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# Multiple health risk behaviour in Czech adolescents: Family, school and geographic factors

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## ABSTRACT

The study examines the relationship of family, school and geographic factors in relation to the prevalence of different health risk behaviours among Czech adolescents (aged 15–16 years) based on cross-sectional study design. Risk behaviours such as cigarette smoking, alcohol drinking and marijuana use among adolescents have often been shown to co-occur with each other. Data from the European School Survey Project on Alcohol and Other Drugs 2007 were used. A total of 7616 students from the Czech Republic were analysed in the study. About two thirds of students (63.5%) did not engage in any type of considered health risk behaviour, 21.1% reported one risk, 10.8% two risks, and 4.6% three risks. Thus, in sum 15.4% of Czech, students were engaged in multiple risk behaviour forms. Separate multilevel logistic regression models were performed in order to explore the redistribution of factors on categories of multiple health risk behaviour.

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## 1. Introduction

In many countries of Central and Eastern Europe, the political changes during the transition period brought a change in the lifestyle and behaviour of many citizens. The democratization of society brought the possibility of free decision making and choice, both on the individual level and on the level of the whole society. In the context of market economy and open borders allowing the free movement of goods, services and citizens, illegal drugs have also appeared, the use of which has spread rapidly and substantially (Nožina, 1997; Csémy et al., 2002). These issues form an important part of current public health challenges, especially in order to find new and effective measures on substance misuse and its prevention. Despite the rapid increase of drug problems, the most serious forms of risk behaviour still remain to be smoking and excessive alcohol drinking, with significant impacts on society as a whole (Sovínová et al., 2003; Csémy et al., 2009). Despite many governmental efforts and other measures (campaigns, taxation, etc.) during the last decade, the prevalence of health risk behaviour in the Czech Republic remains high (Currie et al., 2004; Hibell et al., 2009; Džúrová et al., 2010; Spilková et al., 2011).

In 1990, the Czech Republic started a process of social, economic and political transformation. However, this transformation also brought higher social and economic inequalities, and significantly influenced the lifestyle of the newborn society (Janík, 2010; Spilková and Džúrová, 2012). Societal changes are associated with various forms of risk behaviours that are dangerous to the subsequent health development, especially of the younger generation. Substance misuse during adolescence and young adulthood remains a prominent public health problem in the Czech Republic. Recent analyses (Veselý and Džúrová, 2011) of the “Sample Survey of the Health Status and Life Style of the Population of the Czech Republic” showed that more than half of young people aged 18–29 years did not engage in multiple health risk behaviours (59%), 25% reported one risk, 14% two risks, and 2.6% three health risk behaviours (drinking alcohol four times or more per week, smoking at least one cigarette daily, or drug use during the last 12 months). The results of this study suggest that co-occurrence of health risk behaviours increases with age, while at age 18–29 years 59% was without risk factors, at age 30–39 years it was 63.7%, at age 40–49 years 60.4% and by age 50–64 years it was already 70.8%. In addition to age, it varies also by gender, level of education and socioeconomic status of the individual.

Researchers have found that evidence of risk as well as protective factors contribute to substance use (alcohol, tobacco and illicit substances) at the individual, family, school, and community levels (Jessor, 1991; Brooks et al., 2012). Parental support and family socioeconomic status (SES) can operate as protective

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factors (Vakalahi, 2001). Bobakova et al. (2012) found that parental monitoring is significantly associated with the reduction of substance use in youth subcultures. Young people, whose parents do not provide adequate family care, are more prone to health risk behaviours, whereas those with a non-parental adult mentor may not be (Fergus and Zimmerman, 2005). For example Pickett et al. (2002) study the occurrence of health events associated with multiple risk behaviours through the existence of protective factors. They declare that young people may have high rates of risk behaviours, but also have high rates of protective factors such as family, school or material support. There is scientific evidence that in addition to personal and social factors, geographic factors also play a role in risk behaviour occurrence, e.g. Atav and Spencer (2002) and Jiang et al. (2008) show that frequency of alcohol use differs by community size. Fergus and Zimmerman (2005) describe models of resilience for understanding the healthy development of adolescents. Based on their work, youths living in deprived areas are more likely to indulge in risk behaviour. Programs focused on parental supervision or school-based preventive programs may help to reduce the negative effects of living in such areas.

Reviewing the literature, few studies have examined interconnections of family-level factors with school and geographic environment on risk behaviours of adolescents in the post-communist societies. Recent comparative risk behaviour studies, participating on the ESPAD project involving inter alia Central and Eastern European Countries, have either been focused on differences in youth risk behaviour between countries or they have analysed the impact of family and individual psychological characteristics. However, effects of the school environment and eventual geographic factors have rarely been taken into consideration (Bjarnason et al., 2003a,b; Kokkevi et al., 2007; Olszewski et al., 2009). The major aim of this study was to explore the role of family structure as well as school and geographic factors on specific types of risk behaviour (daily smoking, frequent heavy drinking and cannabis use) in Czech adolescents. The specific objective was to evaluate the impact of these factors on multiple health risk behaviour.

## 2. Methods

The study uses data collected in the frame of the Czech participation in the *European School Survey Project on Alcohol and Drugs* (ESPAD) in 2007. Questionnaires were distributed in the Czech Republic to students during regular classroom time by teachers. Background and purpose of the study was explained and participants were reassured that their participation was fully confidential and voluntary. 45 min were given to complete the questionnaire. Full details of data collection method and survey can be seen in Hibell et al. (2009).

### 2.1. Sample and design

In the study a total of 7616 student respondents from the Czech ESPAD 2007 Survey, aged 15–16 years, with no missing declaration on any of the analysed questions were used. Those with higher or lower age were excluded from the analysis. The study was performed at 342 schools (average number of respondents per school 22.27, SD 5.9) with four different school types: elementary (9th grade, 22.5% of students), secondary grammar (22.1% of students), secondary vocational (30.3% of students), and apprenticeships (25.1% of students). The purpose of surveying was to ensure that data would be nationally as well as regionally representative. Schools were randomly sampled from the school register and implicitly categorized into mentioned types.

### 2.2. Ethical considerations

The study was carried out as an anonymous survey whereby all students participated voluntarily. Therefore, neither the ethics committee approval nor parental permission for participation was required (Hibell et al., 2009).

### 2.3. Family background variables

In the ESPAD questionnaire some questions describing family environment were asked. Six assets of variables were investigated: family composition, perceived family affluence, parental emotional support (student relationship satisfaction with his/her mother and father) and parental level of education.

In the questionnaire students were asked: “Which of the following people live in the same household with you?” According to this, students were categorized into four separate family composition classes: two parents; one parent and one stepparent; just one parent and zero-parent/other—if they lived in a family of any other combination.

Student satisfaction with the quality of his/her relationships to parents was measured by two questions: “How satisfied are you usually with (a) your relationship to your mother? (b) your relationship to your father?” The original six point ordinal scale was recoded into three satisfaction categories: high (“Very satisfied” and “Satisfied”), medium (“Neither satisfied nor not satisfied”) and low (“Not so satisfied” and “Not at all satisfied”).

Based on the question “What is the highest level of schooling your father/mother completed?” the parental level of education was classified into 3 groups: low (when parent completed primary school or less), medium (completed secondary education level) and high (completed university degree).

Perceived family affluence score was measured by the question: “How well off is your family compared to other families in your country?” Respondents answered on a seven point ordinal scale. The scores were recoded into three categories: high (“Very much better off”, “Much better off” and “Better off”), medium (“About the same”) and low (“Less well off”, “Much less well off” and “Very much less well off”).

### 2.4. School and place related variables

Three aggregate variables were investigated: school environment (associated with four different types of school), socioeconomic environment of the school locality (indicated by the unemployment rate; average 6.15%; range 2.20–16.26%) and population number of 116 localities. Population sizes of the localities were plotted on the map using GIS (from very small with less than 5000 inhabitants, to the Capital City of Prague with 1.2 million) as can be seen in Fig. 1.

### 2.5. Measures of the health risk behaviours

The following three types of health risk behaviour (HRB) were assessed:

#### 2.5.1. Tobacco smoking

In the questionnaire students were asked: “How frequently have you smoked cigarettes during the last 30 days?” Answering options were: “Not at all”, “Less than 1 cigarette per week”, “Less than 1 cigarette per day”, “1–5 cigarettes per day”, “6–10 cigarettes per day”, “11–20 cigarettes per day” and “More than 20 cigarettes per day”. Those reporting smoking at least 1 cigarette per day were considered as having a tobacco smoking risk behaviour.

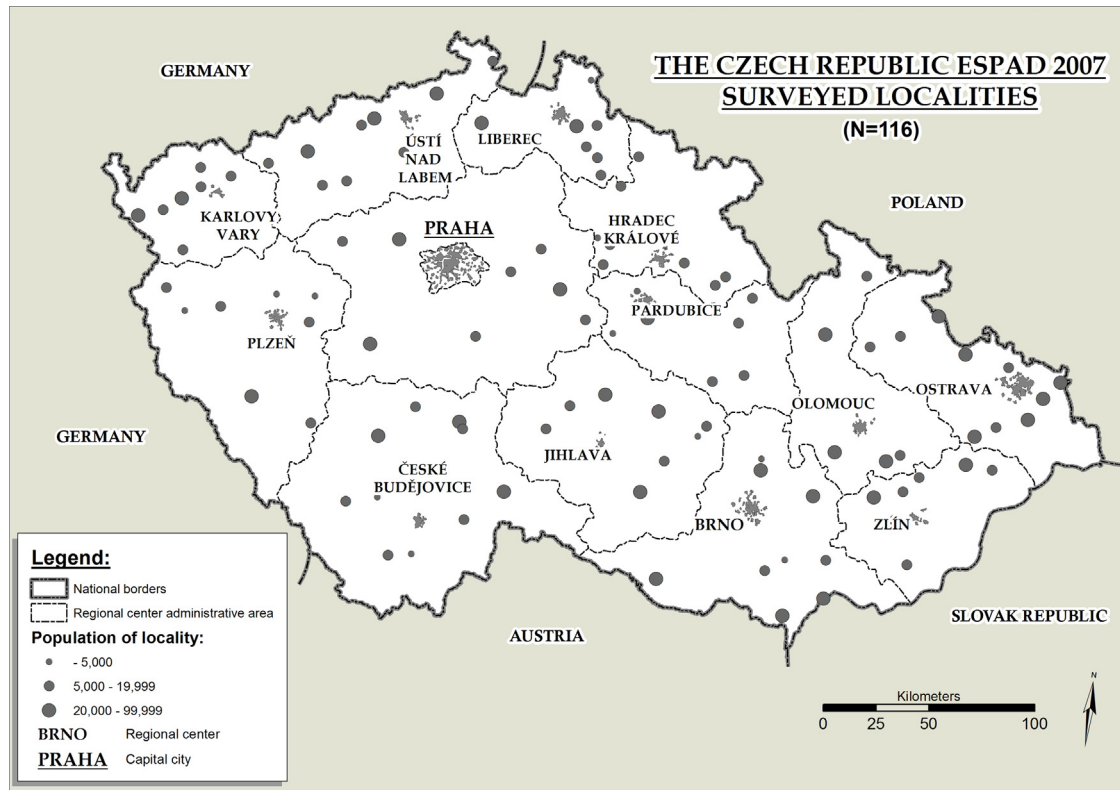


Fig. 1

### 2.5.2. Alcohol drinking

In the questionnaire students were asked: “Think back again over the last 30 days. How many times (if any) have you had five or more drinks on one occasion?” Answering options were: “Number of occasions: 1–2”, “Number of occasions: 3–5”, “Number of occasions: 6–9”, “Number of occasions: 10–19”, “Number of occasions: 20 or more”. Those reporting five or more drinks on three or more occasions were considered as heavy episodic drinkers and coded as cases of health risk behaviour.

### 2.5.3. Marijuana use

In the questionnaire students were asked: “On how many occasions (if any) have you used marijuana or hashish (cannabis) during the last 12 months?” Answering options were: “0 occasions”, “1–2”, “3–5”, “6–9”, “10–19”, “20–39” or “40 or more”. Those reporting cannabis use 6 or more times during last 12 months were considered as marijuana users and coded as cases for this type of health risk behaviour.

In the first step, these measures were used to determine the prevalence of single health risk behaviour in Czech students. Subsequently, respondents were classified as having none, one, two or three types of considered health risk behaviours.

## 3. Data analysis

The analysis was conducted using SPSS Statistics version 21.0. The Chi-square tests combined with confidence limits comparisons of corresponding prevalence proportions examined the relationship between substance use, categories of health risk behaviour (HRB) and basic family, school and area characteristics. Subsequently, separate multilevel logistic regression models controlling for potential intra-class correlation in dependent outcome were conducted (students nested in particular school and locality).

Modelled binary variables (dichotomized in 2 categories: 1—yes; 0—no) were: daily tobacco smoking; heavy episodic drinking; marijuana use. Multinomial dependent variable of adolescent multiple health risk behaviour (m-HRB) was categorized into 4 levels: 0, 1, 2 and 3 (0—without any HRB; 1—indicating those with one HRB; 2—those with two types of HRB; 3—those with all three considered types of HRB).

Tables 1–4 present HRB prevalence rates within 95% confidence limits and fully adjusted odds ratios as outputs of logistic regression models. Significant results ( $p < 0.05$ ) are shaded. Positive categories of explanatory variables were set as reference levels. In addition to the above described factors, gender and age were also included as explanatory variables in regression models, resulting in fully adjusted logistic models presented in Tables 3 and 4.

## 4. Results

A total of 7616 students (age 15–16 years) were analysed in the study. 72.5% of respondents came from families with both own mother and father, 12.7% from families with one own and one stepparent, 12.5% with just one parent and 2.2% came from zero-parent family. The largest proportion of students attended school at localities of 5000–19,999 and 20,000–99,999 inhabitants (34.3%, 33.0% respectively), the smallest proportion of students came from localities with the lowest number of inhabitants (population size less than 5000).

Table 1 provides a full description of the sample according to prevalence rates of daily smoking, heavy episodic drinking and marijuana use cross-tabulated by indicators of family composition and population of locality. Results show that almost a quarter of adolescents (23.0%) reported smoking 1 or more cigarettes per day, about one fifth of them (19.1%) reported 5 or more drinks on

**Table 1**

Prevalence rates of adolescent health risk behaviour by family composition and population of locality, ESPAD, 2007 (N=7616).

