

## Monitoring the stability of risk factors for adolescent cannabis use

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### Abstract

**Aims:** To identify factors associated with repeated cannabis use among Swedish adolescents aged 15 and 17 years and assess the stability of these factors over time, in the context of rising cannabis use and recent socio-economic changes.

**Design:** Two cross-sectional surveys completed in 2006 and 2012 are compared.

**Setting:** Secondary schools in Stockholm, Sweden.

**Participants:** 15- and 17-year-old secondary-school students surveyed in 2006 ( $n = 11,895$ ) and 2012 ( $n = 13,004$ ). Response rates were 76% and 77%, respectively.

**Measures:** Bivariate and multivariate analyses of the Stockholm Student Survey identified associations between repeated cannabis use (2 to 4 times or more) and 20 presumed risk factors.

**Findings:** Despite socio-economic changes in Sweden and recent increases in cannabis use, the factors associated with repeated cannabis use among adolescents have remained stable in recent years. Four key variables were identified in both survey years: having drug-using friends, cigarette smoking, early alcohol debut, and high drug availability.

**Conclusions:** Multi-component prevention strategies that ameliorate peer influences on drug taking and reduce cigarette smoking are highly recommended. Preventing the initiation of alcohol consumption at an early age and reducing drug availability may also reduce the risk of cannabis use.

Illicit drug use among adolescents is common and remains an important public health issue internationally. Patterns of drug use established during adolescence predict long-term patterns of use, mortality and disability in adulthood (Patton et al., 2002; Toumbourou et al., 2007). In 2012, the four drugs most frequently used by Swedish adolescents were cannabis (which accounts for the majority of illicit drug use), benzodiazepines, amphetamines, and ecstasy (Swedish Council for Information on Alcohol and Other Drugs, 2012). In Sweden's capital, Stockholm (population approximately 1.4 million), cannabis use among most adolescents has risen since 2006. Recent cross-sectional data shows that between 2006 and 2012, the proportion of 17-year-old boys who had ever used cannabis increased from 22% to 27%. Seventeen-year-old girls and 15-year-old boys also increased their consumption of cannabis moderately during this period (Figure 1).

One approach to drug prevention is to identify the factors most strongly associated with drug use and then develop interventions targeting those factors (Hawkins, Van Horn,

& Arthur, 2004). Adolescent drug use has multiple influences. Individual characteristics, such as impulsivity, have been linked to drug taking (Yanovitzky, 2005). Family and parenting factors (e.g., lack of empathy, poor supervision and harsh discipline) also play an important role (Bahr, Hoffmann, & Yang, 2005; Jenkins & Zunguze, 1998). Community-level influences, especially drug availability, have been shown to increase the risk of adolescent drug use (Wright, Bobashev, & Folsom, 2007). A recent Swedish study found that low levels of social capital were related to higher levels of adolescent drug use, reinforcing the importance of community belonging and opportunity (Aslund & Nilsson, 2013). It has also been suggested that young adolescents may have a unique susceptibility to the influence of peer drug use (Kelly et al., 2012).

Research to date has focused primarily on the identification of risk factors at a single point in time (Branstrom & Andreasson, 2008; Getz & Bray, 2005; Stafstrom, Ostergren, & Larsson, 2005). Several studies have also

explored the association between adolescent risk factors and adult alcohol use, using prospective designs (Huurre et al., 2010; Swendsen et al., 2009). What remains unclear, however, is whether or not the identified factors remain stable over time, particularly during periods of increased drug use. Drug prevention strategies should target factors that have a constant influence on drug use over time. If similar risk factors emerge on separate measurement occasions, this would imply that the identified factors are stable and highly relevant to prevention. Conversely, large fluctuation in risk factor profiles would indicate that the identified factors are variable.

