Economic and cultural correlates of cannabis use among mid-adolescents in 31 countries

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ABSTRACT
Aims: To examine cannabis use among mid-adolescents in 31 countries and associations with per-capita personal consumer expenditure (PCE), unemployment, peer factors and national rates of cannabis use in 1999.
Design, participants and measurement: Nationally representative, self-report, classroom survey with 22 223 male and 24 900 female 15-year-olds. Country characteristics were derived from publicly available economic databases and previously conducted cross-national surveys on substance use.
Findings: Cannabis use appears to be normative among mid-adolescents in North America and several countries in Europe. The life-time prevalence of cannabis use was 26% among males and 15% among females and was lowest for males and females in the former Yugoslav Republic (TFYR) of Macedonia: 2.5% and to 2.5%, respectively; and highest for males in Switzerland (49.1%) and in Greenland for females (47.0%). The highest prevalence of frequent cannabis use (more than 40 times in life-time) was seen in Canada for males (14.2%) and in the United States for females (5.5%). Overall, life-time prevalence and frequent use are associated with PCE, perceived availability of cannabis (peer culture) and the presence of communities of older cannabis users (drug climate).
Conclusions: As PCE increases, cannabis use may be expected to increase and gender differences decease. Cross-national comparable policy measures should be developed and evaluated to examine which harm reduction strategies are most effective.
Keywords: Adolescents, cannabis, international comparisons, personal consumer expenditure.

INTRODUCTION

In many countries in Europe and North America cannabis is a widely used substance among adolescents, as reflected in life-time and current prevalence estimates [1–5]. During the 1990s there was a general increase in cannabis consumption among adolescents, but recent estimates suggest major fluctuations. The 2004 US Monitoring the Future Report concluded that during the last 3 years cannabis use among American students has decreased [6]. In Europe, life-time and last month prevalences still vary widely across countries that participate in the European School Survey Project on Alcohol and Other Drugs (ESPAD) and the Health Behaviour in School-aged Children (HBSC) studies. The life-time prevalence of cannabis use among the ESPAD and HBSC target group of mid-adolescent 15-year-old students has, in some countries, increased to over 40%, while in others it is well below 10% [3,5]. While

there is a broad literature on personality, parental, peer and policy factors associated with the illicit substance use, investigations into cross-national differences in cannabis use are relatively rare [7,8]. In contrast, cross-national surveys of alcohol consumption are more prevalent (e.g. [9]) and countrylevel characteristics such as gross domestic product [10] and unemployment [11] have been shown to covary with both alcohol use and misuse.

Cannabis use first became a mass phenomenon in industrialized countries in the 1960s among white, middle-class youth and has been described as existing within a social environment generally favouring procannabis attitudes and behaviour, in which cannabis was (perceived to be) easily available [12,13]. These aspects of drug culture in a particular country are associated with frequent use of cannabis [3,14]. Cannabis use has also been shown to be associated with socio-economic status [15]. Thus, cannabis use may be more prevalent in economically prosperous countries that have relatively large groups of young people with both disposable income and increased leisure opportunities, willing to pass on their drug-using behaviour to younger peers. Alternatively, cannabis use may be more prevalent among marginal groups who use the drug as a means of coping with personal difficulties [16–19]. It is possible, however, that marginalized youth in less affluent countries may simply be too poor to purchase cannabis and in some rich countries it may simply be hard to obtain.

Mid-adolescence (15–16 years) is a critical period for initiation to cannabis [20] and initiation in this period or earlier is an indicator of possible drug misuse and related problems later in life (e.g. [21,22]). Adolescents' peers have a strong influences on perceptions of drug availability, substance use attitudes and behaviour during this time [23–26]. In part, this influence operates because young people who have friends who use use substances are more likely to think that drug use is normative and thus appropriate [27–30].

