Is universal prevention against youths' substance misuse really universal? Gender-specific effects in the EU-Dap school-based prevention trial

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ABSTRACT

Background: Studies of effectiveness of school-based prevention of substance misuse have generally overlooked gender differences. The purpose of this work was to analyse gender differences in the effectiveness of a new European school-based curriculum for prevention of substance misuse among adolescents.

Methods: The European Drug Abuse Prevention (EU-Dap) trial took place in seven European countries during the school year 2004–05. Schools were randomly assigned to either a control group or a 12-session standardised curriculum (''Unplugged'') based on a comprehensive social influence model. The analytical sample consisted of 6359 students (3324 boys and 3035 girls). The use of cigarettes, alcohol and illicit drugs, adolescents' knowledge and opinions about substances, as well as social and personal skills were investigated through a self-completed anonymous questionnaire administered at enrolment and 3 months after the end of the programme. Adjusted Prevalence Odds Ratios were calculated as the measure of association between the intervention and behavioural outcomes using multilevel regression modelling.

Results: At enrolment, boys were more likely than girls to have used cannabis and illicit drugs, whereas girls had a higher prevalence of cigarette smoking. At the follow-up survey, a significant association between the programme and a lower prevalence of all behavioural outcomes was found among boys, but not among girls. Age and self-esteem emerged as possible modifiers of these gender differences, but effects were not statistically significant.

Conclusions: Comprehensive social influence school curricula against substance misuse in adolescence may perform differently among girls and boys, owing to developmental and personality factors.

There are well-known gender differences in substance use, including age of start, pattern of use, risk factors, access to treatment and even treatment effectiveness.[1 2]

Concerning primary prevention, few studies have systematically investigated gender differences in the effectiveness of interventions.[3] When differences have been found, the general evidence seems to be in favour of a higher effectiveness among girls.[3] However, limiting the evidence to school-based interventions, the findings appear rather mixed. For example, project Self-Management and Resistance Training (SMART) was effective on girls but had virtually no effect on boys,[4] such as Adolescent Learning Experiences in Resistance Training (ALERT) Plus.[5] On the contrary, the *keepin'it* REAL programme showed more beneficial effects on alcohol and cigarette use, and anti-drug norms among the boys.[6] The Oslo Youth Study showed effects only among baseline non-smoking boys and no treatment effects at all for girls.[7] In the North Karelia Youth Programme the effect on tobacco consumption was slightly more pronounced among boys than among girls.[8] Project Towards No Drug Abuse was effective in preventing marijuana use among male non-users.[9] The Drug Abuse Resistance Education (DARE) and DARE Plus programmes were effective on tobacco, alcohol and polydrug use among boys but not effective at all among girls.[10] Three out of five of the programmes effective on boys were based on the social influence approach (Oslo Youth Study, North Karelia Youth Programme, Project Towards No Drug Abuse), as well as Project SMART and ALERT Plus, which were more effective among girls.

One reason behind the inconsistent results achieved in the evaluation of programme effects may be that effectiveness is not homogeneous across subgroups of the target population. For instance, some prevention studies found that the programme efficacy was higher among baseline users.[5 11] Such differences could be related to programme delivery or to personal characteristics of the pupils (eg, age, stage of use, development). Given the inconsistent results observed in the literature, gender differences become an important issue in all intervention studies. In fact, if a sensitive subgroup exists, this is not only important to guide the programme's application, but it may also cast light on the mechanisms of the programme's effect.

The objective of this work was to analyse gender differences in the effectiveness of a new European school-based curriculum developed and assessed in the European Drug Abuse Prevention (EU-Dap) trial, and to analyse possible explanations for observed differences. The EU-Dap trial is a European multicentric study comparing a comprehensive social influence school curriculum against substance use with traditional programmes in use in local schools. Results of the overall effectiveness of the programme in reducing the probability of use of cigarettes, cannabis and illicit drugs, as well as of recent drunkenness episodes, are published elsewhere.[12]