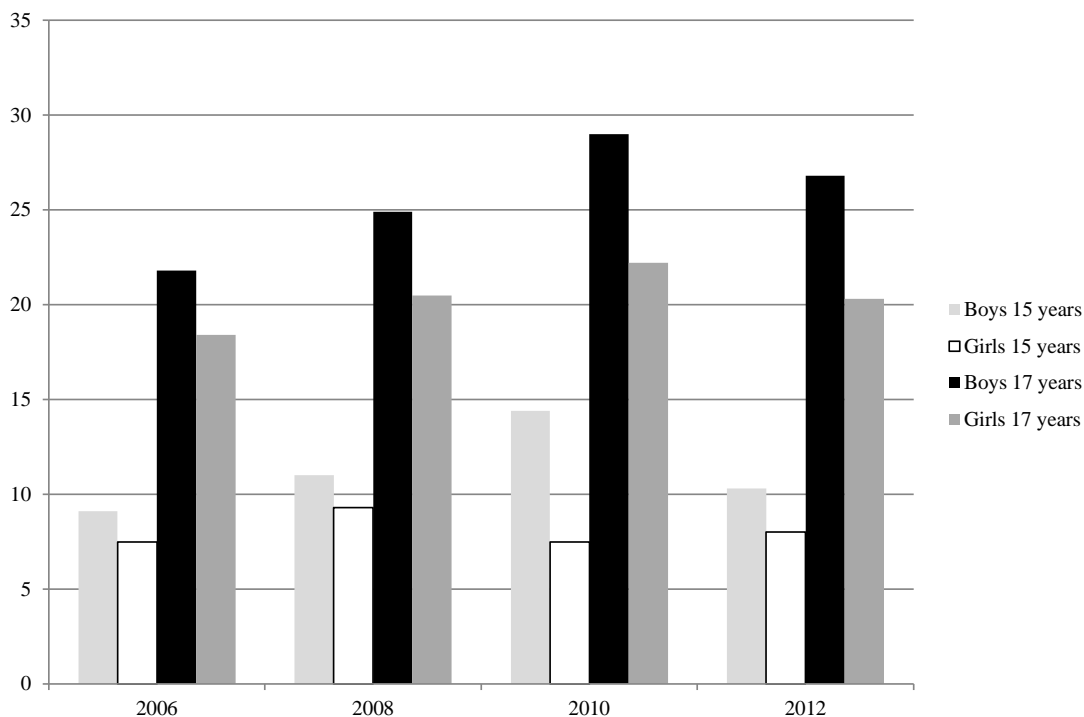
Also relevant in this context is the economic recession which coincided with increases in cannabis use among adolescents in Sweden after 2006. It is known that economic crises are times of high risk to the health of affected people and their families (WHO, 2011). Higher rates of unemployment have been associated with increased rates of youth substance abuse (Fergusson & Horwood, 1997; ter Bogt, Schmid, Gabhainn, Fotiou, & Vollebergh, 2006), although the directional nature of this relationship is not entirely clear (Popovici & French, 2014). Total unemployment in Sweden increased from about 6% in 2008

to 8.9% in 2010. Among youth aged 15 to 24 years, unemployment increased to 22.8% in 2011, slightly above the European Union average of 21.3% (SCB, 2013). We speculate that higher rates of unemployment and greater financial instability in Sweden could be resulting in greater social disparities that indirectly affect adolescent drug use or the factors influencing such behavior. Although we do not aim to study the relationship between indicators of social welfare and drug use *per se*, the recent recession does provide a unique opportunity to monitor changes in adolescent drug use and influencing factors before and shortly after its occurrence. This aspect of our research is somewhat original.

The present study describes findings from an ongoing adolescent health survey in Sweden designed to monitor changes in youth substance use. The paper aims to identify factors associated with repeated cannabis use and to examine the stability of these factors over time by comparing two identical surveys completed in 2006 and 2012—the years preceding and following the recent economic recession. Implications for drug prevention policy are described.