Research on the explanation of cross-national differences in cannabis use is scarce. In this paper we first examine the differences in cannabis use in 31 countries in Europe and North America. Secondly, using hierarchical generalized linear model analysis, the variation in patterns of use between countries is analysed by (1) national characteristics, including the socio-economic indicators of wealth and youth unemployment, (2) indicators of drug climate, i.e. the countries past agglomerated scores on life-time and last month cannabis use and (3) indicators of peer drug culture, i.e. acquaintance with and perceived availability of cannabis, and perception of friends' cannabis use. With this project we extend previous research on correlates of cannabis use, but while most previous attempts to make international comparisons have relied on secondary analysis of surveys with different question structures that have been administered in non-equivalent ways, the advantage of the current work is that the same survey was administered in the same way in all countries, using the same sampling strategy.

METHOD

Sample

The 2001/2002 Health Behaviour in School-Aged Children Study is a World Health Organization (WHO)-supported study of nationally representative samples of adolescents in 36 countries and regions [31]. In each country, a cluster sample design is employed with school classes as sampling units. Schools and classes within schools were selected to be representative by age level and regional geography. The recommended sample sizes for each country were 1536 students per age group. Sample sizes assured a 95% confidence interval of approximately 3% for prevalence estimates, and took the clustering effect of school classrooms into account [32]. It was not possible to correct for the clustering effect of classrooms in the statistical analysis because unique identifiers for individual classrooms were not supplied by all participating countries. The present analysis is based on 22 223 male and 24 900 female students aged 15 years from 31 countries, who answered on the cannabis questions. The multi-level analysis included only 31 of the 36 countries participating in HBSC because of missing socio-economic indicators or missing data on cannabis use, acquaintance, availability or beliefs about the drug use of friends. The 31 countries included were Austria, Belgium, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greenland, Hungary, Ireland, Israel, Italy, Greece,

Latvia, Lithuania, Malta, the Netherlands, Poland, Portugal, Russia, Slovenia, Spain, Sweden, Switzerland, Ukraine, the Former Yugoslav Republic of Macedonia (herein, Macedonia), United Kingdom (not including Northern Ireland) and United States.

Measures

Data were collected at two levels. At the individual level, data include students' self-reported cannabis use. Second-level data comprise information on private consumer expenditure (PCE; an indicator of personal spending power) and youth employment from the United Nations Economic Commission for Europe economic database [33], and cross-national means on life-time and last month prevalences, acquaintance, availability and belief about friends drug use from the 1999 ESPAD and MTF studies [3,4]. As a control, rates of missing data by country were also included.

Descriptions of the cannabis questionnaire items employed and their development have been reported elsewhere [32,34–35]. National questionnaires are translations and adaptations of the international standard version, with independent re-translation back to English, to maximize comparability. The present report utilizes the following questionnaire secondary data set measures.

Cannabis use

In addition to self-reported life-time prevalence of cannabis use, respondents were asked to recall the frequency of cannabis use in the past year, using the following categories: 'never', 'once or twice', 'three to five times', 'six to nine times', '10–19 times', '20–39 times' and 'more than 39 times'. Those who reported using cannabis 40 times and more last year were categorized as 'frequent users' and this binary indicator was used for statistical modelling.

Drug climate

The cannabis use of communities of older adolescents in the participating countries and was taken as an indicator of local drug climate. Their drug use is reported in recent survey on substance use. Country means of (1) life-time and (2) last month prevalence of cannabis use in 1999 were taken from the 1999 ESPAD and Monitoring the Future studies [3,4].

Peer culture

In order to assess perceptions of peer drug culture we employed (1) cannabis acquaintance (percentage of respondents indicating that they have heard of marijuana or hashish), (2) perceived availability (percentage of respondents indicating availability is 'fairly easy' or 'very easy') and (3) belief about friends use (percentage of respondents indicating that some, most or all of their friends use marijuana or hashish) from the ESPAD and MTF 1999 surveys [3,4].

Socio-economic indicators

Country characteristics were taken from the UN/ECE economic database [33]. This database contains crossnational indicators of (1) per capita private consumer expenditure (PCE 2001) in American dollars and (2) the percentage of youth unemployment (PCE 2001).

