Adolescent alcohol and cannabis use in relation to peer and school factors
Results of multilevel analyses
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Abstract
The present study used a multilevel approach with multiple informants to determine whether, at individual level, association with substance-using peer groups, and, at class level, incidences of intoxicated students in school premises, are related to students’ own substance use. Additionally, it tested the hypothesis that such school incidences affect the closeness of the relation between association with substance-using peers and students’ own substance use. Multilevel regression models were estimated separately for drunkenness and cannabis use on the basis of cross-sectional data from 3925 students of eighth and ninth grades in Switzerland (mean age 15.3, S.D. 0.9) and their teachers (N = 220). For both drunkenness and cannabis use, the results confirmed that association with substance-using peers is strongly related to individual substance-use. A higher level of students’ own cannabis use and a closer relation between association with cannabis-using peers and the students’ own cannabis use were found in classes where students saw others coming cannabis-intoxicated to school or taking cannabis in school premises. Such relations were not found for alcohol. It appears that cannabis use at school or shortly before arriving at school creates an atmosphere that favors cannabis use whether or not students are associated with cannabis-using peers. Establishing an overarching environment of disapproval appears to be an effective means of preventing cannabis use by adolescents.
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1. Introduction
For most of the year, typical North American students spend more than one-third of their waking hours each week at school or engaged in school-related activities (Steinberg, 2000). In Europe, the corresponding proportion for students of 14–16 years is even two-thirds (Alsaker and Flammer, 1999). Not only is school the major educational influence on adolescents, but also it largely determines their social environment (e.g. the association with particular peer groups) and shapes their developing sense of identity and autonomy (Steinberg, 2000). One cogent argument against adolescent use of psychoactive substances is the clearly detrimental effect of alcohol consumption (e.g. Lopez-Frias et al., 2001; Windle and Windle, 1996; Yamada et al., 1996) and especially of cannabis use (Fergusson et al., 2003; Lynskey et al., 2003; Lynskey and Hall, 2000; Yamada et al., 1996) on academic performance, completion of schooling, and adolescent development. Longitudinal studies, for example, have found that cannabis use leads to school difficulties, not the converse, and indicated that this causal pathway operates through the social environments within which cannabis is obtained and consumed (Fergusson et al., 2003; Lynskey et al., 2003).

Theorists argue that for a better understanding of adolescent substance use it is essential to examine the different characteristics and environments that affect how individuals function (e.g. Bronfenbrenner, 1986; Petraitis et al., 1995, 1998). They comprise (a) personal characteristics, (b) characteristics of the personal social context, (c) environmental and socio-cultural characteristics, and (d) the interaction of all these factors. Concerning characteristics of the personal social context, association with substance-using peer groups (i.e. friends inside or out-
side the school class with whom students spend their leisure time in joint activities such as substance use) has been found to be the strongest predictor of substance use in adolescence (see, e.g. Hawkins et al., 1992, for a review). Adolescents tend not only to select their peers in the light of their own substance-use habits (Dishion and Owen, 2002; Kandel, 1985) but also to initiate or increase their substance use when associated with substance-using peers – they accept offers of alcohol, they feel pressured to drink, and they submit to the peer-drinking norm or to social modeling (Abbey et al., 1993; Borsari and Carey, 2001; Coffey et al., 2000; Jones-Webb et al., 1997a; Rountree and Clayton, 1999; Dishion and Owen, 2002; Kandel, 1985).

Apart from the personal social context, studies suggest that environmental factors also tend to increase substantially the likelihood of adolescent substance use (e.g. Kuntsche and Kuendig, 2005; Presley et al., 2002; Weitzman et al., 2003). A study conducted from 1992 to 1996, for example, found that adolescents of 13–15 years increased their cannabis use in parallel with indications of its easy availability (Barrett, 1999). Another study aggregated students’ responses on cannabis availability at the school-level and found that easy availability at both the individual and school levels was related to students’ own cannabis use (Swaim, 2003). Also, an increase in the availability of alcohol was shown to be related to an increase in consumption (see Gruenewald et al., 1993; Hawkins et al., 1992, for reviews). Anthony and co-workers (e.g. Anthony et al., 1994; Crum et al., 1996; Van Etten et al., 1997) conclude from their studies that perceived availability moderates the association with adolescents of 13–15 years consuming these substances in school premises, this means an “exposure opportunity” (e.g. Anthony et al., 1994; Crum et al., 1996; Van Etten et al., 1997) and an increase in perceived availability.

