ARTICLE

Some Go Without a Cigarette

Characteristics of Cannabis Users Who Have Never Smoked Tobacco

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Objectives: To estimate the prevalence of youth who use cannabis but have never been tobacco smokers and to assess the characteristics that differentiate them from those using both substances or neither substance.

Design: School survey.

Setting: Postmandatory schools.

Participants: A total of 5263 students (2439 females) aged 16 to 20 years divided into cannabis-only smokers (n=455), cannabis and tobacco smokers (n=1703), and abstainers (n=3105).

Outcome Measures: Regular tobacco and cannabis use; and personal, family, academic, and substance use characteristics.

Results: Compared with those using both substances, cannabis-only youth were younger (adjusted odds ratio [AOR], 0.82) and more likely to be male (AOR, 2.19), to play sports (AOR, 1.64), to live with both parents (AOR, 1.33), to be students (AOR, 2.56), and to have good grades (AOR, 1.57) and less likely to have been drunk (AOR, 0.55), to have started using cannabis before the age of 15 years (AOR, 0.71), to have used cannabis more than once or twice in the previous month (AOR, 0.64), and to perceive their pubertal timing as early (AOR, 0.59). Compared with abstainers, they were more likely to be male (AOR, 2.10), to have a good relationship with friends (AOR, 1.62), to be sensation seeking (AOR, 1.32), and to practice sports (AOR, 1.37) and less likely to have a good relationship with their parents (AOR, 0.59). They were more likely to attend high school (AOR, 1.43), to skip class (AOR, 2.28), and to have been drunk (AOR, 2.54) or to have used illicit drugs (AOR, 2.28).

Conclusions: Cannabis-only adolescents show better functioning than those who also use tobacco. Compared with abstainers, they are more socially driven and do not seem to have psychosocial problems at a higher rate.

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CANNABIS IS THE MOST USED illegal drug among youth.[1,2] Contrary to the United States, where cannabis use rates have been decreasing among adolescents since the late 1990s,[2] in Switzerland and other European countries,[3,4] data indicate that its use has increased in the past years among young[5] and older[6] adolescents. Moreover, at the age of 15 years, Swiss students show the highest rates in Europe both of ever use and use in the previous 12 months.[7]

Cannabis use is associated with the use of other substances,[8-11] especially tobacco.[12-16] The gateway theory[17] hypothesizes that the use of legal drugs (tobacco and alcohol) is the previous step to cannabis consumption. However, recent research also indicates that cannabis use may precede[18,19] or be simultaneous[18] to tobacco use and that, in fact, its use may reinforce cigarette smoking[14,20] or lead to nicotine addiction independently of smoking status.[19,20] Moreover, daily smoking is an important predictor of continued cannabis use.[8,15] Nevertheless, to our knowledge, there are no data referring to whether youth using cannabis but not tobacco differ from those using both substances.

Our objectives were to estimate the prevalence of youth who use cannabis but have never been tobacco smokers and then to assess to what extent they differ from those using both substances and from those using neither cannabis nor tobacco in terms of personal, family, academic, and other legal/illegal substance use characteristics. We had 2 hypotheses: (1) as reported in the literature,[21,22] those using both substances would have more family

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and academic problems and would be heavier substance users; and (2) as described in recent studies,[23,24] abstainers (no smoking and no cannabis use) would do better than cannabis-only users in terms of their overall functioning from a personal, family, and academic point of view.

METHODS

SUBJECTS

Data were drawn from the 2002 Swiss Multicenter Adolescent Survey on Health database, a nationally representative survey including 7548 (3658 female) adolescents in postmandatory school aged 16 to 20 years from the 3 language areas of Switzerland. In Switzerland, school is mandatory up to the age of 16 years. Afterward, about 30% of adolescents go to high school ("students": these are usually the best pupils who will obtain a university education afterward), 60% go to vocational school ("apprentices": they have 1 or 2 days of class per week and spend the rest of the time working in a company related to their field of study), and 10% do not continue school or delay their education. All public educational institutions in Switzerland were included in a 2-stage sampling, using a random cluster sample of classes that was drawn without replacement, the classes being considered as primary sampling units. From the 586 classes (97.7% of the selected sample), only 16 persons refused to participate and 4% of the questionnaires were discarded for incomplete data. The survey was performed by trained health professionals external to the school system, in the absence of the teachers, through an anonymous self-administered questionnaire (in French, German, or Italian, depending on the region) that was completed in the classroom. Students who were absent the day of the survey did not complete the questionnaire. The study protocol was approved by the ethics committee of the University of Lausanne School of Medicine. A description of the questionnaire and sampling method has been published elsewhere,[25] and the questionnaire can be downloaded from our Web site (http://www.umsa.ch).

