

# Ready, willing, and able: the role of cannabis use opportunities in understanding adolescent cannabis use

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## ABSTRACT

**Aims** To examine adolescent cannabis use—both at national and individual levels—by deconstructing it into its necessary conditions of realistic use opportunities and willingness to use the drug given such opportunities. **Design** Nationally representative, repeated cross-sectional survey. **Setting** Norway. **Participants** A total of 8818 16-year-olds who participated in the European School Survey Project on Alcohol and Other Drugs (ESPAD) in 2007, 2011, and 2015. **Measurements** Adolescent reports concerning their life-time ‘cannabis use’ and ‘possibilities to use cannabis’ were used to assess: (a) overall cannabis use, (b) exposure to realistic cannabis use opportunities, and (c) cannabis use among those exposed to use opportunities. Logistic regression models were used to estimate national trends since 2007 in these indicators, and to identify individual-level factors associated with cannabis use versus non-use among youth exposed to concrete use opportunities. **Findings** Prevalence of life-time cannabis use remained stably low, averaging 6.4% across the three surveys. Life-time exposure to cannabis use opportunities decreased [odds ratio (OR)<sub>ESPAD assessment</sub> = 0.90, 95% confidence interval (CI) = 0.84–0.97,  $P = 0.006$ ], yet cannabis use among adolescents with such opportunities increased significantly (OR<sub>ESPAD assessment</sub> = 1.17, 95% CI = 1.03–1.34,  $P = 0.02$ ) since 2007. After controlling for a range of other risk factors, abstinence from alcohol intoxication and cigarette use, as well as the perceptions of even minimal cannabis use as risky remained the factors most robustly associated with lower likelihood of cannabis use among youth with realistic use opportunities. **Conclusions** Approaches accounting for realistic use opportunities proved critical in our understanding of underage cannabis use, both at the national and individual level, and may be informative for development of prevention strategies in the era of cannabis liberalization. In addition, delineation of realistic opportunities from behaviours conditioned upon such opportunities is generalizable to a range of public health issues.

**Keywords** Adolescents, cannabis use, cannabis use opportunities, ESPAD, national temporal trends, Norway.

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## INTRODUCTION

Recent trends favouring liberalization of cannabis have raised concerns about its increasing availability, and the consequences for children and adolescents [1–5] for whom the early and heavy use remains associated with negative outcomes [6–9]. Although current liberalization efforts have targeted adults only, many have argued that these vulnerable underage populations may also be affected indirectly, as both the supply (e.g. availability, access, prices) and demand aspects (e.g. use normalization, intention to use, perceived risks, de-stigmatization) will likely be changed [3,5,10,11]. For example, recent investigations of adolescent cannabis use in the US states with legalized recreational cannabis reported increased

use in the state of Washington (especially among younger cohorts), but not in Colorado [12]. Others demonstrated associations between the more liberal cannabis regimes and greater regular use [13], earlier age of onset among adolescents [14] and other unanticipated outcomes, such as child poisoning resulting from accidental cannabis exposure [15,16]. Finally, considerable proportions of American adolescents reported that they would initiate use or use cannabis more frequently should cannabis become legal [10]. Improved understanding of early cannabis use is thus needed within this rapidly changing legal context, where upsurges in actual opportunities to use cannabis can be expected. As a step in this direction, we investigated cannabis use by deconstructing it into its necessary, yet seldom examined, components of use

opportunity and willingness to use the drug given such opportunity.

To engage in cannabis or any other substance use, one must be 'ready, willing and able'—a concrete opportunity to use drugs is required in addition to the desire to do so [17–20]. Epidemiologically speaking, use is possible only for the individuals who are exposed to real use opportunities, and only if they are also willing to do so. Cannabis use—and substance use in general—can therefore be understood in terms of the two necessary conditions of realistic use opportunities and willingness to use the drug. This basic structure is reflected in our current prevention efforts, where use opportunities are targeted mainly at the state level through policies regulating cannabis supply, availability, and access, and where willingness is targeted mainly at the individual level through various measures presumably reducing interest in cannabis use [21].

