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Depression Predicts Smoking among Adolescent Girls but Not among Boys

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Abstract

This study investigates the comorbidity and longitudinal associations between smoking and self-reported depression in a community-based sample of Finnish adolescents in a 2-year prospective follow-up study. The adolescents took part in a school based survey, the Adolescent Mental Health Cohort Study, first in 9th grade (mean age 15.5) and a follow-up survey was conducted two years later. The subjects of this study are 2070 adolescents who took part in both surveys. Depression was measured by R-BDI, the Finnish version of Beck's short 13-part depression inventory. Smoking was measured by asking the respondents about their current smoking habits and how many cigarettes they had smoked. A concurrent association between depression and smoking was detected among both sexes both at age 15 and at age 17. Depression at age 15 emerged as a risk factor for smoking at age 17 among girls but not among boys. Smoking at age 15 did not predict subsequent depression among either sex. Not living with both parents at age 15 predicted subsequent depression among girls, and subsequent smoking among boys.

Keywords: Depression; Smoking; Adolescence; Follow-up study

Introduction

Smoking and depressive symptoms have both been demonstrated to be associated with somatic and psychiatric outcomes [1]. Having both risk factors may be hypothesized to increase prevalence of negative outcomes. Understanding associations of depression and smoking may inform interventions to early intervene to smoking of a depressed adolescent or detecting symptoms of mood disorders in a smoking adolescent.

The prevalence of mmental disorders is doubled in late adolescence compared to childhood [2]. Of the adolescents in Munich, for example, 17% have at some point in their life met the diagnostic criteria for a depressive disorder at the age of 24 years [3]. The point prevalence of depressive symptoms is even higher, with proportions of adolescents with elevated depressive symptoms or self-reported depression reported to be as high as 30% [4,5]. In adolescence also the typical gender difference occurs: depression is two times more common in females than in males [3,6].

Nicotine causes neurotransmitters like acetylcholine and dopamine concentrations to increase, which causes satisfaction, better concentration and increase in tolerating stress [7]. Smoking is most commonly started at young age, when neurobiological acute and chronic effects of smoking on developing central nervous system are substantial. In Finnish adolescents, as in adolescents in other western countries, smoking is common: of 14-year-old adolescents 15% are daily smokers, and at the age of 16 almost one third smoke daily. Boys smoke more often than girls, but girls' smoking is strongly increasing [8].

Smoking is more common in depressed adults and adolescents than in individuals in the general population [9-11]. Several longitudinal researches among adolescents have suggested that smoking predicts depressive symptoms while others have suggested that depression predicts smoking [12-19]. The association between smoking and depression in adolescence may also be bidirectional [20,21].

There may also be some gender differences in the temporal associations of smoking and depression in adolescence but these

are studied scarcely [20]. In some reports smoking seems to predict depression especially among females and depression seems to predict smoking especially among males, but opposite results have also been reported [16,19]. There are discordant results about genetic components predicting both smoking and depression; some researches state that genetic factors are important especially among men; some state the same among women [20].

There are four main hypotheses explaining the connection between smoking and mental illnesses. Self-medication of psychiatric symptoms by smoking or difficulties in abstaining from smoking due to low self-efficacy among depressed adolescents would explain why depression may predict smoking. The effects of nicotine on neurotransmitter systems [7,16,21-23] may explain the pathway from smoking to depression. Depression has been suggested to be correlated with both the presence of nicotine dependence and the number of cigarettes consumed [22]. And, finally the genetic and environmental factors that predispose to both smoking and depression may be behind the bidirectional associations [24].

The discordant results of the studies may result from the fact that the studies have concentrated on different issues; for example diagnosed depression vs. depressive symptoms, and smokig habits vs. nicotine dependence. Also study designs and the sizes of study populations have varied a lot between different researches. There is no final consensus about the associations of depression and smoking, so further research is needed to find out which of the hypotheses is the most considerable.

The incidence of both depression and smoking grows dramatically in adolescence compared to childhood [20]. Thus, it is most likely to find causal relations in researches focusing on adolescents. With the two year follow-up, it is possible to examine longitudinal associations of depression and smoking in the present study. The unselected study population comprised all ninth grade pupils (15-16 year-olds at baseline) from two Finnish cities.