**Figure 1.**

*Changes in the proportion of adolescent cannabis users 2006–2012 (%)*



## Method

### Data Source

The Stockholm Student Survey is a repeated cross-sectional self-report survey completed every other year by students aged 15 and 17 years in the Stockholm municipality. The survey was developed by the Research and Development Unit of the Stockholm City Council. The goal was to implement a school-based survey to monitor changes in adolescent substance use. It was envisaged that the survey would be used to inform prevention policy by identifying locally relevant risk factors for adolescent drug use. The survey includes questions about a range of issues known to be associated with delinquency and drug use (e.g., psychosocial health, school and community connectedness, relationships with parents and peers). It also assesses the frequency and quantity of alcohol and other drug use, using a questionnaire developed to measure national drug trends (CAN, 2012). Development of the survey was theory driven and influenced by the Social Development Model (Hawkins, Catalano, & Arthur, 2002; Hawkins & Weis, 1985), Control Theory (Hirschi, 1969) and the Theory of Inter-connected Influences (Brounstein, Gardner, & Backer, 2006). Some items were inspired by existing questionnaires; for example, twelve questions about psychosomatic health were taken from a Swedish survey developed by researchers at Stockholm University for the Individual Development and Adaptation (IDA) project (Bergman & Andershed, 2008). Similarly, questions about criminality were inspired by a National Crime Prevention Council survey (Ring, 1999). The extensive international literature on risk and protection was also consulted before determining the final questions. The survey validation and reliability testing procedure has been reported previously (PCS, 2009). Conducted during the spring, the survey is completed anonymously by students during class time and is returned to teachers in a sealed envelope. Participation in the survey is mandatory for all public schools, which in 2012 comprised about 53% of all schools in Stockholm. Estimates of the frequency of lifetime cannabis use were obtained from a single question: "How many times have you ever used hash/marijuana?" There were seven possible response alternatives: never, once, 2 to 4 times, 5 to 10 times, 11 to 20 times, 21 to 50 times, or more than 50 times. The mid-point of each alternative was used to calculate the estimated frequency of use.

### Participants

In 2006, the survey was distributed to 15,519 students from 126 schools. From this group, 11,895 usable questionnaires (77%) were included in the final analyses. In 2012, 17,153 students from 186 schools participated; this group returned 13,004 usable questionnaires (76%). The remaining 24% of students were either absent from school on the day the survey was completed or refused to participate. The response rate represents approximately 54% of all youth aged 15 to 18 years living in Stockholm. The number of participating students increased between 2006 and 2012 due to population growth and expansion of the school system. Approximately equal numbers of males

and females participated. As the survey was anonymous, non-responders could not be followed up for comparison purposes. Separate analyses were conducted to examine whether changes over time in the number of participating schools influenced the results, but no effects were found. A small number (<1%) of extreme or unreliable responders were excluded from the analyses. As recent Swedish studies have shown that risk factors for adolescent substance use can vary by gender and school year (Branstrom, Sjostrom, & Andreasson, 2008; Danielsson, Romelsjo, & Tengstrom, 2011), separate analyses were conducted for these groups.

### Risk factor selection and analysis

Associations between repeated cannabis use and 20 factors presumed to increase the risk of adolescent drug use were explored (Table 1). "Repeated use" was defined as the consumption of cannabis or hash 2 to 4 times *or more* in one's lifetime. The range of choices was as follows: 2 to 4 times, 5 to 10 times, 11 to 20 times, 21 to 50 times, and more than 50 times. Students who indicated that they had used cannabis 2 to 4 times *or more* were included (mean = 16; range = 2 to more than 50 times). This cut-off was chosen because it excluded adolescents who used cannabis only once. While harm can arise from the use of any drug on a single occasion, the risk of adverse consequences is arguably higher with repeated use. The 20 risk factors were selected following a review of the literature, which included several recent Swedish studies (Branstrom et al., 2008; Danielsson et al., 2011; El-Khoury, Sundell, & Strandberg, 2005; Stafstrom et al., 2005).

The risk factors were initially tested individually for associations with cannabis use, using bivariate logistic regression. This method was also used to explore associations between seven socio-demographic variables (gender, school year, living arrangements, length of time in Sweden, parents' education and employment, socio-economic status) and repeated cannabis use, using the 2006 and 2012 surveys. Three levels of socio-economic status were determined, based on the median household income of the adolescent's residential address. Statistical significance was set at 0.05. All analyses were performed using SPSS v.20.0.