An emerging literature focusing on the exposure to use opportunities shows this indeed to be the necessary initial step predicated any future drug use and associated problems [17,19,20,22]. Although cannabis remains the most commonly used drug [23], not all individuals are equally likely to be exposed to cannabis. Exposure to cannabis use opportunities currently assumes a complex selection process [11], presumably reflecting an interplay between the national/community-level and individual-level characteristics [20,21,24–28]. However, the likelihood of use given the use opportunity is relatively high for cannabis [29,30], especially for those receiving repeated use offers [31]. The related studies show that youth faced with use opportunities were more likely to remain cannabis-free if they did not have additional high-risk characteristics such as alcohol and tobacco use, delinquency or drug-using peers [22,32–34].

Aside from this essential but still limited literature on realistic use opportunities, this physical constraint remains somewhat neglected in public health research on cannabis use. For example, how many individuals experienced realistic drug use opportunities is often unknown, even though this would provide a basic gauge for the community-level prevention efforts. We also do not fully appreciate the reasons for non-use, even though this distinction is crucial for targeted preventive efforts. Specifically, much of the traditionally classified non-use may be resulting from the simple lack of use opportunities, telling us very little about the individual (un)willingness to use the drug under situations involving concrete availability of the drug and real use opportunities.

## Aims

Cannabis use—be it at a national or individual level—cannot be understood fully without also understanding the exposure to cannabis use opportunities. The role of this

necessary condition should therefore be considered more carefully in studies of cannabis use and the associated processes and mechanisms. This report aims to do this by examining both (1) the national trends of adolescent cannabis use and (2) individual factors associated with cannabis use versus non-use among youth who had realistic opportunities to use the drug.

## METHODS

### Setting

We examined adolescent cannabis use in Norway, where the official policies concerning cannabis remained both fairly conservative and unchanged during the last decade and where cultivation, transport, possession, and consumption of cannabis are defined as criminal offences. There is no formal legal differentiation of cannabis from other drugs, and prohibition is enforced actively. Suspicions of cannabis involvement will probably elicit law-enforcement reaction, as exemplified by the recent high-school searches conducted by the police Narcotics K-9 units [35,36]. In addition to financial fines, prison sentences for various cannabis offences can range from 6 months to, theoretically, up to 21 years (depending on the amounts and circumstances) [37]. For adolescents, there has been an increased implementation of alternative penal sanctions during the last decade.

Overall, there is a generally low public support for, or approval of, cannabis in any form. Barely 30% of the Norwegian population endorsed the view that cannabis has medical benefits and more than half (54.5%) believed that even medical cannabis is addictive [38]. The views on recreational cannabis are even more critical: between 86 and 88% of the respondents from a nationally representative sample of Norwegian adults opposed cannabis legalization for recreational use [39], as did approximately 90% of the respondents from a 2008 Norwegian youth survey [40]. Finally, the European School Survey Project on Alcohol and Other Drugs (ESPAD) reports the life-time prevalence of cannabis use among Norwegian adolescents to be consistently among the lowest in Europe, and lower than 10% in all ESPAD estimates since 2003 [41].

### Participants

We examined a sample of Norwegian adolescents surveyed through the nationally representative European School Survey Project on Alcohol and Other Drugs (ESPAD), which has been conducted every 4 years since 1995. Because questions capturing the exposure to cannabis use opportunities were included only in the three most recent ESPAD surveys (i.e., 2015, 2011 and 2007), only those surveys were utilized. Thus, our sample can be understood as encompassing three nationally representative

cohorts of Norwegian 16-year-olds, 4 years apart. After the cases with missing responses on the core cannabis items were excluded ( $n = 482$ ), our sample comprised 8818 participants ( $n_{2007} = 3418$ ;  $n_{2011} = 2827$ ;  $n_{2015} = 2573$ ).

In each participating country, ESPAD surveys target the national population of students who turn 16 years of age during the survey year; in Norway, this in practice means students who are enrolled in 10th grade in lower secondary schools. Once the school agreed to survey participation, the proportion of students in participating classes who answered the questionnaire was high: 93% for 2015, 88% for 2011, and 89% for 2007 [41–43]. The students from our 2007–2011–2015 combined sample came from all 19 counties and more than half municipalities in Norway. Even though the specific school-level variables were not available, these were likely overwhelmingly public schools, as private school attendance in Norway reached its peak of 3.6% in 2016 [44]. All surveys were administered with parental consent and in accordance with the national ethical standards. Additional ESPAD procedures and results can be found elsewhere [41].