In the present study, we hypothesize (a) that, at individual level, association with peers who use cannabis is related to the students’ own cannabis use, and association with peers who have already experienced drunkenness is related to the students’ own frequency of drunkenness; (b) that the “school incidences” (i.e. the teachers’ indications of intoxicated students in school premises in general) are related to general substance use (not necessarily in school premises) among students in their class; (c) that the relation between substance-using peers and the students’ own substance use depends on the “school incidences”.

2. Methods

2.1. Study design

The database used for the analysis is part of the international survey “Health Behaviour in School-Aged Children (HBSC)” (Currie et al., 2004); the survey has been conducted every 4 years since 1982 in more than 30, mostly European, countries, under the aegis of the World Health Organization. It collects data on a wide range of health behavior and health indicators, and factors that may influence them. In 2002, for the fifth time, the Swiss Institute for the Prevention of Alcohol and Drug Problems (SIPA) conducted the survey among students of fifth to ninth grades in Switzerland.

The student data were collected anonymously with a self-completed standardized questionnaire between March and June 2002. Teachers administered the questionnaires in the classroom and were advised only to respond to students’ queries about procedure. The students completed the questionnaires independently during one school period (about 45 min). At the same time, teachers were requested to complete a specific questionnaire with items on such different subjects as health education at school or substance use among students in school premises (Kuendig et al., 2003). The study followed the principles of the Declaration of Helsinki (World Medical Association, 2002): the students and the teachers could freely choose whether or not to participate, for example, and confidentiality was guaranteed at all stages of the study.
2.2 Sample

A cluster sampling procedure was used, with classes as the primary sampling units. The fifth to ninth grade classes to take part in the study were randomly selected, on the basis of a list of all classes in public schools in Switzerland compiled by the Swiss Federal Statistical Office. Since about 95% of the students of the fifth to ninth grades are registered in public schools (Swiss Federal Statistical Office, 2003), private schools were not taken into consideration within the sampling procedure. For ethical reasons and to allow the youngest students sufficient time to complete the questionnaire, some questions – on cannabis use, for example – were asked only of students of eighth and ninth grades. The original sample consisted of 131 and 143 classes of eighth and ninth grade students, respectively. From these 274 classes, 225 returned both the completed students’ and teachers’ questionnaires in the given time frame, resulting in a response rate of 82.1%. This sample, which consisted of 4022 students of eighth and ninth grades and 225 corresponding teachers, can be considered as representative of all eighth and ninth graders and their teachers in the public school system.

To insure a certain level of interaction and knowledge exchange between teacher and class, the four teachers (1.8%) who had been teaching the class less than 2 h a week were not included in the analysis. The 22 students (0.6%) and the one teacher (0.4%) who did not respond to more than two questions were also omitted. Thus, the final sample contained 220 teachers and 3925 students from 182 public schools (i.e. that 220 classes were located in 148 schools with 1 class only and in 30 schools with 2 classes and in 4 schools with 3 classes).

2.3 Measures

2.3.1 Individual-level variables. To measure the frequency of drunkenness among adolescents, the students were asked: “Have you ever been really drunk?”, with the response categories “No, never” (coded as 0), “Yes, once” “Yes, 2–3 times”, “Yes, 4–10 times”, and “Yes, more than 10 times”. Mid-points of categories were used and 13.5 occasions for the upper category (11 times plus half the range to the mid-point of the adjacent category). As the distribution on drunkenness was skewed to the left, as recommended by Raudenbush et al. (2001), the logarithm was taken for the analyses in HLM. Such a transformation not only approximates normal distribution but also reduces the impact of outliers (Tabachnick and Fidell, 2001).

