Recurrent cannabis use among Norwegian students: Prevalence, characteristics, and polysubstance use

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Abstract

Background: Research on cannabis has focused on lifetime use or regular/heavy use (i.e., daily or almost daily). Regular, albeit not necessarily daily, cannabis use has received less scientific attention. **Objectives:** This study aims to identify demographic and personality factors associated with recurrent cannabis use (i.e., cannabis usage 5 to 50 times in the last six months) and to investigate the relationship between cannabis use and use of other substances. **Methods:** Public and private university students ($N = 11,236$) in Bergen, Norway, participated in an online survey during autumn 2015. Binary logistic regression was run to identify individual characteristics related to recurrent cannabis use. Chi-square tests were conducted to investigate differences in substance

use (alcohol, nicotine, and illicit drugs) between recurrent cannabis users and cannabis abstainers/low-frequency users. **Results:** A total of 4.0% of the students reported recurrent cannabis use. Students born in North America, non-Christians (compared to non-religious students), and men were more likely to be recurrent users. Recurrent cannabis users scored higher on extroversion and intellect/imagination compared to abstainers/low-frequency users. Male and female recurrent cannabis users had somewhat different characteristics (e.g., agreeableness scores were negatively associated with recurrent use among females but not among males). Recurrent cannabis use was overall strongly associated with polysubstance use. **Conclusions:** The prevalence of recurrent cannabis use among Norwegian students is low. Recurrent cannabis use seems more prevalent among individuals marked by extroversion and intellect/imagination, which supports the notion of cannabis use as a social activity for individuals identifying themselves as outgoing and unconventional. Cannabis use among students seems strongly associated with use of other substances, suggesting that cannabis should not be considered a replacement drug.

Keywords

alcohol, cannabis, drug use, hashish, marijuana, nicotine, personality, polysubstance use, students

Cannabis is the common name of the class of intoxicating drugs originating from the hemp plant, with marijuana and hashish being the most popular forms (Pedersen, 2015). Cannabis use may have positive effects such as improved mood and increased overall life satisfaction (Barnwell, Earleywine, & Wilcox, 2006; Milstein, MacCannell, Karr, & Clark, 1974), but is also associated with adverse outcomes, including psychosis and concentration problems (Arseneault, Cannon, Witton, & Murray, 2004; Caldeira, Arria, O'Grady, Vincent, & Wish, 2008; Caspi et al., 2005). The level of impairment is dose-dependent (Volkow, Baler, Compton, & Weiss, 2014). Heavy consumption (several times a day) and regular cannabis use (daily or almost daily) are especially associated with risk (Hall, 2015; Volkow et al., 2014), but more infrequent use has also been linked to negative effects such as missing classes and concentration problems among college students (Caldeira et al., 2008).

Certain aspects of student life, such as increased autonomy, availability of drugs, sociability, and emotional distress from personal and academic problems/pressure have been suggested to increase the use of cannabis (Suerken et al., 2014; White, Labouvie, & Papadaratsakis, 2005). Drug use in college may, to some extent, predict continual use – potentially leading to unfavourable health-related effects (Tucker, Ellickson, Orlando, Martino, & Klein, 2005). Further, as students are often considered to be a trendsetting group, their cannabis use may be imitated by others (Pedersen, 2015). Such factors highlight the importance of research on cannabis use in the student population. Most studies on the subject focus on adolescents and/or individuals suffering from cannabis dependency, whereas cannabis use among students remains less explored (Caldeira et al., 2008; Suerken et al., 2014).

Prevalence of recurrent cannabis use among students

Previous research on cannabis use among students has primarily focused on either lifetime use or regular/heavy use (i.e., daily or almost daily). Regular, albeit not necessarily daily, cannabis use has received less scientific attention. Studies have found the prevalence of cannabis use at least once in the last month to range from 1.5% to 32.6% among South and North

American students (Allen & Holder, 2014; Hynes, Demarco, Araneda, & Cumsille, 2015; Johnston, O'Malley, Bachman, & Schulenberg, 2011). The variance in prevalence estimates across student populations may imply the influence of social and cultural factors on cannabis use. Few studies have investigated the prevalence of recurrent cannabis use among Scandinavian students. In a Norwegian study, 5% of the students reported having used cannabis at least five times in the last six months (Nedregård & Olsen, 2014), which suggests lower rates of use compared to North American students.