Three groups were created from the database: the cannabis-only group (COG) (455 [129 females]) were those who declared having used cannabis in the previous 30 days but never having smoked cigarettes, the cannabis and tobacco group (CTG) (1703 [687 females]) included all those declaring having used cannabis in the previous 30 days and smoking at least 1 cigarette per day, and abstainers (3105 [1623 females]) included those never having used tobacco or cannabis. Former smokers (342 [178 females]), occasional smokers (those smoking <1 cigarette per day; 826 [528 females]), and daily smokers not having used cannabis in the previous 30 days (1117 [513 females]) were not included in our analyses. We first compared COG with CTG and second COG with abstainers.

MEASURES

Personal Variables

These variables included age, sex, perceived pubertal timing compared with peers (on time [reference category], early, or late), feeling depressed (yes or no), quality of the peer relationship (good or poor), sensation seeking (high or low), and extracurricular sport practice (no practice [reference category], once a week, or twice a week or more). To measure the quality of the peer relationship, a 4-item inventory was used. All 4 items were taken from the Inventory of Parent and Peer Attachment.[26] These items tapped adolescents' perception of their peers' acceptance, trustworthiness, and sensitivity to their emotional state and their own use of their peers as confidants (Cronbach $\alpha = .77$ in the present study). The scale was dichotomized, with subjects in the higher quartile being considered as having a poor relationship with peers.

Sensation seeking was measured on a 5-item scale developed by Gniech et al[27] (Cronbach $\alpha = .80$ in the present study). The scale was dichotomized, with subjects in the higher quartile being considered as high sensation seeking.

Family Variables

These variables included family structure (parents together or other), father's and mother's educational level (mandatory school or less or other), and quality of the relationship with parents. To measure the quality of the parent-adolescent relationship, a 6-item inventory was developed. Five items were taken from the Inventory of Parent and Peer Attachment.[26] These items tapped adolescents' perception of their parents' acceptance, understanding, trustworthiness, and sensitivity to their emotional state and their own use of their parents as confidants. In addition, an item was created tapping the adolescents' perception on how much their parents trusted them (Cronbach $\alpha = .85$ in the present study). The scale was dichotomized, with those in the higher quartile being considered as having a bad relationship with their parents.

School Variables

These variables included academic track (student or apprentice), having good grades (yes or no), truancy (once a week or more or other), being sure to finish schooling (yes or no), and school connectedness (high or low). School connectedness was measured with 5 items used in different earlier studies[28,29] (Cronbach $\alpha = .61$ in the present study). As for the other scales, being in the higher quartile was considered as having low school connectedness.

Current Substance Use Variables

These variables included having been drunk in the previous 30 days (0 times [reference category], 1-2 times, or ≥ 3 times), age at first cannabis use (<15 years or other), cannabis use in the previous 30 days (1-2 times [reference category], 3-9 times, or ≥ 10 times), and use of other illegal drugs (cocaine, synthetic drugs, inhalants, medication to get high, lysergic acid diethylamide, γ-hydroxybutyrate, heroin, nonprescribed tranquilizers, or methadone) in the previous 30 days (yes or no).

We conducted all analyses using computer software (Stata 9.2; Stata Corp, College Station, Texas), which allows computing coefficient estimates and variances, taking into account the sampling weights, clustering, and stratification procedure. Point prevalence and 95% confidence intervals were calculated for each group. All variables with a statistically significant proportion difference were included in a stepwise logistic regression. We first compared COG with CTG and subsequently COG with abstainers. Significance was set at $P = .05$.

