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## Short Communication

# Addictive behaviors, social and psychosocial factors, and electronic cigarette use among adolescents: a population-based study

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## ABSTRACT

**Objectives:** The aim was to investigate associations between e-cigarette use and social and psychosocial factors and cigarette smoking, alcohol consumption, and narcotics use among adolescents attending 9th grade in primary school and 2nd grade in secondary school.

**Study design:** Cross-sectional study.

**Methods:** The public health survey among adolescents in Scania in 2016 includes pupils in grades 9 and 2. The associations between e-cigarette use and lifestyle, social and psychosocial factors, and trust were investigated with logistic regressions.

**Results:** In 9th grade, 32% of male pupils and 27% of female pupils had ever used e-cigarettes, and in 2nd grade, 43% of males and 31% of females had ever used e-cigarettes. E-cigarette use was significantly associated with current smoking, snus (a moist powder tobacco product originating in Sweden) use, water pipe use, intensive alcohol consumption, and narcotics and also with psychosocial conditions related to home and parents, peers, and school.

**Conclusions:** The prevalence of ever e-cigarette use was high among adolescents attending both grades. E-cigarette use was most strongly associated with health-related lifestyles. It was also associated with psychosocial factors such as study difficulties, school stress, problems talking with parents, and generalized trust.

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The e-cigarette or electronic nicotine delivery system (ENDS) has emerged in recent years as a new tobacco-like product and raised several concerns regarding, for example, product features, health effects, consumer perceptions, patterns of use, potential to induce dependence, smoking cessation, marketing communications, sales, and policies.<sup>1</sup>

E-cigarette use is most common among current smokers, followed by former smokers and least common among never smokers.<sup>2</sup> Studies suggest that e-cigarettes have significantly lower propensity to induce dependence than cigarettes but may induce some level of satisfaction.<sup>3</sup> Although most studies on e-cigarettes or ENDS have been conducted on adults,

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adolescence is the period when most smokers start smoking and also when many quit.<sup>4</sup> Studies concerning adolescent use of e-cigarettes are scarce. The prevalence of ever having used e-cigarettes was, for example, 23.5% among adolescents aged 15–19 years in Poland in 2010–2011<sup>5</sup> and rose from 20.4% to 28.1% among male adolescents and from 14.0% to 21.7% among female adolescents aged 12–18 years in Finland from 2013 to 2015.<sup>6,7</sup>

Studies on adolescents have demonstrated that e-cigarette use is associated with male gender, increasing age, and addictive behaviors such as snus, water pipe use, and alcohol,<sup>7</sup> but no study has, to our knowledge, investigated associations with use of narcotics. Only few studies have investigated the association with psychosocial factors such as school performance<sup>6</sup> and psychosocial factors related to family, peers, and school.<sup>8</sup> Social capital is commonly defined as generalized trust in others, reciprocity, and social networks/social participation. Tobacco smoking is associated with low social capital.<sup>9</sup> No study has yet investigated associations between social capital and the use of e-cigarettes.

The public health survey conducted in Scania in the southernmost part of Sweden in 2016 among school children and adolescents is a cross-sectional study. The study was conducted among pupils in the 6th and 9th grades of the primary school (*grundskolan*) and the 2nd grade in secondary school (*gymnasieskolan*). The school system in Sweden comprises nine school years in primary school and three years in secondary school. Questionnaires were either distributed by the teachers in the class room, answered by the respondents, and gathered in the class room during scheduled time in school or distributed and answered digitally during class. Only pupils in the 9th and 2nd grades were included. A total 9143 pupils responded in grade 9 and 7949 pupils in grade 2, which yielded a participation rate in of 77% in grade 9 (81% in paper and 76% digitally) and 73% in grade 2 (79% room and 73% digitally). Subjects with missing information on e-cigarette use ( $n = 3147$ ), sex ( $n = 57$ ), and age ( $n = 53$ ) were excluded. The study was approved by the Ethical Committee at Lund University, Sweden.