METHODS

Study design and study population

The study design and the study population of the EU-Dap trial have been described in detail

elsewhere[13] and will only be summarised here. The trial took place simultaneously in seven European countries during the school year 2004–5. Schools were selected on the basis of inclusion criteria and of willingness to cooperate, and randomly assigned to either intervention (102 schools) or control group (68 schools). Of these schools, 77 intervention schools and 64 control schools continued participation throughout the study. A questionnaire investigating substance use and personal and social skills together with other individual and family characteristics was administered at the beginning of the school year (October 2004) and approximately 3 months after the end of the programme (May 2005). The intervention took place during the school year and consisted of a 12-session standardised curriculum (called "Unplugged" in the English version) based on a comprehensive social influence model.[14] The programme was taught using interactive techniques and focused on developing and enhancing interpersonal skills (group dynamics, assertiveness, problem-solving, creative thinking and self-control) and intrapersonal skills (verbal and non-verbal communication, expression of negative feelings, coping skills). Sessions on normative education and information on the effects of smoking and drug use were also provided. In one-third of the intervention schools the curriculum was complemented with a series of three seminars for the parents of the students while, in an additional one-third, two students from each class conducted a "peer-based" intervention in support of the curriculum taught by one of the class teachers. For the purpose of this analysis, all intervention arms were collapsed together (intervention group) and compared with the control group.

The study sample at baseline consisted of 7079 students (3532 in control schools and 3547 in intervention schools). The study sample at the 3-month post-test follow-up consisted of 6370 students who participated in both the baseline and the follow-up survey. Of these students, 11 did not report their sex, leaving an analytical sample of 3324 (52.2%) boys and 3035 girls (47.8%). The proportion retained at follow-up was 90.3% among boys and 92.3% among girls ($p = 0.003$).

Information on substance use and other covariates

Information on substance use was obtained by means of a self-completed questionnaire, administered anonymously in the classroom. Substance use was investigated both as use ever in life and as use in the past 30 days. Concerning alcohol drinking, the number of episodes of drunkenness in the past 30 days was chosen as the outcome of interest in this analysis, rather than indicators of average alcohol consumption, because it appears to be a stronger predictor of subsequent escalation of use.[15]

A question aiming to assess self-esteem, encompassing 10 items with response alternatives on a four-point Likert scale (strongly agree/agree/disagree/strongly disagree), resulted in two different subscales (positive and negative). Since the internal reliability of the positive scale (Cronbach $\alpha = 0.69$) was higher than the reliability of the negative scale (Cronbach $\alpha = 0.64$), only the former was used in this analysis. The positive self-esteem subscale was composed of the following five items: "I feel I have a number of good qualities"; "I am able to do things as well as most other people"; "I am quite good at sports"; "My being happy is important to my parents"; and "I have plenty of interests and hobbies". Agreement was defined as an answer of "strongly agree/agree" on a four-point Likert scale. For the purpose of this analysis, the total score on the scale was dichotomised as low self-esteem (score 0–3) and high self-esteem (score 4–5).

Positive expectations towards substances were investigated through the answers to the question of whether one would expect to (1) feel more relaxed or (2) become more popular using tobacco, alcohol, cannabis or other illicit drugs. The question was put to all pupils, independently of their substance use. Answering agree/definitely agree to the relaxation item was used as an indicator of positive expectancy towards the rewarding properties of the substance itself, whereas the corresponding answer to the popularity item was used as an indicator of positive expectancy towards the social effects of substance use.

The age of the students was calculated based on year of birth.

Statistical methods

From the information on substance use, eight non-mutually exclusive outcome variables were derived, all of them with reference to the 30 days preceding the survey: (1) any cigarette smoking, defined as smoking at least one cigarette in the past 30 days; (2) frequent cigarette smoking, defined as smoking six or more cigarettes in the past 30 days; (3) daily cigarette smoking, defined as smoking 20 or more cigarettes in the past 30 days; (4) any episode of drunkenness, defined as at least one episode in the past 30 days; (5) frequent drunkenness, defined as three or more episodes in the past 30 days; (6) any cannabis use, defined as use at least once in the last 30 days; (7) frequent cannabis use, defined as use on three or more occasions in the past 30 days; (8) any illicit drug use, defined as use of any illicit drug (including cannabis) in the past 30 days. All outcome variables were analysed as dichotomous (yes/no).

Prevalence Odds Ratios (PORs) and their corresponding confidence intervals (95% CI) were calculated as the measure of association between experimental conditions (all intervention arms pooled together) and behavioural outcomes, separately by gender.