	Daily tobacco smoking ≥ 1 Cigarettes per day			Heavy episodic drinking ≥ 5 Drinks on ≥ 3 occasions			Marijuana use ≥ 6 Times during last 12 months			Sample size N
	N	%	(95% CI)	N	%	(95% CI)	N	%	(95% CI)	
<b>Family composition</b>										
Two parents	1062	<b>19.2%</b>	(18.2–20.4)	975	<b>17.6%</b>	(16.7–18.6)	688	<b>12.5%</b>	(11.6–13.4)	5525
One parent and one stepparent	336	<b>34.6%</b>	(31.6–37.9)	222	<b>22.9%</b>	(20.4–25.8)	181	<b>18.7%</b>	(16.3–21.1)	970
Just one parent	302	<b>31.7%</b>	(28.7–34.9)	215	<b>22.6%</b>	(19.9–25.4)	192	<b>20.1%</b>	(17.5–22.8)	953
Zero-parent/other	53	<b>31.5%</b>	(24.8–39.2)	43	<b>25.6%</b>	(19.2–32.2)	31	<b>18.5%</b>	(12.6–24.8)	168
Asymp. sig. (2-sided)	< 0.0001			< 0.0001			< 0.0001			
<b>Population of locality</b>										
– 5,000	101	<b>38.0%</b>	(32.5–43.6)	74	<b>27.8%</b>	(22.7–33.5)	41	<b>15.4%</b>	(11.2–19.9)	266
5,000–19,999	632	<b>24.2%</b>	(22.5–25.9)	520	<b>19.9%</b>	(18.4–21.5)	374	<b>14.3%</b>	(12.9–15.8)	2615
20,000–99,999	530	<b>21.1%</b>	(19.6–22.7)	474	<b>18.9%</b>	(17.4–20.4)	358	<b>14.3%</b>	(13.0–15.8)	2510
Regional centres	338	<b>21.3%</b>	(19.2–23.2)	263	<b>16.6%</b>	(14.7–18.3)	212	<b>13.4%</b>	(11.7–15.1)	1588
Capital city of Prague	152	<b>23.9%</b>	(20.7–27.2)	124	<b>19.5%</b>	(16.5–22.5)	107	<b>16.8%</b>	(13.9–19.8)	637
Asymp. sig. (2-sided)	< 0.0001			< 0.0001			0.122			
Total	1753	<b>23.0%</b>	(22.0–24.0)	1455	<b>19.1%</b>	(18.2–20.1)	1092	<b>14.3%</b>	(13.6–15.2)	7616

Note: CI of estimates computed by bootstrapping approach, number of bootstrapped samples=1000.

at least 3 occasions in last month and 14.3% had used cannabis more than 6 times during the last 12 months. The highest rates of smoking and alcohol drinking were found in the localities with the lowest population size (38.0%, 27.8% respectively). As regards to marijuana use, significantly lower rates were found in two-parental families (12.5%), however, population of locality did not show significant differences in this type of health risk behaviour.

Table 2 provides estimated rates of health-risk behaviour co-occurrence by family structure and population of locality. Almost two thirds of students (63.5%) did not engage in any type of health risk behaviour, 21.1% reported one risk, 10.8% two risks and 4.6% reported use of all three types of HRB. Hence, the estimated prevalence rate of multiple health risk behaviour (m-HRB) created 15.4% (95% CI=14.6–16.2) of the Czech students aged 15–16 years (two risks+three risks). All combinations of HRB's co-occurrence with corresponding prevalence estimates from the ESPAD 2007 sample are presented in Fig. 2.

According to Fig. 2, daily tobacco smokers with no other HRB form created the largest sample proportion with 9.3% of students, followed by heavy episodic drinkers with no other HRB (8.0%). As one can see from the overlapping Venn diagram areas, these two types of HRB are strongly interconnected. Simultaneously, 4.8% of Czech students reported daily smoking with heavy episodic drinking and this group ranked the third highest proportion in the sample. Strong interdependence of daily tobacco smoking and heavy episodic drinking can be documented also by the Mantel–Haenszel common odds ratio between these two health risk behaviours, OR=4.71 (95% CI=4.197–5.274). Similar results were evident for students with simultaneous daily tobacco smoking and marijuana use (4.3% of the sample). Computing the Mantel–Haenszel odds ratio one can see that the association between these two HRB forms is nearly twice as high as in the previous case, OR=8.29 (95% CI=7.278–9.435). Marijuana users alone represent 3.7% of the sample. The association between heavy episodic drinking and marijuana use is also strong, OR=4.45 (95% CI=3.911–5.055). However, the marijuana users subgroup was shown to have the highest prevalence of the simultaneous use of all three HRB's (31.9% of the marijuana users) and marijuana use combined with daily tobacco smoking following closely in second place (30.3% of the marijuana users).

For the purposes of the study, the figures of the “Without HRB” vs. “Two” and “Three” considered health risk behaviour categories, as presented in Table 2, are of special importance (simultaneous daily tobacco smoking and/or heavy episodic drinking and/or

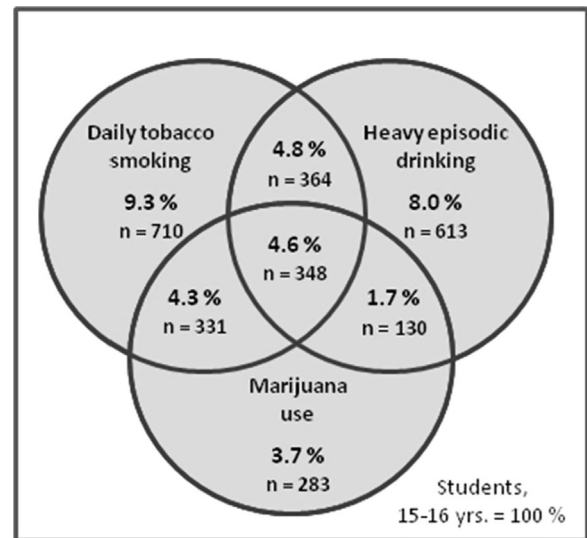


Fig. 2. Prevalence rate estimates of various types of adolescent multiple health risk behaviour in the Czech Republic, ESPAD, 2007 (N=7616).

marijuana use). Adolescents coming from two-parental families with own mother and father have a significantly higher proportion of the “Without HRB” category (67.2%) than those coming from all other considered family types. Similarly, students coming from families with both parents had a significantly lower proportion of the type “Three” m-HRB (3.6%) than those from other groups (6.8% for one parent and one stepparent, 7.1% for one parent, 9.5% for zero-parent). A similar relationship between m-HRB and family composition applies also for the case of “Two” risks (the relatively low number of cases in the zero-parent families lowered the estimated prevalence according to the previous two family types).

As regards the localities, students living in the least populated areas tended to have a lower proportion of “Without HRB” category (51.9%) and higher prevalence of “Two” (16.5%) and “Three” m-HRB (8.3%) categories compared to all other locality categories. Although underlying confidence intervals are overlapping one another, the asymptotic chi-square test is highly significant and the distinctive position of the least populated localities is quite obvious.



**Table 2**  
Prevalence rates of adolescent multiple health risk behaviour (m-HRB) by family composition and population of locality, ESPAD, 2007 (N=7616).

	Co-occurrence of HRB's													
	Without HRB			One			Two			Three			Total	
	N	%	(95% CI)	N	%	(95% CI)	N	%	(95% CI)	N	%	(95% CI)	N	%
<b>Family composition</b>														
Two parents	3712	<b>67.2%</b>	(66.0–68.5)	1099	<b>19.9%</b>	(18.8–20.9)	516	<b>9.3%</b>	(8.5–10.2)	198	<b>3.6%</b>	(3.1–4.1)	5525	100%
One parent and one stepparent	510	<b>52.6%</b>	(49.4–55.5)	247	<b>25.5%</b>	(22.8–28.0)	147	<b>15.2%</b>	(12.8–17.5)	66	<b>6.8%</b>	(5.3–8.4)	970	100%
Just one parent	525	<b>55.1%</b>	(52.3–58.1)	215	<b>22.6%</b>	(19.9–24.9)	145	<b>15.2%</b>	(13.0–17.7)	68	<b>7.1%</b>	(5.5–8.7)	953	100%
Zero-parent/other	90	<b>53.6%</b>	(45.2–61.8)	45	<b>26.8%</b>	(20.1–34.0)	17	<b>10.1%</b>	(5.8–15.3)	16	<b>9.5%</b>	(5.5–14.5)	168	100%
Asymp. sig. (2-sided)	< 0.0001													
<b>Population of locality</b>														
– 5,000	138	<b>51.9%</b>	(46.0–58.2)	62	<b>23.3%</b>	(18.1–28.3)	44	<b>16.5%</b>	(12.0–21.1)	22	<b>8.3%</b>	(5.0–12.0)	266	100%
5,000–19,999	1611	<b>61.6%</b>	(59.7–63.4)	594	<b>22.7%</b>	(21.1–24.4)	298	<b>11.4%</b>	(10.1–12.7)	112	<b>4.3%</b>	(3.6–5.2)	2615	100%
20,000–99,999	1640	<b>65.3%</b>	(63.4–67.2)	493	<b>19.6%</b>	(18.1–21.2)	262	<b>10.4%</b>	(9.3–11.6)	115	<b>4.6%</b>	(3.8–5.5)	2510	100%
Regional centres	1054	<b>66.4%</b>	(63.9–68.6)	323	<b>20.3%</b>	(18.3–22.4)	143	<b>9.0%</b>	(7.6–10.4)	68	<b>4.3%</b>	(3.3–5.4)	1588	100%
Capital city of Prague	394	<b>61.9%</b>	(58.3–65.5)	134	<b>21.0%</b>	(18.1–24.0)	78	<b>12.2%</b>	(9.6–14.9)	31	<b>4.9%</b>	(3.3–6.5)	637	100%
Asymp. sig. (2-sided)	< 0.0001													
Total	4837	<b>63.5%</b>	(62.4–64.6)	1606	<b>21.1%</b>	(20.1–22.0)	825	<b>10.8%</b>	(10.1–11.6)	348	<b>4.6%</b>	(4.1–5.1)	7616	100%

Note: CI of estimates computed by bootstrapping approach, number of bootstrapped samples = 1000.

**Table 3**  
Adjusted odds ratios (OR) and 95% CI for daily tobacco smoking, heavy episodic drinking and marijuana use, ESPAD, 2007 (N=7616).

	Daily tobacco smoking			Heavy episodic drinking			Marijuana use		
	Fully adj. OR*	95% CI		Fully adj. OR*	95% CI		Fully adj. OR*	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper
<b>Family characteristics</b>									
Zero-parent/other	<b>1.48</b>	1.042	2.107	1.41	0.980	2.040	1.37	0.908	2.073
Just one parent	<b>1.72</b>	1.461	2.036	<b>1.24</b>	1.040	1.483	<b>1.59</b>	1.315	1.918
One parent and one stepparent	<b>1.99</b>	1.698	2.326	<b>1.31</b>	1.100	1.549	<b>1.54</b>	1.280	1.859
<b>Family composition: Two parents (ref.)</b>	1	1	1	1	1	1	1	1	1
<b>Perceived family affluence: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	<b>0.77</b>	0.674	0.889	<b>0.77</b>	0.672	0.890	<b>0.77</b>	0.662	0.904
Low	<b>0.56</b>	0.439	0.723	<b>0.70</b>	0.545	0.904	<b>0.69</b>	0.517	0.911
<b>Satisfaction with relationship to mother: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	<b>1.32</b>	1.089	1.591	<b>1.28</b>	1.049	1.564	<b>1.25</b>	1.001	1.556
Low	<b>1.85</b>	1.449	2.371	<b>1.73</b>	1.343	2.233	<b>2.00</b>	1.535	2.614
<b>Satisfaction with relationship to father: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	<b>1.34</b>	1.127	1.601	<b>1.23</b>	1.018	1.478	<b>1.36</b>	1.107	1.663
Low	<b>1.69</b>	1.411	2.026	<b>1.39</b>	1.148	1.690	<b>1.55</b>	1.255	1.902
Low	1.07	0.871	1.327	1.02	0.825	1.262	0.83	0.656	1.046
Medium	0.96	0.789	1.165	0.94	0.779	1.145	0.86	0.698	1.058
<b>Mother educational level: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Low	<b>1.28</b>	1.053	1.566	<b>1.22</b>	0.999	1.497	1.12	0.900	1.403
Medium	1.17	0.962	1.413	<b>1.22</b>	1.010	1.485	1.12	0.910	1.384
<b>Father educational level: High (ref.)</b>	1	1	1	1	1	1	1	1	1
<b>School/area characteristics</b>									
<b>Type of school: Secondary grammar (ref.)</b>	1	1	1	1	1	1	1	1	1
Secondary vocational	<b>2.67</b>	2.073	3.429	<b>1.70</b>	1.404	2.050	<b>1.62</b>	1.314	1.992
Apprenticeship	<b>6.46</b>	5.221	8.004	<b>2.58</b>	2.123	3.126	<b>2.21</b>	1.788	2.742
Elementary	<b>2.67</b>	2.073	3.429	<b>0.92</b>	0.718	1.173	0.89	0.676	1.173
<b>Population of locality: Regional centres (ref.)</b>	1	1	1	1	1	1	1	1	1
– 5,000	<b>2.14</b>	1.593	2.876	<b>1.94</b>	1.413	2.658	1.19	0.812	1.735
5,000–19,999	<b>1.31</b>	1.116	1.535	<b>1.35</b>	1.143	1.601	1.17	0.967	1.406
20,000–99,999	1.01	0.857	1.193	<b>1.22</b>	1.027	1.454	1.06	0.871	1.280
Capital city of Prague	<b>1.51</b>	1.184	1.934	1.28	0.992	1.657	<b>1.58</b>	1.197	2.082
<b>Unemployment rate:</b>	<b>1.03</b>	1.006	1.053	0.99	0.971	1.019	<b>1.05</b>	1.022	1.077

\* Fully adjusted also to gender and age.

Table 3 summarizes results of three separate binary logistic models for each of the considered health risk behaviours. Smoking, alcohol drinking and marijuana use are modelled by two main factor sets—family and school/area characteristics. Significant parameter estimates (odds ratios) are shaded.

Adolescent daily tobacco smoking is strongly correlated with family composition characteristics, self-perceived family affluence position, relationship satisfaction with mother and father and father's level of education. Mother's education did not show significant association. Similar results were given by both the

**Table 4**

Adjusted odds ratios (OR) and 95% CI for one, two and three factors of HRB contrasted to “without HRB”, ESPAD, 2007 (N=7616).