### Measures

The standardized ESPAD questionnaires include commonly used epidemiological indicators of substance use, and are generally evaluated as both valid and reliable [45]. Paper-and-pencil questionnaires were completed by students during regular class time. The measures included here reflect common demographic indicators, as well as the general risk and protective factors associated with adolescent substance use [46].

#### *Life-time cannabis use and exposure to cannabis use opportunities*

Participants reported if they ever (1) used cannabis, and (2) had the possibility to try cannabis without actually doing so. These two items were used to first differentiate the participants into cannabis users versus never-users, and then to classify non-users into those exposed versus non-exposed to cannabis use opportunities. Users, by definition, must have experienced at least one use opportunity: they were thus all exposed to use opportunities by default and classified accordingly. Non-users with at least one reported use opportunity were classified as cannabis opportunity-exposed as well.

#### *Adolescent characteristics*

Demographic characteristics were computed based on sampling information (i.e. urban residence) and on adolescent self-reports (i.e. gender; residing with both parents). Participants were classified into the *low perceived socio-economic status (SES)* category if they rated their family 'less well off' to 'very much less well off' when compared to other families

in Norway. Parenting characteristics were assessed with a single item ('Do your parents know where you spend Saturday nights?'). The original item was dichotomized into *high parental knowledge* for the responses: 'Know quite often'/'Know always'. Adolescent characteristics reflected a range of factors related theoretically to early cannabis involvement. *Current tobacco use* (coded: none; cigarettes-only; snus-only; both cigarettes and snus) and *life-time frequency of alcohol intoxication* (coded: never; one to two times; three times or more) were included as putative risk factors. Indicators of potentially protective factors were also examined—including the *sports training*, *reading books outside of school homework*, and *hobbies involvement* (all coded as regular if performed 'at least once a week' or more frequently). Next, the *perceived risk of cannabis use* was measured with a set of three items recording adolescent beliefs of how much harm (physical or otherwise) people risk if they (1) try marijuana/hashish once or twice, (2) smoke it occasionally, and (3) smoke it regularly. These questions reflected perceived risks of minimal occasional, and regular cannabis use, and were coded as high-risk perceptions for 'moderate' or 'great risk' responses.

### Analyses

First, we examined the national trends across the three ESPAD surveys. Our main focus was on temporal trends (if any) in cannabis use, in exposure to cannabis use opportunities, and in cannabis use among those exposed to use opportunities. All trends were assessed with unadjusted logistic regression models, with ESPAD assessment year as the single key predictor (2007 cohort was coded as '0', 2011 as '1', and 2015 as '2'). These analyses were based on a weighted ESPAD national sample, as recommended for estimation of population-representative parameters [47].

Second, the likelihood of cannabis use (versus non-use) among adolescents who had the opportunity to do so was estimated as a function of ESPAD assessment year and adolescents' individual characteristics using logistic regression. Because the focus was on use opportunities, and because it is not known what adolescents would have done if confronted with such opportunities, non-exposed cases were excluded from this set of analyses. Here we accounted for the survey design and associated clustering at the municipal level, but without individual weighting as is appropriate for complex models investigating putative causal associations [47]. All analyses were conducted with Stata statistical software [48,49].

## RESULTS

### *National trends; 2007–2011–2015*

Table 1 shows sample characteristics for the three examined ESPAD cohorts (Table 1, top), including the

**Table 1** Sample characteristics, cannabis-related outcomes, and associated national trends: ESPAD Norway 2007–2011–2015.

