



Daily tobacco smoking, heavy alcohol use, and hashish use among adolescents in southern Sweden: A population-based multilevel study



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ABSTRACT

Introduction: The aim of this study was to investigate school contextual effects on daily tobacco smoking, heavy alcohol use and hashish use among adolescents, using multilevel analyses adjusting for individual-level factors.

Methods: The 2012 public health survey among adolescents in Skåne includes pupils in ninth grade in primary school (predominantly 15–16 years old) and second grade in secondary school (gymnasium) (predominantly 17–18 years old). Multilevel logistic regressions were performed.

Results: The prevalence of all three behaviors was higher in the second grade in the gymnasium. Several sociodemographic, psychosocial and parental factors were associated with these behaviors. In the ninth grade, variance partition coefficients (VPCs) for tobacco smoking decreased from 10.2% in the empty model to 1.9% in the fully adjusted model, for heavy alcohol use from 6.5% to 6.3%, while VPCs for hashish increased from 9.9% to 11.0%. In the second grade, VPCs for daily tobacco smoking decreased from 13.6% in the empty model to 6.5% in the fully adjusted model, VPCs for heavy alcohol use decreased from 4.6% to 1.7%, and VPCs for hashish use increased from 7.3% to 8.3%.

Conclusions: Daily tobacco smoking (in both grades) and heavy alcohol use in the second grade in the gymnasium may be preventable by actions directed against individual-level protective factors including social capital, social support and peer/parent behavior and attitude, while interventions directed at school contexts may be more important for alcohol use in the ninth grade and hashish use in both grades.

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1. Introduction

Adolescence is of crucial importance for public health. This is because adolescence constitutes a highly formative period of the life course for several health-related behaviors. Health-related behaviors such as tobacco smoking, alcohol use and hashish use are typically associated with a variety of direct health risks (Sznitman et al., 2013) such as unintentional injuries (Boden & Fergusson, 2011), anti-social behavior (Jessor, Donovan, & Costa, 1991), and early onset of sexual intercourse (Paul, Fitzjohn, Herbison, & Dickson, 2000). Health related behaviors during adolescence also have effects in adulthood. A majority of adult tobacco smokers report having started using in adolescence (Hublet et al., 2006), with tobacco smoking during adolescence associated with increased premature death in adulthood in lung cancer, chronic obstructive lung disease and cardiovascular diseases (Lopez et al., 2010). The risk of alcohol dependence in adulthood is four times increased among those who initiate alcohol use before age 15 compared to those who begin at age 21 (MacKay & Duran, 2007). The long-term

effects of illicit drug use of marijuana include an increased risk of poor educational achievement (Fergusson & Boden, 2008), an increase in mental health problems (Dragt et al., 2010), and decreased cognitive functioning (Sanderson, 2004). Adverse health behaviors in adolescence also contribute to the socioeconomic gradient in adult health (Johansen, Rasmussen, & Madsen, 2006).

Health-related behaviors in adolescence are affected by parental, peer and school factors. Parental control and warmth are regarded as essential for youth socialization and health behaviors (Barnes, Hoffman, Welte, Farrell, & Dintcheff, 2006). Adolescent tobacco smoking is associated with living without the biological father, family conflict, maternal smoking, participation in fights (Menezes, Goncalves, Anselmi, Hallal, & Araujo, 2006), and parental socioeconomic factors such as low parental education and immediate family who smoke in the household (Audrain-McGovern et al., 2009). Studies indicate that friends and classmates may influence health behaviors such as tobacco smoking to a greater extent than parents (Johansen et al., 2006; Kristjansson, Sigfusdottir, & Allegrante, 2013). Strong peer effects on adolescent health behavior have also been demonstrated for adolescent binge drinking (Lundborg, 2006), drunkenness (Kristjansson et al., 2013) and cannabis use (Fallu, Brière, & Janosz, 2014).