Individual characteristics of recurrent cannabis users

Knowledge about the characteristics of recurrent cannabis users may identify potential explanatory factors to cannabis use.

Several demographic variables have been linked to cannabis use among students. Younger, non-religious, male, and single students tend to use cannabis more frequently than older, religious, female, and married/cohabiting students do (Allen & Holder, 2014; Arria et al., 2013; Bell, Wechsler, & Johnston, 1997; White et al., 2005). Parental drug and alcohol use is positively associated with cannabis use among their offspring (Andrews, Hops, Ary, Tildesley, & Harris, 1993; Kosty et al., 2015). Having childcare responsibilities has been linked to a decreased likelihood of cannabis use (Redonnet, Chollet, Fombonne, Bowes, & Melchior, 2012).

The five-factor model of personality is a validated and widely used taxonomy of personality traits (McCrae & John, 1992) and describes five broad trait dimensions: extroversion (e.g., being talkative and outgoing), agreeableness (e.g., being sympathetic and warm), conscientiousness (e.g., being organised and prompt), neuroticism (e.g., being nervous and anxiety-prone), and intellect/imagination (e.g., being imaginative and intellectually oriented) (McCrae & John, 1992). Of these personality traits, lower scores on

conscientiousness and agreeableness, and higher scores on intellect/imagination have, in previous studies, been most consistently linked to increased cannabis use (Allen & Holder, 2014; Flory, Lynam, Milich, Leukefeld, & Clayton, 2002; Terracciano, Löckenhoff, Crum, Bienvenu, & Costa, 2008).

Use of cannabis and other substances

Cannabis use correlates strongly and positively with the use of nicotine, alcohol, and/or other particular (illicit) substances (Degenhardt, Hall, & Lynskey, 2001; Hall, 2015; Volkow et al., 2014), and this has also been shown in student populations (Gledhill-Hoyt, Lee, Strote, & Wechsler, 2000). Cannabis use may increase the likelihood of using other substances due to foot-in-the-door processes, where cannabis use seems to lower the threshold of using other substances as well. The association between cannabis use and the use of other substances may, however, also be explained by underlying individual vulnerabilities for drug use (e.g., personality or socioeconomic status) predicting both cannabis use and the use of other substances (Pedersen, 2015; Volkow et al., 2014). That cannabis users have an increased likelihood of using other drugs has raised concern, as the use of other drugs is believed to explain some of the adverse effects related to cannabis use (Degenhardt et al., 2001). However, little is known about the strength of the associations between the use of cannabis and other specific substances among students. It should also be noted that some studies suggest that cannabis use can reduce and partly replace the use of alcohol and other illicit substances under some conditions (Cameron & Williams, 2001; Reiman, 2009).

Study objectives

This study investigates recurrent cannabis use among students and identifies individual characteristics of the recurrent user. A second aim is to investigate the relationship between recurrent cannabis use and the use of other

substances. Recurrent cannabis use was defined as using cannabis 5 to 50 times in the last six months.

Methods

Procedures and sample

All students registered at the four largest institutions of higher education in Bergen municipality, Norway, were invited (via email) to participate in an online survey in the autumn of 2015. Recipients who did not respond within two weeks were sent up to two email reminders. A total of 28,553 students received an invitation, of whom 11,236 (39.4%) participated. The participants provided informed digital consent. The project was approved by the Regional Committee for Medical and Health Related Ethics, Western Norway (no. 2015/1154). Those who responded took part in a lottery with two IPhone 6s and 50 gift cards (each with a value of 500 NOK = ∼ 50 EUR) as prizes.

Measurement

Demographic variables were measured by closed-ended questions about birth year (range: 1940–2000), years studied (range: 0–10 years or longer), place of birth (Norway; North of Europe; other parts of Europe; Asia, Africa; Central/South America; North America; Oceania), current religious identification (Buddhism; Hinduism; Islam; Judaism; Catholic Christianity; Orthodox Christianity; Protestant Christianity; other; none), gender (female; male), experience of parents' alcohol and/or drug use affecting childhood negatively (often; sometimes; none), relationship status (single; in a relationship, but living alone; cohabitant; married; other), and parental status (do not have child/ren; have daily custody of a child/ren; have shared custody of a child/ren; have a child/ren, but not custody).