The frequency of cannabis use was also taken into account. The students responded to the question: “Have you ever taken cannabis (a joint, shit, grass, marijuana, hashish) in your life?”, with the response categories “Never” (coded as 0), “Once”, “Twice”, “3–5 times”, “6–9 times”, “10–19 times”, “20–39 times” and “40 times or more”. Mid-points of categories were used and 45 occasions for the upper category (40 times plus half the range to the mid-point of the adjacent category). As the distribution on cannabis use was also skewed to the left, the logarithm was taken for the analyses in HLM (Raudenbush et al., 2001; Tabachnick and Fidell, 2001). One occasion was added before taking the logarithms (DRUNKLN = LN(DRUNK + 1)), because the log of 0 is not defined. Adding one drink renders the minimum useful value of the logarithmic transform back to 0 (Lee, 1993; Tabachnick and Fidell, 2001).

The frequency of cannabis use was also taken into account. The students responded to the question: “Have you ever taken cannabis (a joint, shit, grass, marijuana, hashish) in your life?”, with the response categories “Never” (coded as 0), “Once”, “Twice”, “3–5 times”, “6–9 times”, “10–19 times”, “20–39 times” and “40 times or more”. Mid-points of categories were used and 45 occasions for the upper category (40 times plus half the range to the mid-point of the adjacent category). As the distribution on cannabis use was also skewed to the left, the logarithm was taken for the analyses in HLM (Raudenbush et al., 2001; Tabachnick and Fidell, 2001). One occasion was added before taking the logarithms (CANNABLN = LN(CANNAB + 1)).

Additionally, items on peers’ drunkenness and cannabis use were taken from a battery assessing multiple statements about peers. The students were asked whether their friends had ever been drunk or taken cannabis (hashish, marijuana, etc.). The five answer categories for both questions were “None of them” (coded as 0), “A few of them” (coded as 1), “About half of them” (coded as 2), “The majority” (coded as 3), and “All of them” (coded as 4).

2.3.2 Class-level variables. To measure school incidences (i.e. the presence in school premises in general of students intoxicated with alcohol or cannabis), teachers were asked: “To your knowledge, which of the following experiences have the students of this class had during this school year?”. The proposed statements were: “Students came drunk to school”; “Alcohol use in school premises” and “Use of other psychoactive substances in school premises (e.g. cannabis, glue)”. The answer categories for the four statements were “No, never” (coded as 0); “Yes, but rarely” (coded as 1) and “Yes, frequently” (coded as 2).

Two additional analyses were undertaken to assess the validity of the teachers’ indications. First, teachers were asked how many students in their different classes had already been drunk or used cannabis (in general, not only in school premises), with the answer categories “None of them”, “A few of them”, “About half of them”, “The majority”, and “All of them”. Correlations were found of $r = 0.34$ between teachers’ indications of drunkenness and class-aggregated individual drunkenness and $r = 0.43$ between teachers’ indications of cannabis use and class-aggregated individual cannabis use; the results demonstrate that teachers are aware of the level of individual substance use in their class. Second, in the 34 cases where 2 or 3 teachers were from the same school, the consistency of answers was investigated. A perfect consistency was found in 87.9% of the cases for “Students came drunk to school”, 50.7% for “Students came stoned or high to school”, 72.7% for “Alcohol use in school premises”, and 72.7% for “Use of other psychoactive substances in school premises (e.g. cannabis, glue)”.

Owing to the effect of alcohol on the physical motor system (English et al., 1995), teachers might more easily detect whether students came drunk to school than stoned or high. Results from these additional analyses confirmed our confidence in the measurement of presence in school premises of students intoxicated with alcohol or cannabis, labeled as school incidences. For the multilevel analysis, the two questions on alcohol and those on cannabis were added to a summary score.

