53 (.48-.58)	<.001	.33 (.28-.40)	<.001	.54 (.48-.62)	<.001

Models adjusted for age, urbanity, academic achievement, paternal educational level, maternal educational level, socioeconomic status, and second-hand smoking.