Personality was measured with the Mini-International Personality Item Pool (Mini-IPIP), a personality scale with 20 items,

Cronbach's alphas: .69–.82 (present study). Mini-IPIP is considered a reliable and valid measure of the five personality dimensions of extroversion, agreeableness, conscientiousness, neuroticism, and intellect/imagination (Donnellan, Oswald, Baird, & Lucas, 2006). This scale covers statements concerning typical behaviour (such as being compassionate, life of the party, tidy, having a rich imagination, and easily becoming upset), where the participants are asked to state to which degree the statements apply to them. There are four statements for each of the five personality traits, and for each trait the total score ranges from 5 to 20.

Cannabis and drug use was measured with the following closed-ended questions: "Have you ever used drugs?" (yes; no). Those who answered "yes" received several questions about the use of specific drugs. "How many times the last six months have you used the following drugs?: a) Hashish/marihuana?, b) Ecstasy?, c) LSD/hallucinogens?, d) Amphetamine/methamphetamine?, e)ADHD medication (without prescription)?, f) Cocaine (crack)?, g) Anabolic steroids?, h) Sedatives (without prescription)?, i) Heroin? and j) Synthetic heroin (without prescription)?" (Response alternatives: Never; I have used before, but not in the last six months; 1–4 times; 5–50 times; more than 50 times) (Nedregård & Olsen, 2014).

Nicotine use was measured by the following questions: "Do you smoke?" and "Do you use 'snus'/chewing tobacco or similar nicotine products?" (Response alternatives: Yes, daily; Yes, sometimes; No, have quit; No). "Snus" is a popular nicotine product in Norway and Sweden.

Alcohol use was measured using the Alcohol Use Disorders Identification Test (AUDIT), comprising 10 items (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001; Bohn, Babor, & Kranzler, 1995), Cronbach's alpha .78 (present study). The test measures three dimensions: consumption (three items: frequency of drinking, quantity consumed, and frequency of heavy drinking), dependency symptoms (three items: impaired control, increased salience, and

morning drinking), and harmful alcohol use (four items: guilt after drinking, blackouts, alcohol-related injuries, and others being concerned about the respondent's drinking) (Babor et al., 2001; Bohn et al., 1995). The total AUDIT score ranges from 0 to 40. AUDIT scores of or above 8, 16, or 20 indicate hazardous, harmful, or dependent alcohol use, respectively (Babor et al., 2001; Bohn et al., 1995).

Analysis

All data analyses were conducted with IBM SPSS Statistics 23. Missing data were deleted list-wise. A total of 1845 respondents were excluded from the analyses due to nonresponse on some of the items included.

A binary logistic regression was run to investigate individual characteristics associated with recurrent cannabis use (i.e., 5 to 50 times in the last six months). The reference category was no or low-frequency use of cannabis. The categorical independent variables were recoded into dichotomised variables before the regression: place of birth (dummy coded for each of the continents: Europe [Norway not included], Asia, Africa, South and Central America, North America, and Oceania, where being born in Norway was used as a reference category), religious identification (dummy coded for the following religious beliefs: Buddhism, Hinduism, Islam, Judaism, Christianity, and other religions, where being non-religious was used as a reference category), parents' alcohol and drug use during childhood (affected childhood negatively vs. did not affect childhood negatively), relationship status (single vs. in a relationship), and custody of children (yes vs. no). The gender variable (female vs. male) was not recoded. The variables of age and years of study were not recoded before being entered to the regression model, whereas responses to the other continuous variables (personality traits) were recalculated into z-scores. Separate analyses were also conducted for women and men.

Chi-square tests were run to examine differences in nicotine, alcohol, and illicit drug use between recurrent cannabis users and abstainers/low-frequency cannabis users. Recurrent users' relative risks (compared to abstainers/low-frequency cannabis users) of using different substances were calculated.