The aim of the present study was to evaluate comorbidity and longitudinal associations between smoking and self-reported depression in Finnish adolescent population. The research questions were:

1) Is there comorbidity between smoking and depression at ages 15 and 17?

2) What is the temporal sequence of smoking and depression in middle adolescence?

The link between smoking and depression has been well established in previous literature. We strongly expected that depressed adolescents in our sample, both boys and girls, will more often be smokers than adolescents free from depression (that is: will show concurrent comorbidity). Adolescence is the period of time when peer pressure to smoke will be at its highest. Thus the effect of poor self-efficacy on difficulties to abstain from smoking will be high. Also the mental health literacy of adolescents may be lower than that of adults. An adolescent with depressive symptoms may not seek treatment and will thus be especially susceptible to self-medicating with substances such as tobacco. Hence we hypothesized that depression at the age of 15 will predict smoking at the age 17. The suggested pathway from smoking to depression goes through the biological effects of nicotine and other psychoactive chemicals in tobacco smoke. Thus, we expected to find no sex differences in this pathway.

Materials and Methods

Study samples and procedures

The present study is part of a prospective cohort study entitled Mental Health in Adolescence. The sample utilised in the study consist of surveys in two waves conducted during the academic years 2002-2003 and 2004-2005 in two Finnish cities, Tampere (population 200,000) and Vantaa (population 180,000). The study has received the approval of the ethics committee of Pirkanmaa Hospital District. The methods of the study are now described briefly; a detailed description can be found elsewhere [25].

The data wave was collected in all Finnish-speaking secondary schools in the two cities when the respondents were at 9th grade. The pupils filled in a person-identifiable questionnaire during a school lesson under teacher's supervision. Pupils absent from school on the original survey day had another opportunity to participate at school within a couple of weeks. Pupils who missed both of these occasions received the questionnaire twice by mail. A covering letter was sent to the parents of the pupils in advance, but the Finnish legislation on medical research does not require parental consent for a 15-year-year-old subject's participation.

A total of 3,597 pupils responded; the response rate was 94.4%. Six responses had to be excluded because of obvious facetiousness and 313 because they were completed by a student under 15 years old. The final sample included 3,278 respondents (mean age 15.5, SD 0.39) of whom 49.1% (n=1,609) were girls and 50.9% (n=1,669) boys.

Of the respondents 71.8% (n=1,487) were living with both parents and 20.6% (n=427) had at least one parent with low educational level (comprehensive school only).

The subjects who responded to the first survey were contacted two years later through their current educational institutes. Subjects not reached through school were contacted three times by mail and finally those who had not yet responded were offered an opportunity to respond through the Internet.

Altogether 2,070 adolescents, of whom 56.4% (n=1167) were girls and 43.6% (n=903) boys, responded to the survey both times. The response rate of the second survey was 63.1% and the mean age of the respondents at the time of the second survey was 17.6 (SD 0.41). Adolescents having completed the questionnaire at both times are the subjects of this study.

Measures

Depression

The Finnish modification of the 13-item Beck Depression Inventory was used to assess depression. R-BDI comprises 13 statements showing increasing intensity of depressive emotions and cognitions. Each item is scored 0–3 according to the severity of the symptom. Sum scores of the 13 items (range 0–39 scores) were dichotomized according to the cut-off point of 8 suggested in the literature into moderate to severe depression/mild depression or no depression [26-28].

Smoking

At the first questionnaire, the respondents were asked about their smoking habits with two different questions, first: "How many cigarettes have you smoked?", with response alternatives: 0 cigarettes, 1 cigarette, 2-50, or over 50. Those who had smoked, were also asked "Which of the following alternatives best describes your current smoking?": once a day or more often, once a week or more often but not daily, less than once a week, or quitted. At the follow-up, respondents were only asked about their current smoking, with the response alternatives: once a day or more often (smokes daily), once a week or more often but not daily (smokes less than daily), less than once a week (smokes less than weekly), or quitted/never smoked (has never smoked or has quitted smoking). Responses to smoking questions at age 15 were combined into one smoking variable according to the response alternatives at age 17. In the final analyses, smoking was dichotomised to current non-smokers (quitted/never smoked) and current smokers.