Statistical analysis

A hierarchical generalized linear model (HGLM [36–38]) was employed. HGLM has been used for the analysis of longitudinal data [39] and is a recommended procedure for analysis of cross-sectional epidemiology data sets [40]. The data were structured hierarchically with variables at

both the individual and the country levels. To account for this structure a multi-level regression model which assumes hierarchical data was applied [41], with one criterion measured at the lowest level and predictors at all existing levels. In this study the criterion variables were life-time cannabis use and frequent cannabis use (both binary), and tested through a binary outcome model that uses a binomial sampling model. The predictors were national characteristics measured at the country level. Level one units were the adolescents and level two units the countries. The software used was HLM version 5.04 [30,42]. This program is able to analyse a sequence of several models.

We tested four consecutive models. First, a socioeconomic model with PCE, youth-employment and the interaction between PCE and youth unemployment as predictors; secondly, a peer culture model with the acquaintance, availability and peer drug use variables; thirdly, a drug climate model with cross-national indicators of past, i.e. 1999, life-time and last month prevalance. Finally, we intended to test a complete model with all the significant predictors from the three preceding analyses.

RESULTS

Descriptive results

A total of 50 816 students in 31 countries, 24 137 males (47.5%) and 26 679 females (52.5%), completed questionnaires and 47 123 (92.7%) answered all questions about cannabis use.

Table 1 gives a description of the individual level data by country. The mean life-time prevalence of cannabis use was 25.8% for males and 14.5% for females. The percentage of students having tried cannabis at least once varies from 3.8% in Macedonia to 49.1% in Switzerland for males, and from 2.5% in Macedonia to 47.0% in Greenland for females. Anglo-American countries (Canada, United Kingdom, United States) and Switzerland and Greenland have relatively high prevalences of life-time cannabis use, whereas most countries from eastern and northern Europe, except Czech Republic, Hungary, Slovenia and Ukraine, have a low prevalence.
Mediterranean countries, except Spain and to a lesser extent Italy and Portugal (Malta, Israel, Greece and Macedonia) also tend to have relatively low prevalence estimates. Most western European countries rank in between (Belgium, Denmark, France, Germany, Ireland, the Netherlands) On the whole, boys have higher prevalence rates than girls, gender differences generally being greatest in the countries from eastern and southern Europe (Table 1).

Table 1 Description of individual level data for 15-year-olds from the 2002 Health Behaviour in School-aged Children study (HBSC).

Country	Boys				Girls			
	Valid n	Missing data (%)	Life-time cannabis use (%)	Frequent cannabis use (%)	Valid n	Missing data (%)	Life-time cannabis use (%)	Frequent cannabis use (%)
Austria	596	9.6	14.7	1.2	592	7.4	12.7	1.0
Belgium	1 603	3.3	28.5	5.8	1 706	2.7	22.5	2.2
Canada	476	9.8	47.9	14.2	640	5.7	41.6	4.4
Croatia	600	4.2	18.9	2.7	804	2.0	14.1	0.6
Czech Rep	781	3.1	34.6	3.3	844	1.2	26.7	2.4
Denmark	646	2.7	25.8	2.6	699	2.4	21.1	0.3
Estonia	614	0.8	23.0	0.7	645	0.5	11.6	0.0
Finland	827	4.9	11.0	1.0	845	3.4	9.6	0.2
France	1 254	3.6	34.1	6.0	1 269	3.4	26.0	3.1
Germany	800	5.3	27.8	5.1	858	5.1	20.2	1.3
Greenland	82	18.8	44.2	3.6	122	12.2	47.0	2.5
Hungary	506	1.2	16.5	2.2	812	0.7	10.8	0.2
Ireland	326	5.5	27.4	6.1	552	3.8	15.2	2.3
Israel	640	9.6	8.3	1.7	798	7.1	4.2	0.6
Italy	545	0.5	26.9	3.7	677	0.6	17.6	3.0
Greece	619	3.7	8.0	1.3	674	1.0	2.7	0.1
Latvia	440	9.3	16.1	0.9	592	6.3	8.8	0.0
Lithuania	973	0.9	11.2	0.5	920	0.3	4.5	0.0
Malta	275	12.1	9.2	1.1	320	9.6	3.9	0.0
Netherlands	621	2.5	28.5	4.3	629	1.1	23.3	1.3
Poland	1 019	1.7	25.0	2.6	1 109	0.5	11.6	0.3
Portugal	356	6.1	25.5	4.2	387	8.5	14.6	1.8
Russia	1 065	6.4	19.0	0.6	1 345	6.4	9.3	9.3
Slovenia	536	3.8	31.0	5.8	505	1.4	25.4	2.6
Spain	785	4.4	36.1	7.2	879	6.0	33.1	3.6
Sweden	599	2.4	7.6	0.7	600	2.0	6.6	0.5
Switzerland	735	7.0	49.1	13.8	699	6.8	40.1	5.0
Ukraine	711	2.6	33.2	0.6	858	1.5	15.2	0.0
TFYR of Macedonia	660	2.9	3.8	0.0	716	2.2	2.5	0.1
United Kingdom	1 866	6.1	39.5	7.7	2 001	4.7	35.9	3.8
USA	667	11.5	41.6	11.4	803	7.8	30.5	5.5
Total	22 223	7.9	25.8	4.2	24 900	6.7	14.5	1.3

