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## Prevalence and characteristics of tobacco and cannabis co-use in 15-year-old students in Slovenia

Razširjenost in značilnosti souporabe tobaka in konoplje med 15-letnimi dijaki v Sloveniji

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**Key words:** psychoactive substances; co-use; co-user characteristics; adolescents

**Ključne besede:** psihoaktivna snov; souporaba; značilnosti souporabnika; mladostnik

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### ABSTRACT

**Introduction:** While the co-use of tobacco and cannabis is common among adolescents, no data on this topic is currently available for Slovenia. The purpose of this study was therefore to explore the prevalence and characteristics of tobacco and cannabis co-use in 15-year-old students in Slovenia.

**Methods:** We analysed the data obtained from a representative sample of 15-year-old Slovene students ( $n = 1615$ ) who took part in the 2014 Health Behaviour in School-Aged Children international cross-sectional survey, and performed a chi-square test and multivariate logistic regression analyses.

**Results:** Lifetime tobacco and cannabis use was reported by 19.5 % of 15-year-old students with no gender difference ( $p = 0.108$ ) and was associated with history of drunkenness (OR = 8.18, 95 % C.I. 5.74–11.64), friends' use of cannabis (OR = 3.93, 95 % C.I. 2.67–5.79) and tobacco (OR = 1.83, 95 % C. I. 1.25–2.69), and with lower perceived family support (OR = 0.88, 95 % C.I. 0.80–0.97). Current co-use was reported by 7.2 % with no gender difference ( $p = 0.136$ ) and was associated with a history of drunkenness (OR = 8.06, 95 % C.I. 4.43–14.67), friends' use of cannabis (OR = 3.72, 95 % C.I. 2.23–6.19) and living in a reconstructed family (OR = 3.33, 95 % C. I. 1.74–6.40).

**Discussion and conclusion:** Our study advocates for expanding preventive and cessation programmes from one to more psychoactive substances. Peers and family are the key factors which need to be addressed in these programmes. They can be reached through the school and healthcare systems. Environmental prevention measures, including legislative measures, create environments promoting healthy choices and thus contribute to the reduction of such co-use.

### IZVLEČEK

**Uvod:** Souporaba tobaka in kanabisa je pogosta med mladostniki, podatkov za Slovenijo ni. Namen raziskave je bil prikazati podatke o souporabi obeh snovi med 15-letniki v Sloveniji.

**Metode:** V analizo je vključen reprezentativni vzorec slovenskih 15-letnih dijakov ( $n = 1615$ ) iz mednarodne presečne raziskave »Z zdravjem povezana vedenja v šolskem obdobju 2014«, uporabljena pa hi-kvadrat test in multivariatna logistična regresija.

**Rezultati:** Kadarkoli v življenju je obe snovi uporabilo 19,5 % 15-letnih dijakov, razlik med spoloma ni ( $p = 0,108$ ). Uporaba obeh snovi kadarkoli v življenju je povezana z opitostjo v preteklosti (OR = 8,18, 95-% I. Z. 5,74–11,64), uporabo konoplje (OR = 3,93, 95-% I. Z. 2,67–5,79) in uporabo tobaka med prijatelji (OR = 1,83, 95-% I. Z. 1,25–2,69) ter nižjo zaznano podporo družine (OR = 0,88, 95-% I. Z. 0,80–0,97). V času raziskave je obe snovi uporabljalo 7,2 % vseh, brez razlik med spoloma ( $p = 0,136$ ). Trenutna souporaba je povezana z opitostjo v preteklosti (OR = 8,06, 95-% I.Z. 4,43–14,67), uporabo konoplje med prijatelji (OR = 3,72, 95-% I.Z. 2,23–6,19) in rekonstruirano družino (OR = 3,33, 95-% I.Z. 1,74–6,40).

**Diskusija in zaključek:** Raziskava podpira širitev programov preprečevanja in opuščanja z ene na več psihoaktivnih snovi. Vrstniki in družina so ključni dejavniki, ki jih moramo nasloviti v preventivnih programih; do njih dostopamo v šolskem in zdravstvenem sistemu. Okoljska preventiva, vključno z zakonodajnimi ukrepi, kreira okolja, spodbudna za zdrave izbire, in prispeva k zmanjšanju souporabe.