Study variables Sample characteristics	2007		2011		2015		Temporal trend (linear)		Direction
	(n = 3418)		(n = 2827)		(n = 2573)		OR (95% CI)	P-level	
	%	%	%	%	%	%			
Urban area residence	19.5	19.6	24.3			1.15 (1.06–1.27)	< 0.001	↑	
Reside with both parents	70.6	74.2	75.4			1.13 (1.06–1.21)	< 0.001	↑	
Perceived low SES	4.1	5.7	6.1			1.24 (1.09–1.41)	0.001	↑	
Gender (boy)	51.3	50.1	53.5			1.03 (.98–1.10)	0.19	=	
Parental knowledge about child's Saturday night whereabouts	85.4	88.5	92.8			1.45 (1.32–1.59)	< 0.001	↑	
Current tobacco user									
None	47.1	56.7	66.9			1.46 (1.37–1.55)	< 0.001	↑	
Cigarette-user only	20.1	12.5	10.9			0	< 0.001	↓	
Snus-user only	6.8	6.4	4.7			0.82 (0.73–0.93)	0.002	↓	
Both cigarette and snus user	25.9	24.5	17.5			0.78 (0.73–0.84)	< 0.001	↓	
Life-time alcohol intoxication									
Never	54.0	63.4	74.9			1.52 (1.43–1.62)	< 0.001	↑	
1–2 times	19.6	18.8	13.4			0.80 (0.75–0.86)	< 0.001	↓	
3 times or more	26.4	17.8	11.7			0.60 (0.56–0.65)	< 0.001	↓	
Sports training once per week or more often	80.7	82.3	80.6			1.00 (0.92–1.07)	0.99	=	
Reading books not for school once per week or more often	25.0	24.2	19.7			0.86 (0.80–0.92)	< 0.001	↓	
Hobbies involvement once per week or more often	45.6	47.0	40.8			0.91 (0.86–0.97)	0.003	↓	
Perceived moderate/great risk from minimal cannabis use	64.5	63.4	60.0			0.91 (0.85–0.97)	0.003	↓	
Perceived moderate/great risk from occasional cannabis use	84.5	84.6	80.0			0.86 (0.79–0.93)	< 0.001	↓	
Perceived moderate/great risk from regular cannabis use	94.6	94.1	90.2			0.71 (0.63–0.81)	< 0.001	↓	
<b>Cannabis-related indicators</b>	%	%	%			OR (95% CI)	P-level	Direction	
Life-time cannabis use <sup>a</sup>	6.4	5.6	7.2			1.05 (0.93–1.19)	0.44	=	
Life-time exposure to cannabis use opportunities <sup>b</sup>	26.0	20.5	22.9			0.90 (0.84–0.97)	0.006	↓	
Life-time cannabis use among those exposed to use opportunities <sup>c</sup>	24.7	27.2	31.3			1.17 (1.03–1.34)	0.02	↑	

All reported estimates are based on the weighted survey sample, as recommended by Solon *et al.* (2015). Shown are prevalence rates (%) for all categorical predictors for all three examined ESPAD cohorts. For example, 19, 50, 19, 60 and 24, 23% of adolescents resided in urban areas in 2007, 2011, and 2015, respectively. Whether there were significant changes over time in these indicators was assessed by logistic regression models, with ESPAD survey as a single continuous predictor. Shown are the resulting odd ratios and corresponding 95% CI, with 2007 set as the base year. For example, the odds of urban area residence increased significantly by an average of 1.5% for each subsequent ESPAD survey/4-year interval since 2007 (i.e. OR = 1.15, 95% CI = 1.06–1.27,  $P < 0.001$ ). <sup>a</sup>Proportion of all adolescents who reported using cannabis at least once during life-time (i.e. users). <sup>b</sup>Proportion of all adolescents reporting exposure to at least one life-time cannabis use opportunity. This subsample includes both users (who, by definition, must have been exposed to cannabis use opportunities in order to become users) and non-users (i.e. those who reported exposure to cannabis use opportunities but resisted them to remain non-users). <sup>c</sup>Proportion of adolescents with exposure to realistic cannabis use opportunities who used cannabis at least once during life-time. Overall trends indicate that, given the exposure to cannabis use opportunity, 2011 and 2015 cohorts were more likely to use cannabis than the 2007 cohort. Specifically, approximately one in three (31.3%) of the opportunity-exposed adolescents from the 2015 cohort used cannabis, but only one in four (24.7%) did so in the 2007 cohort. This translates into a significant temporal increase for each subsequent ESPAD survey/4-year interval since 2007. OR = 1.17, 95% CI = 1.03–1.34,  $P = 0.02$ . ESPAD = European School Survey Project on Alcohol and Other Drugs; SES = socio-economic status; CI = confidence interval; OR = odds ratio.

estimates for cannabis use, exposure to use opportunities, and cannabis use among those exposed to realistic use opportunities (Table 1, bottom). In addition to the proportion of adolescents in each category, shown are also the logistic regression results describing linear trends since 2007 for each examined indicator. In terms of adolescent characteristics and substance use, we observed significant decreases in risky health behaviours (such as tobacco use and alcohol intoxication), as well as in the perceptions of risks associated with cannabis use when compared to the 2007 cohort. In terms of cannabis-related outcomes, the proportion of Norwegian adolescents reporting any cannabis use remained relatively low and stable since 2007, averaging at 6.4% for the combined sample.