The highest prevalence of frequent use of cannabis is observed in Canada for males (14.2%) and in the United States for females (5.5%), while no use of cannabis more than 40 times in the last year is reported in Macedonia for males and in Estonia, Latvia, Lithuania, Malta and Ukraine for females. The geographical patterning of frequent use is similar to that of life-time prevalence. Anglo-American countries (Canada, United Kingdom, United States) have relatively high instances of frequent use with rates within the same range in Switzerland and Spain. Prevalences are relatively low in most northern, eastern and Mediterranean countries. In between these extremities settles a group of countries with moderate prevalences, consisting mainly of countries of western Europe (Belgium, France, Germany, Greenland, Italy, Portugal and Slovenia). Frequent cannabis use is more common among boys than girls (Table 1) (see also Ter Bogt, Fotiou & Nic Gabhainn [43]).

Missing data on the questions about cannabis use are rare in Italy for males (0.5%) and in Lithuania for females (0.3%), but are substantial in Greenland for both genders (18.8% males; 12.2% females). Table 2 shows a description of characteristics found for the different participating countries, derived from the UN/ECE economic database and the ESPAD study [3]. National per capita PCE, an indicator of economic prosperity, is lowest for Macedonia (PCE = 3.7) and highest for the United States (PCE = 24.4). Youth unemployment rates also differ considerably between countries, with Switzerland ranking lowest (5.6%) and Macedonia highest (56.1%). The data from the ESPAD Study show high proportions of respondents indicating having
heard of marijuana or hashish, with rates varying from 76% in Greenland to 98% in Italy. The proportions of respondents indicating the availability of cannabis as being 'fairly easy' or 'very easy' is lowest in Malta and Ukraine (11%) and highest in the United States (78%). The percentage of respondents indicating that some, most or all of their friends use marijuana or hashish is low in Hungary (2%) and high in the United States (45%).

Results of multi-level modelling

The results of the HGLM were calculated for male and female students separately. The individual level criteria are life-time cannabis use and frequent cannabis use. Different models were calculated for different country level predictors and the complete multilevel model includes all predictors simultaneously. Table 3 shows the estimated coefficients, standard errors, degrees of freedom and significance levels by model and gender.

The probability that a male student will use cannabis at least once in his life is estimated as between 0.212 and 0.243 depending on the calculated model. The intercept is the expected log-odds of cannabis use for a student with mean values on the predictors. The expected log-odds corresponds to a probability of $1/[1+ \exp(-\gamma oo)]$, which is the population average for this group. The probability estimates for frequent use vary between 0.022 and 0.038 depending on the model. For female students, the probability of life-time cannabis use is estimated between 0.136 and 0.178 and the probability of frequent use between 0.007 and 0.016.