In order to take into account the hierarchical structure of the data and the cluster effect, a multilevel modelling approach was followed in the analysis of the data.[16] Data were analysed with MLwiN V.2.02 software.[17] The restricted iterative generalised least squares (RIGLS) estimation procedure was used to estimate the random parameters, since it is considered to lead to unbiased estimates.[18] Marginal quasi likelihood (MQL) and "first order" were then selected to include estimated residuals in the RIGLS procedure, and to control the degree of approximation. Multivariate multilevel models were fitted using three grouping levels: centre, class and students. The use of class as group level instead of school, the unit of randomisation, is justified by the higher intraclass correlation coefficient at the level of class than at the level of school.[19] Differences in prevalence of use between centres were adjusted for by including in the model the baseline centre prevalence of current daily smoking, defined as smoking 20 or more cigarettes in the last 30 days. Finally, all estimates were adjusted by individual baseline behaviour of the corresponding outcome.

We also conducted a tabular analysis comparing intervention and control group, separately by gender, as regards to the proportion of students who at the end of follow-up had transitioned to higher (progression) or lower (regression) frequency of use of tobacco, alcohol and drugs. In order to track these transitions, the following mutually exclusive categories of use were used: (1) non-smoker (no cigarette smoking in the past 30 days); (2) occasional smoker (1–19 cigarettes in the past 30 days); (3) daily smoker (20 or more cigarettes in the past 30 days); (4) no drunkenness (no episodes of drunkenness from alcohol drinking in the past 30 days); (5) drunkenness (one or more episodes of drunkenness in the past

Table 1 Main characteristics of the analytical sample at baseline, by gender and experimental group, the European Drug Abuse Prevention (EU-Dap), October 2004

	Boys		Girls	
	Intervention n = 1695	Control n = 1629	Intervention n = 1497	Control n = 1538
Characteristic	**N (Col%)**	**N (Col%)**	**N (Col%)**	**N (Col%)**
Centre				
Spain	85 (5.0)	106 (6.5)	74 (4.9)	106 (6.9)
Germany	171 (10.1)	91 (5.6)	187 (12.5)	112 (7.3)
Belgium	243 (14.3)	172 (10.6)	104 (6.9)	115 (7.5)
Stockholm	274 (16.2)	212 (13.0)	226 (15.1)	213 (13.8)
Greece	197 (11.6)	165 (10.1)	170 (11.4)	156 (10.1)
Austria	156 (9.2)	214 (13.1)	127 (8.5)	216 (14.0)
Italy, centre 1 (Turin)	335 (19.8)	407 (25.0)	298 (19.9)	452 (29.4)
Italy, centre 2 (Novara)	88 (5.2)	167 (10.3)	181 (12.1)	41 (2.7)
Italy, centre 3 (L'Aquila)	146 (8.6)	95 (5.8)	130 (8.7)	127 (8.3)
Age				
11–12 years	424 (25.0)	418 (25.7)	366 (24.4)	415 (27.0)
13–18 years	1271 (75.0)	1211 (74.3)	1131 (75.6)	1123 (73.0)
Behaviours: smoking				
Smoked cigarettes ever in life	544 (32.3)	577 (35.8)	488 (32.8)	520 (34.0)
Smoked cigarettes: past 30 days	157 (9.8)	246 (15.7)	238 (16.5)	227 (15.2)
Smoked 6+ cigarettes: past 30 days	91 (5.7)	154 (9.9)	131 (9.1)	136 (9.1)
Smoked 20+ cigarettes: past 30 days	60 (3.7)	100 (6.4)	81 (5.6)	86 (5.8)
Behaviours: drunkenness episodes*				
Been drunk ever in life	398 (23.5)	433 (26.8)	316 (21.2)	314 (20.5)
Been drunk: past 30 days	93 (5.6)	118 (7.4)	75 (5.1)	87 (5.7)
Been drunk 3+ times: past 30 days	28 (1.7)	34 (2.1)	19 (1.3)	27 (1.8)
Behaviours: cannabis use*				
Used cannabis ever in life	123 (7.3)	169 (10.5)	90 (6.0)	88 (5.7)
Used cannabis: past 30 days	51 (3.0)	86 (5.4)	36 (2.4)	36 (2.4)
Used cannabis 3+ times: past 30 days	28 (1.7)	53 (3.3)	22 (1.5)	16 (1.0)
Behaviours: illicit drugs use*†				
Used any illicit drug† ever in life	162 (9.6)	204 (12.6)	126 (8.4)	142 (9.2)
Used any illicit drug:† past 30 days	75 (4.4)	111 (6.9)	53 (3.5)	71 (4.6)
Score on positive self-esteem*				
High (4–5)	1394 (87.0)	1347 (88.4)	1185 (82.7)	1237 (83.8)
Low (0–3)	208 (13.0)	177 (11.6)	248 (17.3)	240 (16.2)
Positive expectations towards*				
Smoking: feel relaxed	426 (26.3)	435 (28.0)	398 (27.3)	392 (26.4)
Smoking: become more popular	343 (21.2)	331 (21.2)	262 (17.9)	312 (20.9)
Alcohol: feel relaxed	334 (20.5)	346 (22.0)	299 (20.5)	249 (16.7)
Alcohol: become more popular	279 (17.2)	273 (17.4)	216 (14.8)	217 (14.5)
Cannabis: feel relaxed	650 (39.6)	695 (44.1)	567 (38.8)	541 (36.2)
Cannabis: become more popular	339 (20.7)	350 (22.2)	266 (18.1)	286 (19.1)