## Introduction

Tobacco and cannabis are the most commonly used substances in Europe, and their use typically begins in adolescence (European Monitoring Centre for Drugs and Drug Addiction [EMCDDA], 2017). Substantial proportions of adolescents either experiment with tobacco and cannabis or use both substances (Ramo, et al., 2012; Webster, et al., 2014; Badiani, et al., 2015; Hublet, et al., 2015; EMCDDA, 2017). The effects on the brain produced by the co-use of tobacco and cannabis are different than those produced by the use of either substance on its own and are associated with a range of physical, psychological and behavioural problems (Subramaniam, et al., 2016). Consistent consequences of such co-use are mental health symptoms; some studies also show an increase in other risk behaviours and neurocognitive effects. While the association with physical health is less evident, studies indicate an association with respiratory problems and poorer lung function already in young adulthood (Ramo, et al., 2012). Early tobacco use also increases the risk of cannabis dependence and use disorder, while cannabis use in adolescence increases the risk of heavier smoking patterns and development of nicotine dependence (Agrawal, et al., 2011; Peters, et al., 2012; Ramo, et al., 2012; Brook, et al., 2015). There are positive associations between tobacco and cannabis use among adolescents and young adults; tobacco use is associated with cannabis use and vice versa. Less is known about the factors associated with the co-use of tobacco and cannabis in youth. Studies show significant associations with mental and physical health, parenting/family, school and other environmental characteristics (Ramo, et al., 2012).

While in Slovenia, the data on adolescents' use of tobacco or cannabis respectively is available, much less is known about the prevalence and characteristics of the co-use of tobacco and cannabis. Among 15-year-old students, 40.0 % reported a lifetime use of tobacco and 21.1 % a lifetime use of cannabis, 18.9 % of 15-year-old students currently smoke tobacco, and 10.3 % have used cannabis during the last 30 days (Jeriček Klanšček, et al., 2015). We found no published data on the prevalence and characteristics of tobacco and cannabis co-use in adolescents in Slovenia.

### *Aims and objectives*

The aim of the study is to present data on the co-use of tobacco and cannabis (lifetime and current use) in 15-year-old students in Slovenia and to examine the relationship between such co-use and selected socio-demographic, individual, school, family, mental health characteristics and peer use of tobacco and cannabis. The following research questions will be addressed:

- What is the extent of tobacco and cannabis co-use among 15-year-olds in Slovenia?

- What are the characteristics of co-users of tobacco and cannabis in comparison to non-users?

## Method

The study was based on an observational quantitative research method (cross-sectional study on a nationally representative sample).

### *Description of the research instrument*

The World Health Organization's (WHO's) international cross-sectional survey Health Behaviour in School-Aged Children (HBSC) was carried out on a nationally representative sample of 11-, 13- and 15-year-old students (Jeriček Klanšček, et al., 2015; Inchley, et al., 2016).

The study questionnaire included questions on a variety of topics related to youth health behaviour, including tobacco and cannabis use, but not for all age groups. Only the questionnaire for 15-year-old students included questions on cannabis use, so for the purpose of this study only the data for 15-year-old students were used and analysed.

Lifetime co-use of both tobacco and cannabis refers to cases when a study participant reported such use on at least one day in their lifetime. Lifetime smoking of cigarettes was measured using the question "On how many days (if any) have you smoked cigarettes in your lifetime?" with possible answers: never, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days and 30 days or more. Lifetime use of cannabis was measured using the question "Have you ever taken cannabis in your life (on how many days)?" with the same possible answers. In the following text, we refer to lifetime cigarette smoking as lifetime smoking or tobacco use, as a vast majority of 15-year-old students in Slovenia smoke cigarettes (Koprivnikar & Zupanič, 2017).

Current co-use of both tobacco and cannabis refers to cases when a study participant reported both current tobacco smoking and current cannabis use. Current (weekly and daily) tobacco smoking was measured using the question "How often do you smoke tobacco at present?", with possible answers: every day; at least once a week, but not every day; less than once a week and I don't smoke. Use of cannabis during the last 30 days was measured by the question "Have you used cannabis in the last 30 days (on how many days)?" with the following possible answers: never, 1–2 days, 3–5 days, 6–9 days, 10–19 days, 20–29 days and 30 days or more. In the following text, we refer to the use of cannabis during the last 30 days as current cannabis use.