Six variables with only two response alternatives (yes or no) were dichotomized as 1 = present or 0 = not present. The remaining 14 variables included questions with three or more response alternatives. As the distribution of scores for these continuous variables was skewed (and because the analyses assume that the data is normally distributed), each of the continuous variables was dichotomized into a binary outcome using a statistical procedure called Receiver Operating Characteristic (ROC) curve analysis (Streiner, 2002). This technique is an alternative to using the median split and has the advantage of optimizing the level of each predictor variable by considering the specificity and sensitivity of each alternative (Rousson & Zumbrunn, 2011). In all instances, this procedure resulted in a cut-off point at or above the median. Chronbach's alpha was calculated for all predictor variables with more than one

question. Alpha scores were mainly between 0.7 and 0.9, indicating that the risk factors addressed in the questions were strongly related to cannabis use. One item, “poor connection to school,” had a moderately low Alpha score of 0.53.

To avoid the inclusion of multiple variables measuring the same construct (multicollinearity), correlations between each of the significant predictor variables from the bivariate analyses were explored. These were generally low, ranging between .05 and 0.2; the highest correlation found was 0.52 for the association between “norm-breaking behavior” and “drug-taking friends” among 15-year-old males in 2006. Multicollinearity can also be assessed by the Variance Inflation Factor (VIF) and Tolerance statistic. The VIF indicates whether a predictor has a strong relationship with the other predictors, and scores above 10 are considered problematic (Field, 2009). Related to the VIF is the

Tolerance statistic; scores below 0.1 suggest collinearity in the data. VIF scores ranged between 1.0 and 1.9 for all significant predictor variables, and the Tolerance scores ranged between 0.5 and 0.9. In sum, these statistics indicate that multicollinearity in the data is highly unlikely. Following these checks, the significant variables identified in the bivariate analyses were entered into a multivariate regression using the forced entry method, with non-significant variables removed one at a time until the final model was obtained.

To assess changes over time in the level (or strength) of the association between the risk factors that were significant in the multivariate analyses and repeated cannabis use in 2006 compared with 2012, we calculated and compared the 95% confidence intervals for the Beta values from the regression analyses.

**Table 1**

*Presumed risk factors for repeated cannabis use*

Risk factor	Questions addressing the risk factors	Number of questions
Individual		
High spending money	For year 9 students 1,000 SEK (~\$150 USD) per month or more = 1/yes. For year 11 students 1,500 SEK (~\$225 USD) or more per month = 1/yes. All else = 0/no.	1
Smokes regularly	Do you smoke cigarettes? Responses “sometimes” or “daily” were coded 1/yes, all else = 0/no.	1
Excitement seeking	Four questions were scored on a four-point scale from “strongly agree” to “strongly disagree.” Items were summed into a total score. “I like to do exciting and dangerous things, even if they are forbidden”; “I see myself as a very impulsive person”; “I want to be where the excitement is happening”; “I do stupid things even if they are dangerous.”	4
Anti-social behavior	Nineteen questions scored on a five-point scale from “0 times” to “more than 10 times.” “How many times have you done (each of the following) during the past 12 months?” Examples include shoplifting, vandalism, graffiti, car theft, burglary, serious fight, carried a weapon, etc. Items were summed into a total score.	19
Heavy episodic drinking	“How often do you consume the following amounts of alcohol during a single drinking session?” 18cl of spirits; half a bottle of wine; four cans of strong beer/alcoholic cider; six cans of light beer. The item was scored on a seven-point scale from “never” to “a few times per week.”	1
Young when first intoxicated	“How old were you the first time you felt drunk?” Responses were coded as 0–7years = missing, 8–12 years = 1/yes, 13 years plus = 0/no.	1
Psychological distress	Six questions, scored on a five-point scale from “seldom” to “very often.” “Do you feel sad or blue without knowing why?” “How often do you have a poor appetite?” “How much about yourself would you like to change?” “How often during the last school year have you felt a ‘nervous stomach’?” “How often during the last school year have you had difficulty sleeping?” “How often do you think it’s really great to be alive?”	6
Peer		
Drug-using friends	“How many of your friends use illicit drugs?”	1
Heavy-drinking friends	“How many of your friends (in and outside school) get drunk on alcohol?”	1
Norm-breaking or criminal friends	Six questions scored on a four-item scale from “None” to “Very few.” “How many of your friends have done the following: shoplifted, graffitied or vandalized property, been in a physical fight, stolen a car, committed a crime, or truant?”	4
School truant	“Have you been away from school during the last term without permission?” Six-item scale ranging from “never” to “more than 20 times.”	1
Bullies others	Have you bullied another student during the last school year? Five-point scale from “never” to “a few times per week.”	1
Poor connection to school	Two items scored on a four-point scale: “strongly agree” to “strongly disagree.” “I get on well at school” and “I look forward to my school classes.”	2
Poor school performance	If the student failed one or more core school subject (Swedish, English or Mathematics) during the last term, then 1/yes, all else = 0/no.	1