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Adolescent tobacco smoking is also associated with age, sex, current grade in the school system (Leatherdale & Burkhalter, 2012), low self-efficacy, having pocket money (Leatherdale & Ahmed, 2010; Kaai, Manske, Leatherdale, Brown, & Murnaghan, 2014), cost of tobacco (Lovato et al., 2010), tobacco smoking friends (Murnaghan, Leatherdale, Sihvonen, & Kekki, 2008), positive tobacco-related attitudes (Kaai, Leatherdale, Manske, & Brown, 2013; Kaai et al., 2014), and low school-connectedness (Leatherdale, Cameron, Brown, & McDonald, 2005; Kaai et al., 2013, 2014). Heavy alcohol use is associated with age, sex (being male), having a strong connection with friends, having parents with a low level of knowledge of adolescents' daily activities, poor school connectedness, obtaining alcohol from adults and/or friends, peers using alcohol and positive attitude to regular alcohol use (Jackson et al., 2014), poor school performance, delinquency (Moore et al., 2005), and the behavior of peers (Lundborg, 2006; Clark & Loheac, 2007). Hashish use is associated with adolescents' exposure to socially deviant individuals and greater access to cannabis (ter Bogt, Schmid, Gabhainn, Fotiou, & Vollebergh, 2006; ter Bogt et al., 2013), less social control and monitoring (Sampson, Morenoff, & Gannon-Rowley, 2002), and lack of perceived disapproving social norms in the social environment concerning cannabis use (Keyes et al., 2011).

The influence of the school environment on tobacco smoking has mostly been investigated in multilevel analyses analyzing the school level and the individual pupils (Kristjansson et al., 2013; Paek, Hove, & Oh, 2013; Kaai et al., 2013), sometimes with low variance at the school level, e.g. an intra-class correlation in tobacco smoking at the school level from 3.9% in the empty model to 2.3% in the full model, which indicates a comparatively small importance of school context (Kaai et al., 2013). Studies using multilevel analysis on risk of alcohol use and hashish use among adolescents in school are scarcer. One study from Iceland showed an empty model school level intra-class correlations of approximately 10% for daily tobacco smoking, and around 5% for lifetime drunkenness and lifetime cannabis use, which were to an important extent unaffected by the addition of a substantial number of individual lifestyle, socio-demographic and psychosocial factors in the models (Kristjansson et al., 2013). A Swedish study showed significant effects of the school context on binge drinking among adolescents (Svensson, 2010). A Danish study confirmed the notion that adolescent risk behaviors such as tobacco smoking, high alcohol use and cannabis use are more influenced by school context than dietary habits (Johansen et al., 2006). Other recent multilevel studies have investigated the effect of contextual characteristics on adolescent tobacco smoking using contextual variables. The results suggest that the presence of school tobacco control programs and policies (Murnaghan et al., 2008; Lovato et al., 2010), high costs of cigarettes in the proximity of the schools (Lovato et al., 2010), and school neighborhood characteristics such as school location and neighborhood median income (Kaai et al., 2013) was associated with the risk of tobacco smoking among students.

Studies of adults (Lindström, 2003) and adolescents (Thorlindson, Valdimarsdottir, & Jonsson, 2012; Chen, Wu, Chang, & Yen, 2014) show that social capital in the forms of social participation and generalized trust in other people (Putnam, Leonardi, & Nanetti, 1993) is negatively associated with tobacco smoking initiation, continuation and cessation. No studies have investigated the association between generalized trust in others and heavy alcohol use and hashish use among adolescents.

Only few studies have investigated school as a contextual factor behind health-related behaviors such as daily tobacco smoking, heavy alcohol use and hashish use among adolescents, and no previous study has included both social networks and generalized trust in others as social capital indicators in such studies.

The aim of this study was to investigate tobacco smoking, heavy alcohol use and hashish use among adolescents in multilevel analyses including the individual and school context levels.

2. Material and methods

2.1. Study design

The 2012 public health survey among school pupils in Skåne, the southernmost part of Sweden, is a cross-sectional study which was performed primarily in order to assess social, economic, school and health conditions among school pupils in the sixth and ninth grades in primary school (*grundskolan*) and the second grade in secondary school (*gymnasium*). The Swedish school system entails nine compulsory school years in primary school and three school years in secondary school (*gymnasium*). Most schools in the 33 municipalities in Skåne participated in this study, with the exception of the municipality of Lund regarding the sixth and ninth grades in primary school.

2.2. Participants and procedures

Questionnaires were distributed by the teachers, answered by the pupils and gathered in the class room during school time. Only pupils in the ninth (15–16 year olds) grade in primary school and second (17–18 year olds) grade in the gymnasium are included in this study. A total of 9791 pupils in the ninth grade (of a total 11,735 pupils) participated, which yielded an 83% participation rate, while 9987 pupils in the second grade (total 13,848) in the gymnasium participated, yielding a 72% participation rate. In Sweden, primary school attendance with nine school years (normally children 7–16 years old) is mandatory until the ninth grade and an overwhelming majority also attend secondary school with its three school years (normally adolescents 16–19 years old). The third level of the Swedish educational system is the universities which are not included in this study. Approval was attained from the Ethical Committee at Lund University, Sweden.