Results

The mean age of the sample was 24.9 years (range: 17–75 years, $SD = 6.5$); 63.3% ($n = 7084$) were women; and the vast majority were born in Norway (92.4%, $n = 10,235$). Key tendencies on the demographic and personality variables for the whole sample, as well as broken down by different subgroups (recurrent users and non-recurrent cannabis users), are shown in Table 1.

Table 2 shows the frequency of cannabis use among students. A total of 72.6% had never used cannabis, 14.5% had used cannabis at some point in their lives but not in the past six months, 7.7% had used cannabis one to four times in the past six months, 4.0% had used cannabis 5 to 50 times in the past six months, and 1.1% had used cannabis 50 times or more in the past six months.

The whole sample of recurrent cannabis users (including both men and women) were significantly more likely to have been born in North America, to be Christian, male, single, and not to have child/ren, compared to abstainers/low-frequency cannabis users. Recurrent cannabis users scored higher on extroversion, neuroticism, and intellect/imagination, and lower on conscientiousness than the abstainers/low-frequency users in the analysis where both men and women were included.

Being born in North America was not significantly associated with recurrent cannabis use in the separate gender analyses, while being single was only significantly (positively) associated with recurrent cannabis use among men, and having child/ren was only significantly (negatively) associated with recurrent use among women. Agreeableness scores were

Table 1. Sample characteristics.

	Total sample (N = 11,236)	Recurrent cannabis users (n = 379)	Abstainers/low-frequency users of cannabis (n = 8908)
	Mean (SD) / %(95% CI)	Mean (SD) / %(95% CI)	Mean (SD) / %(95% CI)
Demographics			
Age in years	24.9 (6.5)	23.5 (3.7)	24.9 (6.5)
Years of studying	2.7 (2.2)	2.5 (2.0)	2.8 (2.2)
Place of birth			
Norway	92.4% (91.9–92.9%)	91.6% (88.7–94.4%)	92.8% (92.3–93.4%)
Europe (Norway not included)	4.4% (4.0–4.8%)	5.8% (3.4–8.2%)	4.3% (3.8–4.7%)
Asia	1.7% (1.5–2.0%)	0.5% (0.0–1.3%)	1.6% (1.3–1.8%)
Africa	0.5% (0.4–0.7%)	0.5% (0.0–1.3%)	0.4% (0.3–0.6%)
South or Central America	0.4% (0.3–0.6%)	0.3% (0.0–0.8%)	0.4% (0.3–0.5%)
North America	0.5% (0.3–0.6%)	1.3% (0.2–2.5%)	0.5% (0.3–0.6%)
Oceania	0.0% (n = 3)	0.0% (n = 0)	0.0% (n = 3)
Religious identification			
Non-religious	65.2% (64.3–66.1%)	86.8% (83.4–90.2%)	64.3% (63.3–65.3%)
Buddhism	0.6% (0.4–0.7%)	0.5% (0.0 –1.3%)	0.5% (0.4–0.7%)
Hinduism	0.2% (0.1–0.3%)	0.0% (n = 0)	0.1% (0.1–0.2%)
Islam	0.9% (0.7–1.1%)	0.5% (0.0–1.3%)	0.8% (0.6–1.0%)
Judaism	0.0% (n = 3)	0.0% (n = 0)	0.0% (n = 2)
Christianity	31.7% (30.9–32.6%)	11.6% (8.4–14.9%)	32.9% (31.9–33.9%)
Other religion	1.4% (1.2–1.6%)	0.5% (0.0–1.3%)	1.4% (1.1–1.6%)
Women	63.3% (62.4–64.2%)	36.9% (32.1–41.8%)	65.0% (64.0–65.9%)
Parents' alcohol and/or drug use affected childhood negatively	10.1% (9.5–10.7%)	13.5% (10.0–16.9%)	10.2% (9.6–10.8%)
Single	47.3% (46.4–48.2%)	58.8% (53.9–63.8%)	46.5% (45.5–47.6%)
Have child/ren	11.5% (10.9–12.1%)	2.1% (0.7–3.6%)	11.6% (11.0–12.3%)
Personality[a]			
Extroversion	14.1 (3.6)	14.7 (3.8)	14.0 (3.6)
Agreeableness	16.8 (2.8)	16.4 (3.1)	16.9 (2.8)
Conscientiousness	14.7 (3.2)	13.2 (3.5)	14.8 (3.2)
Neuroticism	11.0 (3.6)	11.0 (3.9)	11.0 (3.7)
Intellect/imagination	14.6 (3.2)	16.2 (3.0)	14.5 (3.2)