Sosiodemographic background

Data were collected on family structure and parental education level. The respondents were asked: "Which of these belong to your family?" with response alternatives: mother and father, mother and stepfather, father and stepmother, only mother, only father, or some other guardian. On parental education level the question was: "What is the highest educational level obtained by your father (mother)?" and the response alternatives were: comprehensive school only, comprehensive school with vocational education, upper secondary school with/without vocational education, and academic degree. In the analyses, family structure was dichotomised to living with both parents vs. any other, and maternal and paternal education were dichotomised to low (comprehensive school only) vs. intermediate/high education.

Statistical analyses

The comorbidity of depression and smoking was analyzed at both

age 15 and age 17. The proportions of those reporting depression by smoking were calculated and the significance of differences in proportions were analyzed by chi-square test. The proportions of those reporting smoking by depression were calculated and the significance of differences in proportions were analyzed by chi-square test.

The longitudinal associations between depression and smoking were analyzed by calculating the proportion of depression at age 17 according to smoking at age 15, and the significance of differences between groups was analyzed by chi-square test. To study multivariate associations, binary logistic regression was used. Firstly, odds ratio (OR) with 95% confidence interval (CI) for depression at age 17 (dependent variable) according to smoking at age 15 (independent variable) was calculated. Depression at age 15 and soscio-demographic variables (family structure and maternal and paternal education level) were controlled for.

To test whether depression at age 15 predicts smoking at age 17, the proportion of smoking at age 17 was calculated according to depression at age 15. The significance of differences between groups was analyzed by chi-square test. OR (with 95% CI) for smoking at age 17 (dependent variable) by depression at age 15 (independent variable) was calculated using logistic regression analysis. Smoking at age 15 and soscio-demographic variables (family structure and parental educational levels) were controlled for.

All the analyses were done separately for boys and girls. Statistical analyses were performed with the SPSS 15.0 software package.

Drop out

Adolescents who dropped out of the second survey were more likely to be boys (63% vs. 44%, p=0.001). They did not live as often with both parents as those who took part in the second survey (28% vs. 35%, p=0.001). They were also more likely to come from families where the parental educational level was low (mother, comprehensive school only: 13% vs. 18%; father, comprehensive school only: 17% vs. 22%, p=0.001).

The drop-outs had more often depression at 9th grade (12% vs. 9%, p=0.02). The drop-outs also smoked more at 9th grade (37% vs. 27% had smoked over 50 cigarettes, p<0.001).

Results

Prevalence

The prevalence of depression among girls at age 15 was 12% (n=133) and at age 17 it was 10% (n=119). The prevalence of depression among boys was 6% both at age 15 (n=53) and at age 17 (n=57).

At the age of 15, 67% (n=768) of girls were current non-smokers, 8% (n=97) smoked less than weekly, 4% (n=51) smoked less than daily, and 20% (n=235) smoked daily. At the age of 15, 71% (n=633) of boys were current non-smokers, 5% (n=46) smoked less than weekly, 3% (n=31) smoked less than daily, and 20% (n=887) smoked daily.

At the age of 17, 61% (n=712) of girls were current non-smokers, 9% (n=104) smoked less than weekly, 4% (n=48) smoked less than daily, and 26% (n=296) smoked daily. At the age of 17, 63% (n=558) of boys were current non-smokers, 9% (n=76) smoked less than weekly, 3% (n=28) smoked less than daily, and 26% (n=229) smoked daily.

Comorbidity

Smoking and depression were statistically significantly associated among girls both at age 15 and 17. Among boys they were statistically significantly associated only at age 15. At age 15 depression was over two times more common among daily smokers compared to current non-smokers among both girls and boys. At age 17 depression was over two times more common in daily smokers compared to current non-smokers among girls. There was no association between depression and smoking among boys at age 17 (Table 1).

Longitudinal associations between depression and smoking

Depression at age 17 was not predicted by smoking at age 15 among girls or boys (Table 1).