	1 Risk factor=1/No=0			2 Risk factors=1/No=0			3 Risk factors=1/No=0		
	Fully adj. OR <sup>a</sup>	95% CI		Fully adj. OR <sup>a</sup>	95% CI		Fully adj. OR <sup>a</sup>	95% CI	
		Lower	Upper		Lower	Upper		Lower	Upper
<b>Family characteristics</b>									
Zero-parent/other	1.45	0.996	2.107	1.12	0.653	1.929	<b>2.48</b>	1.391	4.436
Just one parent	<b>1.30</b>	1.080	1.554	<b>1.84</b>	1.477	2.293	<b>1.97</b>	1.445	2.687
One parent and one stepparent	<b>1.53</b>	1.292	1.821	<b>1.94</b>	1.568	2.404	<b>2.20</b>	1.621	2.982
<b>Family composition: Two parents (ref.)</b>	1	1	1	1	1	1	1	1	1
<b>Perceived family affluence: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	<b>0.77</b>	0.665	0.881	<b>0.67</b>	0.561	0.808	<b>0.71</b>	0.544	0.933
Low	<b>0.64</b>	0.496	0.820	<b>0.51</b>	0.363	0.712	<b>0.56</b>	0.345	0.900
<b>Satisfaction with relationship to mother: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	<b>1.34</b>	1.096	1.638	<b>1.45</b>	1.127	1.871	1.41	0.977	2.042
Low	<b>1.57</b>	1.189	2.074	<b>1.99</b>	1.426	2.779	<b>3.31</b>	2.232	4.922
<b>Satisfaction with relationship to father: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Medium	1.14	0.945	1.379	<b>1.41</b>	1.117	1.785	<b>1.69</b>	1.209	2.362
Low	<b>1.55</b>	1.272	1.883	<b>1.59</b>	1.236	2.041	<b>2.36</b>	1.705	3.270
Medium	1.19	0.964	1.474	1.05	0.795	1.384	0.75	0.505	1.120
Low	1.07	0.880	1.290	0.89	0.693	1.152	0.77	0.537	1.113
<b>Mother educational level: High (ref.)</b>	1	1	1	1	1	1	1	1	1
Low	1.21	0.997	1.473	1.26	0.969	1.649	1.38	0.930	2.040
Medium	1.10	0.914	1.327	1.25	0.970	1.613	1.28	0.877	1.879
<b>Father educational level: High (ref.)</b>	1	1	1	1	1	1	1	1	1
<b>School/area characteristics</b>									
<b>Type of school: Secondary grammar (ref.)</b>	1	1	1	1	1	1	1	1	1
Sec. vocational	<b>1.68</b>	1.406	2.011	<b>2.68</b>	2.057	3.505	<b>3.50</b>	2.255	5.438
Apprenticeship	<b>2.77</b>	2.294	3.348	<b>5.12</b>	3.904	6.723	<b>8.25</b>	5.329	12.768
Elementary	1.17	0.927	1.465	<b>1.48</b>	1.060	2.063	<b>1.74</b>	1.012	2.999
<b>Population of locality: Regional centres (ref.)</b>	1	1	1	1	1	1	1	1	1
–5,000	<b>1.45</b>	1.035	2.037	<b>2.35</b>	1.568	3.512	<b>2.54</b>	1.476	4.364
5,000–19,999	<b>1.28</b>	1.093	1.509	<b>1.54</b>	1.232	1.920	1.28	0.930	1.769
20,000–99,999	0.98	0.828	1.159	1.19	0.944	1.493	1.16	0.834	1.602
Capital city of Prague	<b>1.36</b>	1.058	1.750	<b>1.88</b>	1.351	2.604	1.54	0.952	2.499
<b>Unemployment rate:</b>	<b>1.03</b>	1.002	1.050	<b>1.03</b>	1.003	1.067	1.03	0.982	1.075

\* Fully adjusted also to gender and age.

heavy episodic drinking and marijuana use models. In the latter case, parental level of education (neither mother nor father) did not show significant association. Students who perceived themselves as coming from families relatively better well off had generally higher odds of HRB's than those who perceived themselves to be from families with lower level of household income.

Secondary grammar school students were characterized by generally lower levels of HRB than those from the other schools. Comparing odds ratios between types of school one can see a higher risk associated with the lower academic demands imposed on students by the school type attended. For example, students from apprenticeships had 6.46 times higher odds of daily tobacco smoking than those coming from secondary grammar schools.

Locality differences in adolescent health risk behaviours showed that those living in less populated areas had generally higher prevalence of HRB's. Students coming from municipalities with less than 5000 inhabitants had on average 2.14 times higher odds of daily tobacco smoking and 1.94 times higher odds of heavy episodic drinking than those living in regional centres. Towns with 5000–19,999 inhabitants showed similar results (OR=1.31; 1.35 respectively compared to regional centres). On the contrary, students living in the Capital City of Prague were the most prevalent marijuana users within all the geographic areas (OR=1.58), and additionally, their daily tobacco smoking showed an elevated risk (OR=1.51).

The association of HRB's with the “socioeconomic climate” of locality (measured by the unemployment rate) was also present in the models. Although the effect was quite small, it was still statistically significant, showing a higher prevalence of daily tobacco smoking and marijuana use in more deprived areas.

Table 4 presents results of the adolescent m-HRB modelled by the multinomial logistic approach. The same factor variable sets were considered as in the previous Table 3.

Generally, results gave similar findings as the previous analysis. Full families with own mother and father, satisfying personal relationship with parents, higher academic intensity of student secondary education are protective factors in adolescent multiple health risk behaviours. For example, Czech apprenticeship students had 5.12 times higher odds of two HRB's and 8.25 times higher odds of daily tobacco smoking and heavy episodic drinking combined with marijuana use than those coming from secondary grammar schools. Students' additional financial resources can potentially elevate m-HRB's. Consistent with previous findings, m-HRB's were higher in both less densely populated areas and the capital city compared to regional centres. Areas with the least inhabitants had the highest risk of m-HRB's. Association with the unemployment rate was also significant, giving a higher risk of m-HRB in areas with higher unemployment.

## 5. Discussion

First, results show that various forms of health risk behaviour are mutually interconnected. Strong associations were found between all three considered forms of risk behaviour. Second, results give empirical evidence that family structure, type of school attended and geographic characteristics aid in understanding the complexity of health risk behaviours in Czech adolescents.

Regarding the strong interconnection between analysed forms of health risk behaviour, results show that all three forms are strongly associated. Heavy episodic drinking students have about 4 to 5 times higher odds of also being tobacco smokers or marijuana users. The association between tobacco smoking and marijuana use is even stronger and nearly twice as high. Such menace between cigarette smoking and the possibility of becoming a marijuana user has been revealed in other studies on young people too (Nyári et al., 2005).

Regarding other publications on multiple HRB prevalence within the Czech population, our results could be compared with those obtained by the study of Czech adults (18–64 years old) (Veselý and Džurová, 2011). Here, a polysubstance use variable was constructed as a sum of three health-related behaviours (drinking alcohol four times or more per week, smoking at least one cigarette daily and drug use during the last 12 months). About 64% of Czech adults reported no risk, 26% one risk, 9% two risks and 1% reported all three risk behaviour forms.

The educational level of parents operates variously. While a higher level of father's education is associated with protective effects, the level of maternal education is not related to the occurrence of health risk behaviour. The fact that the father's education did apply in separate analysis of daily tobacco smoking and heavy episodic drinking is probably due to different behavioural patterns related to the level of education. Adult men with lower education are more prevalent smokers and excessive drinkers and their behaviour is assumed as a model by their descendants (White et al., 2000; Williams et al., 2000; Spilková et al. 2011). However, this effect did not show significant association with either adolescent marijuana use or the analysis of multiple HRB forms.

There are consistent findings confirming the influence of family composition on the prevalence of risk behaviour. Growing up in a non-complete family implies higher probability of risk behaviour related to all three substances and multiple HRB. Similarly strong results are predicted by family ties, particularly the quality of relationships with father and/or mother. Satisfaction with these relations represents a significant protective factor. The protective effect of family ties have also been confirmed by other studies (Repetti et al., 2002; Bjarnason et al., 2003a,b; Wang et al., 2009; Brooks et al., 2012). Kuendig and Kuntsche (2006) found that "strong family bonds were related to lower level of alcohol use in adolescents irrespective if they live in a family with or without excessive alcohol drinking".

Family affluence also acted as a significant predictor. In our study, similar to other publications (Hanson and Chen, 2007; Richter et al., 2006), a better financial family situation was associated with higher prevalence of health risk behaviours, as well as with its multiple forms. Hanson and Chen (2007) concluded that high SES teens are more likely to use substances than low SES teens and that family financial resources are a stronger predictor of substance use than family status. However, contrary to these publications, there are also several other studies concluding different results in the issue of family affluence than in the previous ones. Boys et al. (2003) reported that children from more affluent families were slightly more likely to be regular alcohol users, but less likely to smoke cigarettes. Wang et al. (2009) found family affluence as a significant predictor of substance use in adolescents in a model where substance use was a composite variable for alcohol drinking, smoking and use of marijuana. Results from a recent multicultural study (Richter et al., 2009) showed that family affluence had almost no significant effect on regular smoking in 28 countries, and the association between alcohol use and parental socioeconomic status was weak and inconsistent too. Nevertheless, based on the results obtained from our data, we can hypothesize that excess disposable financial resources can lead to adolescent misuse of such family relative

advantages compared to other schoolmates, resulting in a higher risk of substance abuse in the context of the Czech adolescent population. However, further studies are needed to establish stronger empirical evidence according to such hypothesis.

Secondary grammar school students are characterized by the lowest level of substance use compared to other school types. There is a strong risk gradient followed by decreasing intensity of study imposed on students in particular type of school attended. Generally lower levels of HRB's in the category of elementary school students compared to secondary vocational schools and apprenticeships can be explained by heterogeneous socio-economic family background among students attending elementary schools. These differences are being selectively homogenized on the next study level. Thus, elementary school students create, from the socio-economic point of view, a kind of "mixture" in their classes, resulting in averaged risk behaviour prevalence. Subsequently, at the next study level (secondary grammar schools, apprenticeships, secondary vocational schools), students tend to come from families with greater socio-economic background similarities. This is mirrored also by aggregate risk behaviour patterns of these schools, either in a relatively positive (secondary grammar schools) or negative way (apprenticeships, secondary vocational schools).

Czech students living in localities with a lower number of inhabitants have generally higher prevalence of HRB's than those living in other geographic areas. These observations are in contrast to the expected facts that higher intensity and better social relations in smaller settlements tend to be understood as a protective factor for health risk behaviour (Atkins et al., 2002; Smylie et al., 2006; Bartkowski and Xu, 2007). In our case, we can assume this is related to the fact that smaller municipalities have less to offer adolescents in the way of leisure activities (active or passive) than larger ones, e.g. sport, cultural, further educational activities, etc., thus raising the potential for HRB's in the Czech context. However, students living in the Capital City of Prague are characterized specifically by more prevalent marijuana use, and together with the students from small municipalities constitute the most endangered groups in the context of multiple HRB's.

## 6. Strengths and limitations

Co-occurring substance use is a topic of growing interest. Though most of this work has been conducted in the USA, this study represents results from a specific context of countries after transition, which could be very welcome. Limitations of the study that should be mentioned are: (1) cross-sectional study design, which reflects associations between analysed phenomena but not the causal relationships; (2) all the data were self-reported. Despite careful methodology, self-reports may be partly influenced by memory and/or social desirability factors.

## 7. Conclusions and implications

The outcomes offer important consequences for policies aimed at preventing future health risk behaviours. Despite the situation that substance use is highly prevalent within the Czech society and Czechs are rather tolerant to smoking and alcohol drinking, the key role is still being played by family and both behavioural norms and family rules are still being set by parents. Our results revealed a close association between teenage risk behaviours and satisfaction with his/her relationship to parents.

Especially in the socially deprived and less affluent areas, with the concentration of socio-pathological phenomena, the accessible counselling services focused on family and social support which

seem to be the key measures in tackling the risk behaviour prevalence.

International implementation experiences of the youth risk behaviour prevention programs suggest the need for comprehensive and complex approaches to design effective political measures (Jackson, 2012; Strang et al., 2012), both at national as well as local level, taking into account the impact of contextual factors and socio-cultural specificity of the particular environment.

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# 3. Jakou roli hrají v Česku faktory rodinného, školního a geografického prostředí?

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## 3.1. Úvod

V této kapitole se zaměřujeme na prevalenci rizikového chování českých adolescentů, jejich vzájemnou propojenost a podmíněnost, a to v kontextu specifických podmínek rodinného a školního prostředí, které ve své každodennosti dospívající mládež obklopují na mikroúrovni. Zaměřujeme se i na specifické sociogeografické faktory a vlivy působící na jejich chování v prostorově širším aspektu. Využitím tří indikátorů zdravotně rizikového chování (denní kouření, nadměrná konzumace alkoholu a užívání marihuany) byl odvozen ukazatel syndrom rizikového chování a následně byly identifikovány jeho základní prediktory ve vztahu k výše uvedeným sociálně prostorovým podmíněnostem.

Pro účely analýz byla využita data ze studie ESPAD 2007 pro Česko, obsahující individuální údaje o rizikovém užívání návykových látek českou mládeží v dokončeném věku 15 až 16 let, přičemž vedle běžných analytických technik byly aplikovány i pokročilé postupy víceúrovňového statistického modelování dat. Kapitola je souhrnem hlavních zjištění, která byla publikována již jinde (Kázmér a kol. 2014).

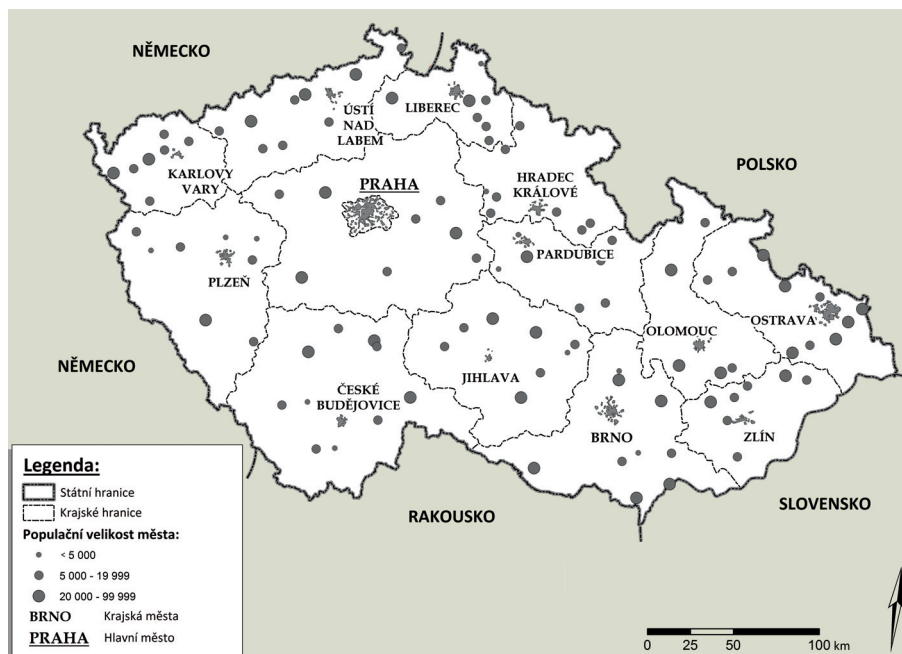
## 3.2. Teoretická východiska

V kontextu užívání návykových látek existují jak faktory rizikové, tak protektivní (Jessor 1991; Brooks a kol. 2012), a to jednak na úrovni individuální (např. pohlaví, věk, vzdělání, disponibilní příjem, životní styl, přítomnost chronického onemocnění, hodnotová orientace apod.), tak i prostorové (sociálně environmentální) – např. struktura a kvalita rodinného prostředí, prostředí školy,

kulturní vzorce a normy dané sociální skupiny, resp. komunity v užším měřítku; nebo dokonce i specifický vliv jednotek sociálně prostorové organizace v měřítku prostorově širším (např. rozdíly mezi městským a venkovským prostředím, příp. i rozdíly mezi sídly téže velikostní úrovně). Rodičovská podpora a její pozice v rámci sociální struktury (socioekonomický status) mohou v kontextu rizikového chování typicky působit jako protektivní faktor (Vakalahi 2001). Bobakova a kol. (2012) např. poukazuje na skutečnost, že rodičovský dohled je u dospívající mládeže spojen s významně nižším výskytem užívání návykových látek. Mladí lidé, kteří naopak vyrůstají v prostředí neadekvátní nebo nedostatečné rodinné péče jsou zase k takovému rizikovému chování náchylnější. Přítomnost vychovatele mimo přímou rodičovskou příbuznost však může na úroveň rizikového chování působit kompenzačně (Fergus, Zimmerman 2005). Příslušné faktory je přitom možné vystopovat jednak v rámci užívání návykových látek samostatně, tak i simultánně (tj. situace, kdy dospívající užívá více návykových látek souběžně, viz např. Pickett a kol. 2002).