*Proportions calculated out of number of subjects answering the question
†Cannabis, tranquillisers, LSD, amphetamines, crack, cocaine, heroin, ecstasy, GHB, methadone, hallucinogens, ketamine.
Col%, column percentage.

30 days); (6) no cannabis use (no cannabis use in the past 30 days); (7) cannabis use (use of cannabis on one or more occasions in the past 30 days). Thus, a case of progression was considered every time a student reported at follow-up a more frequent use than at baseline, whereas a report of less frequent use was considered as regression. Students who fell into the same category of use at baseline and at follow-up were considered as staying stable in that stage of use.

RESULTS

The characteristics of the analytical sample at baseline are shown in table 1, separately by gender and experimental condition. The age structure did not differ between genders.

At enrolment, boys were more likely than girls to have used cannabis (4.2% vs 2.4%, p<0.001) and illicit drugs (5.6% vs 4.1%, p = 0.005) at least once in the past 30 days, whereas girls had a higher prevalence of any cigarette smoking in the past 30 days (15.9% vs 12.7%, p<0.001). The proportion reporting recent episodes of drunkenness was slightly higher among boys, but the difference was not statistically significant (p = 0.07). Also, at baseline, more boys in the control group were current users of all substances than boys in the intervention group; however, this imbalance was not seen among girls.

At baseline, a lower proportion of girls scored high on the positive self-esteem score (83.2% vs 87.7%, p<0.001). In contrast, no appreciable gender differences were seen concerning positive expectations towards smoking, although boys endorsed more often than girls positive expectations towards alcohol ("feel relaxed": 21.2% vs 18.5%, p = 0.008, "become more popular": 17.3% vs 14.7%, p = 0.005) and cannabis ("feel relaxed": 41.8% vs 37.5%, p = 0.001, "become more popular": 21.4% vs 18.6%, p = 0.006).

Table 2 Adjusted Prevalence Odds Ratios and 95% CIs of substance use in the past 30 days among boys and girls, the European Drug Abuse Prevention (EU-Dap) study short-term follow-up, May 2005

	Boys			Girls		
Indicator of use	**n/N* Control**	**n/N* Intervention**	**Adjusted POR (95% CI)**	**n/N* Control**	**n/N* Intervention**	**Adjusted POR (95% CI)**
Any smoking	304/1509	220/1563	0.88 (0.66 to 1.18)	300/1453	276/1412	0.86 (0.65 to 1.15)
Frequent smoking	211/1509	126/1563	0.68 (0.50 to 0.93)	175/1453	171/1412	1.07 (0.74 to 1.55)
Daily smoking	159/1509	80/1563	0.49 (0.34 to 0.71)	117/1453	113/1412	0.99 (0.64 to 1.52)
Any drunkenness	209/1548	136/1623	0.64 (0.49 to 0.85)	143/1501	117/1456	0.86 (0.63 to 1.18)
Frequent drunkenness	80/1548	51/1623	0.68 (0.45 to 1.04)	39/1501	25/1456	0.66 (0.37 to 1.18)
Any cannabis	161/1596	88/1668	0.62 (0.45 to 0.85)	63/1528	64/1478	1.05 (0.70 to 1.58)
Frequent cannabis	106/1596	54/1668	0.60 (0.40 to 0.91)	30/1528	34/1478	1.17 (0.59 to 2.33)
Any illicit drug	194/1615	115/1686	0.64 (0.48 to 0.86)	97/1534	107/1495	1.40 (0.95 to 2.04)

*Number of users out of the total number of students answering the question at follow-up (multilevel adjusted model).
POR, Prevalence Odds Ratio (intervention vs control) estimated using multilevel model 3 (RIGLS bin first order MQL with three levels), adjusted for centre prevalence of daily smoking and baseline use of the corresponding substance.