*E-cigarette use* was investigated with the item ‘Have you ever used e-cigarettes (electronic cigarette which transforms nicotine-containing fluid to water vapor)?’ with the alternative answers ‘No’, ‘Yes, during the past 30 days’, ‘Yes, during the past 12 months’ and ‘Yes, more than 12 months ago’. For the three latter alternatives more than one alternative could be chosen by the respondent. The item was dichotomized with the no against the three yes answers collapsed.

The normal *age* of pupils in grade 9 is 15–16 years and in grade 2 17–18 years. We included participants who reported the ages 14–17 years in grade 9 and 15–21 years in grade 2, which only excluded a small number of participants.

All analyses were stratified by sex.

*Narcotics use* was assessed with the item ‘Have you ever used narcotics?’ with the alternatives ‘No’, ‘Yes, more than twelve months ago’, ‘Yes, during the past twelve months’, and ‘Yes, during the past 30 days’. It was possible to answer more than one yes alternative, but the item was dichotomized with the no alternative opposed to the three yes alternatives.

*Feeling happy in school* was assessed with the item ‘To what extent do you feel happy in school’ with the options ‘Very

good’, ‘Good’, ‘Neither good nor bad’, ‘Bad’, and ‘Very bad’. It was dichotomized with the two first alternatives as ‘Good’ and the three latter as ‘Bad’.

*Difficulties in school* were assessed with the question ‘Do you have difficulties with any of the following in school’ including the alternatives ‘Keeping up in class’, ‘Doing my homework or other assignments’, ‘Preparing before an examination’, ‘Finding most suitable study technique’, ‘Starting or finishing assignments demanding my own initiative’, ‘Completing written assignments’, and ‘Completing reading assignments such as reading a book’. Each of these could be answered ‘Not at all’, ‘Rather little’, ‘Rather much’, and ‘Very much’. An index was formed if the respondent gave at least three ‘rather much’ answers or at least one ‘very much’ answer, in which case the index for the respondent was defined as difficulties in school.

*Stressed by school work* was assessed with the question ‘Do you feel stressed by your school work?’ with the alternative answers ‘Not at all’, ‘Rather little’, ‘Rather much’, and ‘Very much’. The item was dichotomized with the first two alternatives as ‘No’.

*Generalized trust in other people* was assessed with the item ‘Most people can be trusted’ with the alternative answers ‘Do not agree at all’, ‘Do not agree’, ‘Agree’, and ‘Completely agree’. The item was dichotomized with the two latter alternatives defined as ‘Yes’.

All other variables have been defined in research from a previous school questionnaire study.<sup>10</sup>

Factors associated with ever use of e-cigarettes were calculated in logistic regression models in bivariate and multiple analyses, stratified by sex. In the bivariate models, the association between each factor and ever having used e-cigarettes was calculated, adjusted for age and stratified by sex (model 1 in Tables 1 and 2). In the multiple models all factors were included in the same logistic regression model (model 2 in Tables 1 and 2). The SPSS, version 22.0, was used.

Results not shown in the tables indicate that 31.6% of male pupils in grade 9 and 43.2% in grade secondary school grade 2 had ever used e-cigarettes. Among female pupils, 26.8% in grade 9 and 31.4% in grade 2 had ever used e-cigarettes. A 10.8% prevalence of male pupils in grade 9 and 11.1% in grade 2 had smoked e-cigarettes during the past 30 days. The prevalence among female pupils was 7.0% in grade 9 and 5.0% in grade 2. Only 7% reported that e-cigarette use had helped to quit smoking.

Table 1 shows that in the bivariate logistic regression models for male pupils, the group with both parents born in other countries than Sweden had a significantly lower odds ratio of ever having used e-cigarettes than those with both parents born in Sweden. Current smokers, snuff users, ever smokers of water pipe, respondents with intensive alcohol consumption, ever users of narcotics, and parents' approval of cigarette use had significantly higher odds ratios of ever having smoked e-cigarettes with strong effect measures. Male pupils with study difficulties, school stress, problems talking with parents, and low generalized trust also had significantly higher odds ratios of ever having smoked e-cigarettes. Male pupils feeling happy in school had tested e-cigarettes to a lower extent.

Table 2 shows that in the bivariate models, female pupils with one parent born abroad had a significantly higher odds

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