Kromě zmíněných individuálních a sociálních vlivů jsou rovněž k dispozici doklady o další, širší podmíněnosti rizikového chování, jež spadají do kategorie „geografických faktorů“ (např. Atav, Spencer 2002; Jiang a kol. 2008). Fergus a Zimmerman (2005) v tomto ohledu odkazují na koncept „odolnosti“ (resilience). Vycházejíc z jejich práce, mládež žijící v sociálně deprimovaných oblastech má obecně vyšší sklon k zdravotně rizikovému chování než ostatní jedinci, žijící v prostředí, ve kterém se tato (relativní) deprivace nevyskytuje. Intervenční preventivní programy rizikového chování, explicitně cílené na problémové území, mohou výskyt takovýchto negativních jevů snížit.

**Obrázek 3.1 – Lokalizace škol zařazených do studie ESPAD 2007 v Česku**



### 3.3. Data a metody

Do analýz bylo celkem zahrnuto 7 616 respondentů ve věku 15–16 let, kteří v dotazníku ESPAD 2007 zodpověděli všechny 3 otázky týkající se frekvence užívání vybraných návykových látek (chybějící odpovědi byly tedy z dalších analýz vyloučeny): (1) kouření cigaret, (2) konzumace alkoholu, (3) užívání marihuany. Výběrového zkoumání se zúčastnilo 342 škol (průměrný počet respondentů v jedné škole = 22,3; SD = 5,9). Celkově se jednalo o studenty 4 různých typů škol: základních škol (studenti 9. třídy; 22,5 %), gymnázií (22,1 %), středních odborných škol (30,3 %) a odborných učilišť (25,1 %).

Geografickou polohu škol zařazených do šetření prezentuje obrázek 3.1. V prvním kroku byli studenti hodnoceni ve vztahu k jednotlivým formám rizikového užívání návykových látek. Následně byli klasifikováni do skupin (úrovní) s „ani jednou“, „jednou“, „dvěma“ nebo všemi „třemi“ formami syndromu rizikového chování.

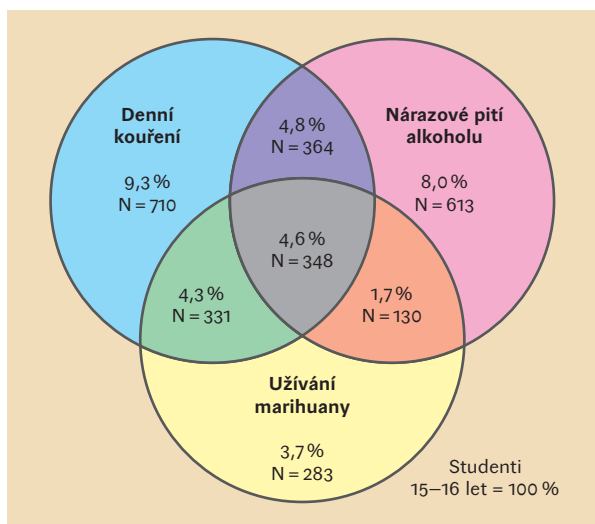
### 3.4. Analýza a diskuse

Obrázek 3.2 sumarizuje prevalenci rizikového užívání sledovaných tří návykových látek mezi šetřenou českou mládeží v roce 2007, a to jak samostatně, tak v kombinované formě. Téměř čtvrtina z šetřených studentů (23,0 %) deklarovala, že

denně kouří cigarety (alespoň jednu cigaretu za den). Přibližně pětina dotázaných (19,1 %) uvedla, že v průběhu posledního měsíce minimálně třikrát pila nárazově nadměrné dávky alkoholu (konzumace 5 a více alkoholických nápojů na jedno posezení). Celkově 14,3 % studentů uvedlo, že užívá marihuanu opakovaně (více než 6 užití za posledních 12 měsíců).

Z obrázku 3.2 je patrné, že „výluční“ denní kuřáci (tj. bez užívání jiných z analyzovaných návykových látek) tvoří z rizikově se chovající mládeže největší část (9,3 % z celku). Za nimi následuje skupina těch, kteří přiznávají časté epizodické pití alkoholu, tj. opět bez dalších z uvažovaných forem rizikového chování (8,0 %). Jak je z navzájem se překrývajících diagramů zřejmé, kouření a pití alkoholu jsou navzájem silně propojeny. Celkově 9,4 % českých studentů (4,8 % + 4,6 %) uvedlo, že kromě denního kouření cigaret má také sklony k pití velkých dávek alkoholu.

Silnou provázanost kouření a pití je přitom možné dokumentovat také pomocí ukazatele Mantel-Haenszelova poměru šancí: OR = 4,71 (95% CI = 4,197–5,274), viz tabulka 3.1. Výskyt jedné z forem rizikového chování tedy zvyšuje šance výskytu druhé v průměru 4,7krát. Podobně silnou provázanost je možné pozorovat taky mezi kouřením cigaret a užíváním marihuany, nebo nárazovým pitím alkoholu a užíváním marihuany (tabulka 3.1). Analýzy ukazují, že všechny tři vybrané indikátory rizikového chování spolu



**Obrázek 3.2 – Prevalence rizikového užívání návykových látek mezi adolescenty, Česko, ESPAD, 2007 (N = 7 616)**

Poznámka: Obrázek byl vytvořen na základě kombinatorického pravidla součtu, zobrazuje čtverec se třemi kružnicemi, podsoubory (denní kuřák, konzument nárazového pití a uživatel marihuany) s neprázdnými průniky, mimo kružnice je doplněk celku (respondenti bez rizikového chování).

Výchozí soubor 7 616 studentů tvořilo 100 %. Bez rizikových faktorů (mimo kružnice celkem 63,6 % studentů). Jeden či více rizikových faktorů vykazalo 36,4 % studentů a zbylá část studentů (63,6 %) byla bez rizikového chování. Podíl studentů se třemi rizikovými faktory byl 4,6 % (N = 348).

úzce souvisejí, tj. výskyt jedné z forem vede často i k formě jiné. Z příslušných tří primárních ukazatelů byl tedy pro účely analýz odvozen i sekundární ukazatel četnosti rizikového chování. V následujícím textu se zaměříme na identifikaci základních (sociogeografických) faktorů, které jednotlivé formy vícečetného rizikového užívání návykových látek podmiňují.

Tabulka 3.2 podává informaci o prevalenci jednotlivých úrovní vícečetného rizikového chování českých adolescentů odděleně podle typu rodinného a geografického prostředí, ze kterého příslušná mládež pochází. Téměř dvě třetiny studentů (63,5 %) se na rizikovém užívání sledovaných návykových látek nepodílelo, přibližně pětina (21,1 %) uvedla jednu látku, 10,8 % dvě a 4,6 % všechny tři návykové substance. Příslušné prevalence jsou přitom významně strukturovány podle obou uvažovaných faktorů. Výskyt kombinovaných forem rizikového chování roste s neúplností rodiny. Například rizikové užívání všech tří návykových látek bylo přítomno u 3,6 % adolescentů s oběma vlastními rodiči. V případě rodiny s jedním vlastním a jedním nevlastním

rodičem byl však tento podíl už 6,8 %, u rodin jenom s jedním (vlastním) rodičem 7,1 % a u adolescentů pocházejících z prostředí bez vlastního rodiče až 9,5 %.

Obdobnou strukturaci vidíme i v tabulce 3.2 v případě populační velikosti města, kde je poměrně překvapující, že výskyt vícečetného rizikového užívání návykových látek je relativně vyšší nejen u adolescentů pocházejících z hlavního města Praha, ale i z populačně nejmenších sídel Česka (do 5 000 obyvatel). Příslušné rizikové faktory užívání návykových látek jsou však podmíněny rovněž individuálními faktory (v daném případě hlavně pohlavím), nebo i jinými faktory prostředí, které s uvedenými sociogeografickými proměnnými úzce souvisí. Zde se uplatňuje především typ navštěvované školy, kde např. „výskyt“ žáků základní školy / respondentů může být typický hlavně pro malá města, nebo „protektivní efekt gymnázií“ může být lokalizován především do měst s vyšším počtem obyvatel). Příslušné vlivy a jejich efekt na prevalenci vícečetného rizikového chování je proto v analýzách nutno navzájem kontrolovat.

Tabulka 3.3 pak dokumentuje výstupy z komplexní, víceúrovňové regresní analýzy, kde jsou efekty uvedených faktorů navzájem kontrolovány a odstupňovány (hierarchizovány) – tj. individuální efekt pohlaví či věku na úrovni 1 je na další (prostorové) úrovni 2 efekt typu navštěvované školy explicitně kontrolován. Výsledky analýzy podávají následující závěry.

Rodinné prostředí s oběma vlastními rodiči vytváří společně se spokojenými vzájemnými vztahy studenta ke svým rodičům výrazně protektivní efekt na úroveň rizikového užívání návykových látek. V kontextu efektu rodinné struktury a vnímané kvality vzájemných vztahů se však jako rizikovější jeví mládež pocházející z rodin s relativně vyšším příjmem. Tato souvislost se může jevit na první pohled jako překvapující, protože je obecně známo, že osoby s nižším vzděláním (a následně i celkově nižším příjmem) jsou častějšími (rizikovými) konzumenty alkoholu či tabáku, přičemž mladé osoby od svých rodičů takovéto chování často přebírají. Zde nutno podotknout, že uvedené výsledky jsou získané po explicitní kontrole jak na vzdělání rodičů, tak na efekt (studentem) navštěvované školy. Můžeme se tedy domnívat, že vyšší (disponibilní) příjem (oproti osobám se stejnou úrovní vzdělání) může v kontextu vícečetného zdravotně rizikového chování české mládeže působit rizikověji, a to v důsledku vyšší

**Tabulka 3.1 – Vzájemné asociace mezi rizikovým užíváním tří vybraných návykových látek u adolescentů, Česko, ESPAD, 2007**

Mantel-Haenszelův poměr šancí (Ano/Ne)	Nárazové pití alkoholu		Užívání marihuany	
	Poměr šancí	95% CI	Poměr šancí	95% CI
Denní kouření cigaret	4,71	(4,197–5,274)	8,29	(7,278–9,435)
Nárazové pití alkoholu	.	.	4,45	(3,911–5,055)

(finanční) dostupnosti sledovaných návykových látek. K účinkům rodinného prostředí se přidávají také efekty prostředí školy, ve které mládež dospívá. Studenti gymnázií mají z ostatních typů škol nejnižší prevalenci (vícečetného) rizikového chování.

Naopak, jako nejrizikovější se jeví studenti středních odborných učilišť. Vyšší náročnost studia působí na rizikové chování mládeže protektivním účinkem. V souladu s předchozími výsledky v tabulce 3.2 je rovněž vidět, že prevalence (vícečetného) rizikového užívání návykových látek je významně diferencována podle populační velikosti města. K příslušné diferenciaci se přidává i míra nezaměstnanosti v daném městě. Ukazuje se, že kromě hlavního města Prahy jsou dalšími rizikovými místy populačně nejmenší a (socioekonomicky) deprimované oblasti Česka. Toto empirické zjištění lze interpretovat v rámci skutečnosti, že menší sídla mají nižší nabídku možností aktivního i pasivního trávení volného času (např. různé kulturní, sportovní, širší vzdělávací aktivity apod.), což v kontextu české mládeže následně může zvyšovat její sklon k zdravotně rizikovému chování.

### 3.5. Shrnutí

Výsledky studie nabízejí významná zjištění pro tvorbu doporučení a plánování preventivních programů rizikového chování mládeže. I navzdory skutečnosti, že „kultura rizikového chování“ je v domácím českém prostředí v porovnání s jinými evropskými zeměmi více rozšířená a celkově tolerovaná, základní normy jsou v daném kontextu stále nastaveny skrze strukturu a kvalitu rodinného prostředí, ve kterém adolescent vyrůstá. Vlivy rodinného prostředí jsou následně moderovány sociálním a normotvorným prostředím školy, ve které dospívající studenti tráví významnou část svých každodenních aktivit. Zdravotně rizikové chování mládeže je však

významně podmíněno také širšími sociálně prostorovými vlivy, ve kterých má pozice města/sídla v hierarchii prostorové organizace společnosti na straně jedné a relativní socioekonomická deprivace příslušného prostředí na straně druhé, také významné postavení. Pro plánování úspěšných a efektivních preventivních programů by projektové plány měly ve své komplexnosti a prostorové víceúrovňovosti klást důraz také na socioekonomickou a sociokulturní specifickou daného města/místa, ve kterém daná mládež žije, studuje a dospívá.