Note. Recurrent cannabis use = cannabis use 5–50 times in the last six months; Abstention or low-frequency cannabis use = cannabis use less than five times in the last six months.
SD = standard deviation; CI = confidence interval.
[a]Total scores range from 5–20 for each trait.

Table 2. Cannabis use among students, total *n* = 9391.

	n	% (95% CI)
Never used	6821	72.6% (71.7–73.5%)
Have used, but not in the last six months	1365	14.5% (13.8–15.3%)
1–4 times in the last six months	722	7.7% (7.2–8.2%)
5–50 times in the last six months	379	4.0% (3.6–4.4%)
More than 50 times in the last six months	104	1.1% (0.9–1.3%)

CI = confidence interval.

negatively associated with recurrent cannabis use among women but not men, and conscientiousness scores were negatively associated with recurrent use among men but not women. Neuroticism was positively associated with recurrent cannabis use among women, but not among men. Table 3 shows demographic and personality factors associated with recurrent cannabis use.

Table 4 presents the distribution of use of other substances among recurrent cannabis users and abstainers/low-frequency cannabis users. Recurrent cannabis users were significantly more likely to use nicotine products, to report a hazardous, harmful, or dependent alcohol intake, and to have used different illicit drugs a few or several times over the last six months, compared to the abstainers/low-frequency cannabis users. A total of 87.1% of the recurrent cannabis users had hazardous, harmful, or dependent alcohol consumption, whereas 51.1% of the abstainers/low-frequency users fell into one of these categories. The association between recurrent cannabis use and use of other substances was strongest for hallucinogens (MDMA, LSD, and other hallucinogens), stimulants (amphetamine/methamphetamine, ADHD medicines [without prescription], and cocaine/crack), sedatives (without prescription), and opiates (heroin and synthetic opiates [without prescription]).

Discussion

Prevalence of cannabis use among Norwegian students

Cannabis use seems to have low prevalence among Norwegian students compared to cannabis use in some other student populations (Allen & Holder, 2014; Johnston et al., 2011). While the current results support the notion of drug use as a culturally specific phenomenon (Abebe, Hafstad, Brunborg, Kumar, & Lien, 2015), cannabis use among Norwegian students should not be considered marginal, as about one in ten reported use in the past six months.

Characteristics associated with recurrent cannabis use

The whole sample of recurrent cannabis users (including both men and women) were more likely to have been born in North America, which may be unsurprising given the high prevalence of cannabis use among North American students. The recurrent cannabis users were also more likely to be non-Christian (rather than non-religious), men, single, and to be without child/ren. These findings are in line with previous research (Allen & Holder, 2014; Bell et al., 1997; Redonnet et al., 2012; White et al., 2005). Other religious beliefs, besides Christianity, had a negative association to recurrent cannabis use, but these associations were not significant, which could probably be explained by the low *n* in these religious groups. Being single was positively associated with recurrent cannabis use in the whole sample group (including both men and women) and in the separate analysis for male recurrent cannabis users. Being single was, however, not significantly associated with recurrent cannabis use among women, which indicates that single men are more likely to use cannabis regularly than are single women. Being in a romantic relationship has in general been found to reduce the risk of cannabis use, which may be particularly true for men, as they often rely more on social support from their romantic partner compared to women, who tend to receive more social support from friends (Bell et al., 1997; Walen & Lachman, 2000). Having child/ren was negatively associated with recurrent cannabis use in the full sample group (including both men and women) and in the separate analysis for female recurrent cannabis users. Having child/ren was, however, not significantly associated with recurrent cannabis use among men, which indicates that women with child/ren are less likely to use cannabis regularly compared to men with child/ren. This finding may reflect women's tendency to be more involved in childcare responsibilities compared to men (Evertsson, 2014). Childcare responsibilities seem incompatible with cannabis use.