Risk factor	Questions addressing the risk factors	Number of questions
Family		
Lives with neither parent	Coded as 1 = does <i>not</i> live with parents. 0 = lives with one or both parents.	1
Gets alcohol from parents	"Where do you normally get your alcohol?" If "from my parents with permission" then 1/yes, all else = 0/no.	1
Poor parental monitoring	"Do your parents (or carer) know where you are when you are out with friends in the evening?" Scored on a four-point scale from "never" to "always."	1
Community		
High-risk neighborhood	Seven questions, scored on a four-point scale from "strongly disagree" to "strongly agree": "If a person did something illegal in my area, my parents would probably do something about it"; "Criminal activity is unusual in my area"; "People would intervene if there was a fight outside my house"; "People would intervene if I was robbed in a public place in my area"; "My neighbors acknowledge me when we pass each other in my house/area"; "I get along well in my area"; "If I were forced to move, I would miss this area."	7
Tolerant community attitude to drugs	"Adults would intervene if someone openly tried to sell narcotics to a young person in my neighborhood." Scored on a four-point scale from "strongly disagree" to "strongly agree."	1
High drug availability	"There are people who sell drugs in my neighborhood": Scored on a four-point scale from "strongly disagree" to "strongly agree."	1

Note: All continuous variables were dichotomized using ROC curve analysis, as described in the Methods section

## Results

Four socio-demographic factors were associated with greater odds of using cannabis repeatedly in 2012: Male gender ( $OR = 1.87$ ,  $CI = 1.51-2.31$ ,  $p < .01$ ), older age (17 years) ( $OR = 1.49$ ,  $CI = 1.20-1.85$ ,  $p < .01$ ), living with neither parent ( $CI = 1.38$ ,  $CI = 1.03-1.85$ ,  $p < .05$ ), and having two unemployed parents ( $OR = 4.94$ ,  $CI = 1.16-20.94$ ,  $p < .05$ ). Socio-economic status, length of time in Sweden, and parents' level of education were not significantly associated with repeated cannabis use. The same four factors were also significant in 2006. Approximately half the factors examined in the bivariate analyses (not shown) were associated with greater odds of repeated cannabis use. Overall, both the total number and type of risk factors associated with cannabis use did not change markedly in the bivariate analyses over time.

Tables 2 and 3 show results from the multivariate regression analyses for 2006 and 2012, respectively. Wald's Chi-square statistic, degrees of freedom ( $df$ ), odds ratios ( $OR$ ) and 95% confidence intervals ( $CI$ ) are shown. In total, nine variables were associated with greater odds of repeated cannabis use. However, only four factors (drug-using friends, cigarette smoking, young when first drunk, and high drug availability) were present in the final regression model in both years. Having drug-using friends was the most "stable" factor, as it was present for all students in both surveys. In 2012, cigarette smoking was also significant for all adolescents. Getting drunk for the first time when young was significant only among girls in 2006, and among 15-year-old boys and 17-year-old girls in 2012. The fourth factor that appeared in the final

regression model in both survey years was "high drug availability." This risk factor was significant only among girls in both years.

Having norm-breaking friends and frequently being truant from school were factors linked to cannabis use among boys only, but not in both surveys. Heavy episodic drinking, a presumed risk factor, was not significant in any of the multivariate analyses. The final regression models accounted for between 13% and 23% of the variance in cannabis use.

The Beta confidence intervals for each of four risk factors present in both survey years largely overlapped across years, suggesting that there were no differences in the level of influence that each factor had on cannabis use over time.