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**Tabulka 3.2 – Prevalenční odhady jednotlivých úrovní vícečetného zdravotně rizikového chování mládeže dle typu rodinného prostředí a populační velikosti města, ESPAD, 2007 (N = 7 616)**

	Počet užívaných návykových látek													
	Ani jedna			Jedna			Dvě			Tři			Celkem	
	N	%	(95% CI)	N	%	(95% CI)	N	%	(95% CI)	N	%	(95% CI)	N	%
<b>TYP RODINNÉHO PROSTŘEDÍ</b>														
Oba rodiče vlastní	3 712	67,2	(66,0–68,5)	1 099	19,9	(18,8–20,9)	516	9,3	(8,5–10,2)	198	3,6	(3,1–4,1)	5 525	100
Jeden vlastní a jeden nevlastní rodič	510	52,6	(49,4–55,5)	247	25,5	(22,8–28,0)	147	15,2	(12,8–17,5)	66	6,8	(5,3–8,4)	970	100
Jen jeden vlastní rodič	525	55,1	(52,3–58,1)	215	22,6	(19,9–24,9)	145	15,2	(13,0–17,7)	68	7,1	(5,5–8,7)	953	100
Ani jeden vlastní rodič / jiný	90	53,6	(45,2–61,8)	45	26,8	(20,1–34,0)	17	10,1	(5,8–15,3)	16	9,5	(5,5–14,5)	168	100
<i>Asymp. sig. (oboustranný test)</i>														
							< 0,0001							
<b>POPULAČNÍ VELIKOST MĚSTA</b>														
do 5 000	138	51,9	(46,0–58,2)	62	23,3	(18,1–28,3)	44	16,5	(12,0–21,1)	22	8,3	(5,0–12,0)	266	100
5 000 – 19 999	1 611	61,6	(59,7–63,4)	594	22,7	(21,1–24,4)	298	11,4	(10,1–12,7)	112	4,3	(3,6–5,2)	2 615	100
20 000 – 99 999	1 640	65,3	(63,4–67,2)	493	19,6	(18,1–21,2)	262	10,4	(9,3–11,6)	115	4,6	(3,8–5,5)	2 510	100
Krajská města	1 054	66,4	(63,9–68,6)	323	20,3	(18,3–22,4)	143	9,0	(7,6–10,4)	68	4,3	(3,3–5,4)	1 588	100
Praha – hlavní město	394	61,9	(58,3–65,5)	134	21,0	(18,1–24,0)	78	12,2	(9,6–14,9)	31	4,9	(3,3–6,5)	637	100
<i>Asymp. sig. (oboustranný test)</i>														
							< 0,0001							
<b>Celkem</b>	<b>4 837</b>	<b>63,5</b>	<b>(62,4–64,6)</b>	<b>1 606</b>	<b>21,1</b>	<b>(20,1–22,0)</b>	<b>825</b>	<b>10,8</b>	<b>(10,1–11,6)</b>	<b>348</b>	<b>4,6</b>	<b>(4,1–5,1)</b>	<b>7 616</b>	<b>100</b>

Poznámka: konfidenční intervaly vypočteny použitím metody *bootstrap*, počet *bootstrapových* výběrů = 1 000

**Tabulka 3-3 – Výstupy z multinomiální logistické regrese. Závisle proměnná – počet užívaných návykových látek. Tříúrovňový model: (1) student → (2) škola → (3) město. Česko, ESPAD, 2007 (N = 7 616)**

	Poměr šancí (rel. riziko)*		95% CI		Poměr šancí (rel. riziko)*		95% CI	
	Dolní	Horní	Dolní	Horní	Dolní	Horní	Dolní	Horní
1 návyková látka = 1 / ani jedna = 0								
2 návykové látky = 1 / ani jedna = 0								
3 návykové látky = 1 / ani jedna = 0								
<b>RODINNÉ PROSTŘEDÍ</b>								
<i>Typ rodiny: Oba rodiče vlastní (ref.)</i>								
Ani jeden vlastní rodič / jiný	1,45	0,996	2,107	1	1	1	1	1
Jen jeden vlastní rodič	1,30	1,080	1,554	1,84	1,477	2,293	1,929	2,436
Jeden vlastní a jeden nevlastní rodič	1,53	1,292	1,821	1,94	1,568	2,404	1,621	2,982
<i>Percepce rodinné ekonomické situace: Dobrá (ref.)</i>								
Průměrná	0,77	0,665	0,881	0,67	0,561	0,808	0,71	0,933
Špatná	0,64	0,496	0,820	0,51	0,363	0,712	0,56	0,900
<i>Percepce spokojenosti se vztahem s matkou: Vysoká (ref.)</i>								
Střední	1,34	1,096	1,638	1,45	1,127	1,871	1,41	2,042
Nízká	1,57	1,189	2,074	1,99	1,426	2,779	3,31	4,922
<i>Percepce spokojenosti se vztahem s otcem: Vysoká (ref.)</i>								
Střední	1,14	0,945	1,379	1,41	1,117	1,785	1,69	2,362
Nízká	1,55	1,272	1,883	1,59	1,236	2,041	2,36	3,270
<i>Vzdělání matky: VŠ (ref.)</i>								
ZŠ	1,19	0,964	1,474	1,05	0,795	1,384	0,75	1,120
SŠ nižší, SŠ vyšší	1,07	0,880	1,290	0,89	0,693	1,152	0,77	1,113
<i>Vzdělání otce: VŠ (ref.)</i>								
ZŠ	1,21	0,997	1,473	1,26	0,969	1,649	1,38	2,040
SŠ nižší, SŠ vyšší	1,10	0,914	1,327	1,25	0,970	1,613	1,28	1,879
<b>ŠKOLNÍ A GEOGRAFICKÉ PROSTŘEDÍ</b>								
<i>Typ školy: Gymnázium (ref.)</i>								
Střední odborná škola	1,68	1,406	2,011	2,68	2,057	3,505	3,50	5,438
Odborné učiliště	2,77	2,294	3,348	5,12	3,904	6,723	8,25	12,768
Základní škola	1,17	0,927	1,465	1,48	1,060	2,063	1,74	2,999
<i>Populační velikost města: Krajská města (ref.)</i>								
do 5 000	1,45	1,035	2,037	2,35	1,568	3,512	2,54	4,364
5 000 – 19 999	1,28	1,093	1,509	1,54	1,232	1,920	1,28	1,769
20 000 – 99 999	0,98	0,828	1,159	1,19	0,944	1,493	1,16	1,602
Praha – hlavní město	1,36	1,058	1,750	1,88	1,351	2,604	1,54	2,499
Míra nezaměstnanosti	1,03	1,002	1,050	1,03	1,003	1,067	1,03	1,075

Poznámka: ZŠ – základní, SŠ – středoškolské, VŠ – vysokoškolské

\* standardizováno současně na *pohlaví a věk*, statisticky významné koeficienty zvýrazněny kurzivou (p-hodnota < 0,05)

# TRENDS IN LIFETIME CANNABIS USE AMONG CZECH SCHOOL-AGED CHILDREN FROM 2002 TO 2014

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## SUMMARY

**Objective:** The aim of the study was to examine trends in the prevalence of lifetime cannabis use among the Czech 15-year old students.

**Methods:** Data from the nationally representative Health Behaviour in School-aged Children Survey, conducted in the Czech Republic in 2002, 2006, 2010 and 2014, were used. Trends in cannabis use among both boys and girls were modelled through binary logistic regression with period as a predictor of the lifetime cannabis use.

**Results:** The prevalence of lifetime cannabis use has significantly decreased among young Czechs, particularly among boys. Gender differences in cannabis use have been also gradually decreasing since 2002, with no significant differences between genders in recent period.

**Conclusions:** Although there are positive changes in the prevalence of adolescent cannabis use, from the European perspective, Czech students still belong to those with significantly higher rates in this respect. Thus, alongside with the use of other substances, adolescent cannabis consumption remains an important challenge for the national public health policy.

**Key words:** cannabis, adolescents, prevalence, trends

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## INTRODUCTION

Substance use during adolescence is a serious public health concern (1, 2) with significant impact on society as a whole. Among illicit substances, cannabis is the most prevalent psychoactive drug with consumption primarily concentrated among young population (3). From an international perspective, the Czech Republic belongs to countries with relatively high rates of illicit substance use (4), which is apparent particularly for cannabis use. For example, data from the recent European Drug Report indicate that, in 2015, almost one in five (18.8%) young adults aged 15–34 years had used cannabis in the past year, ranking the Czech Republic on 3rd position among European countries (4, 5).

In epidemiology, there is a rich scientific evidence documenting how early and intensive cannabis use can lead to a number of physical, mental and social problems during the adolescence or later in adulthood (6). Although there is still a debate on its causal link to other substances (7, 8), cannabis is frequently regarded as a gateway to other forms of illicit drug use (9, 10). This increased risk of later drug-related problems is of particular concern among individuals where the first experience with drug occurs before mid-adolescence (11, 12).

Given the specific vulnerability of juveniles to substance use related consequences, research on adolescent illicit drug use

provides an important insight into the complex picture of both adolescent health assessment and national drug monitoring. Applying internationally comparable data, we analyse both the prevalence of cannabis use among the Czech 15-year old youths and possible temporal changes in this respect. As the prevalence rates of substance use typically vary between boys and girls, gender specific differences are also taken account.

## MATERIAL AND METHODS

The data used in our analysis were obtained through the Health Behaviour in School-aged Children study (HBSC). The aim of HBSC is to increase understanding of adolescent health behaviours as well as general health and wellbeing in the specific social context of adolescents. This is achieved through the collection of high quality data available for both scientific and policy purposes, obtained by large cross-national school-based research (13). In the Czech Republic, HBSC has been conducted every four years since 1994 and it provides reliable and comparable database for variety of adolescent health indicators.

As regards adolescents' substance use, HBSC provides data on consumption of both licit (tobacco, alcohol) and illicit substances (cannabis). Data on adolescent cannabis use are available

since 2002, providing information on the prevalence of lifetime cannabis use during the last 12-year period (2002–2014). The HBSC provides some additional data on cannabis use (past year prevalence, past month prevalence), however, these data were not collected regularly; thus, they were not suitable for our analysis.

In HBSC, the question on lifetime cannabis use was surveyed amongst 15-year-old respondents only (i.e. younger student cohorts were not included in this part of the questionnaire). Students reported the frequency of cannabis use in their life on a 7-point scale ranging from “never” to “40 times or more”. Those who reported at least one cannabis experience in their life were classified as lifetime cannabis users. The data were collected during the survey using an anonymous self-reported questionnaire, where all respondents participated on voluntary basis. Therefore, no consent was required for the study.

The statistical analysis was conducted in two steps. First, prevalence estimates of lifetime cannabis use with corresponding 95% confidence intervals (95% CI) were computed for both genders and plotted to graph. Gender differences in prevalence estimates were tested by both Pearson Chi-square statistic and Mantel-Haenszel common odds ratio (14). Second, trends in lifetime cannabis use were modelled by binary logistic regression. In the model, survey period was used as a predictor of the lifetime cannabis use.

## RESULTS

As already stated above, we used data from the last four HBSC studies conducted in the Czech Republic from 2002 to 2014. Table 1 summarizes sample sizes of 15-year-old students

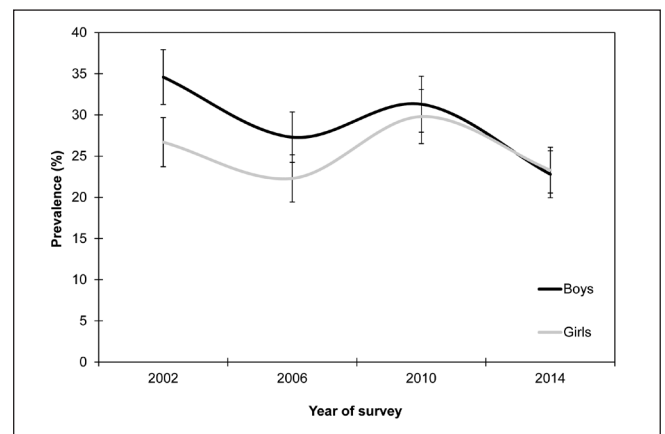
**Table 1.** Sample structure for the study by gender and the year of survey, 15 years old students, Czech Republic, HBSC data 2002–2014 (N=6,607)

	Year of survey			
	2002	2006	2010	2014
Boys	806	842	747	852
Girls	854	823	775	908
Total	1,660	1,665	1,522	1,760

surveyed in each cross-sectional period. The size of samples varied from 1,522 in 2010 to 1,760 in 2014, with a proportional share of both genders. In the analysis, a total sample of 6,607 respondents compiled from four surveys was used (3,247 boys and 3,360 girls). With regards to the response rates, the share of missing responses on lifetime cannabis use did not exceed 4% in any survey. The overall percentage of missing values in the compiled dataset was also very low (2.7%).

Table 2 presents time series of the estimated share of 15-years-old Czechs, who have ever used cannabis in their life. Both separate estimates by gender and total prevalence rates are presented. The total prevalence rate varied from 30.5% in 2002 to 23.1% in 2014. Additionally, gender differences were tested by Pearson Chi-square and Mantel-Haenszel common odds ratio statistics. While in 2002 there were clear gender differences in lifetime cannabis use with significantly lower rate among girls (OR=0.69,  $p < 0.001$ ), these differences gradually decreased in later periods. In 2010 and 2014, no significant differences were detected.

The following Fig. 1 summarizes trends in lifetime cannabis use separately for boys and girls; 95% CIs are also plotted. There is a gradual decline in the proportion of students with the lifetime cannabis experience, particularly among boys. Among girls, the time series has a rather fluctuating character with no clear temporal trend. This resulted in a gradual de-



**Fig. 1.** Trends in lifetime cannabis use in 15 years old students by gender (%), 95% CI, Czech Republic, HBSC (2002–2014).

**Table 2.** Prevalence estimates of lifetime cannabis use in 15 years old students by gender and the year of survey, Czech Republic, HBSC (2002–2014)

	Year of survey			
	2002	2006	2010	2014
Prevalence estimates (%)				
Boys	34.6	27.3	31.3	22.8
Girls	26.7	22.3	29.8	23.3
Total	30.5	24.8	30.5	23.1
Tests of gender differences				
Pearson chi-square (df)	12.25 (1)	5.35 (1)	0.37 (1)	0.07 (1)
M-H odds ratio	0.69	0.77	0.93	1.03
p value	<0.001	0.021	0.544	0.791

p values are 2-sided; M-H – Mantel-Haenszel common odds ratio (girls vs. boys).



**Table 3.** Binary logistic regression by gender. Dependent variable – Lifetime cannabis use in 15 years old students, Czech Republic, HBSC (2002–2014)

		Beta (SE)	p value	Exp(Beta) (95% CI)
Boys	Time period <sup>a)</sup>	-0.04 (0.009)	<0.001	0.96 (0.945–0.978)
	Constant	-0.67 (0.064)	<0.001	0.51 (0.451–0.578)
Girls	Time period <sup>a)</sup>	0.00 (0.009)	0.601	1.00 (0.978–1.013)
	Constant	-1.05 (0.066)	<0.001	0.35 (0.308–0.399)
Total	Time period <sup>a)</sup>	-0.02 (0.006)	<0.001	0.98 (0.966–0.990)
	Constant	-0.86 (0.046)	<0.001	0.42 (0.387–0.463)

<sup>a)</sup>Continuous variable, number of years since the baseline period 2002. Lifetime cannabis use: Yes = 1, No = 0

crease of differences in the prevalence of lifetime cannabis use between the genders.

In the last step, temporal trends were tested through the binary logistic regression. In the model, survey period was used as an independent predictor of the lifetime cannabis use. It was measured as a continuous variable indicating the number of years since the baseline period 2002 (i.e. “0” for 2002; “4” for 2006, etc.). The analysis was conducted both separately for genders and for total prevalence. Results are presented in Table 3.

The regression analysis confirmed previous results summarised in Table 2 and Fig. 1. The total prevalence of lifetime cannabis use significantly decreased from 2002 to 2014 (Beta=-0.02;  $p<0.001$ ). However, temporal trends were different between genders (Z-test for difference in Beta coefficients between boys and girls = -3.14,  $p=0.002$ ). While the gradual decline in the prevalence of lifetime cannabis use was pronounced particularly among boys (Beta<sub>boys</sub> = -0.04;  $p<0.001$ ), there was no significant change in the prevalence among girls (Beta<sub>girls</sub> = 0.00;  $p=0.601$ ).

## DISCUSSION

Results of the analysis clearly pointed to a downward trend in the prevalence of cannabis use among the Czech youth. Although we had to limit the study only to the examination of lifetime cannabis use, our results can be compared with some other studies focused on the level of adolescent cannabis consumption.

The issue of decreasing trends in cannabis use among the school-age youngsters, particularly among those living in western societies, has been already presented by some authors. Kuntsche et al. (2) studied the prevalence of adolescent past year cannabis use, and found that in most of the 31 countries there was a decrease in the prevalence from 2002 to 2006. In a similar manner, Brooks-Russell et al. (15) found that from 1998 to 2010, there was a continuous decline in the past year cannabis use among the 10th grade students living in the United States. The study by Hublet et al. (16) generally confirmed the decreasing trend in adolescent cannabis use both in Europe and North America – despite some regional variations particularly among Eastern European countries. According to latest data published by the 2015 European School Survey Project on Alcohol and Other Drugs (ESPAD) report (17), the prevalence of lifetime cannabis use among the Czech 16-year old students also continually declined from 2003 to 2015. Put together, all these positive trends are in congruence with our analysis and point to lowering prevalence of adolescent cannabis use as a rather more general trend in developed countries.