2.4 Missing value imputation

For the multilevel analyses, Markov Chain Monte Carlo (MCMC) estimates (Congdon, 2003; Hox, 2002) were used to replace by multiple imputations missing values of the 259 students (6.6%) and the 4 teachers (1.8%) who did not answer one or two questions. MCMC is a simulation method in the Bayesian convention. Beginning with the prior distribution of observed values, random draws are taken of missing values on the basis of observed values. The individual missing value is imputed by randomly selecting a value for the given individual from this conditional distribution and that individual’s observed item-response pattern. The procedure is iterative and uses Markov Chains up to convergence of the posterior distribution. The advantage of such an imputation method is that it takes into account the information from observed values for an individual. The program LISREL 8.51 (Joreskog and Sorbom, 2001) was used for the missing value imputation.

To insure variations in imputed missing values, without which sample size would be overestimated and lead to too small confidence intervals, each missing value was multiple imputed by the use of different random starting values in the MCMC procedure. This procedure resulted in 10 different files, 5 at each level. Accordingly, five sufficient statistics matrices (SSM, including at a time one of the imputed level-1 files and one of the imputed level-2 files) were created in the multilevel program HLM 5.04 (Raudenbush et al., 2001). For each HLM model, the program performed each of the five SSM internally, and produced their average value and the correct standard errors of each estimated coefficient. All multilevel models were based on robust standard errors, which provide consistent results even with data that are not completely normally distributed (Raudenbush et al., 2001).

2.5 Statistical analysis

The study was designed to determine the frequency of drunkenness and cannabis use according to school-level factors among adolescents grouped in school classes. We estimated three hierarchical linear regression models, which account for the nested structure of the data. Each model was adjusted for effects of sex and age and calculated separately for drunkenness and cannabis use. The first model was an intercept-only model with school-level characteristics as the only predictor. This model served to assess whether “school incidences” (i.e. the teachers’ indications of intoxicated students in school premises in general, not in a particular class) were related, in a particular class, to substance-use by students (i.e. in general, and not necessarily in school premises). The equation
is given as

Adolescent substance use

\[ y_{ij} = \beta_0 + \beta_1 x_{i} + \beta_2 x_{j} + \epsilon_{ij} \]

where \( j \) indicates the class and \( i \) the individual within a class, \( \beta \) and \( \gamma \) represent the non-standardized regression weights at individual and class level, respectively, and \( \epsilon \) and \( u \) are the error terms at individual and class levels, respectively.

In the next step (Model 2), association with substance-using peers was added to the model. Its object was to assess the joint impact of school and peer factors on substance use by students. The equation is given as

Adolescent substance use

\[ y_{ij} = \beta_0 + \beta_1 x_{i} + \beta_2 x_{j} + \beta_3 x_{i} x_{j} + \epsilon_{ij} \]

The third model took into account also the interaction between the two levels, which means that indications of school incidences were also used to explain the variation in the relation between association with substance-using peers and students’ substance use. The equation is given as

Adolescent substance use

\[ y_{ij} = \beta_0 + \beta_1 x_{i} + \beta_2 x_{j} + \beta_3 x_{i} x_{j} + \beta_4 x_{i} x_{j}^2 + \epsilon_{ij} \]

3. Results

Random seeds were used to create 10 files with variation in impute missing values. Therefore, Table 1 describes the final sample before imputation of missing values. Of the students, 49.7% were males, of mean age 15.3 years (standard deviation 9.3); 73.6% were from the germanophone region. About half had been drunk; one of four had already been drunk at least twice, and about 6% had been drunk more than 10 times.

Cannabis is a more frequent cause than alcohol of intoxication of students at school. More than one-third of the teachers, for example, indicated that students came “stoned” or “high” to school (Table 2). At the individual level, more than one-fifth of the adolescents indicated that half or more of their peers had already been drunk; one of four had already been drunk at least twice, and about 6% had been drunk more than 10 times.

Descriptive analysis shows that it is not common for students in Swiss schools to come to school alcohol-intoxicated. For example, only 4% of the teachers indicated that students had come drunk to school during the current school year (Table 2), but drunkenness among students in general (not necessarily in school premises) was at a higher level (Table 3). Nearly half of the students indicated that half or more of their peers had already been drunk; one of four had already been drunk at least twice, and about 6% had been drunk more than 10 times.