RESULTS

Among current cannabis users in our sample, 21.1% (455/2158) (95% confidence interval, 19.4%-22.8%) reported never having used tobacco. The overall prevalence for the entire sample was 6.0% (455/7548) (95% confidence interval, 5.5%-6.6%).

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Table 1. Comparison Between Tobacco Smokers and Nonsmokers Among Current Cannabis Users[a]

Variable	Nonsmokers (n = 455)	Smokers (n = 1703)
Personal		
Age (years)[b]	17.64 (17.54-17.75)	17.94 (17.88-18.00)
Male sex[b]	71.6 (67.5-75.8)	59.7 (57.3-62.0)
Perceived pubertal timing[b]		
On time	58.5 (54.0-63.1)	50.1 (47.7-52.5)
Early	22.2 (18.3-26.0)	36.0 (33.7-38.3)
Late	19.3 (15.6-22.9)	13.9 (12.2-15.5)
Feels depressed[b]	26.4 (22.3-30.4)	37.5 (35.2-39.8)
Good peer relationship	87.0 (83.9-90.1)	87.8 (86.2-89.3)
High sensation seeking	37.8 (33.3-42.3)	42.0 (39.7-44.4)
Sport practice		
None[b]	14.4 (11.2-17.7)	33.3 (31.1-35.6)
Once a week	19.3 (15.7-23.0)	22.8 (20.8-24.8)
Twice a week or more[b]	66.2 (61.9-70.6)	43.9 (41.5-46.3)
Family		
Family structure (parents together)[b]	78.2 (74.5-82.0)	68.3 (66.1-70.5)
Good relationship with parents[b]	74.1 (70.0-78.1)	66.2 (64.0-68.5)
Father's educational level (mandatory or less)	11.0 (8.1-13.9)	13.6 (12.0-15.3)
Mother's educational level (mandatory or less)	17.6 (14.1-21.1)	20.7 (18.8-22.7)
School		
Academic track (student)[b]	46.2 (41.6-50.7)	24.9 (22.8-27.0)
Good grades[b]	77.5 (73.7-81.4)	66.6 (64.3-68.8)
Truancy (once a week or more)	10.6 (7.7-13.4)	10.6 (9.1-12.0)
Sure to finish schooling[b]	93.0 (90.6-95.3)	87.6 (86.0-89.2)
Good school connectedness	62.6 (58.2-67.1)	58.1 (55.7-60.4)
Current substance use		
Drunkenness (last 30 d)[b]		
0 times	60.4 (55.9-64.9)	45.0 (42.6-47.3)
1-2 times	28.1 (24.0-32.3)	37.1 (34.8-39.4)
≥3 times	11.4 (8.5-14.4)	17.9 (16.1-19.7)
Age at first cannabis use (<15 y)[b]	25.9 (21.9-30.0)	37.5 (35.2-39.8)
Cannabis use (last 30 d)		
1-2 times[b]	56.0 (51.5-60.6)	34.0 (31.7-36.2)
3-9 times	18.7 (15.1-22.3)	16.9 (15.1-18.6)
≥10 times[b]	25.3 (21.3-29.3)	49.1 (46.8-51.5)
Other illegal drugs (30 d)[b]	8.4 (5.8-10.9)	17.9 (16.0-19.7)

[a] Data are given as point prevalence (95% confidence interval).
[b] Significant differences were found (2-sample test of proportion at the 95% level).

COG VS CTG

Compared with CTG youth, COG youth were younger; mostly male; less likely to perceive their pubertal timing as early, to feel depressed, and to be sensation seeking; and more likely to practice sports. They were also more likely to live with both parents and to have a good relationship with them. Academically, they were more likely to be students, to have good grades, and to believe that they would finish their schooling. In the domain of substance use, they were more likely to be occasional cannabis users (1-2 joints in the past 30 days) and less likely to have started using cannabis before the age of 15 years, to have been drunk, or to use other illegal drugs (**Table 1**).