Table 3. Characteristics related to recurrent cannabis use, total $n = 9287$ (reference category: no use of cannabis or less than five times in the last six months).

	Recurrent cannabis use ($n = 379$)	Female recurrent cannabis users ($n = 140$)	Male recurrent cannabis users ($n = 239$)
	OR (95% CI)	*OR (95% CI)*	*OR (95% CI)*
Demographics			
Age in years	0.98 (0.95–1.02)	1.01 (0.95–1.07)	0.97 (0.93–1.01)
Years of studying	0.97 (0.91–1.03)	0.93 (0.83–1.03)	0.99 (0.91–1.07)
Place of birth			
Norway	1.00	1.00	1.00
Europe (Norway not included)	1.45 (0.91–2.30)	1.79 (0.91–3.52)	1.22 (0.65–2.29)
Asia	0.44 (0.10–1.85)	*Could not compute*	0.83 (0.18–3.83)
Africa	1.70 (0.38–7.62)	*Could not compute*	2.19 (0.46–10.45)
South and Central America	0.87 (0.11–6.66)	*Could not compute*	1.48 (0.18–12.17)
North America	3.22 (1.20–8.64)*	3.40 (0.74–15.66)	3.26 (0.90–11.86)
Oceania	*Could not compute*	*Could not compute*	*Could not compute*
Religious identification			
Non-religious	1.00	1.00	1.00
Buddhism	0.73 (0.17–3.08)	1.00 (0.13–7.66)	0.57 (0.07–4.41)
Hinduism	*Could not compute*	*Could not compute*	*Could not compute*
Islam	0.64 (0.15–2.74)	*Could not compute*	0.94 (0.20–4.40)
Judaism	*Could not compute*	*Could not compute*	*Could not compute*
Christianity	0.35 (0.25–0.48)***	0.38 (0.24–0.61)***	0.32 (0.20–0.50)***
Other religion	0.27 (0.07–1.13)	0.37 (0.05–2.70)	0.22 (0.03–1.65)
Gender			
Female	1.00	–	–
Male	2.67 (2.08–3.41)***	–	–
Parents' alcohol and/or drug use			
No effect on childhood	1.00	1.00	1.00
Affected childhood	1.33 (0.97–1.83)	1.19 (0.73–1.93)	1.45 (0.95–2.22)
Relationships status			
In a relationship	1.00	1.00	1.00
Single	1.28 (1.03–1.60)*	1.24 (0.87–1.76)	1.37 (1.03–1.83)*
Children			
Without children	1.00	1.00	1.00
Have child/ren	0.27 (0.12–0.62)**	0.12 (0.02–0.57)**	0.45 (0.17 –1.17)
Personality			
Extroversion Z	1.31 (1.17–1.47)***	1.56 (1.28–1.91)***	1.20 (1.04–1.38)*
Agreeableness Z	0.93 (0.84–1.04)	0.74 (0.61–0.89)**	1.04 (0.91–1.19)
Conscientiousness Z	0.74 (0.67–0.83)***	0.86 (0.73–1.02)	0.67 (0.59–0.77)***
Neuroticism Z	1.16 (1.04–1.30)*	1.25 (1.04–1.50)*	1.09 (0.94–1.26)
Intellect/imagination Z	1.51 (1.33–1.70)***	1.55 (1.28–1.88)***	1.48 (1.26–1.73)***
Model	χ^2 (df = 23) = 378.680, $p < .001$	χ^2 (df = 22) = 126.390, $p < .001$	χ^2 (df = 22) = 159.444, $p < .001$
	Cox & Snell = .040; Nagelkerke R^2 = .138	Cox & Snell = .021; Nagelkerke R^2 = .105	Cox & Snell = .046; Nagelkerke R^2 = .115

OR = odds ratio; CI = confidence interval; Z = the variable was based on z-scores.
*$p < .05$, **$p < .01$, ***$p < .001$.

Table 4. Alcohol, nicotine and drug use among recurrent cannabis users[a] and abstainers/low-frequency users of cannabis, total *n* = 9287.