Accounting for cannabis use opportunities revealed additional information. Specifically, exposure to cannabis use opportunities was much more common than the use itself, as almost one in four (an average of 23.4%) students reported it. Most importantly, we observed increased cannabis use among adolescents exposed to use opportunities. Specifically, among students with realistic opportunities to do so, approximately one in three used cannabis in the 2015 cohort, but only one in four did so in the 2007 cohort. Figure 1 depicts these temporal trends.

#### *Cannabis use versus non-use among adolescents exposed to cannabis-use opportunities*

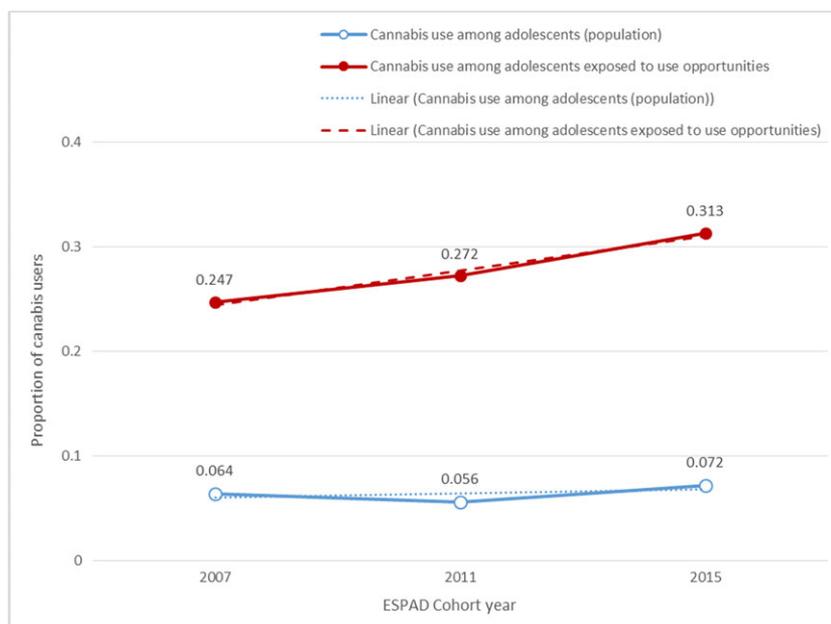
Table 2 shows the results from a logistic regression model estimating the likelihood of cannabis use among

adolescents exposed to cannabis-use opportunities as a function of time (i.e., ESPAD assessment in 4-year increments) and adolescent characteristics. Our main focus was on the protective factors lowering the odds of cannabis use for adolescents who were realistically able to do so.

In both the 2011 and 2015 cohorts, adolescents exposed to use opportunities were more likely to be cannabis users than to resist such opportunities than they were in the 2007 cohort. These results reiterate the national-level descriptive nationally representative estimates from Table 1 while accounting for a range of demographic-, family-, and individual-level characteristics. Current cigarette use (but not snus use only) and more frequent alcohol intoxication were both significantly associated with greater risk for cannabis use among opportunity-exposed youth. In contrast, greater parental knowledge of their child's whereabouts, adolescent regular participation in sports, and their perceptions of risks stemming from minimal and occasional cannabis use were significantly associated with lower likelihood of use, despite the afforded use opportunity.

## DISCUSSION

We examined adolescent cannabis use—both at the national and individual levels—by deconstructing it into its necessary conditions of realistic use opportunities and willingness to use the drug given such opportunities. Specifically, our analyses accounting for the necessary



**Figure 1** Cannabis use among adolescents [European School Survey Project on Alcohol and Other Drugs (ESPAD) Norway 2007–2011–2015]. [Colour figure can be viewed at [wileyonlinelibrary.com](http://wileyonlinelibrary.com)]

**Table 2** Likelihood of life-time cannabis use among adolescents exposed to cannabis use opportunities (ESPAD Norway 2007–2011–2015).