Table 2. Comparison Between Tobacco Smokers and Nonsmokers Among Current Cannabis Users[a]

Variable	Adjusted Odds Ratio (95% Confidence Interval)	*P* Value
Personal		
Age	0.82 (0.74-0.91)	<.001
Male sex	2.19 (1.68-2.85)	<.001
Perceived pubertal timing		
On time	1 [Reference]	<.001
Advanced	0.59 (0.45-0.76)	
Sport practice		
None	1 [Reference]	NA
Once a week	1.64 (1.14-2.37)	.008
Twice a week or more	2.36 (1.72-3.22)	<.001
Family structure (parents together)	1.33 (1.02-1.75)	.04
School		
Academic track (student)	2.56 (2.02-3.26)	<.001
Good grades	1.57 (1.21-2.06)	.001
Current substance use		
Drunkenness (last 30 d)		
0 times	1 [Reference]	NA
1-2 times	0.55 (0.43-0.72)	<.001
≥3 times	0.56 (0.39-0.80)	.002
Age at first cannabis use (<15 y)	0.71 (0.54-0.93)	.01
Cannabis use (last 30 d):		
1-2 times	1 [Reference]	NA
3-9 times	0.64 (0.47-0.87)	.004
≥10 times	0.34 (0.26-0.45)	<.001

Abbreviation: NA, data not applicable.
[a] Tobacco smokers was the reference group. Stepwise logistic regression was used for comparisons.

In the multivariate analysis, COG youth were younger, mainly male, less likely to perceive their pubertal timing as early, and more likely to practice sports. They were also more likely to live with both parents, to be students, and to have good grades. The COG youth were less likely to have been drunk, to have started using cannabis before the age of 15 years, and to use cannabis more than once or twice in the previous month (**Table 2**).

COG VS ABSTAINERS

Compared with abstainers, COG youth were more likely to be male, to have a good relationship with their friends, to be sensation seeking, and to practice sports. They were also less likely to have a good relationship with their parents. Academically, they were more likely to be students and to skip school and less likely to have good grades or good school connectedness. Overall, they were more likely to misuse alcohol or to have used illegal drugs other than cannabis in the previous month (**Table 3**).

In the multivariate analysis, COG youth were mainly male and more likely to have a good relationship with their friends, to be sensation seeking, and to practice sports twice a week or more. However, they were less likely to have a good relationship with their parents. The COG youth were also more likely to be students and to skip class at least once a week. They were significantly more likely to have been drunk and to have used illegal drugs in the previous month (**Table 4**).

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Table 3. Comparison Between Abstainers and Nonsmoker Current Cannabis Users[a]

Variable	Nonsmokers (n = 455)	Abstainers (n = 3105)
Personal		
Age (years)	17.64 (17.54-17.75)	17.75 (17.71-17.79)
Male sex[b]	71.6 (67.5-75.8)	47.7 (46.0-49.5)
Perceived pubertal timing:		
On time	58.5 (54.0-63.1)	57.8 (56.0-59.5)
Early	22.2 (18.3-26.0)	23.3 (21.9-24.8)
Late	19.3 (15.6-22.9)	18.9 (17.5-20.3)
Feels depressed	26.4 (22.3-30.4)	24.6 (23.1-26.2)
Good peer relationship[b]	87.0 (83.9-90.1)	83.2 (81.9-84.5)
High sensation seeking[b]	37.8 (33.3-42.3)	21.8 (20.4-23.3)
Sport practice[b]		
None	14.4 (11.2-17.7)	23.4 (21.9-24.9)
Once a week	19.3 (15.7-23.0)	24.7 (23.1-26.2)
Twice a week or more	66.2 (61.9-70.6)	51.9 (50.2-53.7)
Family		
Family structure (parents together)	78.2 (74.5-82.0)	81.7 (80.4-83.1)
Good relationship with parents[b]	74.1 (70.0-78.1)	82.4 (81.1-83.8)
Father's educational level (mandatory or less)	11.0 (8.1-13.9)	13.9 (12.7-15.1)
Mother's educational level (mandatory or less)	17.6 (14.1-21.1)	21.5 (20.0-22.9)
School		
Academic track (student)[b]	46.2 (41.6-50.7)	41.3 (39.5-43.0)
Good grades[b]	77.5 (73.7-81.4)	82.5 (81.1-83.8)
Truancy (once a week or more)[b]	10.6 (7.7-13.4)	3.8 (3.1-4.4)
Sure to finish schooling	93.0 (90.6-95.3)	94.0 (93.1-94.8)
Good school connectedness[b]	62.6 (58.2-67.1)	71.5 (69.9-73.1)
Current substance use[b]		
Drunkenness (last 30 d)		
0 times	60.4 (55.9-64.9)	85.8 (84.6-87.0)
1-2 times	28.1 (24.0-32.3)	12.0 (10.9-13.2)
≥3 times	11.4 (8.5-14.4)	3.1 (2.2-3.7)
Other illegal drugs (30 d)	8.4 (5.8-10.9)	3.1 (2.5-3.7)