Nevertheless, as documented by recent international studies surveyed by both HBSC (2014) and ESPAD (2015) consortiums, the Czech adolescents still belong to those with a relatively extensive cannabis use as compared to their counterparts from other European countries. For example, in 2015, the rate of adolescent lifetime cannabis use in the Czech Republic was 2.3 times higher than the ESPAD average (17). Similar results were published for 2014 by the HBSC report (the Czech rate was 1.5 times higher than the average from all HBSC countries) (18). For current cannabis use, defined as the prevalence of use within the last 30 days, the Czech rate was twice as high as the 2015 ESPAD average (17). Furthermore, the age of cannabis initiation among the Czech students was also relatively low (in 2014, the percentage of 15-year-olds, who used cannabis at the age 13 or earlier, was 2.2 times higher among Czechs than in other HBSC countries) (18). Therefore, the issue of adolescent cannabis consumption, as well as the use of other substances, cannot be neglected. This is particularly important due to the fact that in the Czech Republic the availability of cannabis is still relatively high and possession of low amount of marijuana is not defined as a criminal act any more (19).

There can be several factors underlying recent positive trends in cannabis use among the Czech youth. In this regard we emphasize, however, social factors, especially those responsible for changes in patterns of leisure time activities of the contemporary youth. In the study of Kuntsche et al. (2) authors demonstrated that in most countries participating in the HBSC project, the decrease in adolescent cannabis use from 2002 to 2006 occurred in accordance with general decrease in frequency of going out with their friends. Results from the recent research presented by Chomynová et al. (20) provides empirical evidence on significant changes in leisure time activities among the Czech adolescents as well. Applying the Czech data obtained within six waves of the ESPAD study (1995–2015), they document that since 2003 there has been strong and gradual decline in the proportion of students going out with their friends, seeking for various fun activities (e.g. parties, discos, etc.). On the other hand, proportion of students preferring internet surfing as a leisure time activity and using various tools of information and communication technologies for entertainment strongly increased. Thus, adolescents nowadays seem to spend significantly less time with their peers than the Czech youth twelve years ago. Additionally, changes in higher awareness and/or perceptions of risks associated with the cannabis use do not seem to explain the positive trend (there are no significant changes from 2003 to 2015 as documented by Chomynová et al.) (20). Therefore, in accordance with the

international research conducted by Kuntsche et al. (2) and their reference to the concept of “exposure opportunity” (21), it seems to be plausible that new modes of leisure time activities mostly contribute to the lowering prevalence of (lifetime) cannabis use. This can be attributed to the contemporary Czech youths, as well as to adolescents living in other countries in general.

At the end of the discussion, we also point to some methodical considerations related to our study. In the analysis, representative data from large sample school-based research with internationally unified methodology were used. This is undoubtedly a strength of the study. However, we should also mention that the data rely on self-reported responses of students present in the school at the time of survey. This could partially underestimate prevalence rates of illicit substance use due to both willingness to disclose accurate information on socially undesirable behaviour and possibly higher rates of school absenteeism among adolescent substance users. Although there can be several factors related to reliability of the data, the available research evidence suggest that self-reports on adolescent substance use are mostly valid and reliable. This applies especially to studies where surveys are anonymous and confidentiality of responses is assured (22, 23), as in our research.

## CONCLUSIONS

The study provides an empirical evidence on decreasing trend in the prevalence of adolescent cannabis use in the Czech Republic. This positive development is consistent with some other studies focusing on adolescent cannabis consumption, conducted in developed countries. The analysis showed that the decreasing trend was present particularly among boys. This resulted in shrinking gender differences in the prevalence of lifetime cannabis use among the Czech youths. Although the lowering prevalence is seen to be a positive trend, it has to be emphasized that adolescents in the Czech Republic still belong to those with relatively high rates of cannabis consumption comparing to other European teenagers.

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## Conflict of Interests

None declared

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# TRENDS IN TOBACCO SMOKING AMONG CZECH SCHOOL-AGED CHILDREN FROM 1994 TO 2014

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## SUMMARY

*Objective:* The aim of the article is to examine trends in tobacco consumption among the Czech school-age population.

*Methods:* For the analysis, data from the Czech Health Behaviour in School-aged Children project, conducted between 1994 and 2014 were used. Trends in tobacco smoking were determined separately for boys and girls, applying the binary logistic regression with survey period as an independent variable for the smoking status.

*Results:* The analysis showed that there have been significant changes in adolescent tobacco smoking for the recent 20 years. While the share of current school-aged smokers was continuously increasing since the mid-1990s, the trend reached its peak in the mid-2000s.

*Conclusion:* In recent years, the prevalence of adolescent smokers has significantly declined in the Czech Republic. Despite this recent decline, adolescent smoking remains a major challenge for the national health policy.

*Key words:* tobacco smoking, adolescents, prevalence, trends

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## INTRODUCTION

Despite many reports on the negative health consequences of smoking, tobacco consumption is still the leading cause of preventable death in developed countries (1, 2). It has been estimated that the life expectancy for smokers is about 10 years shorter than for non-smokers (3). In a similar vein, it has been recognized that smoking increases the risk of a variety of diseases causing the major proportion of total deaths, including several sites of cancer, vascular diseases and chronic pulmonary diseases (4). In the Czech Republic, tobacco smoking is currently related to approximately 16% of total adult mortality (23.5% in men and 10% in women) (5). The negative effects on health are proportional to the smoking exposure in terms of both number of years and frequency of tobacco consumption during the lifespan. Given the high burden of smoking-related harms and its direct effects on population morbidity and mortality, it is of major concern of public health in many developed countries all over the world.

Adolescence is a critical period for the future smoking habits in adulthood. Most of adult daily smokers tried their first cigarette before the age of 18 (6). However, once the habit changes to addiction, smoking is extremely difficult to break. It has been shown that less than half of all smokers successfully quit before the age of 60 (7).

Despite of all the negative health consequences, adolescents still may see positive aspects in smoking. The most prevalent func-

tions of smoking are: controlling negative moods and depression (relaxation, concentration, stress reduction, boredom elimination); social group affiliation (smoking as a tool for joining a desired friendship group, for establishing contact with other gender); weight control (especially among girls); identification with a certain image of adulthood and self-reliance (8). More recent research reveals complexity of social roles that smoking plays in the life of adolescents (9, 10).

The research on prevalence of smoking among adolescent population provides important data for both the complex national monitoring of health-related behaviours and addressing the specific needs for national health policy. The information on recent trends can subsequently serve as an empirical evidence on changing behaviour of the growing-up part of the population, as a response to policy changes and preventative measures introduced in the past. The aim of this study is, therefore, the examination of trends in tobacco consumption in the Czech teenage population, covering relatively long period of 20 years. The paper refers to some other similar studies published in the past (11, 12).

## MATERIAL AND METHODS

For the study, data from the series of nationally representative surveys on adolescents' health conditions were used; drawn from

the Czech part of the international project of Health Behaviour in School-aged Children (HBSC). HBSC is a major cross-sectional study that deals with monitoring of young people's health, life satisfaction and its determinants. In the Czech Republic, HBSC has been conducted at four-year intervals since 1994. The project is based on a unified methodology, where all countries follow the same research protocol in terms of sampling, questionnaire and survey administration. A detailed description of the aims, methods and design of the study is available elsewhere (13). For this paper, data from the last 6 survey waves, conducted in the Czech Republic from 1994 to 2014, were used.

Regarding the analysis, data on the current status of adolescents' smoking were applied. The data were collected by self-administered questionnaire completed in the classroom in a standardized way. Among the other HBSC questions on adolescent tobacco consumption, data on the current smoking status were the only ones that were fully comparable to the other waves of the survey.

The question used in the analysis was as follows: "How often do you smoke tobacco at present?" The possible answers were: 'every day'; 'at least once a week, but not every day'; 'less than once a week'; 'I do not smoke'. Respondents 11, 13 and 15 years old were asked this question. Those who answered 'I do not smoke' were then coded as non-smokers; other responses were coded as current adolescent smokers.

The analysis was carried out in two steps. In the first step, age-specific prevalence estimates of adolescent current smoking with corresponding 95% confidence intervals (95% CI) were computed for the three age groups (11-, 13- and 15-year olds) and plotted to graph. Trends in smoking were assessed both visually and by fitted trend curve. The shape of the curve was determined by consecutive fitting of linear, logarithmic, exponential, and polynomial trends. The shape with the highest fit ( $R^2$ ) was selected – in our case, the quadratic trend.

In the second step of the analysis, trends in adolescent current smoking were tested by binary logistic regression. Based on the previous results, following regression equation was estimated:

$$\text{Log} [\pi/(1-\pi)] = \text{Constant} + \beta_1 \cdot (\text{period}) + \beta_2 \cdot (\text{period}^2), \text{ period} = 0, 4, 8, 12, 16, 20;$$

where  $\pi$  is the prevalence of adolescent current smokers and *period* is a number of years since the first HBSC survey in 1994. Lastly, the peak of the quadratic trend (vertex) was computed from the estimated regression coefficients.

The analysis was conducted both separately by gender and for total student population. As the prevalence of current smokers was very low among the 11-year olds, trend analyses were tested only among 13- and 15-year old students.

## RESULTS

Table 1 presents description of the sample used in our study. Number of respondents surveyed in each cross-sectional period is presented separately by their gender and age. The sample size varied from 3,585 students in 1994 to 5,055 in 2014 with a proportional share of 11-, 13- and 15-year olds in each wave (approximately one third of the respondents per age group). The total sample size, compiled from all 6 survey periods, was 26,589 (a total of 13,021 boys and 13,568 girls).

In Table 2, age-specific prevalence estimates of adolescent current smoking are presented in the 20-year time series since 1994. The proportion of smoking adolescents gradually increases with students' age. For example, in 2002, there was almost 30% of current smokers among 15-year old Czechs, while it was 11% among 13-year olds and only 2% among 11-year olds. Regarding differences between genders, these were apparent only at the beginning of the analysed period, with higher rates of smoking among boys. During the 2000s, gender differences declined and, in recent years, higher prevalence estimates were even observed among girls.

Trends in adolescent smoking are plotted in Fig1abc, separately by age-group and gender. The corresponding 95% CIs of prevalence estimates are also presented. As one may observe, there were significant changes in adolescent smoking since the mid-1990s, particularly among 13- and 15-year olds. While there was a strong increase in the share of smoking teenagers between 1994 and 2002, the trend was rather declining in 2006 and 2010.

**Table 1. Sample structure for the study by gender, age and the year of survey, Czech Republic, HBSC data 1994–2014**

Gender	Age group	Year of survey					
		1994	1998	2002	2006	2010	2014
Boys	11 years old	539	586	826	765	719	738
	13 years old	644	646	780	804	669	818
	15 years old	606	607	806	842	747	852
	Total boys	1,789	1,839	2,412	2,411	2,135	2,408
Girls	11 years old	555	598	865	744	707	836
	13 years old	646	644	881	797	787	903
	15 years old	595	622	854	823	775	908
	Total girls	1,796	1,864	2,600	2,364	2,269	2,647
Total	11 years old	1,094	1,184	1,691	1,509	1,426	1,574
	13 years old	1,290	1,290	1,661	1,601	1,456	1,721
	15 years old	1,201	1,229	1,660	1,665	1,522	1,760
	Total sample size	3,585	3,703	5,012	4,775	4,404	5,055



**Table 2.** Current smoking prevalence estimates (%), by gender, age and the year of survey, Czech Republic, HBSC 1994–2014

Gender	Age group	Year of survey					
		1994	1998	2002	2006	2010	2014
Boys	11 years old	2.2	1.9	3.0	1.6	2.4	1.6
	13 years old	7.3	10.1	13.7	7.9	8.9	4.0
	15 years old	15.8	22.4	28.7	19.7	22.0	10.8
Girls	11 years old	1.4	1.0	1.0	1.1	0.9	0.8
	13 years old	4.2	7.0	8.6	8.8	10.3	3.6
	15 years old	11.9	17.5	30.6	23.4	27.8	15.6
Total	11 years old	1.8	1.4	2.0	1.3	1.6	1.2
	13 years old	5.7	8.5	11.0	8.3	9.7	3.7
	15 years old	13.9	19.9	29.7	21.6	25.0	13.3

The most significant decline was, however, observed in the recent period of 2014.

In the last step of the analysis, trends in adolescent tobacco smoking were modelled by binary logistic regression. The analysis was conducted for 13- and 15-year old students, with the results presented in Table 3.

Regression analyses in Table 3 confirmed previous findings from Fig. 1bc. The prevalence of adolescent smoking experienced significant non-linear changes in the Czech Republic since 1994. While the share of current school-age smokers was increasing since the mid-1990s, the trend reached its peak in the mid-2000s

and dropped in recent period (negative values of  $\beta_2$  coefficients for period squared reflect the concave shape of the trend curve). Trends in tobacco smoking were similar in both genders, with approximately 2.5-year later onset of decline among girls (compared vertex estimates between the genders).

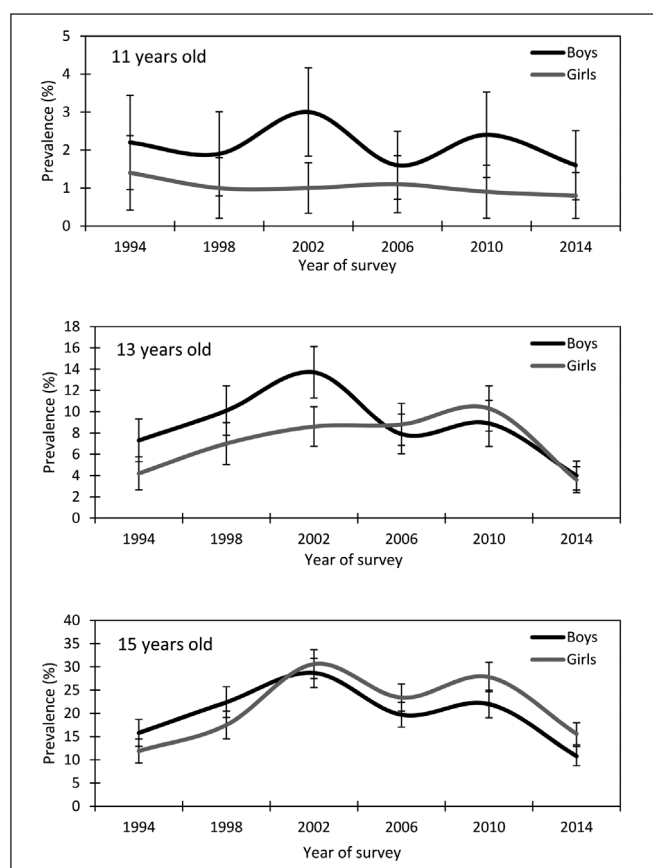
## DISCUSSION

The results of our analysis prove the significant changes in the prevalence of tobacco smoking among the Czech adolescent population during the last 20 years. While the share of current school-age smokers was continuously increasing since the mid-1990s, the trend reached its peak in mid-2000s. In recent years, the prevalence of adolescent smoking has significantly decreased in the Czech Republic.