On the follow-up survey conducted 3 months after the completion of the experimental school curriculum, significant programme effects with decreased risks in almost all indicators of substance use were observed among boys (table 2). Among girls, there was an indication of decreased risk of frequent drunkenness in the past 30 days, but the estimate did not attain the statistical significance.

This gender difference was also found in centres where significant programme effects could be detected on the whole sample, and was maintained even after exclusion of current users at baseline (not shown).

Some gender differences were found concerning the transitions between different stages of substance use from baseline to follow-up. Among boys, the proportion progressing to more advanced stages of smoking was lower among those who received the experimental curriculum than among controls, whereas the proportion regressing was higher (table 3). Among girls a similar but less pronounced pattern was observed (table 4). Daily smokers were not affected by the intervention in either gender, but among girls a higher proportion of the control group regressed from daily use compared with the intervention group. Similar patterns emerged in the use of other substances: delayed progression and enhanced regression were higher in the intervention group among boys, whereas no, minimal or reverse differences were observed among girls.

When the gender-specific estimates of programme effect were analysed in separate strata of the self-esteem indicator, some differences emerged (table 5), although they were based on not statistically significant estimates. Among boys, the level of self-esteem did not substantially affect the curriculum effect seen in the whole group. Among girls, the programme was rather associated with a tendency towards unfavourable effect in the group categorised as having low self-esteem (table 5).

When stratifying the programme effects by gender and positive expectancies indicators (''feel more relaxed'' and ''become more popular'', respectively), the results closely matched the main results (data not shown).

In a separate analysis by gender and age group (table 6), non-statistically significant associations with risk reduction for the exposed to the experimental curriculum compared with controls were found for frequent and daily smoking, as well as for recent drunkenness, among girls in the youngest age group (11–12 years at baseline), whereas among boys the associations were similar in both age groups.

DISCUSSION

In a multinational sample of European students we found pronounced gender differences in the effectiveness of a comprehensive social influence school-based programme for the prevention of substance misuse. These differences indicated a greater preventive potential of the curriculum among boys, consistent across diverse geographical locations, suggesting that cultural and normative differences are unlikely to account for this observation.

Table 3 Transitions in substance use between baseline and follow-up in the European Drug Abuse Prevention (EU-Dap) study, October 2004–May 2005: boys

	Transition at follow-up (%)				Transition at follow-up (%)			
Baseline use during the past 30 days*	**Intervention group**				**Control group**			
	N	**Stable**	**Regressed†**	**Progressed‡**	**N**	**Stable**	**Regressed†**	**Progressed‡**
Non-smoker (no cigarette smoking)	1410	91.7	–	8.3	1274	90.2	–	9.8
Occasional smoker (1–19 cigarettes)	94	37.2	46.8	16.0	137	36.5	35.0	28.5
Daily smoker (20+ cigarettes)	59	83.0	17.0	–	98	81.6	18.4	–
No drunkenness	1531	94.1	–	5.9	1436	90.3	–	9.7
Drunkenness	92	50.0	50.0	–	112	62.5	37.5	–
No cannabis use	1620	96.5	–	3.5	1511	93.8	–	6.2
Cannabis use	48	66.7	33.3	–	85	78.8	21.2	–

*Mutually exclusive categories of use.
†Lower frequency of use reported at follow-up compared with baseline.
‡Higher frequency of use reported at follow-up compared with baseline.

Table 4 Transitions in substance use between baseline and follow-up in the European Drug Abuse Prevention (EU-Dap) study, October 2004–May 2005: girls

Baseline use during the past 30 days*	Transition at follow-up (%)				Transition at follow-up (%)			
	Intervention group				Control group			
	N	Stable	Regressed†	Progressed‡	N	Stable	Regressed†	Progressed‡
Non-smoker (no cigarette smoking)	1183	91.0	–	9.0	1237	90.1	–	9.9
Occasional smoker (1–19 cigarettes)	151	47.7	37.1	15.2	133	50.4	24.8	24.8
Daily smoker (20+ cigarettes)	78	87.2	12.8	–	83	81.9	18.1	–
No drunkenness	1385	93.9	–	6.1	1417	93.4	–	6.6
Drunkenness	71	46.5	53.5	–	84	58.3	41.7	–
No cannabis use	1442	97.4	–	2.6	1492	97.4	–	2.6
Cannabis use	36	75.0	25.0	–	36	69.4	30.6	–

*Mutually exclusive categories of use.
†Lower frequency of use reported at follow-up compared with baseline.
‡Higher frequency of use reported at follow-up compared with baseline.