[a] Data are given as point prevalence (95% confidence interval).
[b] Significant differences were found (2-sample test of proportion at the 95% level).

Table 4. Comparison Between Abstainers and Nonsmoker Current Cannabis Users[a]

Characteristic	Adjusted Odds Ratio (95% Confidence Interval)	*P* Value
Personal		
Male sex	2.10 (1.64-2.67)	.001
Good peer relationship	1.62 (1.19-2.22)	.002
High sensation seeking	1.32 (1.05-1.67)	.02
Sport practice		
None	1 [Reference]	NA
Twice a week or more	1.37 (1.09-1.71)	.007
Good relationship with parents	0.59 (0.46-0.76)	<.001
School		
Academic track (student)	1.43 (1.14-1.78)	.002
Truancy (once a week or more)	2.28 (1.53-3.40)	<.001
Current substance use		
Drunkenness (last 30 d)		
0 times	1 [Reference]	NA
1-2 times	2.54 (1.98-3.26)	<.001
≥3 times	4.51 (2.99-6.80)	<.001
Other illegal drugs (30 d)	2.28 (1.48-3.52)	<.001

Abbreviation: NA, data not applicable.
[a] Abstainers was the reference group. Stepwise logistic regression was used for comparisons.

COMMENT

Our findings in this nationally representative sample of adolescents show that 6.0% of them use cannabis without having used tobacco and that one-fifth of current cannabis users (21.1%) declare never having used tobacco. This last prevalence is similar to the one found in a longitudinal study[30] among males. As described in the literature,[14,31] our results confirm that cannabis use is much more frequent among males.

Our results also verify our first hypothesis that among cannabis users, nonsmokers seem to have fewer problems than regular smokers. Compared with CTG youth, COG youth seem to be basically occasional cannabis users, because most of them (56.0%) have only used it once or twice in the previous month, while 49.1% of CTG youth used cannabis 10 times or more. These findings agree with previous research[4,11,18,22,32] indicating that smokers were significantly more likely to be heavy cannabis users than nonsmokers. Furthermore, COG adolescents are less likely to have started using cannabis before the age of 15 years and to have misused alcohol. Our results are in line with previous studies reporting that early initiation of cannabis use is associated with problematic polydrug use[15] and that adolescents using both tobacco and cannabis report higher rates of alcohol misuse than those using only cannabis.[22] However, the multivariate analysis showed similar rates in the use of other illegal substances.

The COG adolescents also seem to be doing better academically than the CTG adolescents: they are significantly more likely to be high school students and to have good grades. Kohn et al[4] also found that high school students were more likely to be occasional or experimental cannabis users, compared with technical and vocational students. Cannabis use has also been associated with truancy[4] and with decreased educational achievement,[31,33] although in our sample both groups showed the same truancy rate.

The literature indicates that living in an intact family and having a good relationship with parents are protective against smoking[34] and cannabis use.[31,35] This is only partially confirmed in our study: COG youth are slightly more likely to live with both parents, but have a similar relationship with them compared with CTG youth.