2.3. Measures

2.3.1. Daily tobacco smoking

Daily tobacco smoking was assessed with the question “Do you smoke?” with the answers “No, I have never smoked”, “No, but I have tried”, “No, I have smoked but stopped”, “Yes, every day”, “Yes, almost every day”, “Yes, at parties” and “Yes, sometimes”. Dichotomization was conducted with “Yes, every day” versus the others.

2.3.2. Heavy alcohol use

Heavy alcohol use was assessed by a question measuring how often a large quantity of alcohol had been consumed in one session. Examples of alcohol were given in different standard containers, i.e. “alcohol corresponding to at least four cans of strong beer (“starköl”), or strong cider/alcopop or six cans of medium-strong beer (“folköl”) or a whole bottle of wine or 25 cl hard liquor (about 6 shots or drinks)” (Henriksson & Leifman, 2011).

2.3.3. The use of hashish during the past year

The use of hashish during the past year was assessed with the question “Have you used narcotics during the past twelve months?” with the alternative answers “I have not used narcotics”, “No, not during the past twelve months”, “Yes, hashish/marijuana”, “Yes, ecstasy”, “Yes, amphetamine”, and “Yes, other narcotics”. Dichotomization was conducted with “Yes, hashish/marijuana” versus the others.

2.3.4. Age

Age was normally 15–16 years in the ninth grade in primary school and normally between 17 and 18 years in the second grade in secondary school.

2.3.5. Country of birth

Participants were born in Sweden with both or one parent born in Sweden, born in Sweden with both parents born abroad, born in other

Nordic countries, born in other European countries, and born outside Europe.

2.3.6. Parental occupation

Parental occupation assessed whether no parent, father, mother or both parents worked (full- or part-time).

2.3.7. Family status

Family status included living with both parents, living with one parent, and neither living with the mother or the father.

2.3.8. Participation in one or more organizations

Participation in one or more organizations (social capital), was assessed with the question “Have you during the past twelve months been a member of an association, club or organization?” with “yes” and “no”.

2.3.9. Generalized trust in other people

Generalized trust in other people (social capital) was assessed with “Most people can be trusted” with the alternatives “Do not agree at all”, “Do not agree”, “Agree”, and “Completely agree”, and dichotomized with the two first alternatives as “No” (do not trust) and the two latter alternatives as “Yes” (do trust).

2.3.10. Ease of being able to talk with parents and friends when facing problems

Ease of being able to talk with parents and friends when facing problems was assessed by the question “If you have any problems or just want to talk with someone, how easy or difficult do you think it is to turn to...” with the two sub-items – “Parents or other grown-ups” and “Friends”, and the alternative answers “Very easy”, “Rather easy”, “Neither easy nor difficult”, “Rather difficult” and – “Very difficult”. Both were dichotomized with the two first two alternatives as “Yes” and the three latter “No”.

2.3.11. Close friend

Close friend was assessed by “Do you have any really close friend with whom you can talk intimately concerning almost any subject?” with the alternatives “Do not have any close friends”, “Have one close friend”, “Have two close friends”, and “Have several close friends”. The first alternative was dichotomized versus the three latter.

2.3.12. Tobacco smoking in the social environment

Tobacco smoking in the social environment was assessed with the question “Is there anyone in your close social environment who smoke?” with the alternatives “None”, “Mother (stepmother, foster mother)”, “Father (stepfather, foster father)”, “Sibling”, “Boy- or girlfriend”, “Friends”, “Other people in my proximity with whom I socialize”. This variable was dichotomized with “None” versus all others.

2.3.13. Parents allowing the use of cigarettes

Parents allowing the use of cigarettes was assessed with “Do your parents allow you to use of tobacco?” with the alternatives “Neither of them”, “Father, but not mother”, “Mother, but not father”, “Yes, both”, “I do not know”, categorized as neither of them, at least one of them and uncertain.

2.3.14. Allowed to taste parents' alcohol

Allowed to taste parents' alcohol was assessed with “Does it occur that your parents offer you alcohol?” with alternatives “No, never”, “Yes, I am allowed to taste from their glasses”, “Yes, I get a glass of my own”, and “Yes, I get to pour myself”. This variable was dichotomized into “No” (“No, never” alternative) and “Yes”.