Outcomes	Recurrent cannabis users (*n* = 379) Distribution (95% CI)	Abstainers/low-frequency users of cannabis (*n* = 8908) Distribution (95% CI)	Relative risks
Nicotine use			
Daily smoking	7.9% (5.2–10.7%)	1.7% (1.4–2.0%)	4.64***
Daily use of "snus"	36.7% (31.8–41.6%)	16.6% (15.9–17.4%)	2.20***
Alcohol use			
Hazardous drinking (AUDIT ≥ 8)	59.9% (54.9–64.9%)	44.7% (43.7–45.8%)	1.34***
Harmful drinking (AUDIT ≥ 16)	17.2% (13.3–21.0%)	4.6% (4.2–5.1%)	3.71***
Dependent drinking (AUDIT ≥ 20)	10.0% (7.0–13.1%)	1.8% (1.5–2.0%)	5.69***
Use of other drugs in the last six months			
Hallucinogens (MDMA, LSD, other)	24.1% (19.7–28.4%)	0.9% (0.7–1.1%)	27.49***
Stimulants (amphetamine/methamphetamine, ADHD medicines, cocaine/crack)	18.8% (14.8–22.7%)	1.0% (0.8–1.2%)	19.23***
Anabolic steroids	0.3% (0.0–0.8%)	0.1% (0.0–0.1%)	4.71
Sedatives	9.0% (6.1–11.9%)	0.6% (0.4–0.7%)	15.41***
Opiates (heroin and synthetic opiates)	1.3% (0.2–2.5%)	0.1% (0.0–0.1%)	23.57***
Repeated use of other drugs in the last six months[b]			
Hallucinogens (MDMA, LSD, other)	3.7% (1.8–5.6%)	0.1% (0.0–0.2%)	36.66***
Stimulants (amphetamine/methamphetamine, ADHD medicines, cocaine/crack)	4.0% (2.0–6.0%)	0.3% (0.1–0.4%)	16.07***
Anabolic steroids	0.0% (0.0%)	0.0% (0.0%)	1.00
Sedatives	2.4% (0.8–3.9%)	0.1% (0.0–0.2%)	21.21***
Opiates (heroin and synthetic opiates)	1.1% (0.0–2.1%)	0.0% (0.0%)	94.27***

[a]Cannabis use 5–50 times in the last six months.
[b]Drug use five times or more in the last six months.
CI = Confidence interval; AUDIT = Alcohol Use Disorders Identification Test.
*$p < .05$, **$p < .01$, ***$p < .001$.

Recurrent cannabis users of both genders had higher scores for extroversion compared to the abstainers/low-frequency cannabis users. This association has not been reported before. In student settings, sociability – the hallmark of extroversion (McCrae & John, 1992) – has been pointed to as a main gateway to cannabis use (Suerken et al., 2014). Extroverts may appreciate and pursue the social ritual associated with cannabis use, where users send the joint or pipe around (Pedersen, 2015). Also, studies on other drugs, such as alcohol, have found increased use to be related to extroversion (Hakulinen et al., 2015). In line with this, it has also been suggested that extroverts have a greater risk for drug use than introverts as they are assumed to have a greater need for external stimulation (Hill, Shen, Lowers, & Locke, 2000). Agreeableness had a significant negative association with recurrent cannabis use among women, but not among men or for the whole sample group (including both men and women). Consideration for others (hallmark of agreeableness) may hence be a stronger motivation for abstaining from cannabis use among women compared to men. The current finding is in line with previous research (Allen & Holder, 2014; Flory et al., 2002; Terracciano et al., 2008), but elaborates on the relationship between gender, agreeableness, and cannabis use. Recurrent