Sports participation has been considered a protective factor against smoking.[34,36] Contrary to cannabis, tobacco use is considered inappropriate for sports practice because it has an effect on performance. This phenomenon could explain the higher rates of sedentary youth among CTG adolescents that we found. Along this line, a French study[37] reported that occasional cannabis users were more likely to participate in outdoor activities, while regular users were more likely to be music ori-

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ented and to spend time at a friend's home. There is also evidence that the priorities of tobacco smokers are more social than academic or athletic.[12] The comparisons that we made between COG and CTG are in line with the literature focusing on differences between smokers and nonsmokers in general, showing that nonsmokers do better than smokers psychologically, academically, and socially. From a preventive point of view, it is important that health professionals give a clear message to their adolescent patients indicating that cannabis use is as adverse for sports performance as the use of tobacco.

Interestingly, our results do not confirm our hypothesis of better overall functioning among abstainers. In fact, what our research indicates is that the main difference between COG youth and abstainers is that the former are more socially driven: they are significantly more likely to practice sports, and they have a better relationship with their peers. Moreover, even though they are more likely to skip class, they have the same level of good grades; and although they have a worse relationship with their parents, they are not more likely to be depressed. Nevertheless, our results seem to indicate that, although typical of the adolescence process, having good support from friends together with a less solid relationship with parents is a risk factor for occasional cannabis use.

Tucker et al[23] concluded that *abstainers* (defined as never having used cannabis or other illegal drugs) were less socially engaged and had a stronger orientation toward school. Zambon et al[38] found that having difficult relationships with peers was associated with lower physical activity. Nevertheless, it seems that substance use (at least tobacco, alcohol, and cannabis) is largely used by adolescents for socializing purposes. This fact could explain the difference between COG youth and abstainers regarding peer relationships. Zambon et al also found that having a good relationship with a best friend was related to increased use of cannabis, alcohol, and tobacco. Similarly, Hoel et al[39] reported that although abstainers are successful in many social arenas, they socialize less frequently with friends than youth who drink, while a Finnish study[40] indicated that moderate use of alcohol among adolescents was associated with a positive self-image in social relationships. Another study,[41] performed in New Zealand, also indicated an association between a high level of connectedness to friends and an increased level of smoking and use of cannabis in the previous month.

In addition, and contrary to previous research,[23] our study does not confirm the negative effect of cannabis on academic performance among COG youth. In our case, they are more likely to be high school students and they report similar grades as abstainers, even though they skip class more often.

However, compared with abstainers, COG adolescents are more likely to have been drunk or to have used illegal drugs in the previous month. Although this finding might be part of the exploratory behavior this specific group seems to have, there is research[11] indicating that compared with nonusers, cannabis users have more frequent access to other drugs, such as 3,4-methylenedioxymethamphetamine (Ecstasy).

On the other hand, they have a worse relationship with their parents than abstainers, in line with a previous publication.[31] Because their school results are not worse, it could be hypothesized that the worse relationship they have with their parents is more likely due to their drug consumption.

The main strength of our study is that it is based on a nationally representative sample of adolescents. Nevertheless, some limitations need to be stressed. First, the cross-sectional nature of our survey does not allow us to ascertain causality. Second, although technically youth in the nonsmoking group do not smoke cigarettes, we do not know from our data whether they use tobacco to prepare their cannabis cigarettes. Third, school dropouts, who are known to be heavier substance users,[42] were not included in the study. Fourth, because our data are self-reported, there is always room for speculation about the honesty of the answers. However, the fact that the questionnaire was anonymous should minimize any reporting bias.

While our results confirm that CTG youth tend to present psychosocial problems at a higher rate than COG youth and as such constitute a potential target for preventive interventions, the fact that COG youth, compared with abstainers, seem to do at least as well, if not better, in some areas raises 2 questions. First, those adolescents who only use cannabis but who may also use some tobacco to prepare their cannabis cigarettes should be advised about the possibility of becoming addicted to nicotine. Second, because the step between being an occasional or a regular cannabis user is not well established, this specific group of adolescents should also be counseled and closely monitored over time. In any case, and even though they do not seem to have great personal, family, or academic problems, the situation of those adolescents who use cannabis but who declare not using tobacco should not be trivialized.