2.3.15. Parents buying alcohol to the pupil

Parents buying alcohol to the pupil was assessed with “Has it occurred that any of your parents have bought beer, strong beer, cider,

strong cider, soft drink with alcohol, wine or strong liquor for you?” with the alternatives “Yes, beer or cider”, “Yes, strong beer or strong cider”, “Yes, wine”, “Yes, strong liquor”, and “No, they have not”. It was dichotomized with the last alternative as “No” (“No, they have not” alternative) versus “Yes” (all other alternatives).

2.3.16. Parental control index

The pupils answered eight questions concerning parental control, i.e., 1) “My parents give me credit when I have done something good”, 2) “My parents decide when I am to be home at night”, 3) “In my family we often do things together during leisure time”, 4) “I feel that I receive support and encouragement from my parents”, 5) “I can stay out as long as I like on Friday and Saturday nights”, 6) “I tell my parents about things that have happened even though I feel ashamed or embarrassed”, 7) “In my family we have dinner together”, and 8) “I feel that my parents have confidence in me and let me take responsibility”, with the alternatives: “Fits very poorly”, “disagree somewhat”, “agree somewhat” and “corresponds very well”. The questions were collapsed with the first two alternatives coded as “No” and given 1 point per question, and the other two coded as “Yes” and given 0 points per question, except for question number 5 where “Yes” was given 1 point and “No” was given 0 points. The score thus ranged between 0 and 8 with the index scoring 0 as highest level of parental control and the scoring 8 as the lowest.

2.4. Statistics

As the data was hierarchically structured, with the adolescents as the first level nested within schools, multilevel logistic regression analysis was used. School contextual effects on various health-related behaviors were measured through calculation of the variance partition coefficients (VPCs) using the latent variable method: $VPC_{\text{school}} = \text{school variance} / (\text{school variance} + \pi^2 / 3) * 100$. The unobserved individual variance was set to 3.29 ($\pi^2/3$). (Snijders & Bosker, 1999). All statistical analyses were conducted in multilevel logistic regression models in Mlwin 2.15. VPCs were calculated for an empty model (a random intercept model) and for the full model (including sociodemographic factors, psychosocial factors and parental behavior, attitude and parental control). To estimate individual risk factors in relation to health-related behaviors, odds ratios (ORs with 95% CIs) were calculated.

3. Results

3.1. Sample characteristics

Table 1 shows the characteristics of the study population among boys and girls. Daily tobacco smoking, heavy alcohol use and hashish use were much more common among boys and girls in the second grade in secondary school (gymnasium) compared to the ninth grade in primary school. In the empty model, the VPCs showed that 10.2% of the individual variation in daily tobacco smoking, 6.5% of the individual variation in heavy alcohol use and 9.9% of the individual variation in the use of hashish in the ninth grade students were statistically attributed to the school level (data not shown). Corresponding empty model VPCs for the second grade in the gymnasium were for daily tobacco smoking: VPC_{school} 13.6%; heavy alcohol use: VPC_{school} 4.6% and for the use of hashish: VPC_{school} 7.3% (data not shown).

3.2. Factors associated with daily tobacco smoking and hashish use

Table 2 shows that daily tobacco smoking was significantly associated with cohabitating with none of the parents, low trust, low participation in organizations, problems talking with parents, lower parental control index, regular tobacco smoking of parents in the close environment, regular tobacco smoking of peers or siblings in the close environment, at least one of the parents allowing the use of cigarettes and being uncertain of whether parents allow the use of cigarettes among both

Table 1
Characteristics of the study population. The Scania public health survey among children and adolescents, 2012.