Table 2 and Table 3 show the percentage of repeated drunkenness and cannabis use was about the same the percentage of half or more substance-using friends was more than twice as high for drunkenness as for cannabis use.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Teachers</th>
<th>Students</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age/S.D.</td>
<td>44.8/9.3 (217)</td>
<td>15.3/0.9 (3811)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>72.6% (159)</td>
<td>49.7% (1926)</td>
</tr>
<tr>
<td>Female</td>
<td>27.4% (60)</td>
<td>50.3% (1949)</td>
</tr>
<tr>
<td>School level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eighth graders</td>
<td>46.4% (102)</td>
<td>46.9% (1842)</td>
</tr>
<tr>
<td>Ninth graders</td>
<td>53.6% (118)</td>
<td>53.1% (2083)</td>
</tr>
<tr>
<td>Linguistic regions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>German</td>
<td>73.6% (162)</td>
<td>72.3% (2839)</td>
</tr>
<tr>
<td>French</td>
<td>15.9% (35)</td>
<td>16.8% (660)</td>
</tr>
<tr>
<td>Italian</td>
<td>10.0% (22)</td>
<td>10.6% (416)</td>
</tr>
<tr>
<td>Rhaeto-Rumantsch</td>
<td>0.5% (1)</td>
<td>0.5% (10)</td>
</tr>
</tbody>
</table>

Table 2 Alcohol and cannabis use: measures at class-level (before missing value imputation)

<table>
<thead>
<tr>
<th></th>
<th>No. never</th>
<th>Yes, but rarely</th>
<th>Yes, frequently</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students came drunk to school</td>
<td>95.9</td>
<td>4.1</td>
<td>–</td>
<td>220</td>
</tr>
<tr>
<td>Alcohol use in school premises</td>
<td>86.8</td>
<td>13.2</td>
<td>–</td>
<td>219</td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students came “stoned” or “high” to school</td>
<td>65.6</td>
<td>33.9</td>
<td>0.5</td>
<td>218</td>
</tr>
<tr>
<td>Use of cannabis and other psychoactive substances in school premises</td>
<td>83.0</td>
<td>16.5</td>
<td>0.5</td>
<td>218</td>
</tr>
</tbody>
</table>

Table 3 Alcohol and cannabis use: measures at individual-level (before missing value imputation)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of drunkenness</td>
<td>59.1</td>
<td>15.2</td>
<td>13.1</td>
<td>6.7</td>
<td>5.8</td>
<td>3904</td>
</tr>
<tr>
<td>Peers’ drunkenness</td>
<td>22.2</td>
<td>29.0</td>
<td>14.4</td>
<td>21.7</td>
<td>12.7</td>
<td>3872</td>
</tr>
<tr>
<td>Cannabis</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frequency of cannabis use</td>
<td>62.9</td>
<td>11.8</td>
<td>4.6</td>
<td>4.0</td>
<td>16.7</td>
<td>3875</td>
</tr>
<tr>
<td>Peers’ cannabis use</td>
<td>52.3</td>
<td>26.5</td>
<td>8.7</td>
<td>8.7</td>
<td>3.9</td>
<td>3869</td>
</tr>
</tbody>
</table>

a Answer categories: (0) no, never; (I) yes, once; (II) yes, 2–3 times; (III) yes, 4–10 times; (IV) yes, more than 10 times.

b Answer categories: (0) none of them; (I) a few of them; (II) about half of them; (III) the majority; (IV) all of them.

c Answer categories: (0) never; (I) once or twice; (II) 3–5 times; (III) 6–9 times; (IV) 10 times or more.
Results of the multilevel analysis reveal that, adjusted for the students’ sex and age, school incidences – i.e. teachers’ indications of alcohol-intoxicated students in school premises – was not related to students’ drunkenness (see Model 1 in Table 4). Adding the association with peers who had been already drunk in Model 2 revealed this to be a strong predictor of individual drunkenness. Adding the cross-level interaction in Model 3 did not change the prediction of students’ drunkenness. In schools where students came drunk to school or taking alcohol in school premises, there was the same relation between the proportion of peers who had already been drunk and the frequency of the students’ own drunkenness.