cannabis users had lower scores on conscientiousness, which supports previous observations (Allen & Holder, 2014; Flory et al., 2002; Terracciano et al., 2008). Conscientiousness is linked to being organised, industrious, and hard working (McCrae & John, 1992), which implies that those with high scores on this trait may avoid cannabis to be able to comply with their obligations. Conscientiousness was, however, not significantly associated with recurrent cannabis use in the female group, which may suggest that complying with obligations is a more important motivation for abstaining from cannabis among men compared to women. Neuroticism had a significant positive association with recurrent cannabis use in the whole sample group and among women, but not among men. Neuroticism has previously been found to be associated with cannabis use (Degenhardt et al., 2001), but that this association may particularly apply to women has not been reported previously. Neuroticism is strongly linked to anxiety, and individuals with heightened neuroticism scores may hence use cannabis to relieve tension and stress (Degenhardt et al., 2001). The current results suggest that tension relief might, further, be a more common motivation for recurrent cannabis use among women compared to men. High scores on intellect/imagination increased the likelihood of recurrent cannabis use in both gender groups, and this is also in line with previous findings (Allen & Holder, 2014). Individuals scoring high on intellect/imagination tend to seek out unconventional and norm-breaking experiences (McCrae & John, 1992); these tendencies may explain the link between intellect/imagination and cannabis use.

Relationship between recurrent cannabis use and use of other substances

Recurrent cannabis users were more likely than abstainers/low-frequency users to report daily use of nicotine products, high alcohol use, and use of other illicit drugs. A vast majority of the recurrent cannabis users (87.1%) reported an alcohol consumption that is regarded as hazardous, harmful, or dependent. This should be considered worrisome, as this level of alcohol consumption has been linked to a range of adverse effects (Babor et al., 2001). Previous research has indicated that cannabis and alcohol are often used simultaneously. Such simultaneous polysubstance use may be particularly dangerous, as combining the two substances has been suggested to enhance the substances' detrimental effects (Pape, Rossow, & Storvoll, 2009). Further, recurrent cannabis use had the strongest association to use of hallucinogens, stimulants, sedatives, and opiates. Hallucinogens and stimulants are considered dangerous substances, with potential serious adverse effects even at low-frequency levels of use (Fischbach, 2017; Karuppagounder et al., 2014; Parrott, 2014; Pedersen, 2015); although others have claimed that certain hallucinogens could be therapeutic and involve a low risk of adverse effects (Gasser, Kirchner, & Passie, 2015). Recurrent users' heightened risk of using sedatives could be troublesome, because some sedatives, such as benzodiazepines, are known to have highly addictive properties (Tan, Rudolph, & Lüscher, 2011). The recurrent users' increased risk of opiate use was substantial, which may also raise concern. It should, however, be noted that opiate use was quite rare among the recurrent student users, which may make their increased risk of opiate use of little practical interest. The current finding is in accordance with previous studies that have established a clear association between cannabis use and use of other substances (Degenhardt et al., 2001; Volkow et al., 2014), but the current results elaborate current knowledge on substances that are particularly associated to cannabis use. Several explanatory mechanisms have been proposed to clarify the relationship between increasing cannabis use and increasing use of other intoxicating substances. Suggested explanations include that cannabis use might increase the individual's suggestibility to other intoxicating drugs, and that common factors (such as personality and socioeconomic status)

may predict and explain the use of both cannabis and other substances (Pedersen, 2015; Volkow et al., 2014).

Limitations and strengths

The cross-sectional study design precludes conclusions about directionality and causality. Some of the investigated characteristics are, however, assumed to be relatively stable over time and likely to have existed before cannabis use, such as demographic and personality characteristics. Furthermore, answers to questions about substance use may be influenced by social desirability bias (Tourangeau & Yan, 2007), although this bias seems to be reduced in Internet-based studies such as the current one (Gnambs & Kaspar, 2015). It should also be noted that the number of men in the recurrent user group was higher than the number of women, providing differences in statistical power for the gender-specific analyses.

The large sample and the broad coverage of variables represent important strengths of the current study. Few previous studies have examined predictors and associations of regular, albeit not necessarily daily, cannabis use, and there are particularly few studies on students' cannabis use in the Scandinavian context. To our knowledge, the association between cannabis use and extroversion is a novel finding. The findings of gender-specific characteristics associated with cannabis use are novel as well.

Conclusions

The prevalence of recurrent cannabis use among Norwegian students is relatively low, compared to some other student populations. The elevated cannabis use among individuals with high scores on extroversion and intellect/imagination supports the notion of cannabis use as a social activity for individuals identifying themselves as unconventional. Cannabis use seems to be strongly associated with the use of nicotine, alcohol, and other drugs among students. Future research should investigate whether drug use in college/university predicts further drug use.

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