	9th grade primary school		2nd grade secondary school	
	Boys	Girls	Boys	Girls
	(n = 4876)	(n = 4797)	(n = 5043)	(n = 4805)
Sociodemographic factors				
Country of birth (%)				
Sweden	75.3	74.3	77.7	77.9
Sweden, both parents born abroad	12.6	14.6	11.4	12.5
In Europe (outside Sweden)	5.4	4.8	5.0	4.3
Outside Europe	6.6	6.3	5.9	5.3
Parental occupation (%)				
Both parents working	81.4	78.5	80.0	79.1
One parent working	14.8	17.0	15.5	16.6
No parent working	3.8	4.5	4.5	4.3
Cohabiting with (%)				
Both parents	68.8	67.5	64.7	63.0
One parent	29.5	31.1	32.6	33.8
No parent	1.7	1.4	2.7	3.2
Social capital				
Low trust (%)	56.2	67.9	61.1	67.7
Participation in one or more organizations the last year (%)	67.3	59.0	61.7	55.2
Social support				
Easy to talk to parents (%)				
Yes	65.4	60.2	64.1	64.9
No	34.6	39.8	35.9	35.1
Easy to talk to friends (%)				
Yes	75.8	79.4	75.1	79.5
No	24.2	20.6	24.9	20.5
No close friend (%)	7.9	4.9	7.9	4.4
Parental behavior and attitude				
Parental control index, Mean (SD)	2.1 (1.6)	1.8 (1.6)	2.9 (1.7)	2.5 (1.7)
Regular smoking in close environment (%)				
No	34.0	28.7	18.7	22.5
Parents	26.3	29.2	22.5	33.7
Peers or siblings	39.7	42.1	58.8	43.8
Parents allowing the use of cigarettes (%)				
No	89.0	90.2	65.9	80.7
At least one of them	3.2	3.4	21.5	17.1
Uncertain	7.8	6.4	12.6	2.2
Allowed to taste parent's alcohol (%)	40.0	44.2	59.2	63.4
Parents have bought alcohol to the pupil (%)	14.6	16.1	37.1	41.3
Life-style factors				
Daily smoking (%)	6.9	7.2	13.3	14.3
Intense alcohol consumption (%)	16.6	15.1	44.7	34.4
Use of hashish during the last year (%)	6.4	4.5	15.4	9.9

ninth grade primary school and second grade secondary school (gymnasium) pupils. The odds ratios of hashish use during the past year were significantly higher among male respondents, respondents having low parental control index (with the exception of the very lowest 8 points parental control among pupils in the ninth grade in primary school for reasons that the OR 2.3 (0.3–15.8) reflects very small numbers), regular tobacco smoking in the close environment, parents who allow the use of cigarettes and being uncertain of whether parents allow the use of cigarettes among both ninth grade primary school and second grade secondary school (gymnasium) pupils, and among pupils born in Europe, pupils cohabitating with only one or no parent, and pupils reporting low trust among the ninth grade primary school pupils. The VPCs for tobacco smoking at the school level were reduced with 80% (from 10.2% to 1.9%) in the ninth grade in primary school and with 50% in the second grade in secondary school pupils (from 13.6% to 6.5%) with regard to daily tobacco smoking, while the school level VPCs for hashish use remained nearly unchanged in both the ninth and second grades.

3.3. Factors associated with intense alcohol use

Table 3 illustrates that heavy alcohol use by the individual was significantly associated with cohabitating with one parent, cohabitating with no parent, low trust, high parental control index, being allowed to taste parents' alcohol and having parents who buy alcohol to pupil

among both ninth grade primary school and second grade secondary school pupils. Heavy alcohol use was also significantly associated with being male among second grade secondary school (gymnasium) pupils but not among ninth grade primary school pupils. In contrast, being born in Sweden with both parents born abroad, being born outside Europe, having one parent working and finding it not easy to talk with friends was significantly negatively associated with intense alcohol use among both ninth grade primary school and second grade secondary school (gymnasium) pupils. Having no parent working and having no close friend was also significantly negatively associated with heavy alcohol use among second grade secondary school pupils but not among ninth grade primary school pupils. The VPCs at the school level were nearly unchanged regarding heavy alcohol use in the ninth grade in primary school, but decreased in the second grade in secondary (gymnasium) school, in the fully adjusted model.

4. Discussion

The results showed that daily tobacco smoking, hashish use and heavy alcohol use were to an important but varying extent associated with the school level context. After adjustment for individual socio-demographic, psychosocial and social capital factors, the school level variations in daily tobacco smoking (in both grades) and heavy alcohol use (in the second grade in the gymnasium) were heavily reduced

Table 2
Fixed effects (odds ratios (OR) and 95% confidence intervals (CI)) and random effects (variance partition coefficient) between health-related behaviors, individual characteristics and parental behavior/control in boys and girls in the 9th grade in primary school and 2nd grade in secondary school. The Scania public health survey among children and adolescents, 2012.