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REFERENCES

1. Commission on Narcotic Drugs. *Youth and Drugs: A Global Overview.* Vienna, Austria: United Nations Economic and Social Council; 1999.
2. Johnston LD, O'Malley PM, Bachman JG, Schulenberg JE. *Monitoring the Future: National Results on Adolescent Drug Use: Overview of Key Findings, 2005.* Bethesda, MD: National Institute on Drug Abuse; 2006. NIH publication 06-5882.
3. Choquet M, Morin D, Hassler C, Ledoux S. Is alcohol, tobacco and cannabis use as well as polydrug use increasing in France? *Addict Behav.* 2004;29(3):607-614.
4. Kohn L, Dramaix M, Favresse D, Kittel F, Piette D. Trends in cannabis use and its determinants in the French-speaking community of Belgium. *Rev Epidemiol Sante Publique.* 2005;53(1):3-13.
5. Kuntsche EN. Progression of a general substance use pattern among adolescents in Switzerland? investigating the relationship between alcohol, tobacco, and cannabis use over a 12-year period. *Eur Addict Res.* 2004;10(3):118-125.
6. Michaud PA, Berchtold A, Jeannin A, Chossis I, Suris JC. Secular trends in legal and illegal substance use among 16 to 20 year old adolescents in Switzerland. *Swiss Med Wkly.* 2006;136(19-20):318-326.
7. Currie C, Roberts C, Morgan A, et al. *Young People's Health in Context: Health Behaviour in School-aged Children (HBSC) Study: International Report From the 2001/2002 Survey.* Copenhagen, Denmark: World Health Organization; 2004.
8. Coffey C, Lynskey M, Wolfe R, Patton GC. Initiation and progression of cannabis use in a population-based Australian adolescent longitudinal study. *Addiction.* 2000;95(11):1679-1690.
9. von Sydow K, Lieb R, Pfister H, Höfler M, Wittchen HU. What predicts incident use of cannabis and progression to abuse and dependence? a 4-year prospective examination of risk factors in a community sample of adolescents and young adults. *Drug Alcohol Depend.* 2002;68(1):49-64.
10. Kandel DB. Does marijuana use cause the use of other drugs? *JAMA.* 2003;289 (4):482-483.
11. Zimmermann P, Wittchen HU, Waszak F, Nocon A, Höfler M, Lieb R. Pathways into ecstasy use: the role of prior cannabis use and ecstasy availability. *Drug Alcohol Depend.* 2005;79(3):331-341.
12. Rigotti NA, Lee JE, Wechsler H. US college students' use of tobacco products: results of a national survey. *JAMA.* 2000;284(6):699-705.
13. Henry JA, Oldfield WL, Kon OM. Comparing cannabis with tobacco. *BMJ.* 2003; 326(7396):942-943.
14. Amos A, Wiltshire S, Bostock Y, Haw S, McNeill A. "You can't go without a fag . . . you need it for your hash": a qualitative exploration of smoking, cannabis and young people. *Addiction.* 2004;99(1):77-81.
15. Ellickson PL, Tucker JS, Klein JD, Saner H. Antecedents and outcomes of marijuana use initiation during adolescence. *Prev Med.* 2004;39(5):976-984.
16. Scal P, Ireland M, Borowsky IW. Smoking among American adolescents: a risk and protective factor analysis. *J Community Health.* 2003;28(2):79-97.
17. Kandel D. Stages in adolescent involvement in drug use. *Science.* 1975;190(4217): 912-914.
18. Aung AT, Pickworth WB, Moolchan AT. History of marijuana use and tobacco smoking topography in tobacco-dependent adolescents. *Addict Behav.* 2004; 29(4):699-706.
19. Patton GC, Coffey C, Carlin JB, Sawyer SM, Lynskey M. Reverse gateways? frequent cannabis use as a predictor of tobacco initiation and nicotine dependence. *Addiction.* 2005;100(10):1518-1525.
20. Highet G. The role of cannabis in supporting young people's cigarette smoking: a qualitative exploration. *Health Educ Res.* 2004;19(6):635-643.
21. Moore BA, Budney AJ. Tobacco smoking in marijuana-dependent outpatients. *J Subst Abuse.* 2001;13(4):583-596.