This finding was somewhat unexpected, since the new generations of programmes based on the enhancement of social skills are generally considered to be more effective, if anything, among girls than among boys.[3] However, if only school-based social influence interventions are considered, the evidence is rather mixed.

Because the class composition in the schools enrolled for the EU-DAP trial was universally gender balanced, we can exclude programme-delivery factors (eg, that the curriculum was taught differently among boys and among girls). Therefore, the only possible explanations pertain to factors inherent to the receivers.

First, girls may have been reached at more advanced stages of substance use. In a previous report we observed that the programme's efficacy was highest in hindering the progression from low or no use to advanced use.[12] However, girls were slightly more advanced than boys only in cigarette smoking when recruited for this study, whereas the differential effectiveness was observed for all classes of substances.

Second, the developmental stage of the two genders in terms of general life skills and coping mechanisms may differ, given attained age.[20 21] At the same age, the acquisition of skills and competences may still be susceptible to modifications among boys, but less so among girls. In fact, girls cope with puberty-related social and emotional changes at an earlier age.[21] Consistent with this, we found indications that the programme may have been effective among very young girls (11–12 years old), whereas the effectiveness among boys did not differ by attained age. Although caution is needed when interpreting these results, owing to lack of statistical significance, previous studies support the conclusion that most programmes based on skill enhancement achieve better results among girls when administered at young ages.[3 22]

Third, boys and girls may differ in mediators of the programme's effects, such as personality characteristics and expectations towards substances. In our study, positive expectations towards substances did not significantly modify the programme's effect in either gender. This was also the case for an indicator of self-esteem, although the data in this case suggested a differential modifying effect of self-esteem on the programme's effectiveness in the two genders, indicating that girls with low self-esteem had the least benefit from the programme.

A differential gender effect linked to self-esteem would not be surprising, and should be thoroughly investigated in larger studies. In fact, there is some evidence that lack of self-esteem can be a stronger risk factor for drug use among girls than among boys.[20 23] Theoretical models[24] suggest that girls are more influenced by family protective factors, whereas boys are more influenced by school or community environment. Among girls, self-esteem is strongly dependent on a positive relationship with parents.[22]

The emphasis on self-esteem is justified by the fact that this is not a key element of social influence programmes, which focus

Table 5 Adjusted Prevalence Odds Ratios and 95% CIs of substance use in the past 30 days among boys and girls, by level of self-esteem, the European Drug Abuse Prevention (EU-Dap) study short-term follow-up, May 2005

Indicator of use	Boys		Girls	
	High self-esteem N = 2741	Low self-esteem N = 385	High self-esteem N = 2422	Low self-esteem N = 488
	Adjusted POR (95% CI)	Adjusted POR (95% CI)	Adjusted POR (95% CI)	Adjusted POR (95% CI)
Any smoking	0.76 (0.55 to 1.04)	1.23 (0.61 to 2.50)	0.85 (0.62 to 1.16)	0.70 (0.39 to 1.26)
Frequent smoking	0.62 (0.45 to 0.87)	0.70 (0.27 to 1.80)	1.04 (0.69 to 1.57)	0.92 (0.43 to 1.97)
Daily smoking	0.46 (0.30 to 0.68)	0.56 (0.20 to 1.58)	0.86 (0.53 to 1.40)	1.35 (0.63 to 2.87)
Any drunkenness	0.69 (0.50 to 0.94)	0.58 (0.29 to 1.17)	0.83 (0.58 to 1.19)	1.23 (0.66 to 2.29)
Frequent drunkenness	0.71 (0.43 to 1.14)	0.75 (0.25 to 2.19)	0.59 (0.31 to 1.12)	1.71 (0.49 to 5.92)
Any cannabis	0.63 (0.43 to 0.91)	0.43 (0.20 to 0.92)	0.89 (0.58 to 1.37)	1.83 (0.66 to 5.06)
Frequent cannabis	0.62 (0.39 to 1.00)	0.42 (0.16 to 1.09)	0.74 (0.38 to 1.43)	2.14 (0.58 to 7.95)
Any illicit drug	0.68 (0.48 to 0.97)	0.35 (0.18 to 0.71)	1.27 (0.88 to 1.85)	1.59 (0.78 to 3.22)

POR, Prevalence Odds Ratio (intervention vs control) estimated using multilevel model 3 (RIGLS bin first order MQL with three levels), adjusted for centre prevalence of daily smoking and baseline use of the corresponding substance.