	Daily smoking				Use of hashish during the last year				
	9th grade primary school		2nd grade secondary school		9th grade primary school		2nd grade secondary school		
	OR	95% CI	OR	95% CI	OR	95% CI	OR	95% CI	
Fixed effects									
Sociodemographic factors									
Sex									
Female	1.0		1.0		1.0		1.0		
Male	1.0	0.8, 1.3	0.8	0.6, 0.9	1.7	1.3, 2.2	1.5	1.3, 1.8	
Country of birth									
Sweden	1.0		1.0		1.0		1.0		
Sweden, both parents born abroad	1.1	0.7, 1.6	1.0	0.7, 1.3	0.9	0.6, 1.3	0.8	0.6, 1.1	
In Europe (outside Sweden)	0.8	0.4, 1.5	0.8	0.5, 1.3	1.7	1.04, 2.7	1.5	1.0, 2.1	
Outside Europe	0.9	0.5, 1.8	0.8	0.5, 1.2	1.1	0.6, 2.1	0.8	0.5, 1.3	
Parental occupation									
Both parents working	1.0		1.0		1.0		1.0		
One parent working	1.0	0.7, 1.4	0.9	0.7, 1.1	0.8	0.6, 1.2	1.0	0.8, 1.2	
No parent working	0.9	0.5, 1.7	1.4	0.9, 2.1	0.8	0.4, 1.5	1.0	0.6, 1.5	
Cohabiting with									
Both parents	1.0		1.0		1.0		1.0		
One parent	1.4	1.1, 1.9	1.1	0.9, 1.4	1.3	1.02, 1.8	1.1	0.9, 1.3	
No parent	5.7	2.7, 12.6	1.8	1.1, 2.8	2.7	1.2, 6.1	1.1	0.7, 1.8	
Social capital									
Low trust									
No	1.0		1.0		1.0		1.0		
Yes	1.4	1.1, 1.9	1.4	1.2, 1.7	1.7	1.3, 2.2	1.1	0.9, 1.3	
Participation in one or more organizations									
Yes	1.0		1.0		1.0		1.0		
No	1.6	1.2, 2.0	1.6	1.4, 1.9	1.2	0.9, 1.6	1.0	0.8, 1.2	
Social support									
Easy to talk to parents									
Yes	1.0		1.0		1.0		1.0		
No	1.5	1.1, 1.9	1.1	0.9, 1.3	1.2	0.9, 1.5	1.2	1.01, 1.42	
Easy to talk to friends									
Yes	1.0		1.0		1.0		1.0		
No	0.7	0.5, 1.0	0.8	0.6, 0.9	1.1	0.8, 1.5	0.9	0.7, 1.1	
No close friend									
Yes	1.0		1.0		1.0		1.0		
No	0.8	0.5, 1.5	0.6	0.4, 1.0	1.0	0.7, 2.0	0.7	0.5, 1.1	
Parental behavior and attitude									
Parental control index									
0 (Highest parental control)	1.0		1.0		1.0		1.0		
1	1.1	0.7, 1.8	1.7	1.01, 3.0	1.4	0.9, 2.3	1.5	0.9, 2.6	
2	1.1	0.7, 1.8	1.6	1.0, 2.8	1.6	1.0, 2.6	2.2	1.3, 3.7	
3	1.3	0.8, 2.1	1.9	1.1, 3.2	1.7	1.02, 2.9	2.4	1.4, 4.0	
4	1.6	0.9, 2.8	2.6	1.6, 4.6	1.8	1.0, 3.2	2.8	1.7, 4.8	
5	3.0	1.6, 5.4	3.2	1.8, 5.6	3.0	1.7, 5.7	4.4	2.5, 7.6	
6	3.4	1.6, 6.7	2.5	1.3, 4.8	5.8	2.8, 9.9	3.9	2.1, 7.2	
7	4.8	2.1, 11.6	4.0	2.0, 8.5	6.1	3.1, 14.5	6.2	3.1, 12.2	
8 (Lowest parental control)	7.4	1.7, 32.1	3.0	1.0, 8.6	2.3	0.3, 15.8	9.0	3.5, 23.1	
Regular smoking in close environment									
No	1.0		1.0		1.0		1.0		
Parents	4.7	2.9, 7.7	6.0	4.2, 8.6	4.3	2.7, 6.7	3.3	2.4, 4.5	
Peers or siblings	3.7	2.3, 5.8	2.8	1.9, 4.2	4.3	2.7, 6.8	2.3	1.7, 3.1	
Parents allowing the use of cigarettes									
No	1.0		1.0		1.0		1.0		
At least one of them	17.9	12.6, 25.6	2.9	2.4, 3.5	4.4	3.0, 6.6	1.5	1.2, 1.8	
Uncertain	3.7	2.3, 5.8	4.2	3.2, 5.6	1.8	1.2, 2.7	1.7	1.4, 2.4	
Random effects									
Variance partition coefficient (%)									
School	1.9%		6.5%		11.0%		8.3%		

suggesting that the variance between schools depended predominantly on individual characteristics and not the school context. However, the second level variations in the use of hashish in both grades as well as heavy alcohol use in the ninth grade in primary school were unaffected by the inclusion of such individual-level factors in the models.