Girls who had depression at age 15, were daily smokers two times more often at age 17 than girls without depression at age 15 (23% vs. 46%, p<0.001). Girls without depression at age 15 were more likely to smoke less than once a week at age 17 compared to depressed girls (7% vs. 9%, p<0.001). Girls depressed at age 15 were more likely to smoke less than daily at age 17 (5% vs. 4%, p<0.001). Girls who weren't depressed at age 15, were non-smokers at age 17 more often than girls who were depressed at age 15 (42% vs. 64%, p<0.001). Among boys, the differences were not statistically significant.

The association between depression at age 15 and smoking at age 17 among girls persisted in logistic regression analysis controlling for smoking at age 15, parental education, family structure and age. Smoking at age 17 was also predicted by smoking at age 15. Among boys, depression at age 15 had no association with smoking at age 17. Smoking at age 17 was predicted by smoking and by not living with both parents at age 17 (Table 2).

Smoking at age 15 did not predict subsequent depression among either girls or boys. Depression at age 17 was among both sexes predicted by previous depression and among girls by not living with both parents at age 15 (Table 3).

Discussion

Earlier studies have found out that there is comorbidity between smoking and depression, but the reason for the association is partially unsolved, as there are many hypotheses but no final conclusion about it. The present study suggests no pathway from smoking to depression and a pathway from depression to smoking among girls only.

The findings of the present study support the findings of many earlier studies about depression predicting later smoking [16-20,29]. This temporal sequence can be explained by the self-medication hypotheses, but also by the increased harmful health behaviour of the depressed adolescents. Some large studies have found depressed adolescents to be more likely than their peers to engage in multiple health-risk behaviours, like smoking. The association is thought to be mediated by reported levels of hopelessness, anhedonia and suicidality [30,31].

There are few studies addressing gender differences in the association between smoking and depression. Depressive mood was suggested to predict smoking initiation in early adolescent girls but not in boys in Netherland [16]. Adolescent girls may be more prone to self-medicate their depression with smoking. Depressive mood may also make females more vulnerable to peer pressure concerning smoking.

In our study smoking at age 15 does not predict depression at age 17. Thus, our study did not support the hypothesis of smoking predicting later depression. Perhaps the depressogenic effect of smoking on

	Smoking at age 15				
Depression at age 15	no	less than weekly	less than daily	daily	p
Girls					<0.001
yes	8.3% (64/768)	11.3% (11/97)	11.8% (6/51)	22.1% (52/235)	
no	91.7% (704/768)	88.7% (86/97)	88.2% (45/51)	77.9% (183/235)	
Boys					0.006
yes	4.9% (31/633)	4.3% (2/46)	0.0 % (0/31)	11.3% (20/177)	
no	95.1% (602/633)	95.7% (44/46)	100.0% (31/31)	88.7% (157/177)	
	Smoking at age 15				
Depression at age 17	no	less than weekly	less than daily	daily	p
Girls					0.340
yes	9.1% (70/769)	11.3% (11/97)	11.8% (6/51)	13.0% (31/238)	
no	90.9% (699/769)	88.7% (86/97)	88.2% (45/51)	87.0% (207/238)	
Boys					0.570
yes	6.5% (41/632)	2.1% (1/47)	9.7% (3/31)	6.3% (11/174)	
no	93.5% (591/632)	97.9% (46/47)	90.3% (28/31)	93.7% (163/174)	
	Smoking at age 17				
Depression at age 17	no	less than weekly	less than daily	daily	p
Girls					<0.001
yes	8.1% (58/712)	4.8% (5/104)	10.4% (5/48)	17.2% (51/296)	
no	91.9% (654/712)	95.2% (99/104)	89.6% (43/48)	82.8% (245/296)	
Boys					0.394
yes	5.6% (31/558)	10.5% (8/76)	7.1% (2/28)	7.0% (16/229)	
no	94.4% (527/558)	89.5% (68/76)	92.9% (26/28)	93.0% (213/229)	

Table 1: Prevalence (%, n/N) of depression according to smoking among girls and boys at age 15 and at age 17, and prevalence of smoking according to depression among girls and boys at age 15 and at age 17.