Age at first smoking of cigarettes was measured using the question "At what age did you first smoke a cigarette (more than a puff)?", while age at first use of cannabis was measured using the question "At what age did you first use cannabis?", with the following

response options: never, 11 or earlier, 12, 13, 14, 15 and 16 years. We assessed the associations of the co-use of tobacco and cannabis with gender, a subjective assessment of family affluence, peers' use of tobacco or cannabis, the participant's use of alcohol (having been drunk on two or more occasions), family and parenting characteristics (family type, perceived family support, perceived family communication, spending time with friends after 8 p.m. every day), school characteristics (the type of school programme, perceived school performance, liking school, perceived teachers' support), and measures of mental and physical health (feelings of depression, self-rated health, emotional and behavioural difficulties). More information about these measures is available in published reports (Jeriček Klanšček, et al., 2015; Inchley, et al., 2016).

### Description of the research sample

Data from the Ministry of Education, Science and Sport on the enrolment and number of classes for the 2013/2014 school year served as the basis for the sample frame. School class was the primary sampling unit; classes were randomly selected from the list of all relevant classes. A stratified two-stage sampling was used. During the first stage, primary and secondary schools were selected; during the second stage, classes within different secondary school programmes were selected (grammar school, 4-year technical school, middle vocational school and lower vocational school). The survey was performed in February 2014 through a self-administered web questionnaire. The final response rate (based on selected classes) was 92.7 %. The survey methodology is described in detail in study reports by Jeriček Klanšček and colleagues (2015) and Inchley and colleagues (2016). The final study sample consisted of a total of 1.615 15-year-old students, of whom there were 46.1 % boys and 53.9 % girls. Overall, 40.9 % were enrolled in grammar schools, 38.2 % in technical schools, and 20.9 % in vocational schools. The respondents for whom the data on tobacco smoking or cannabis use were missing were coded as missing.

### Description of the research procedure and data analysis

The web survey was carried out with the assistance of school counsellors or teachers in February of 2014. The research group guaranteed the anonymity and voluntariness of participation. All analyses were conducted using SPSS ver. 21 (SPSS Inc., Chicago, IL, USA). We used the chi-square test ( $\chi^2$ ) to examine the association between the selected variables. Multivariate logistic regression analyses were performed to estimate the odds ratio (OR) and their 95 % confidence intervals (95 % CI) with two-sided probability ( $p$ ) values. A  $p$  value of  $< 0.05$  was considered as statistically significant (in both analyses). We prepared two models: in the first model, we estimated the OR for lifetime use of both substances, and in the second one, we estimated the OR for current use of both substances. In both models, we compared the users of both substances with all other 15-year-old students in the study. In both models, respondents with missing data on tobacco smoking, cannabis use, or any of the independent variables were excluded from further analyses.

## Results

### Lifetime and current co-use of tobacco and cannabis

Overall, 20.5 % of 15-year-old students reported a lifetime use of only tobacco, 1.9 % reported a lifetime use of only cannabis, 19.5 % reported a lifetime use of both substances, while 58.1 % of all participants had not used tobacco or cannabis in their lifetime. Out of the whole sample, 11.3 % of 15-year-old students currently smoked tobacco only, 3.1 % currently used cannabis only, and 7.2 % reported current co-use of tobacco and cannabis, while 78.4 % did not currently use either tobacco or cannabis. Table 1 shows the percentages of lifetime and current co-use of tobacco and cannabis among 15-year-old students by gender.