Adolescents spend a substantial amount of time in school and are influenced by norms and values in school. In this study, school level variation in daily tobacco smoking was reduced by individual level characteristics to a higher extent than school level variation in heavy alcohol

use, while school level variation in hashish use in the original empty model remained unaffected. This is in accordance with earlier studies which also demonstrated that school contextual effects on heavy alcohol use and drug use persisted after adjustment for individual characteristics (Johansen et al., 2006; Kristjansson et al., 2013). However, in these studies variations in tobacco smoking between schools also persisted after adjustment for individual characteristics. Important aspects such as the influence of peers and trust were not included in previous studies. The mechanisms involved might include peer-pressure, norms and

Table 3

Fixed effects (odds ratios (OR) and 95% confidence intervals (CI) and random effects (variance partition coefficient) between intense alcohol use by individual characteristics and parental behavior/control in boys and girls in the 9th grade in primary school and 2nd grade in secondary school. The Scania public health survey among children and adolescents, 2012.

	9th grade primary school		2nd grade secondary school	
	OR	95% CI	OR	95% CI
Fixed effects				
Sociodemographic factors				
Sex				
Female	1.0		1.0	
Male	1.1	0.9, 1.3	1.8	1.6, 2.0
Country of birth				
Sweden	1.0		1.0	
Sweden, both parents born abroad	0.5	0.3, 0.7	0.5	0.4, 0.6
In Europe (outside Sweden)	1.0	0.7, 1.4	0.9	0.7, 1.1
Outside Europe	0.5	0.3, 0.7	0.5	0.4, 0.7
Parental occupation				
Both parents working	1.0		1.0	
One parent working	0.7	0.5, 0.8	0.8	0.7, 0.9
No parent working	0.8	0.5, 1.2	0.8	0.5, 0.97
Cohabiting with				
Both parents	1.0		1.0	
One parent	1.3	1.1, 1.6	1.2	1.1, 1.3
No parent	2.8	1.6, 5.2	1.4	1.0, 1.9
Social capital				
Low trust				
No	1.0		1.0	
Yes	1.3	1.2, 1.5	1.2	1.1, 1.4
Participation in one or more organizations				
Yes	1.0		1.0	
No	1.1	1.0, 1.3	0.9	0.8, 1.0
Social support				
Easy to talk to parents				
Yes	1.0		1.0	
No	1.1	0.9, 1.2	1.0	0.9, 1.1
Easy to talk to friends				
Yes	1.0		1.0	
No	0.7	0.5, 0.8	0.6	0.6, 0.7
Close friend				
Yes	1.0		1.0	
No	0.7	0.5, 1.0	0.6	0.5, 0.8
Parental behavior and attitude				
Parental control index				
0 (Highest parental control)	1.0		1.0	
1	1.6	1.2, 2.0	1.4	1.1, 1.8
2	1.8	1.4, 2.3	1.9	1.5, 2.4
3	2.5	2.0, 3.3	2.3	1.8, 2.8
4	2.9	2.2, 4.0	2.4	1.9, 3.1
5	3.8	2.7, 5.4	2.9	2.2, 4.0
6	4.4	2.8, 6.9	2.9	2.0, 4.1
7	5.5	3.1, 9.9	2.7	1.8, 4.1
8 (Lowest parental control)	6.9	2.0, 21.3	3.5	1.7, 7.2
Allowed to taste parent's alcohol				
No	1.0		1.0	
Yes	1.6	1.4, 1.9	1.6	1.4, 1.8
Parents buying alcohol to the pupil				
No	1.0		1.0	
Yes	2.7	2.3, 3.2	2.1	1.9, 2.3
Random effects				
Variance partition coefficient (%)				
School	6.3%		1.7%	

social values, and satisfaction with school work (Johansen et al., 2006; Kristjansson et al., 2013; Holm, Kremers, & De Vries, 2003). Daily tobacco smoking in the school context particularly in the ninth grade in primary school but also in the second grade in the gymnasium and heavy alcohol use in the second grade in the gymnasium may be preventable by actions directed against known individual-level protective factors including social capital, social support and peer/parent behavior and attitude, while interventions directed at school contextual

factors might be of larger importance in explaining school variations in heavy alcohol use in the ninth grade and hashish use in both grades.