Our findings are in line with the results from other studies on trends in adolescent health-related behaviours conducted in Europe. Although the adolescent smoking is still of a concern for national health policies, data from the recent HBSC surveys indicate that the prevalence of smoking is declining in other European countries as well (13, 14).

The decline in smoking prevalence has been evident in Northern and Western European countries since 1998. The trend was, in general, similar in countries of the Southern Europe, with a slight increase in prevalence between 2006 and 2010. However, smoking among adolescents from the post-communist countries of Central Europe was and still is more common compared to their Western European peers. Based on our data from the HBSC study conducted in the Czech Republic, an increasing trend between years 1998 to 2002 was reported, followed by a slight continual increase to 2010. The decrease from 2010 to 2014 was the most impressive up to now.

The results of the ESPAD study are in line with the findings of the HBSC study. The last data collection from 2015 confirmed the overall decline in smoking in most of the countries. On average, about one in five (21%) of European adolescents reported current smoking (during the past 30 days), as compared to 29% in the study carried out in 2011. In a similar vein, more European students reported they had never smoked (54% in 2015; 44% in 2011). Between 2011 and 2015, the Czech students surveyed in ESPAD reported similar rapid decrease in smoking, as that re-



**Fig. 1abc.** Trends in current smoking (%; 95% CI), by age and gender, Czech Republic, HBSC (1994–2014).

**Table 3. Binary logistic regression by gender and age. Dependent var. – Current smoking (Yes = 1; No = 0), Czech Republic, HBSC 1994–2014**

Gender	Age group	Independent <sup>a)</sup>	Beta (SE)	95% CI for Beta		p value	Vertex estimate <sup>b)</sup>
				Lower	Upper		
Boys	13 years old	Time period squared	-0.008 (0.001)	-0.011	-0.005	<0.001	7.9
		Time period	0.122 (0.030)	0.064	0.181	<0.001	
		Constant	-2.514 (0.132)	-2.773	-2.255	<0.001	
	15 years old	Time period squared	-0.008 (0.001)	-0.010	-0.006	<0.001	8.7
		Time period	0.136 (0.021)	0.095	0.177	<0.001	
		Constant	-1.645 (0.097)	-1.835	-1.455	<0.001	
Girls	13 years old	Time period squared	-0.009 (0.002)	-0.012	-0.006	<0.001	10.5
		Time period	0.194 (0.035)	0.125	0.263	<0.001	
		Constant	-3.229 (0.173)	-3.568	-2.891	<0.001	
	15 years old	Time period squared	-0.009 (0.001)	-0.011	-0.007	<0.001	11.2
		Time period	0.203 (0.022)	0.160	0.246	<0.001	
		Constant	-2.053 (0.109)	-2.267	-1.840	<0.001	
Total	13 years old	Time period squared	-0.008 (0.001)	-0.010	-0.006	<0.001	9.2
		Time period	0.150 (0.022)	0.106	0.194	<0.001	
		Constant	-2.820 (0.105)	-3.026	-2.615	<0.001	
	15 years old	Time period squared	-0.008 (0.001)	-0.010	-0.007	<0.001	10.1
		Time period	0.166 (0.015)	0.137	0.196	<0.001	
		Constant	-1.834 (0.072)	-1.976	-1.693	<0.001	

<sup>a)</sup>Time period is a continuous variable representing number of years since the baseline period 1994.

<sup>b)</sup>Vertex represents the time period, where the estimated quadratic regression function reaches its maximum.

ported in the HBSC study. Despite this decrease, the prevalence of smoking among young Czechs is still higher than the European average or the smoking in Scandinavia and in most of the Western European countries. (13, 15, 17, 20).

According to our findings, differences in the smoking prevalence between genders were apparent only at the beginning of the analysed period, with higher rates of smoking among boys. The gender differences declined during the 2000s, and, in recent years, there have been even higher rates of smoking among girls. The phenomenon of decline of gender inequalities in smoking is not unique for the Czech students only. It has been documented by international studies based on data from the HBSC in Europe (14), as well as in a global perspective on the data from the Global Youth Tobacco Survey (15, 16).

As regards the decline in both prevalence and gender inequalities in adolescent smoking, the descriptive model of cigarette epidemic proposed by Lopez et al. (21) states there are four main stages of tobacco consumption that can be recognized in developed countries. The stages are characterized by distinctive patterns of both prevalence of smoking and smoking-attributable mortality in the population, differentiated between the genders (the onset of the smoking epidemic among women is delayed to that among men). In its final stages, prevalence of smoking continually declines among both genders, possibly with higher prevalence rates among women (depending on the specific stage). Although the model was proposed for adult population, some parallels with the research aimed at adolescents is apparent. The model is, however, descriptive and do not refer to broader social factors related to the smoking behaviour, other than income, availability

of tobacco products and preventative policy measures. Therefore, concerning particularly inequalities between genders, factors of converging gender-specific social roles, perceived norms and expectations in the society should be emphasized as well (22).

Given the method used in our study, we also point to some potential limitations related to the findings presented in the paper. In the analysis, we used self-reported information on adolescent substance use, collected within the large school-based survey. Although self-reports are, in general, considered as a good estimator of the smoking status (23), factors related to possible underreporting of the actual prevalence among the adolescent population should be still taken into account (24). In the school-based study, such bias may arise in situations, where a specific group of students is not included in the survey, e.g. due to school dropouts or absenteeism. Similarly, specific recall bias on the actual frequency of substance use and/or perceived normativity on adolescent behaviour may play a certain role, too. Furthermore, the presented study is rather descriptive and cannot provide evidence on causes underlying the recent trends in the prevalence of adolescent health-related behaviours. The future research should focus on a more detailed analysis of factors related to the recent decline, as well as to possibly different effects of preventative measures between adolescents coming from the distinctive social environment.

## CONCLUSIONS

The findings of our study demonstrated the declining trend of tobacco consumption among the Czech adolescents. The trend is

apparent among both boys and girls, and there are rather minor differences in this respect. However, given the higher prevalence of smoking among adolescent girls, as compared to boys in recent periods, there are some implications that should not be neglected.

As suggested by our findings, preventive programmes instituted in the Czech schools should pay more attention to gender-specific perceptions and norms related to smoking behaviour. Moreover, existing regulatory measures on the sale of tobacco products to minors need to be enforced vigorously as, unfortunately, there are some deficiencies (17, 25).

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#### Conflict of Interests

None declared

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## Temporal Trends and Risk Factors of Excessive Alcohol Consumption among Czech Adolescents



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**BACKGROUND:** Alcohol use in adolescence poses a major risk to people's health in their later life. In the long term, Czech adolescents show the highest levels of alcohol consumption in Europe. **AIMS:** To analyse the prevalence of excessive drinking among Czech adolescents and assess its development in the past 20 years, as well as to identify selected risk factors associated with different levels of drinking among Czech adolescents at present. **METHODS:** Quantitative analysis of data generated by a sample survey of risk behaviour among young Czechs, correlation and regression analysis, and multilevel modelling. **SAMPLE:** Individual data from the ESPAD international surveys (1995–2015), a total of six cross-sectional waves, representative data on Czech adolescents aged 16 ( $N=2,738$  to  $5,399$ ) with the proportionate representation of gender, type of school attended, and regions. **RESULTS:** The prevalence of excessive drinking seems to have dropped in the most recent pe-

riod (2015). Male students at apprentice training centres (without the school-leaving examination – “maturita”) continue to be the most vulnerable group in this respect. Significantly higher rates of excessive alcohol use were found among adolescents from incomplete families and those showing poor relationships with their parents, high degrees of social alienation, and generally low life satisfaction. Excessive drinking also tends to be more common among adolescents from families with low levels of education and higher family affluence. **CONCLUSIONS:** Despite a marked decline in the prevalence of excessive alcohol use among Czech adolescents, this issue continues to be a challenge for the national health and drug policies. This paper demonstrates that the levels of drinking continue to be strongly conditioned by both individual and social or environmental factors (such as family and school).

**KEY WORDS:** ALCOHOL – ADOLESCENCE – PREVALENCE – TEMPORAL TRENDS – RISK FACTORS

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# Trendy a rizikové faktory nadměrné konzumace alkoholu u českých adolescentů



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**VÝCHODISKA:** Konzumace alkoholu v období dospívání představuje závažné riziko pro budoucí zdraví daného jedince. Úroveň pití mezi českými nezletilými patří dlouhodobě k nejvyšším v Evropě. **CÍLE:** Analýza prevalence nadměrné konzumace alkoholu u mladistvých Čechů a zhodnocení jejího vývoje za posledních přibližně 20 let. Identifikace vybraných rizikových faktorů souvisejících s rozdílnou úrovní pití u současných českých adolescentů. **METODY:** Kvantitativní analýza dat z výběrového šetření zaměřeného na rizikové chování české mládeže. Korelační a regresní analýza, víceúrovňové modelování. **SOUBOR:** Individuální data z mezinárodní studie ESPAD (1995–2015), celkem 6 průřezových vln. Reprezentativní údaje o českých dospívajících ve věku 16 let (N=2 738 až 5 399) s proporcionalním zastoupením pohlaví, typu navštěvované školy a kraje. **VÝSLEDKY:** Prevalence nadměrného pití v po-

sledním období klesla (rok 2015). Nejrizikovější skupinou v daném ohledu jsou i nadále chlapci studující na odborných učilištích (bez maturity). U adolescentů pocházejících z neúplných rodin, se špatnými vztahy k rodičům, s vysokým stupněm sociálního odcizení a s celkově nízkou spokojeností se svým životem se nadměrná konzumace alkoholu vyskytuje významně častěji. Častější je rovněž u dospívajících pocházejících z rodin s nižším vzděláním a s vyšší finanční zámožností. **ZÁVĚRY:** I navzdory výraznému poklesu prevalence nadměrného pití mezi českými adolescenty zůstává tato problematika i nadále výzvou pro státní zdravotní a drogovou politiku. Článek dokládá, že úroveň pití je i nadále významně podmíněna jak individuálními faktory u daného jedince, tak i faktory širšího sociálního charakteru, ve kterých jedinec dospívá (rodinné a školní prostředí).

**KLÍČOVÁ SLOVA:** ALKOHOL – ADOLESCENCE – PREVALENCE – ČASOVÉ TRENDY – RIZIKOVÉ FAKTORY

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## ● 1 ÚVOD

Nadměrná konzumace alkoholu je závažný celospolečenský problém. Jelikož dospívání je v životě mladého člověka specifickým a senzitivním obdobím, časný začátek pravidelné konzumace alkoholu může být zásadním zlomem pro jeho budoucí zdravotní, sociální a psychologický vývoj.

Z mezinárodních prevalenčních šetření vyplývá, že je v České republice úroveň konzumace alkoholu dlouhodobě vysoká, a to jak u mladistvých, tak i dospělých osob. V roce 2015 pilo v obecné populaci (ve věku 15–64 let) alkohol denně nebo téměř denně 12,5 % lidí (18,9 % mužů a 6,4 % žen). Do kategorie škodlivého pití spadalo 6,0 % obyvatel starších 15 let, dalších 7,2 % pak spadalo do kategorie rizikového pití; celkově tedy přibližně 540 tis., resp. 640 tis. osob (Mravčík et al., 2016). Co se týče mladistvých, výsledky poslední Evropské školní studie o alkoholu a jiných drogách (ESPAD) z roku 2015 ukázaly, že i navzdory poklesu užívání návykových látek v posledním období zůstává česká mládež nadále nad evropským průměrem (Kraus et al., 2016). Tato pozice je přitom patrná nejen u konzumace alkoholu, ale i v užívání tabáku či v zkušenostech s konopím. Ze studie ESPAD 2015 např. vyplynulo, že 95,8 % českých mladistvých již v životě ochutnalo alkohol, přičemž v posledních dnech ho konzumovalo 68,5 %. Pití nadměrných dávek (5 a více sklenic alkoholu při jedné příležitosti) v posledních 30 dnech přitom uvedlo 41,9 % dospívajících Čechů (Chomynová et al., 2016; Kraus et al., 2016).

Negativní důsledky konzumace alkoholu u mladistvých na jejich zdraví jsou zdokumentovány v mnoha zahraničních studiích. V případě psychologických problémů se jedná např. o poruchy spánku, depresivní stavy, sebevražedné myšlenky apod. (Bossarte et al., 2011; Harding et al., 2016). Kvůli své neurotoxicitě může alkohol způsobit poškození mozku a kognitivní deficity následně vedoucí ke zhoršeným výkonům ve škole a dalším negativním důsledkům, které jsou nezřídka dlouhodobé (Zeigler et al., 2005). Z přímých efektů na fyzické zdraví se pak jedná o negativní jevy způsobené intoxikací alkoholem (nevolnost, otrava), které bývají obvykle hůře snášeny než u dospělých (Zeigler et al., 2005). Dlouhodobá konzumace alkoholu následně způsobuje početné chronické zdravotní potíže – poškození jater, pankreatu, ledvin, kardiovaskulárního systému, poruchy endokrinního systému, imunity apod. (Newbury-Birch et al., 2009).

Alkohol je u mladistvých rovněž spojen s rizikovým sexuální chováním, dopravními nehodami a úrazy. Ze sociálních problémů se zvyšuje riziko, že se mladistvý stane obětí trestného činu, případně se sám dostane do konfliktu se zákonem (Harding et al., 2016). V případě excesivního pití dochází také k častému narušení vztahů s rodiči, vztahů s kamarády a zanedbávání školní docházky.

Kromě těchto negativních důsledků je typické, že adolescenti konzumující alkohol v nadměrné míře jsou náchylní

nejší i k užívání jiných návykových látek (tabák, konopné drogy apod.) (Donoghue et al., 2016; Kázmér et al., 2014; Newbury-Birch et al., 2009). Riziko rozvoje závislosti je u nich rovněž větší než u dospělých osob. U mladých je také obvyklejší, že alkohol konzumují nárazově ve velkých dávkách – tzv. „binge drinking“ (Harding et al., 2016). Vzorce konzumace alkoholu však zůstávají relativně stabilní a ti, kteří pijí alkohol rizikově již v období adolescence, obvykle pijí rizikově i v dospělosti (Percy et al., 2015). Rizika a dopady na zdraví jsou přitom o to vyšší, čím nižší je věk, v němž k prvním zkušenostem s alkoholem dochází (Cheng et al., 2016; Liang et al., 2015).

Faktorů, které mohou mít vliv na časnou konzumaci alkoholu, je celá řada. Část z nich je individuální, jako jsou např. pohlaví, genetické predispozice, traumatická zkušenost (fyzické a sexuální zneužívání, úmrtí blízkého člena rodiny), nebo specifické osobnostní rysy (impulzivita, tendence vyhledávat nové zážitky, depresivní symptomy, nízká sebevědomí, horší sociální dovednosti, celková spokojenost se svým životem apod.) (Blatný et al., 2016; Heinrich et al., 2016; Newbury-Birch et al., 2009; Skopal et al., 2014; Spilková a Dzúrová, 2012; Suchá et al., 2016; Wartberg et al., 2016). Časné problémy s chováním dítěte jsou jedním z prediktorů rizikové konzumace alkoholu, zejména jsou-li spojeny s genetickou zátěží a užíváním alkoholu v rodině (Newbury-Birch et al., 2009).