## Discussion

Drug prevention strategies are often developed around a model of risk and protection. Identifying risk factors that have a stable influence on adolescent drug use is important, as it provides policy makers with an opportunity to reduce these factors' potential impact. This study has identified four key risk factors associated with repeated cannabis use among Swedish adolescents. It further observes that the identified factors have remained fairly stable over time, despite recent increases in cannabis use and socio-economic changes in Sweden. Also relevant is the finding that the strength of these associations did not alter substantially over time, suggesting that their level of influence has remained constant.

**Table 2.***Multivariate analyses showing the association between regular cannabis use and different risk factors (2006)*

Risk factors	Boys year 9			Girls year 9			Boys year 11			Girls year 11		
	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI
Drug-using friends	4.82(1)	3.10	<b>1.13–8.50*</b>	7.14(1)	3.26	<b>1.37–7.75**</b>	16.85(1)	7.10	<b>2.78–18.12**</b>	4.53(1)	3.33	<b>1.10–10.12*</b>
Young when first drunk		_a		6.72(1)	2.47	<b>1.24–4.89**</b>		_a		10.93(1)	3.04	<b>1.57–5.90**</b>
Smokes	7.65(1)	2.26	<b>1.26–4.04**</b>	8.13(1)	3.06	<b>1.41–6.61**</b>		_a			_a	
High-risk neighborhood	10.32(1)	2.59	<b>1.45–4.63**</b>		_a			_a			_a	
Norm-breaking friends		_a			_a		5.02(1)	1.72	<b>1.07–2.78*</b>		_a	
High drug availability		_a			_a			_a		6.46(1)	3.13	<b>1.29–7.54**</b>
Poor connection to school		_a		5.82(1)	3.75	<b>1.28–10.98*</b>		_a			_a	

a: Only the variables that significantly contribute to the prediction of the dependent variable were included in the final model.

\*\* $p < .01$ , \* $p < .05$ **Table 3.***Multivariate analyses showing the association between regular cannabis use and different risk factors (2012)*

Risk factor	15 year old boys			15 year old girls			17 year old boys			17 year old girls		
	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI	$\chi^2$ (df)	OR	95% CI
Drug-using friends	5.73(1)	3.51	<b>1.25–9.82*</b>	6.69(1)	3.67	<b>1.37–9.86**</b>	20.55(1)	4.31	<b>2.29–8.12**</b>	11.51(1)	2.96	<b>1.58–5.56**</b>
Smokes	5.31(1)	2.47	<b>1.14–5.35*</b>	9.65(1)	3.61	<b>1.60–8.13**</b>	11.59(1)	2.11	<b>1.37–3.24**</b>	12.52(1)	2.34	<b>1.46–3.75**</b>
Young when first drunk	4.39(1)	3.04	<b>1.07–8.59*</b>		_a			_a		6.22(1)	4.05	<b>1.35–12.17*</b>
High drug availability		_a		7.86(1)	3.60	<b>1.47–8.84**</b>		_a			_a	
Excitement seeking		_a			_a			_a		9.14(1)	2.22	<b>1.32–3.72**</b>
Truancy		_a			_a		5.06(1)	2.11	<b>1.10–4.05*</b>		_a	

a Only the variables that significantly contribute to the prediction of the dependent variable were included in the final model.

\*\* $p < .01$ , \* $p < .05$ 

Having drug-using friends was associated with greater odds of repeated cannabis use among all adolescents surveyed in both years. This was the most stable risk factor, and highlights the important influence of peer behavior on cannabis use. Previous investigators have reported similar findings. Using a nationally representative sample of over 28,000 adolescents in the United States, Hawkins et al. (2004) found an association between drug taking and having friends who use drugs. In a recent cross-national study between the United States and Australia involving over 40,000 adolescents aged 12 and 17 years, Beyers et

al. (2003) reported a significant association between having anti-social and/or drug-using peers and current cannabis use. These findings support the social influence model of drug taking (Christakis & Fowler, 2008) and measures which aim to improve adolescents' social competence.