Among current tobacco smokers, 38.8 % reported current cannabis use (44.4 % of weekly tobacco smokers and 53.5 % of daily tobacco smokers). Conversely, among current cannabis users, 69.8 %

**Table 1:** Co-use of tobacco and cannabis (lifetime, current) among 15-year-old students, total and by gender

**Tabela 1:** Souporaba tobaka in konoplje (kadarkoli v življenju, trenutno) med 15-letnimi dijaki, skupno in po spolu

Co-use of tobacco and cannabis / Souporaba tobaka in konoplje	Total n(%) / Skupaj n(%)	Boys n(%) / Fantje n(%)	Girls n(%) / Dekleta n(%)	p value / p vrednost	Estimated no. of users a* / Ocena števila uporabnikov a*
Lifetime co-use	286 (19.5)	140 (21.4)	146 (18.0)	0.108	3951
Current co-use	111 (7.2)	58 (8.3)	53 (6.3)	0.136	1459

Legend / Legenda: a – estimated number of users among 15-year-olds of both genders in Slovenia / ocena števila uporabnikov med 15-letniki obeh spolov v Sloveniji; \* – calculated on number of enrolled 15-year-olds for the 2013/2014 school year / izračunano na osnovi števila všolanih 15-letnikov v šolskem letu 2013 / 2014; % – percentage / odstotek; n – number / število; p – statistical significance / statistična značilnost

were current tobacco smokers (55.3 % of these were weekly tobacco smokers and 42.8 % were daily tobacco smokers). Current tobacco smokers showed increased odds of current cannabis use ( $\text{Exp}(B) = 16.0$ , 95 % C.I. = 11.0–23.2) compared to 15-year-old students who

currently did not smoke tobacco. Current cannabis users showed increased odds of current tobacco smoking ( $\text{Exp}(B) = 16.0$ , 95 % C.I. = 11.0–23.2) compared to 15-year-old students who currently did not use cannabis.

**Table 2:** Results of the multivariate logistic regression examining the relationship among different characteristics and co-use of tobacco and cannabis (lifetime, current)

**Tabela 2:** Rezultati multivariatne logistične regresije povezav med različnimi značilnostmi tistih, ki poročajo o souporabi tobaka in konoplje (kadarkoli v življenju, trenutna)

<i>Co-use of tobacco and cannabis / Souporaba tobaka in konoplje</i>		<i>Lifetime co-use / Souporaba kadarkoli v življenju</i>		<i>Current co-use / Trenutna souporaba</i>	
<i>Characteristics / Značilnosti</i>	<i>Categories / Kategorije</i>	<i>Exp(B)</i>	<i>95 % C.I.</i>	<i>Exp(B)</i>	<i>95 % C.I.</i>
Gender	Girls	1.00	/	1.00	/
	Boys	1.22	0.85–1.75	1.40	0.83–2.44
Have been drunk on two or more occasions	No	1.00	/	1.00	/
	Yes	8.18***	5.74–11.64	8.06***	4.43–14.67
Friends' use of tobacco	None / few	1.00	/	1.00	/
	Most / all	1.83**	1.25–2.69	1.69	0.90–3.16
Friends' use of cannabis	None / few	1.00	/	1.00	/
	Most / all	3.93***	2.67–5.79	3.72***	2.23–6.19
Type of school programme	Grammar school	1.00	/	1.00	/
	Technical school	1.03	0.71–1.50	1.50	0.85–2.64
	Vocational school	0.76	0.47–1.24	1.60	0.81–3.18
Perceived school performance	Good or very good	1.00	/	1.00	/
	Average/below average	1.02	0.70–1.47	1.14	0.68–1.91
Liking school a lot	Yes	1.00	/	1.00	/
	No	1.14	0.80–1.64	0.68	0.40–1.15
Perceived lack of support from teachers <sup>a</sup>		1.18	0.92–1.51	1.24	0.88–1.75
Subjective assessment of family affluence	Above average	1.00	/	1.00	/
	Average	0.87	0.60–1.25	1.01	0.59–1.73
	Below average	0.85	0.49–1.47	1.48	0.74–2.98
Family type	Both parents	1.00	/	1.00	/
	Single parent	1.08	0.66–1.77	0.90	0.45–1.80
	Reconstructed/other	1.60	0.93–2.76	3.33***	1.74–6.40
Perceived family support <sup>a</sup>		0.88*	0.80–0.97	0.95	0.82–1.09
Perceived lack of family communication <sup>a</sup>		1.12	0.90–1.40	1.09	0.81–1.48
Spending time with friends after 8 p.m. every day	No	1.00	/	1.00	/
	Yes	1.11	0.55–2.25	1.95	0.90–4.22
Feelings of depression	No	1.00	/	1.00	/
	Yes	1.04	0.70–1.54	1.22	0.70–2.13
Self-rated health	Good / very good	1.00	/	1.00	/
	Fair / poor	1.26	0.80–1.99	1.56	0.86–2.83
Strengths and Difficulties Questionnaire	Normal	1.00	/	1.00	/
	Borderline	1.08	0.66–1.76	1.46	0.78–2.76
	Elevated	0.93	0.52–1.64	0.83	0.38–1.81