According to the economic model, the odds of using cannabis at least once in a life-time and of using cannabis frequently are higher in countries with high PCE, for both genders. Neither youth unemployment nor the interaction between PCE and youth unemployment accounted for any of the variance in cannabis use. Within the peer culture model, for both genders perceived availability was associated significantly with both life-time and in frequent use. In countries where availability is perceived as easy, the odds of using cannabis are higher. However, in this model acquaintance with cannabis and friends use did not predict cannabis use. Within the drug climate model both the 1999 ESPAD/MTF rates of life-time and 30-day prevalences were associated with current cannabis use. Analysis of the missing data indicated that these did not have any predictive value for either the lifetime or frequent use of cannabis. In the complete model, which included the significant predictors identified from the first three models, the 1999 ESPAD/MTF rates of both life-time and last month prevalences were significant predictors of current cannabis use. The other correlates of cannabis use from the economic and peer culture-models, PCE and perceived availability did not reach statistical significance. This indicates that the existing drug climate (operationalized as the presence of groups of cannabis using young people in a country) is the strongest predictor of current cannabis use. It should be noted, however, that in this last model only 21 countries remain in the analysis. Finally, the analysis of the factors associated with cannabis use shows that, even though females are less likely to use

cannabis than males, the relationships between the second level predictors and reported individual use similar for both genders.

Table 2 Description of level two data for country characteristics.

Country	UN/ECE private per capita consumer expenditure(PCE/1000, in dollars)	UN/ECE youth unemployment rate	ESPAD acquaintance:% heard of cannabis	ESPAD availability: % very easy or fairly easy	ESPAD friends: belief about % some, most or all of my friends use cannabis
Austria	16.3				
Belgium	15.1	15.3			
Canada	16.7	12.8			
Croatia	5.0	37.3	93.0	29.0	19.0
Czech Rep	8.0	16.6	98.0	50.0	11.0
Denmark	14.0	8.3	96.0	57.0	23.0
Estonia	5.7	22.2	93.0	19.0	12.0
Finland	13.3	19.9	91.0	20.0	
France	14.7	18.7	95.0	44.0	34.0
Germany	15.7	8.4			
Greenland			76.0	13.0	11.0
Hungary	6.7	10.8	95.0	19.0	2.0
Ireland	14.1	6.2	92.0	59.0	24.0
Israel	10.5	18.5			
Italy	15.9	27.0	98.0	43.0	44.0
Greece	11.5	28.0	94.0	33.0	10.0
Latvia	4.8	20.7	93.0	18.0	12.0
Lithuania	5.4	30.2	86.0	15.0	7.0
Malta	5.9	15.4	96.0	11.0	3.0
Netherlands	14.6	5.8	87.0	41.0	17.0
Poland	6.4	41.0	86.0	30.0	8.0
Portugal	11.0	9.2	87.0	26.0	16.0
Russia	4.3	18.0	95.0	22.0	4.0
Slovenia	9.5	16.1	96.0	47.0	26.0
Spain	12.6	20.8			
Sweden	12.8	11.8	97.0	26.0	6.0
Switzerland	18.3	5.6			
Ukraine	2.4		78.0	11.0	12.0
TFYR of Macedonia	3.7	56.1			
United Kingdom	17.2	10.5	96.0	52.0	34.0
USA	24.4	10.6		78.0	45.0

Table 3 Results for the hierarchical generalized linear model (HGLM): estimated coefficients, standard errors, degrees of freedom and significance levels by model and gender.