Analysis of cannabis use, adjusted for sex and age, showed a significant association between cannabis incidences at school and students’ use of cannabis (i.e. in general, not necessarily in the class) who came cannabis-intoxicated to school or used cannabis in school premises, there was the same relation between the proportion of peers who had already been drunk and the frequency of the students’ own drunkenness.

To illustrate the cross-level interaction, the intercepts and regression slopes predicted at individual-level in the final full multilevel model were plotted in a graph according to cannabis incidences at school. As Fig. 1 shows, individual cannabis use was higher in schools where teachers indicated that students came cannabis intoxicated to school or used cannabis in school premises. In all three conditions, individual cannabis use increased considerably with the proportion of peers who had used cannabis. However, there was a stronger relation (a steeper regression slope) between cannabis-using peers and individual cannabis use in schools where teachers indicated that students came cannabis intoxicated to school or used cannabis in school premises than in schools without such incidences.

4. Discussion

The study was designed to determine the frequency of drunkenness and cannabis use among adolescents in reference to peer and school factors and their interaction. More precisely, we hypothesized higher levels of drunkenness and cannabis use among adolescents who associate with substance-using peers and among those being confronted with intoxicated students in school premises, as measured by teachers’ indications of students coming intoxicated to school or taking psychoactive substances in school premises. In addition, when there were such school incidences, we hypothesized a closer relation between association with substance-using peers and the students’ own substance use.

The study, based on a large, representative sample of adolescents in Switzerland, confirms that association with substance-using peers is a highly significant predictor of students’ use of both alcohol and cannabis (e.g. Abbey et al., 1993; Borsari and Carey, 2001; Coffey et al., 2000; Jones-Webb et al., 1997a; Rountree and Clayton, 1999).

However, school incidences increased students’ own use of cannabis but not that of alcohol. Additionally, when teachers indicated that the students in their classes saw others coming cannabis-intoxicated to school or using cannabis in school premises, there was a stronger relation between the proportion of peers who had been using cannabis and the students’ own use of cannabis. Moreover, the teachers’ indications that students (in general, not necessarily in the class) who came cannabis-intoxicated to school or took cannabis in school premises still

![Fig. 1. Relation between the proportion of cannabis-using peers and individual cannabis use according to school incidences (predicted intercepts and regression slopes at individual-level based on the final class-level model).](image-url)
increased the individual frequency of cannabis use among students in the class (e.g. Coffey et al., 2000) whether or not they had been associated with cannabis-using peers. Cannabis use at school or before arriving at school appears to create an atmosphere in which its use appears acceptable or to be a social norm that favors its use (cf. Borsari and Carey, 2001; Hawkins et al., 1992); this also affects students who do not associate with cannabis-using peers.

For excessive drinking, however, the study found neither a second-level main effect nor a cross-level interaction. The differences between the use of alcohol and cannabis observed here can be explained by differences in teachers’ indications of intoxicated students in school premises and general availability of the two substances.

In contrast to cannabis use, no teacher observed frequent drunkenness at school (see Table 2). Moreover, the teachers’ perception that students at times came drunk to school was not only at individual-level (association with cannabis-using peers), but also at school level, the perceived availability of cannabis has the effect of increasing its use by students (Swaim, 2003). Our results are further consistent with studies demonstrating that differences in cannabis use can be traced back to differences in exposure opportunities in different environments (e.g. Anthony et al., 1994; Crum et al., 1996; Van Etten et al., 1997).