*Legend / Legenda:* a – continuous variable / kontinuirana spremenljivka; \* – statistical significance set at  $p < 0.05$  / statistična značilnost pri  $p < 0.05$ ; \*\* – statistical significance set at  $p < 0.01$  / statistična značilnost pri  $p < 0.01$ , \*\*\* – statistical significance set at  $p < 0.001$  / statistična značilnost pri  $p < 0.001$ ;  $\text{Exp}(B)$  – odds ratio (OR) / razmerje obetov; 95% C. I. – 95 % confidence interval / 95% interval zaupanja

## *Age at first use of tobacco and cannabis*

Among 15-year-old students who reported lifetime use of both substances, altogether 52.8 % used tobacco first, 6.5 % used cannabis first, while 40.8 % reported first use of both substances at the same age. The 15-year-old students with early first use of cannabis (at age 13 or younger) showed increased odds of current tobacco smoking ( $\text{Exp}(B) = 10.3$ , 95 % C.I. = 5.3–20.2), current weekly tobacco smoking ( $\text{Exp}(B) = 7.9$ , 95 % C.I. = 4.2–14.9) and current daily tobacco smoking ( $\text{Exp}(B) = 8.1$ , 95 % C.I. = 4.2–15.6) compared to those who had first used cannabis at age 14 or 15. The 15-year-old students with early initiation of smoking (at age 13 or younger) did not show increased odds of current use of cannabis compared to those who had first used tobacco at 14 or 15 years of age ( $\text{Exp}(B) = 1.3$ , 95 % C.I. = 0.9–1.9).

## *Characteristics of co-users of tobacco and cannabis*

Table 2 shows the results of our multivariate logistic regression analyses of various factors associated with lifetime ( $n = 1361$ ,  $p = 0.889\%$ , explanation of variability = 41.2 %) and current ( $n = 1438$ ,  $p = 0.951\%$ , explanation of variability = 35.8 %) co-use of tobacco and cannabis. Lifetime co-users of tobacco and cannabis show increased odds of experiencing drunkenness on two or more occasions in their lifetime ( $\text{Exp}(B) = 8.18$ , 95 % C.I. = 5.74–11.64,  $p < 0.001$ ), having more friends who use tobacco ( $\text{Exp}(B) = 1.83$ , 95 % C.I. = 1.25–2.69,  $p = 0.002$ ), having more friends who use cannabis ( $\text{Exp}(B) = 3.93$ , 95 % C.I. = 2.67–5.79,  $p < 0.001$ ), and having lower perceived family support ( $\text{Exp}(B) = 0.88$ ; 95 % C.I. = 0.80–0.97,  $p = 0.012$ ). Current co-users of tobacco and cannabis show increased odds of experiencing drunkenness on two or more occasions ( $\text{Exp}(B) = 8.06$ , 95 % C.I. = 4.43–14.67,  $p < 0.001$ ), having more friends who use cannabis ( $\text{Exp}(B) = 6.19$ , 95 % C.I. = 2.23–6.19,  $p < 0.001$ ), and coming from a reconstructed/other type of family ( $\text{Exp}(B) = 3.33$ , 95 % C.I. = 1.74–6.40,  $p < 0.001$ ).

## **Discussion**

Even though the majority of 15-year-old students in Slovenia had never in their lifetime co-used (54 %) or did currently not co-use (74 %) tobacco and cannabis, a substantial proportion did, despite the fact that cannabis is an illicit drug and there is a ban on the sale of tobacco products to those under 18 years of age. Approximately one in five subjects (18 %) reported lifetime use of both substances, and approximately one in fourteen (7 %) currently used both substances. Co-use of tobacco and cannabis among 15-year-old students in Slovenia is close to that reported for 15-year-old students in Eastern European countries, where 8 % used both substances and 73 % reported no use (Hublet, et al., 2015).