Model	Country level predictor	Individual level criterion	Parameter	Coefficient	SE	df	P	1/(1+ exp{-γoo})
Males								
Economic	Intercept	Life-time cannabis use	γ_{00}	-1.205	0.128	24	0.000	0.231
	Private consumer expenditure		γ_{01}	0.067	0.033	24	0.052	
	Youth unemployment rate		γ_{02}	-0.014	0.018	24	0.432	
	PCE x Youth unemployment		γ_{03}	0.004	0.166	24	0.982	
Economic	Intercept	Frequent cannabis use	γ_{00}	-3.417	0.142	24	0.000	0.032
	Private consumer expenditure		γ_{01}	0.137	0.036	24	0.001	
	Youth unemployment rate		γ_{02}	-0.012	0.019	24	0.553	
	PCE x youth unemployment		γ_{03}	0.030	0.186	24	0.873	
Peer Culture	Intercept	Life-time cannabis use	γ_{00}	-0.310	0.104	15	0.000	0.212
	Acquaintance		γ_{01}	-0.028	0.028	15	0.336	
	Availability		γ_{02}	0.023	0.010	15	0.040	
	Belief about friends use		γ_{03}	0.015	0.013	15	0.249	
Peer Culture	Intercept	Frequent cannabis use	γ_{00}	-3.735	0.116	15	0.000	0.023
	Acquaintance		γ_{01}	-0049	0.031	15	0.136	
	Availability		γ_{02}	0.034	0.011	15	0.007	
	Belief about friends use		γ_{03}	0.028	0.013	15	0.051	
Drug Climate	Intercept	Life-time cannabis use	γ_{00}	-0.310	0.095	22	0.000	0.213
	Life-time prevalence in 1999		γ_{01}	0.054	0.009	22	0.000	
Drug Climate	Intercept	Frequent cannabis use	γ_{00}	-3.780	0.122	22	0.000	0.022
	30 days prevalence in 1999		γ_{01}	0.136	0.020	22	0.000	
Missing data	Intercept	Life-time cannabis use	γ_{00}	-0.136	0.145	29	0.000	0.243
	Missing data		γ_{01}	0.033	0.037	29	0.383	
Missing data	Intercept	Frequent cannabis use	γ_{00}	-3.233	0.193	29	0.000	0.038
	Missing data		γ_{01}	0.072	0.049	29	0.154	
Complete model	Intercept	Life-time cannabis use	γ_{00}	-1.242	0.086	17	0.000	0.224
	Private consumer expenditure		γ_{01}	-0.021	0.030	17	0.508	
	Availability		γ_{02}	0.004	0.013	17	0.779	
	Life-time prevalence in 1999		γ_{03}	0.049	0.015	17	0.004	
Complete model	Intercept	Frequent cannabis use	γ_{00}	-3.705	0.107	17	0.000	0.024
	Private consumer expenditure		γ_{01}	0.026	0.035	17	0.477	
	Availability		γ_{02}	0.019	0.013	17	0.161	
	Life-time prevalence		γ_{03}	0.063	0.028	17	0.037	

	in 1999							
Females								
Economic	Intercept	Life-time cannabis use	γ_{00}	-0.656	0.139	24	0.000	0.160
	Private consumer expenditure		γ_{01}	0.087	0.036	24	0.023	
	Youth unemployment rate		γ_{02}	-0.017	0.019	24	0.401	
	PCE x Youth unemployment		γ_{03}	-0.010	0.181	24	0.957	
Economic	Intercept	Frequent cannabis use	γ_{00}	-4.467	0.186	24	0.000	0.011
	Private consumer expenditure		γ_{01}	0.180	0.047	24	0.001	
	Youth unemployment rate		γ_{02}	-0.003	0.025	24	0.904	
	PCE x youth unemployment		γ_{03}	0.138	0.243	24	0.575	
Peer Culture	Intercept	Life-time cannabis use	γ_{00}	-1.846	0.127	15	0.000	0.136
	Acquaintance		γ_{01}	-0.007	0.034	15	0.833	
	Availability		γ_{02}	0.030	0.012	15	0.026	
	Belief about friends use		γ_{03}	0.018	0.015	15	0.275	
Peer Culture	Intercept	Frequent cannabis use	γ_{00}	-4.916	0.221	15	0.000	0.007
	Acquaintance		γ_{01}	.-0.012	0.061	15	0.851	
	Availability		γ_{02}	0.051	0.021	15	0.027	
	Belief about friends use		γ_{03}	0.043	0.025	15	0.110	
Drug Climate	Intercept	Life-time cannabis use	γ_{00}	-1.798	0.115	22	0.000	0.142
	Life-time prevalence in 1999		γ_{01}	0.065	0.011	22	0.000	
Drug Climate	Intercept	Frequent cannabis use	γ_{00}	-4.969	0.173	22	0.000	0.007
	30 days prevalence in 1999		γ_{01}	0.192	0.028	22	0.000	
Missing data	Intercept	Life-time cannabis use	γ_{00}	-1.530	0.166	29	0.000	0.178
	Missing data		γ_{01}	0.085	0.054	29	0.126	
Missing data	Intercept	Frequent cannabis use	γ_{00}	-4.113	0.240	29	0.000	0.016
	Missing data		γ_{01}	0.126	0.078	29	0.118	
Complete model	Intercept	Life-time cannabis use	γ_{00}	−1.805	0.102	17	0.000	0.141
	Private consumer expenditure		γ_{01}	-0.007	0.036	17	0.860	
	Availability		γ_{02}	0.008	0.015	17	0.595	
	Life-time prevalence in 1999		γ_{03}	0.050	0.018	17	0.012	
Complete model	Intercept	Frequent cannabis use	γ_{00}	-4. 942	0.193	17	0.000	0.007
	Private consumer expenditure		γ_{01}	0.061	0.063	17	0.346	
	Availability		γ_{02}	0.014	0.023	17	0.544	
	Life-time prevalence in 1999		γ_{03}	0.121	0.050	17	0.028	