	Risk for Smoking at age 17 Girls		Risk for Smoking at age 17 Boys	
	OR (95% CI)	p	OR (95% CI)	p
Depression at age 15		0.009		0.677
yes	1.82 (1.16-2.86)		1.16 (0.57-2.36)	
no (ref.)				
Smoking at age 15		<0.001		<0.001
yes	12.05 (8.92-16.28)		15.27 (10.52-22.18)	
no (ref.)				
Maternaleducationallevellow		0.425		0.368
yes	1.21 (0.76-1.95)		1.29 (0.74-2.23)	
no (ref.)				
Paternaleducationallevellow		0.768		0.920
yes	0.94 (0.62-1.43)		1.03 (0.60-1.77)	
no (ref.)				
Living with bothparents		0.417		0.040
yes (ref.)				
no	1.14 (0.83-1.58)		1.49 (1.02-2.18)	
Age		0.498		0.789
15 yrs (ref.)				
over 15 yrs	0.78 (0.83-1.58)		1.49 (1.02-2.18)	

Table 2: Risk for [odds ratio (OR), 95% confidence interval (CI)] smoking at age 17 according to depression at age 15, smoking at age 15 and sosiodemographic factors.

neurotransmitters needs a longer follow-up time to emerge. In some earlier studies the follow-up time has been five to six years [12,14].

We also found out that not living with both parents is predictive of depression among girls. This has been noted in earlier studies, too. Among boys, not living with both parents emerged as independent

	Risk for Depression at age 17 Girls		Risk for Depression at age 17 Boys	
	OR (95% CI)	p	OR (95% CI)	p
Smoking at age 15		0.641		0.396
yes	0.90 (0.57– 1.42)			
no (ref.)				
Depression at age 15		<0.001		<0.001
yes	13.60 (8.62-21.44)		8.39 (4.16-16.94)	
no (ref.)				
Maternaleducationallevellow		0.270		0.414
yes	1.43 (0.76-2.70)		0.66 (0.25-1.78)	
no (ref.)				
Paternaleducationallevellow		0.615		0.358
yes	1.16 (0.65-2.10)		1.48 (0.64-3.38)	
no (ref.)				
Living with bothparents		0.011		0.569
yes (ref.)				
no	1.80 (1.15-2.82)		1.21 (0.63-2.30)	
Age		0.637		0.361
15 yrs (ref.)				
over 15 yrs	0.81 (0.33-1.96)		2.00 (0.45-8.90)	

Table 3: Risk for [odds ratio (OR), 95% confidence interval (CI)] depression at age 17 according to smoking at age 15, depression at age 15, and sociodemographic factors.

predictor of later smoking. Also this has been noted in earlier studies [32].

In our study the adolescents who smoked daily were concurrently more than two times more likely to display with depression compared to the non-smokers. However, we were not able to demonstrate a liner dose-effect type association between smoking and depression. This is probably due to small numbers in some smoking categories.

One of the main strengths of this study was a large community-based cohort of adolescents with a reasonable response rate in the two-year follow-up. The samples of this study, however, present only 63% of the adolescents taking part in the first survey. This may impair the generalize ability of the study, as drop-outs smoked more often and had slightly more depression at age 15. The results might have been even clearer if the drop-outs had continued at the study. The community-based cohort also made it possible to study adolescents with subclinical depression.

It also would have been possible to exclude those who have quitted smoking, because they might confuse the results of those who have never smoked. However, the group of quitters was rather large (n=341 at age 15, n=261 at age 17), and we did not want to exclude that many people from the analyses. We tried the effect of excluding quitters to the comorbidity of smoking and depression, and found out that depression was one percent less common in those who have never smoked, compared to never-smokers and quitters together (6% vs. 7% at age 15 and 6% vs. 7% at age 17). Unfortunately we could not ascertain the maternal smoking status of the respondents. It has been suggested that the smoking status of adolescents at the age of 17 may be independently predicted by maternal smoking status at pregnancy [33].

Conclusion

Depression and smoking are concurrently associated at ages 15 and 17. Among girls, earlier depression predicts subsequent smoking in middle adolescence. Adolescents presenting with depression are in need of preventive measures of smoking. On the other hand, with adolescents who smoke, in addition to health education, screening for depression is advised. Particular effort may be needed to help

adolescents with depression to quit smoking, as depression may impair both motivation and persistence in attempting to quit smoking.

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