	<i>Exposed non-users (n = 1462) versus exposed users (n = 545)</i>		
	<i>OR</i>	<i>95% CI</i>	<i>P-value</i>
ESPAD survey cohort			
2007	1.00 (ref.)	–	–
2011	1.35	0.96–1.89	0.08
2015	1.64	1.13–2.38	0.009
Urban area residence	1.71	1.23–2.38	0.001
Parental knowledge about child's Saturday night whereabouts	0.58	0.42–0.79	0.001
Current tobacco user			
None	1.00 (ref.)	–	–
Cigarette-user only	5.11	2.86–9.16	0.001
Snus-user only	1.88	0.81–4.36	0.14
Both cigarette and snus user	7.65	4.27–13.71	0.001
Life-time alcohol intoxication			
Never	1.00 (ref.)	–	–
1–2 times	1.17	0.73–1.89	0.49
3 times or more	2.75	1.74–4.33	< 0.001
Sports training once per week or more often	0.68	0.50–0.92	0.01
Reading books not for school once per week or more often	0.94	0.68–1.31	0.72
Hobbies involvement once per week or more often	0.89	0.67–1.20	0.46
Perceived moderate/great risk from minimal cannabis use	0.44	0.31–0.62	< 0.001
Perceived moderate/great risk from occasional cannabis use	0.59	0.40–0.88	0.01
Perceived moderate/great risk from regular cannabis use	0.75	0.51–1.12	0.16

Shown are odd ratio (OR) estimates, corresponding 95% confidence intervals (CI), and exact *P*-values from a logistic regression model estimating the likelihood of cannabis use among adolescents exposed to cannabis use opportunities. The model accounted for clustering at the municipal level, and for basic demographic characteristics (residing with both parents, perceived socio-economic status (SES), and gender; see Table 1). Intercepts not shown. ESPAD = European School Survey Project on Alcohol and Other Drugs

condition of use opportunity provided some additional and substantively different insights into the national cannabis-related trends, as well as into the risk and protective factors associated with cannabis use versus non-use among youth exposed to realistic use opportunities.

Our results documenting the prevalence of cannabis use among Norwegian adolescents match the officially reported ESPAD results for Norway [41], including the 'no change' for the 2007–2011–2015 period. Even though cannabis use remained stable across our three youth cohorts, these basic prevalence estimates obscured potentially important underlying shifts in cannabis-related phenomena in Norway since 2007. Namely, while the overall proportion of cannabis users among all adolescents remained stably low, the proportion of users among adolescents exposed to concrete use opportunities increased significantly from one in four in the 2007 cohort to approximately one in three in the 2015 cohort. More importantly, this shift coincided with the observed trends of declining exposure to cannabis use opportunities, as well as in tobacco and alcohol use. Finally, the time-period examined (2007–15) was

marked by no significant changes in the Norwegian fairly conservative cannabis-related policies.

However, this increased cannabis-susceptibility among opportunity-exposed youth corresponded to other secular shifts that we observed during the same time-period. Specifically, perceptions of risks stemming from cannabis use were significantly lower in the 2015 cohort than in the 2007 cohort. We speculate that these changes could be attributed at least partially to the intense and growing international debate concerning cannabis deregulation, which may be interpreted as evidence of its minor harms, de-stigmatization, and use normalization among young [50,51]. While causality cannot be inferred from these largely descriptive results, they echo similar trends observed internationally [52–54], including lower perceptions of cannabis harm among adolescents from states with legalized recreational cannabis [12].

The second set of our analyses examined factors associated with cannabis use among those who had the actual opportunity to do so. First, temporal trends pointing at increased likelihood of cannabis use given the opportunity emerged again: opportunity-exposed

adolescents from 2011 and 2015 cohorts were significantly more likely to be(come) users than were such adolescents from the 2007 cohort, even after controlling for a range of individual characteristics and behaviours. Second opportunity-exposed adolescents were significantly more likely to be(come) users than to remain cannabis-free if they currently smoked or had greater history of alcohol intoxication. These results are not unexpected, as licit substance use has been recognized as one of the key risk factors for cannabis involvement among youth [27,55,56]. This was especially true for smoking (but not snus use alone), likely reflecting administration route familiarity [57]. Finally, opportunity-exposed adolescents were more likely to reject such cannabis use opportunities and to remain non-users if they reported that their parents knew where they spend their Saturday nights, if they were involved in sports regularly, and if they perceived even minimal or occasional cannabis use to be risky.