Our study shows no significant differences in lifetime or current use of both substances by gender, and some, but not all, other studies show similar results regarding gender differences (Suris, et al., 2007; Suris, et al., 2010; Ramo, et al., 2012; Webster, et al., 2014; Badiani, et al., 2015). These findings support the notion that the use of both substances should be considered equally important in both genders.

It is significantly more likely for those 15-year-old students who currently smoke tobacco to also be current users of cannabis than is the case for current non-smokers, and, in turn, it is significantly more likely for those who currently use cannabis to also be current tobacco smokers than is the case for those who currently do not use cannabis. This is in line with other studies showing that the use of either tobacco or cannabis increases the likelihood of the use of the other drug, as they each support and reinforce the use of the other (Agrawal, et al., 2012; Ramo, et al., 2012; Badiani, et al., 2015). There are several possible mechanisms linking tobacco and cannabis use, among others these can be genetic and environmental (Agrawal, et al., 2011; Badiani, et al., 2015). The two substances also share a common route of administration, i.e. smoking. Furthermore, cannabis can be smoked by itself or can be rolled with small amounts of tobacco (Agrawal, et al., 2012; Ramo, et al., 2012).

As shown by the results of our study, the majority (around 70 %) of cannabis users also smoke, while around 40 % of smokers also use cannabis. According to data from other countries, this could change in the future. As stated by Webster and colleagues (2014), in the early 1990s, Canada reported a situation similar to that shown by our study; however, recent Canadian data show that the share of smokers among cannabis users has decreased to 25 %, while the share of cannabis users among smokers has increased to 92 %. The authors suspect this could be the result of a changed perception of cannabis and tobacco use as a deviant/normative behaviour. While cannabis use may be an increasingly normative behaviour, smoking may have become a more socially deviant behaviour as a result of the decreasing prevalence of tobacco use among youth due to stricter tobacco control measures (Webster, et al., 2014). In Slovenia, the new strict tobacco control law introduced in the beginning of 2017 will most likely contribute to future changes in the perception of smoking; it includes large graphic health warnings on the packaging of tobacco products that are intended for smoking, plain packaging of cigarettes and hand-rolling tobacco, a total ban on advertising, display and promotion of tobacco products, a ban on characteristic flavours in cigarettes and hand-rolling tobacco, permissions for selling tobacco, a ban on smoking in all vehicles in the presence of minors (ZOUTPI, 2017).

Approximately one half of the 15-year-old students who reported a lifetime use of both substances had used tobacco before they had used cannabis; around 40 % had

used both at the same age, while the minority (6.5 %) had used cannabis first. Other studies also show similar findings (Leatherdale, et al., 2007; Agrawal, et al., 2011; Green, et al., 2016). The sequence of drug use could to some extent reflect its ease of access and youth may use tobacco prior to cannabis due to its availability (Agrawal, et al., 2012). Overall, 66 % and 45 % of 16-year-olds in Slovenia report the availability of tobacco and cannabis to be very easy or fairly easy (European School Survey Project on Alcohol and Other Drugs [ESPAD], 2016).

In our study, early use of cannabis (at age 13 or younger) was associated with increased odds for current smoking, while early cigarette smoking did not increase the odds for current cannabis use. The majority of other studies show that early use of either tobacco or cannabis is positively associated with later use of the other substance (Patton, et al., 2005; Leatherdale, et al., 2007; Agrawal, et al., 2011; Ramo, et al., 2012; Taylor, et al., 2017), but studies typically include participants of an older average age than those included in our study (Patton, et al., 2005; Leatherdale, et al., 2007; Agrawal, et al., 2011; Agrawal, et al., 2012). The impact of age at initiation could become more apparent at later ages, e.g., in late adolescence or young adulthood (Leatherdale, et al., 2007; Ramo, et al., 2012).