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DISCUSSION

Occasional cannabis use has become normative among a substantial minority of adolescents especially in Anglo-American countries, Switzerland, Greenland and Spain. A substantial minority of North American and European high school-age students have tried or use cannabis. Anglo-American countries (Canada, United Kingdom, United States) and Switzerland and Greenland have a relatively high prevalence of life-time cannabis use, whereas most countries from eastern and northern Europe, and most Mediterranean countries have relatively low prevalence figures. Countries from western Europe fall between these extremes. The patterning of frequent cannabis use is similar. Anglo-American countries, Switzerland and Spain have relatively high instances of frequent use. Prevalences are relatively low in most northern, eastern and Mediterranean countries, and most countries from western Europe hold an intermediate position.

The relative amount of missing data on the cannabis use item differs greatly between the countries. Our analysis cannot separate the possible reasons for missing data, such as forgetting to answer, poor comprehension of the question and fear appraisal because of the illicit character of the behavior. However, no systematic relationship between the amount of missing data and lifetime prevalence and frequent use of cannabis was found.The absence of a relationship could reflect that nonresponders do not differ from responders in terms of drug use behaviour, a finding that has already been reported elsewhere [44].

We sought to model the associations between macroeconomic indicators—PCE, youth unemployment—and manifestations of existing drug culture and cannabis use among 15-year-olds. Our results illustrate that in wealthy countries young people use cannabis more frequently. This may stem from increased leisure opportunities for larger segments of the population in wealthier countries. These opportunities include cannabis use and young people may be the first and most frequent users of the drug. Within Europe large differences in social wealth still exist between countries. Across Europe we may expect an increase in cannabis use, particularly in the central and eastern European regions where cannabis use is currently relatively infrequent, and marketorientated economies are developing rapidly.

Another important phenomenon concerns growing economic wealth and gender. Throughout Europe and North America, boys tend to report higher cannabis prevalence and more frequent drug use. The differences between boys and girls are generally smaller in the wealthier countries in this sample. Patterns of drug use in Anglo-American and western countries may be indicative of potential changes in these patterns in Southern, Central and Eastern European countries, as increasing wealth appears to be associated with a higher prevalence of cannabis use among females. Accordingly, gender differences, expressed traditionally as females' using cannabis less often than males, may also decrease in the near future.

Although we did not find an association between cannabis use and youth unemployment we cannot conclude that unemployed young people do not use more cannabis. An overall socio-economic measure such as youth unemployment may, by definition, be too general to assess the potential link between individual marginality and drug use. Individual unemployment, or deprivation conceptualized as perceived social marginality, associated as such with personal psychological characteristics and weak interpersonal ties, may influence drug use but these factors were not within the remit of this study. Previously measured cannabis use was

conceptualized as a proxy measure of an objectified 'drug climate': the existence of a group of users from which younger people can learn where to obtain cannabis and how to use it.