These results extend previous findings on the inverse association between cannabis involvement and its perceived risks [21,33,58,59], and underscore potentially modifiable protective factors associated with cannabis non-use even in the face of concrete use prospects. Despite the observed secular decline in risk perceptions, adolescents who perceived harms stemming from even the irregular cannabis use were more likely to refrain from it when afforded use opportunity than were those adolescents who perceived lower, or no such harms. As these harms were defined as 'physical or otherwise', they are not limited only to the negative health outcomes, but include any number of other—personal, legal, etc.—consequences of subjective importance or objective significance [60]. Such harms may be especially salient for underage users, for whom cannabis use would remain illicit even in the more liberal regimes and for whom even a single-use occasion could bring about multiple repercussions. If adolescents tend to underestimate the risks of 'physical or otherwise' harms associated with cannabis use, initiatives to increase their awareness may affect their susceptibility for using the drug. In that vein, educational efforts informing students of multiple risks—legal, personal, educational, etc.—associated with cannabis use may prove useful for youth exposed to cannabis use opportunities. Conversely, adolescent sports involvement and parental knowledge about their children's whereabouts may be more difficult to modify or to integrate into preventive measures. This is especially true for parental knowledge, as its source and meaning remain somewhat unclear [61]. However, our results are in line with previous findings documenting the general positive effects of proactive parenting strategies and close parent-child relationships when it comes to early cannabis involvement [26,62].

In conclusion, the proportion of adolescents who are 'ready, willing, and able' to engage in cannabis use varies across time, cultures, and cannabis regimes. Recent changes in cannabis legislations are poised to affect cannabis availability and corresponding use opportunities. In other words, the 'ability' to use the drug has perhaps already increased in many places, even for underage populations supposedly not targeted by these legislative shifts. This changing context also affects our prevention strategies, which are still largely reliant upon the current prohibition policies and the drug's still largely illicit status. Instead, more complex strategies (similar to the current regulations of underage tobacco and alcohol sales) aiming to reduce cannabis access and use opportunities for youth, as well as the individual-level approaches aimed at reducing willingness to use cannabis despite such use opportunities, will be needed. Such approaches, combined with current efforts to curb underage alcohol and tobacco use, may inform future integrated preventive approaches. Identifying specific, practical, and modifiable protective factors, such as understanding that early cannabis use infers certain risks [59,63,64], may prove useful for cannabis prevention efforts targeting adolescents.

#### *Strengths and limitations*

Even though our repeated cross-sectional ESPAD data allowed for the examination of short-term secular trends, this design nevertheless precluded full examination of causal inferences and underlying mechanisms driving early cannabis use. Also, our analyses were limited to the indicators included in ESPAD surveys, and this list was by no means exhaustive. For example, the role of peers in early cannabis involvement could not be examined with these data. Also, while ESPAD is to be commended for including some critical questions on cannabis use opportunities, we still did not know a great deal about the nature or timing of those opportunities. Finally, as is the case with all similarly collected data, these surveys may be susceptible to self-reporting biases.

Nevertheless, we believe that these three nationally representative cohorts provided robust estimates of the examined phenomena. We also argue that conceptualization of these issues to include realistic opportunities is valuable and generalizable beyond the Norwegian context and beyond the cannabis-use questions, and should therefore be taken into consideration when examining a broad range of substance use phenomena and health behaviours. Finally, the extant surveillance systems should emulate these ESPAD efforts and aim to capture concrete—as opposed to hypothetical—individual exposure to regulated substances.

## CONCLUSIONS

Accounting for realistic use opportunities proved critical in better understanding of underage cannabis use, both at national and individual levels. Technically flat national prevalence trends obscured increasing cannabis use among adolescents who had realistic opportunities to do so. At the individual level, abstinence from tobacco use and alcohol intoxication, and perceptions of even minimal cannabis use as risky emerged as the potentially modifiable factors reducing the likelihood of cannabis use among opportunity-exposed youth. These results may be informative for the preventive strategies in the era of cannabis liberalization and the expected increases in cannabis availability and use opportunities. At the same time, these basic conceptualizations and approaches delineating realistic opportunities versus behaviours conditioned upon such opportunities may be useful and applicable in examination of multiple public health issues.

## Declaration of interests

None.

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