While there are numerous studies on the characteristics associated with tobacco use or cannabis use, fewer focus on the characteristics associated with co-use. The available studies focusing on adolescents and young adults have revealed significant positive associations between the use of both substances and aspects of mental and physical health, such as high-intensity pleasure temperament, externalizing mental health symptoms, perceived general health (Ramo, et al., 2012) and anxiety (Brook, et al., 2012; Ramo, et al.,), with the history of drunkenness/alcohol misuse (Suris, et al., 2007; Suris, et al., 2010; Ramo, et al., 2012; Schauer & Peters, 2018) and vocational education (Ramo, et al., 2012). An authoritative parenting style (Ramo, et al., 2012), living with both parents (Suris, et al., 2007; Ramo, et al., 2012), a better relationship with parents (Brook, et al., 2012), better grades (Suris, et al., 2007; Suris, et al., 2010; Ramo, et al., 2012) and school enrolment have been found to be protective factors, while a diagnosis of attention-deficit hyperactivity disorder and self-control have been found to be negatively associated with the use of both substances (Ramo, et al., 2012). While in some studies, sensation-seeking personality traits, depression symptoms, mood disorder and conduct disorder have been found to have no relationship with co-use (e.g., Ramo, et al., 2012), in other studies, such associations have been shown (e.g., Brook, et al., 2015). There is a lack of studies focussing on the associations of co-use with peer characteristics (Ramo, et al., 2012). In our study, the factors which were found to be positively associated with lifetime

and current use of both substances are a history of being drunk, friends' use of cannabis and family characteristics (lower level of perceived family support in lifetime co-use and a reconstructed or other type of family in current co-use). Additionally, friends' use of tobacco was positively associated with a lifetime use of both substances. The model in our study included many factors previously shown to have significant associations with the use of both substances and the results are mostly consistent with other studies. While according to other studies, we could expect self-rated health, other family factors, and vocational education to have significant associations with co-use, this was not the case in our model. This could also be related to our selection of variables, the age of study participants or the selection of the comparison group.

To our knowledge, our study is the first one on tobacco and cannabis co-use to be published for Slovenia on a representative sample of adolescent students. Independent variables analysed in this study explained a large proportion of variability in all models. Our study does not include school dropouts, as this could lead to an underestimation of use of both substances. Other limitations of our study are its cross-sectional design, which does not allow for any conclusions on causality or chronology, and possible underreporting due to self-reported data. Data on the age of initiation of tobacco or cannabis use may be subject to recall bias, but as these are quite recent events for study participants, we assume that such bias is not significant. The missing data (tobacco and cannabis use) accounted for 2.2 %, which should not have any significant impact on the results.

As has already been emphasised by other researchers (Ramo, et al., 2012), studies addressing substance use in adolescence and young adulthood should assess multiple substance use as this has been shown to be a common behaviour, which deserves more research attention (Hublet, et al., 2015). Due to past changes in the questions about cannabis use we were not able to analyse the trends in the use of both substances, and this should therefore be the objective of future research. To facilitate further improvement in prevention efforts, future research should also focus on risk and protective factors for early initiation.

## Conclusion

Co-use of tobacco and cannabis is present in a substantial share of 15-year-old students in Slovenia. We should recognise the fact that the use of both substances is an existing and substantial problem in adolescents in Slovenia, as well as the fact that this problem is equally prevalent in both genders. The use of either tobacco or cannabis is positively associated with the use of the other and is associated with common factors such as a history of drunkenness and peers' use of tobacco and cannabis. The impact of substance use, such as tobacco

and cannabis, on public health is significant and an early prevention is of utmost importance. Our findings support the notion that the preventive and cessation programmes targeted at one substance should be expanded to include more substances, such as tobacco, cannabis, as well as alcohol.

## Conflict of interest / Nasprotje interesov

The authors declare that no conflicts of interest exist. / Avtorice izjavljajo, da ni nasprotja interesov.

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## Ethical approval / Etika raziskovanja

The study was approved by the Republic of Slovenia National Medical Ethics Committee on 29 October 2013 under the number 139/10/13. / Raziskava je bila odobrena s strani Komisije Republike Slovenije za medicinsko etiko 29. oktobra 2013, št. dopisa 139 / 10 / 13.

## Author contribution / Prispevek avtorjev

All authors contributed to this article. The second author conducted the statistical analysis. The first and third authors wrote the article, while the fourth author contributed to the preparation of the final version of the article. / Vse avtorice so sodelovale pri zasnovi članka. Druga avtorica je pripravila statistične analize podatkov. Prva in tretja avtorica sta napisali članek, četrta avtorica je sodelovala pri pripravi zadnje verzije besedila.

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