Limitations of the study concern the measures and the nature of the data. The teachers’ questionnaire was designed to globally assess whether or not the event “students saw others coming intoxicated to school or consuming alcohol or cannabis in school premises” happened during the school year. Although we conducted additional analysis to validate these questions, it was not possible to assess how many students came intoxicated to school or how often, or took alcohol or cannabis in school premises. For future research, it would be worthwhile to survey all students and teachers in several schools to obtain a comprehensive picture. This was, however, not possible in this national representative survey. Furthermore, the present analysis could use only the lifetime prevalence of students’ own drunkenness and cannabis use. Although, in other studies, we found the same relation for lifetime drunkenness and for current drinking frequency among adolescents in Switzerland (Kuntsche and Kuendig, 2005, 2006), 30-day prevalence of drunkenness and cannabis use would be more appropriate measures in relation to events in the current school term. Even more interesting, future studies using longitudinal data could assess how individual drunkenness and cannabis use change over the school term as a function of alcohol and cannabis incidences at school. In the present study, we adjusted the regression analyses for effects of sex and age at individual level. However, since potential confounders exist also at the school-level (e.g. prevention activities, density of alcohol outlets in the school surrounding, and adolescent substance use in public; Kuntsche and Kuendig, 2005), future research should test whether the present results remain stable if such school-level factors are controlled.

Despite these limitations, the results of the present study have important indications for prevention. More than 20% of students indicated that cannabis was easily available at school in Switzerland (Hibell et al., 2004); more than 16% of teachers agreed that adolescents had taken cannabis in school premises and more than 34% that adolescents came “stoned” or “high” to school. These are disturbing results and should alert policy-makers, prevention agencies, and school administrators. Not only is school the principal source of education for adolescents: it largely defines the

### Table 5

Coefficients of the three hierarchical linear models calculated to determine cannabis use by adolescents

| Individual level | Class level | Model 1 | | Model 2 | | Model 3 |
|------------------|-------------|---------|---------|---------|---------|
|                  |             | $B$     | (S.E., d.f.) | $t$-ratio | $B$     | (S.E., d.f.) | $t$-ratio | $B$     | (S.E., d.f.) | $t$-ratio |
| Intercept ($\beta_0$) | Intercept ($\gamma_{00}$) | 0.86 | 0.029, 218 | 30.0 | 0.86 | 0.018, 218 | 48.6 | 0.86 | 0.018, 218 | 47.3 |
| Cannabis incidences at school ($\gamma_{01}$) | 0.24 | 0.042, 218 | 5.6 | 0.08" | 0.025, 218 | 3.1 | 0.12 | 0.026, 218 | 4.5 |
| Cannabis-using peers ($\beta_1$) | Intercept ($\gamma_{10}$) | 0.82 | 0.019, 219 | 42.2 | 0.81 | 0.019, 218 | 42.4 | 0.11 | 0.025, 218 | 4.1 |
| Cannabis incidences at school ($\gamma_{11}$) | 0.11 | 0.025, 218 | 4.1 |

All models have been adjusted for sex and age at individual level. S.E., standard error; d.f., degrees of freedom. All coefficients are significant at the 0.001-error-level except "0.001 < $p$ < 0.01."
social environment of young people and shapes their developing sense of identity and autonomy (Steinberg, 2000). In Europe, students of 14–16 years spend about two thirds of their waking hours in school, or in school-related activities (Alsaker and Flammer, 1999). Particularly, cannabis use impairs academic performance and adolescent development, and cuts schooling short (Fergusson et al., 2003; Lynskey et al., 2003; Lynskey and Hall, 2000; Yamada et al., 1996).

Evaluation of preventive programs shows that countering social influence and establishing norms of disapproval are effective means of preventing adolescent substance use (e.g. Cuijpers, 2002; Palmer et al., 1998), especially in regard to middle- and high-school students (Gottfredson and Wilson, 2003; Kumar et al., 2002). Cuijpers (2002), for example, concluded from his review of the effectiveness of school-based drug-prevention programs that the most effective were based on the social-influence model. One part of this social-influence approach focuses on social norms (e.g. normative expectations, social acceptability, friends’ reaction to substance use) and the commitment or intention not to use psychoactive substances. Kumar et al. (2002), for example, found that a school environment of disapproval exerted a protective effect even on those students in the eighth and tenth grades who themselves disapproved of substance use. These results argue for preventive programs that include as many agents or agencies as possible, such as parents, teachers, school administrators, and the community, to create an overarching environment of disapproval of substance use.

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