Table 6 Adjusted Prevalence Odds Ratios and 95% CIs of substance use in the past 30 days among boys and girls, by age, the European Drug Abuse Prevention (EU-Dap) study short-term follow-up, May 2005

	Boys		Girls	
	11–12 years N = 842	13–18 years N = 2482	11–12 years N = 781	13–18 years N = 2254
Indicator of use	Adjusted POR (95% CI)	Adjusted POR (95% CI)	Adjusted POR (95% CI)	Adjusted POR (95% CI)
Any smoking	1.27 (0.57 to 2.85)	0.81 (0.59 to 1.10)	0.78 (0.45 to 1.34)	0.84 (0.63 to 1.13)
Frequent smoking	1.17 (0.40 to 3.46)	0.63 (0.45 to 0.87)	0.52 (0.23 to 1.21)	1.21 (0.83 to 1.77)
Daily smoking	1.41 (0.35 to 5.75)	0.41 (0.28 to 0.61)	0.45 (0.18 to 1.13)	1.19 (0.77 to 1.85)
Any drunkenness	0.56 (0.25 to 1.28)	0.63 (0.48 to 0.83)	0.44 (0.19 to 1.04)	0.94 (0.68 to 1.29)
Frequent drunkenness	0.53 (0.13 to 2.24)	0.69 (0.46 to 1.04)	0.70 (0.16 to 3.01)	0.65 (0.37 to 1.16)
Any cannabis	0.60 (0.16 to 2.31)	0.61 (0.44 to 0.86)	*	1.15 (0.77 to 1.71)
Frequent cannabis	*	0.62 (0.40 to 0.95)	*	1.19 (0.62 to 2.27)
Any illicit drug	0.90 (0.36 to 2.23)	0.61 (0.45 to 0.83)	1.03 (0.47 to 2.28)	1.42 (0.98 to 2.06)

*The model did not converge because of the low number of observations.
POR, Prevalence Odds Ratio (intervention vs control) estimated using multilevel model 3 (RIGLS bin first order MQL with three levels), adjusted for centre prevalence of daily smoking and baseline use of the corresponding substance.

on normative beliefs and on social and personal skills. It is, therefore, possible that the ''Unplugged'' curriculum, heavily relying on the development of social skills, was not able to deal with lack of self-esteem. Therefore, the effectiveness of this programme after inclusion of gender-specific components warrants further formal evaluation.

A fourth alternative explanation for the observed difference could be a higher reliability of girls in reporting risk behaviours, an interpretation which is not supported by previous findings.[25]

This study had both strengths and limitations. Its main strengths are the large sample of students from diverse geographical locations, with enrolment and assessment conducted with a very standardised protocol. The survey instrument was administered individually and anonymously, thus ensuring high reliability of reports. The evaluation of effectiveness was performed through an experimental study design, with a good retention rate. The statistical analysis took into account the cluster effect, the hierarchical structure of the data and possible confounding factors. The main limitations were the low power of the study for subgroup analyses, which had an impact on the precision of the estimates. Other limitations include the short-term follow-up, and possible bias due to self-reports of behavioural outcomes. This last limitation, however, should be of minor concern, since youths' answers in anonymous questionnaires appear generally highly reliable[26 27] and do not depend on gender.[25]

In conclusion, our findings suggest that school curricula based on comprehensive social influence against substance misuse may perform differently among girls and boys, possibly because of developmental and personality factors. Adding gender-specific components to such programmes and/or anticipating their delivery in early grades of compulsory school could increase their overall effectiveness, but this possibility must be formally evaluated.

What is already known on this subject

The existing evidence on gender differences in the effectiveness of substance misuse prevention programmes is rather mixed, with inconsistent results from a few studies presenting gender-stratified analysis.

What this study adds

This study showed evidence of a favourable effect of comprehensive social influence programmes among boys, with lack of effect among girls. The data suggest that age and psychosocial factors should be considered in order to enhance the programme's effects among girls.

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