Cigarette smoking was associated with cannabis use among all adolescents surveyed in 2012 and among all 15-year-old students in 2006. Although, in the present study, it was not possible to determine whether smoking preceded cannabis use, smoking may act as a gateway to illicit drug use. A

ten-year prospective study involving 5,001 adolescents and young adults aged 15 to 44 years reported significant associations between smoking at baseline and illicit drug dependence 10 years later (Swendsen et al., 2009). Previous studies have linked the consumption of alcohol in early adolescence to a range of problems in adulthood (Pitkanen, Lyyra, & Pulkkinen, 2005; Reboussin, Song, Shrestha, Lohman, & Wolfson, 2006) and to brain damage during adolescence (Lubman, Yucel, & Hall, 2007). Similarly, getting drunk for the first time when young was associated with repeated cannabis use among girls in 2006, and among boys and girls in 2012. Again, a likely explanation is that experimentation with one drug (alcohol) naturally increases the risk of other drug use. Another possibility, however, is that underlying mechanisms or pathological behaviors—for example, impulsivity or hyperactivity—are partly responsible for a range of dysfunctional adolescent behaviors, including substance abuse.

Drug availability was associated with cannabis use in both survey years, but only among 17-year old-girls in 2006 and 15-year-old girls in 2012. For this reason, it may be regarded as the least stable of the four main risk factors, even though it was present in both years. Laws restricting access to drugs, and social norms against drug taking, have been linked to lower levels of drug use in the community (Toumbourou et al., 2007). A survey of the economic and cultural correlates of cannabis use in 31 countries found that personal consumer expenditure and perceived availability of cannabis were significantly related to lifetime prevalence and frequency of use (ter Bogt et al., 2006).

The findings that boys tend to use cannabis more frequently than girls and that certain living arrangements are linked to drug use (e.g., living with neither parent) have been reported previously (Branstrom et al., 2008). Although socio-economic status was *not* associated with repeated cannabis use in the present study, living in a high-risk neighborhood was a risk factor for some adolescents. Various mechanisms have been suggested to explain the influence of community factors on adolescent drug use (Chuang, Ennett, Bauman, & Foshee, 2005; Wickes, Hipp, Sargeant, & Homel, 2013). These include collective socialization, where parents and other adults act as poor role models for adolescents, and socio-economic deprivation, where families lack the necessary resources to support adolescent development. An epidemic model has also been suggested, whereby problem behaviors are assumed to be contagious and operate mainly through peer influences (Chuang et al., 2005).

The large sample size, high response rates, and comprehensive survey are strengths of this study. As noted, the choice of survey years was purposeful and adds new information to the existing risk factor literature. Several limitations are acknowledged. Cross-sectional data does not allow causality to be established, so the factors described in this study are *presumed* to influence cannabis use. Prospective studies enable stronger assertions about relationships between variables. Our findings are based on

self-report surveys and the inherent limitations of such surveys are well known. Estimates can be biased if adolescents exaggerate their consumption habits, and the heaviest users may refuse to respond at all. However, our reliance on self-reported data does not invalidate our findings; anonymous self-reports are generally valid, provided that confidentiality is stressed, which it was in this survey (Campanelli, Dielman, & Shope, 1987). Consideration was given to following students prospectively by using the classroom as the primary unit of analysis in a multilevel study. This was not possible, however, due to the structure of the Swedish secondary school system, where the final three years are completed in separate “gymnasiums” (upper-level high schools). Consequently, 15-year-old students could not be followed up with two years later. Most of the predictor variables were dichotomized—a common procedure in risk factor analysis, but one with recognized drawbacks (e.g., increased risk of Type II error and loss of statistical power). However, due to the skewed distribution of the data comprising these items, this method was considered appropriate (Streiner, 2002). Finally, non-responders could not be followed up with and compared to the responder group.

The findings should be seen in context. A large proportion of the variance explained by the final regression model was attributable to other factors. Adolescent drug abuse has multiple developmental influences, and some of these were not assessed by the survey. Among others, opportunities for meaningful community participation and parental efficacy are understood to influence youth delinquency and substance abuse (Cameron et al., 2012).

In conclusion, while some differences exist, the risk factor profiles for 2006 and 2012 are largely the same, suggesting that the four identified factors are relevant to drug prevention efforts implemented over several years. Multi-component strategies that ameliorate peer influences on drug taking and reduce cigarette smoking are highly recommended. Preventing the initiation of alcohol consumption at an early age and reducing drug availability generally may also reduce the risk of cannabis use. Future research should explore relationships between social changes, drug use, and levels of influencing factors among youth.

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