We found evidence that this aspect of drug culture is related to the behaviour of the younger members of the population. Older users may pass on their knowledge and habits to the willing and interested among their younger peers. Next, 'peer culture' is an important facilitator of cannabis use: the perception young people have of their social environment is associated with their own drug use. young people living in countries where knowledge of the existence of the drug is disseminated throughout youth culture, where they think that many of their peers use drugs and where availability (through friends) is perceived as easy, are more likely to use cannabis.
The generalized perception of an existing peer drug culture within a country is associated both with experimentation and frequent use of the drug. Within 'peer culture', perceived availability stands out as the single most important predictor.

Thus, our results show that countries' wealth (PCE) the existence of drug-using older youngsters ('drug climate') and young people's generalized perception that cannabis is readily available ('peer culture') are associated with cannabis use. 'Drug climate' appeared to be the strongest predictor of cannabis use among 15-year-olds, both for girls and boys, and it is the only remaining significant predictor left in the full model. As both PCE and availability are correlated with 'drug climate', this set of relationships may indicate mediation [45], i.e. 'drug climate' mediates the relationship between wealth and availability on one side and cannabis use on the other.

Historically, the sequence may be that wealth and availability foster the emergence of a drug-using community of young people but once this community exists, it plays a crucial role in the socialization of younger, potential cannabis users. We speculate that leisure opportunities for a rising middle class may facilitate drug use among the most bohemian segments of its youth, and that these behaviours trickle down to (some) young people with a lower social economic status once they have the money and opportunity to buy drugs. Future research should explore this process of mediation in more detail, both theoretically and historically.

However, our data also show that wealth is by no means a sufficient cause for cannabis use. Within the group of countries with high PCE large differences exist in use of the drug. For example, the Anglo-American countries all have high life-time prevalences and relatively large groups of frequent users while some Scandinavian countries, for example Sweden, report extremely low proportions of both experimenters and frequent users. Policy may make a difference. While we were able to incorporate macro-economic indicators, it was impossible to model other possible factors influencing drug use. To our knowledge, there exists no cross-nationally comparable policy indicators, and therefore our study is limited in this context. Along with uncovering the mechanisms through which macro-economic indicators work, cross-national research should be directed at operationalizing comparable policy indicators and identifying those policies that prevent groups of young people from becoming frequent users, or that are successful in breaking the link between drug climate and use.

Large-scale cross-national research on the determinants of cannabis use is scarce. The strength of this study is that the same survey was carried out in each country with the same questionnaire and sampling strategy. This is rare, as most studies of this kind are based on secondary analyses of national surveys with different conceptual frameworks. The data

presented here make it possible to explore cross-nationally some of the factors that are associated with cannabis use. Nevertheless, we acknowledge study limitations. First, the HBSC survey was conducted in classroom settings. The advantage of this is that response rates in classrooms are high, but children who drop out of school or play truant are less likely to be included in school surveys. Because these are both known risk factors for cannabis use their exclusion could bias school survey results, leading to lower cannabis prevalence estimates. Secondly, the cross-sectional study design allowed us to report on associations of country level variables for cannabis use, without any assessment of causality. It would be valuable to try to combine largescale surveys with a longitudinal design to study causal mechanisms in greater detail. Thirdly, only aggregated data on country levels were used in our models to predict cannabis use. These models would have been more sophisticated if predictors at the individual level had been added, i.e. in addition to aggregated data on PCE, unemployment drug climate and peer-use measures of individual spending power, job status, contacts in the drug scene and cannabis use by friends. These data would have enabled a more precise picture to be drawn of the link between macrofactors and microfactors and their interaction, and drug use. Our results provide evidence for the value of cross-national comparison of the antecedents of cannabis use. The challenge for future cross-national studies is to include aggregated and non-aggregated predictors in a longitudinal design to provide a better understanding of the social, economic and personal determinants of cannabis use.

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