Boys in the second grade in secondary school (gymnasium) more often reported a use of hashish and heavy alcohol use, while girls in the second grade more often reported daily tobacco smoking, findings similar to previous studies (Johansen et al., 2006). There was no clear pattern of association between socioeconomic status measured according to parental employment versus parental unemployment, and health-related behaviors. This is in accordance with a study showing only weak associations between socioeconomic status and tobacco smoking, alcohol use and hashish use among adolescents, but stronger associations with food habits (Johansen et al., 2006). Similar to earlier studies, having a close friend or finding it easy to talk with friends was sometimes associated with unhealthy behaviors (Johansen et al., 2006). Heavy alcohol use has previously been reported to be lower among pupils with foreign background or born abroad (Lindström, Modén, & Rosvall, 2014). Lack of trust and lack of participation in organizations during the past year were significantly associated with daily tobacco smoking among pupils in both grades. The associations between social capital and heavy alcohol use were weaker. The associations between social capital and hashish use were even weaker. Only lack of trust in others was significantly and positively associated with hashish use among 9th grades pupils. Associations between aspects of social capital and lifestyles among adolescents have to our knowledge not previously been investigated, although one study investigated closer social network with parents and peers (Johansen et al., 2006). It seems that socioeconomic status of parents defined as parental employment should be less emphasized in preventive strategies. In contrast, trust, social participation in social networks and having a close friend seems to be crucial individual factors to include in such strategies.

Parental factors such as parental behavior and attitudes, parents allowing the use of cigarettes, parents tobacco smoking, parents allowing the pupil to taste alcohol and parents buying alcohol to the pupil were strongly associated with lifestyles in accordance with previous studies (Johansen et al., 2006; Barnes et al., 2006). These results imply that parents should be informed about the importance of their own behaviors, attitudes and support, and the importance of their involvement and interest in their offsprings' health-related behaviors such as tobacco smoking, heavy alcohol use and hashish use.

4.1. Strengths and limitations

The study is not based on a random sample of the population but the major part of the population in these age groups. The high participation rates in the school survey decreases the risk of selection bias. The responses were anonymous, which might enhance the validity of the answers. However, students have in previous studies been shown to underreport tobacco smoking which may partly be due to restrictions on purchase (Patrick et al., 1994). Regarding alcohol use, students might underreport as well as overreport the true consumption (Gripe, 2013). Such misclassification of exposure would most likely attenuate the true associations. The outcome items concerning tobacco smoking, alcohol use and hashish are internationally considered valid and reliable (Henriksson & Leifman, 2011; Steffensen, Lauritzen, & Sörensen, 1995), although the items available in the questionnaire are not optimal for this study. The high number of schools made possible a variation between schools. The lack of contextual second-level school variables reported from other studies in the introduction such as the presence of school tobacco control programs and policies (Murnaghan et al., 2008; Lovato et al., 2010), and school neighborhood characteristics such as school location and neighborhood median income (Kaai et al., 2013) may be regarded as a weakness of our study.

Potential confounders have been adjusted if present as items in the questionnaire. Causal inference can formally not be drawn from cross-sectional studies.

4.2. Conclusions

School level VPCs were highest for daily tobacco smoking and lowest for heavy alcohol use. Adjustment for covariates substantially reduced the VPCs for daily tobacco smoking but less for alcohol, while VPCs for hashish use were unaffected. Daily tobacco smoking in the school context (in both grades) and heavy alcohol use in the second grade in the gymnasium may be preventable by actions directed against known individual-level protective factors including social capital, social support and peer/parent behavior and attitude, while interventions directed at school contextual factors may be more important in explaining school variations in heavy alcohol use in the ninth grade and hashish use in both grades.

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Authors' contributions to the study

ML and MR conceived and elaborated the study and its study design. MR conducted the statistical calculations in collaboration and discussion with ML. ML wrote and revised the manuscript under discussion with MR.

Conflict of interest

The authors declare that they have no conflict of interest.

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