22. Duhig AM, Cavallo DA, McKee SA, George TP, Krishnan-Sarin S. Daily patterns of alcohol, cigarette, and marijuana use in adolescent smokers and nonsmokers. *Addict Behav.* 2005;30(2):271-283.
23. Tucker JS, Ellickson PL, Collins RL, Klein DJ. Are drug experimenters better adjusted than abstainers and users? a longitudinal study of adolescent marijuana use. *J Adolesc Health.* 2006;39(4):488-494.
24. Walton KE, Roberts BW. On the relationship between substance use and personality traits: abstainers are not maladjusted. *J Res Pers.* 2004;38:515-535.
25. Jeannin A, Narring F, Tschumper A, et al. Self-reported health needs and use of primary health care services by adolescents enrolled in post-mandatory schools or vocational training programmes in Switzerland. *Swiss Med Wkly.* 2005; 135(1-2):11-18.
26. Armsden GC, Greenberg MT. The inventory of parent and peer attachment: individual differences and their relationship to psychological well-being in adolescence. *J Youth Adolesc.* 1987;16:427-454.
27. Gniech G, Oettling T, Brohl M. *Untersuchungen zur Messung von "Sensation Seeking": Bremer Beiträge zur Psychologie Nr 110.* Bremen, Germany: Universität Bremen; 1993.
28. Flammer A, Alsaker FD, Grob A. *Fragebogen Alltag und Schule von Kindern und Jugendlichen in der Schweiz und in Norwegen.* Bern, Switzerland: Institut für Psychologie, Universität Bern; 1994.
29. Ingenkamp K. *Landauer Skalen zum Sozialklima (LASSO 4-13).* Weinheim, Germany: Beltz Test; 1987.
30. Tarter RE, Vanyukov M, Kirisci L, Reynolds M, Clark DB. Predictors of marijuana use in adolescents before and after licit drug use: examination of the gateway hypothesis. *Am J Psychiatry.* 2006;163(12):2134-2140.
31. Butters JE. Family stressors and adolescent cannabis use: a pathway to problem use. *J Adolesc.* 2002;25(6):645-654.
32. Lewinsohn PM, Rohde P, Brown RA. Level of current and past adolescent cigarette smoking as predictors of future substance use disorders in young adulthood. *Addiction.* 1999;94(6):913-921.
33. Fergusson DM, Horwood LJ, Beautrais AL. Cannabis and educational achievement. *Addiction.* 2003;98(12):1681-1692.
34. Tyas SL, Pederson LL. Psychosocial factors related to adolescent smoking: a critical review of the literature. *Tob Control.* 1998;7(4):409-420.
35. Ledoux S, Miller P, Choquet M, Plant M. Family structure, parent-child relationships, and alcohol and other drug use among teenagers in France and the United Kingdom. *Alcohol Alcohol.* 2002;37(1):52-60.
36. Schepis TS, Rao U. Epidemiology and etiology of adolescent smoking. *Curr Opin Pediatr.* 2005;17(5):607-612.
37. Peretti-Watel P, Lorente FO. Cannabis use, sport practice and other leisure activities at the end of adolescence. *Drug Alcohol Depend.* 2004;73(3):251-257.
38. Zambon A, Lemma P, Borraccino A, Dalmasso P, Cavallo F. Socio-economic position and adolescents' health in Italy: the role of the quality of social relations. *Eur J Public Health.* 2006;16(6):627-632.
39. Hoel S, Eriksen BM, Breidablik HJ, Meland E. Adolescent alcohol use, psychological health, and social integration. *Scand J Public Health.* 2004;32(5):361-367.
40. Laukkanen ER, Shemeikka SL, Viinamaki HT, Polkki PL, Lehtonen JO. Heavy drinking is associated with more severe psychosocial dysfunction among girls than boys in Finland. *J Adolesc Health.* 2001;28(4):270-277.
41. Carter M, McGee R, Taylor B, Williams S. Health outcomes in adolescence: associations with family, friends and school engagement. *J Adolesc.* 2007;30 (1):51-62.
42. Michaud PA, Delbos-Piot I, Narring F. Silent dropout in health surveys: are nonrespondent absent teenagers different from those who participate in school-based health surveys? *J Adolesc Health.* 1998;22(4):326-333.

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