Rodinné vzorce chování a historie problémů s alkoholem u rodinných příslušníků jsou také významnými faktory ovlivňujícími úroveň konzumace alkoholu u adolescentů (Newbury-Birch et al., 2009). Dalšími faktory souvisejícími s rodinou jsou rodinná struktura (úplná vs. neúplná rodina) a hodnocení vztahu se svými rodiči (Tomčíková et al., 2015). K dalším faktorům patří rovněž školní prostředí, vztahy se spolužáky či ostatními vrstevníky (Ajilore et al., 2016), které u dospívajících osob výrazně ovlivňují jejich očekávání a postoje ke konzumaci alkoholu. Neméně důležitý je ale také celospolečenský kontext. Jedná se zejména o specifické vzorce chování a postoje přítomné u ostatních dospělých, se kterými mladí lidé přicházejí do kontaktu. Jako odraz těchto vzorců může sloužit např. celková úroveň konzumace alkoholu v dospělé populaci (Nelson et al., 2009) nebo také dostupnost alkoholu pro mládež (Harding et al., 2016; Rowland et al., 2016).

Je tedy vidět, že otázky týkající se konzumace alkoholu v období dospívání mají komplexní charakter. Monitoring a analýza rizik spojených s takovýmto chováním však poskytuje užitečný vhled do problematiky, který následně slouží i jako podklad pro vytváření efektivní politiky v této oblasti. V předkládaném příspěvku se proto zaměříme na několik cílů. Prvním je analýza prevalence nadměrné konzumace alkoholu u českých adolescentů, a to ve vývojové perspektivě posledních přibližně 20 let. Navzdory tomu, že v posledním období došlo v tomto ohledu k výrazným změnám



nám, v dalších analýzách poukážeme na skutečnost, že rizikové faktory související s výskytem nadměrného pití zůstávají zachovány. Jedním z hlavních faktorů, který je výrazný po celou analyzovanou dobu, je druh navštěvované školy, na který se zaměřujeme ve druhé části příspěvku. Třetím cílem je pak identifikace dalších faktorů, které jsou spojeny s rozdílnou úrovní konzumace alkoholu u současných českých adolescentů (kromě pohlaví a školního prostředí také rodinné vlivy a individuální psychologické faktory).

## ● 2 MATERIÁL A METODIKA

Článek čerpá z dat české části mezinárodního průřezového šetření ESPAD (*European School Survey Project on Alcohol and Other Drugs*) zaměřeného na konzumaci alkoholu a užívání návykových látek mezi adolescenty. Studie poskytuje vysoce kvalitní a mezinárodně srovnatelná data sbíraná jednotnou metodologií, následně sloužící jak pro účely monitoringu drogové problematiky u dospívajících, tak pro hodnocení rizikových faktorů a následnou přípravu a evaluaci strategií zaměřených na prevenci a léčbu poruch způsobených užíváním návykových látek.

V České republice se studie realizuje již od roku 1995, a to v pravidelných 4letých intervalech. Cílovou populací jsou dospívající ve věku 15–16 let, tedy studenti 1. ročníku středních škol, příp. 9. ročníku ZŠ. Studie má v Česku celostátní rozsah a poskytuje reprezentativní údaje o dospívajících s proporčním zastoupením všech krajů. Podrobné informace o metodice sběru dat v jednotlivých vlnách jsou dostupné ve výzkumných zprávách projektu ESPAD a na webové adrese [www.espad.org](http://www.espad.org). V příspěvku jsou kromě pře-

dešlých vln přednostně využita data z posledního dostupného roku šetření (rok 2015).

Pro účely analýz v našem příspěvku byly jako výchozí použity dva ukazatele:

A/ **pití nadměrných dávek** alkoholu (5 a více sklenic na jedno posezení) v období posledních 30 dnů;

B/ četnost **opití** v posledních 30 dnech.

Analýzy byly rozděleny do tří na sebe navazujících kroků. V prvních dvou krocích jsme se zaměřili na celé dostupné období let 1995–2015. Nejprve byl hodnocen vývoj prevalence nadměrného pití, následně pak byly analyzovány rozdíly mezi studenty z různých typů škol. Oba výchozí ukazatele byly v analýzách dichotomizovány: 1 = *pití nadměrných dávek/opití se alespoň jednou*, 0 = *ani jednou*.

Cílem třetího kroku byla identifikace dalších rizikových faktorů vázících se ke konzumaci alkoholu u současných českých dospívajících (rok 2015), a to využitím nástrojů víceúrovňové regresní analýzy (I. studenti ve II. školách). Analýzy byly zpracovány v softwarovém prostředí programu IBM SPSS Statistics 21 (Heck et al., 2012). Oba výchozí ukazatele (závisle proměnné) byly přitom ponechány na své původní škále. Jako nezávisle proměnné byly použity vybrané indikátory týkající se tří skupin rizikových faktorů: 1) socioekonomické zázemí; 2) rodinná struktura a vztahy s rodiči; 3) individuální psychologické faktory. Přesnou formulaci všech otázek použitých v analýzách uvádíme pro lepší přehlednost na konci článku (viz tabulka 5 – příloha).

## ● 3 VÝSLEDKY

Tabulka 1 podává základní přehled a deskripci dat použitých v příspěvku. Analýzy celkově čerpají ze série šesti na

Tabulka 1 / Table 1

Popisná charakteristika série výběrových souborů použitých v analýze, Česko, 1995–2015  
Descriptive characteristics of the series of samples used in the analysis, Czechia, 1995–2015

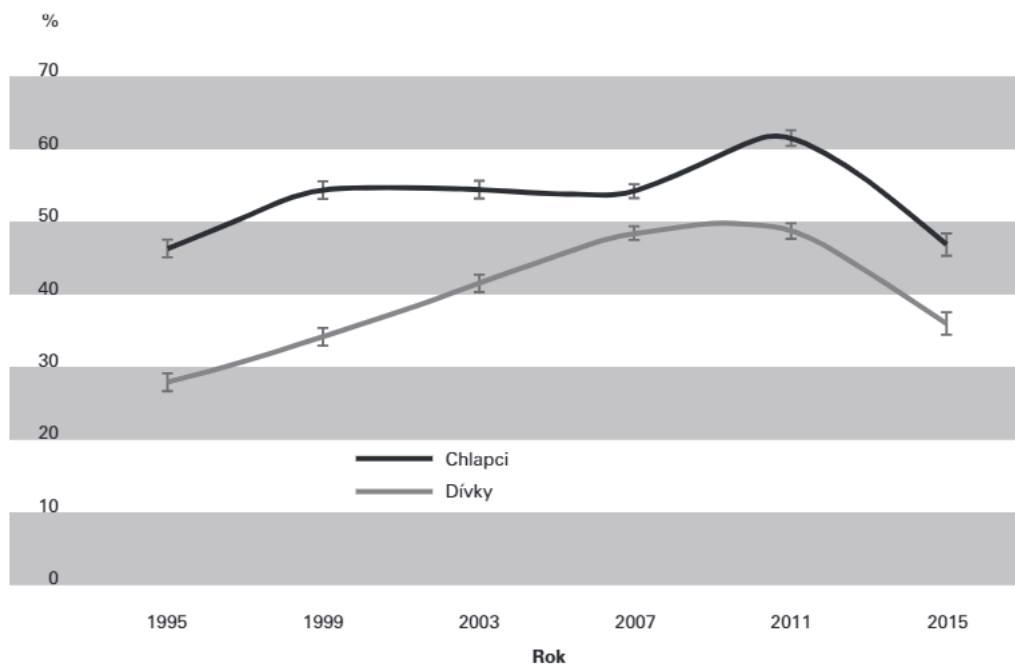
Průřezové období (rok)		1995	1999	2003	2007	2011	2015	2015 (celý soubor)
(ročník narození)		(1979)	(1983)	(1987)	(1991)	(1995)	(1999)	(1998–2000)
Pohlaví	Mužské (%)	54,9	47,1	46,1	45,6	46,0	46,7	49,3
	Ženské (%)	45,1	52,9	53,9	54,4	54,0	53,3	50,7
Typ školy	Gymnázium (%)	15,0	23,0	26,4	19,7	20,8	26,1	24,5
	SOŠ (%)	37,3	44,3	40,8	28,0	28,2	31,0	29,9
	SOU (%)	47,7	32,7	32,9	25,2	24,4	20,7	23,5
	ZŠ (%)	-	-	-	27,2	26,6	22,2	22,0
Počet škol (M)		133	127	180	350	363	206	208
Počet respondentů (N)		2 962	3 579	3 172	5 399	5 104	2 738	5 713

Poznámka: SOŠ – střední odborná škola s maturitou; SOU – střední odborné učiliště (bez maturity); ZŠ – základní škola (9. ročník)

Zdroj: ESPAD, vlastní výpočty

Note: SOŠ – secondary vocational school with the "maturita" school-leaving examination; SOU – apprentice training centre (without the "maturita" school-leaving examination); ZŠ – middle school (9th grade)

Source: ESPAD, original study calculations



**Graf 1 / Figure 1**

Vývoj prevalence konzumace nadměrných dávek alkoholu, adolescenti ve věku 16 let, Česko, 1995–2015

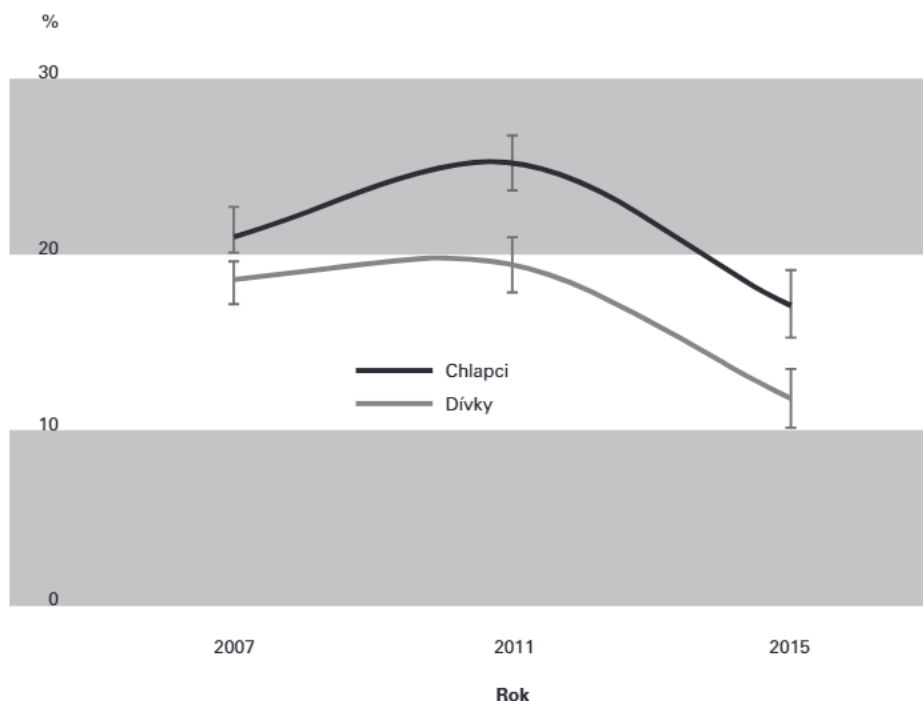
*Development of the prevalence of excessive alcohol use, adolescents aged 16, Czechia, 1995–2015*

Nadměrné pití definováno jako konzumace 5 a více sklenic alkoholických nápojů na jedno posezení. Data reprezentují podíl těch respondentů, kteří v průběhu posledního měsíce alespoň jednou konzumovali alkohol v uvedené nadměrné míře.

Zdroj: ESPAD, vlastní výpočty

*Excessive drinking is defined as the consumption of five or more drinks on one occasion. The data represents the proportions of those respondents who engaged in such excessive alcohol use at least once during the last month.*

*Source: ESPAD, original study calculations*



**Graf 2 / Figure 2**

Vývoj prevalence opití v posledních 30 dnech, adolescenti ve věku 16 let, Česko, 2007–2015

*Development of the prevalence of drunkenness in the last 30 days, adolescents aged 16, Czechia, 2007–2015*

Zdroj: ESPAD, vlastní výpočty

*Source: ESPAD, original study calculations*



Tabulka 2 / Table 2

Rozdíly v prevalenci konzumace nadměrných dávek alkoholu mezi jednotlivými typy škol, adolescenti ve věku 16 let, Česko, 1995–2015  
*Variations in the prevalence of excessive alcohol use among different types of schools, adolescents aged 16, Czechia, 1995–2015*

Rok (ročník narození)	1995 (1979)	1999 (1983)	2003 (1987)	2007 (1991)	2011 (1995)	2015 (1999)
<b>Chlapci</b>						
Gymnázium (%)	22,1	41,7	36,7	41,3	53,1	34,6
SOŠ (%)	35,8	53,6	51,7	54,9	63,8	48,5
SOU (%)	56,7	61,0	64,7	67,6	71,4	59,5
ZŠ (%)	-	-	-	47,5	53,9	41,7
$\chi^2$ test (stupně volnosti)	109,4 (2)	32,1 (2)	68,2 (2)	92,4 (3)	58,9 (3)	40,2 (3)
p-hodnota	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001
<b>Dívky</b>						
Gymnázium (%)	14,7	21,9	27,2	39,4	38,9	28,7
SOŠ (%)	26,5	33,3	39,3	48,3	52,4	40,2
SOU (%)	36,3	46,4	61,5	63,9	62,3	46,7
ZŠ (%)	-	-	-	41,4	40,8	30,7
$\chi^2$ test (stupně volnosti)	38,7 (2)	70,0 (2)	113,1 (2)	95,2 (3)	85,2 (3)	29,4 (3)
p-hodnota	<0,001	<0,001	<0,001	<0,001	<0,001	<0,001

Poznámka: SOŠ – střední odborná škola s maturitou; SOU – střední odborné učiliště (bez maturity); ZŠ – základní škola (9. ročník); pro celkovou prevalenci – porovnej s grafem 1

Zdroj: ESPAD, vlastní výpočty

Note: SOŠ – secondary vocational school with the "maturita" school-leaving examination; SOU – apprentice training centre (without the "maturita" school-leaving examination); ZŠ – middle school (9th grade); see Figure 1 for the overall prevalence rates.

Source: ESPAD, original study calculations

sebe navazujících vln projektu ESPAD poskytujících reprezentativní údaje o rizikovém chování české mládeže v období let 1995 až 2015. V prvních třech vlnách se jednalo o studenty prvních ročníků středních škol (gymnází, středních odborných škol nebo odborných učilišť), v dalších vlnách i o žáky v posledním ročníku základních škol (9. ročník). Pro účely analýz v prvních dvou krocích (období let 1995–2015) byli vybráni jenom respondenti narození v tom samém roce – za účelem explicitní kontroly na studentův věk. Ve třetím kroku (regresní analýza) byla využita data dostupná z celého vzorku studentů, kteří se na studii podíleli v roce 2015 (ročníkové kohorty 1998 až 2000); přičemž věk respondentů byl kontrolován implicitně (věk jako nezávislá proměnná byl zahrnut do regresních modelů – viz níže).

Graf 1 poskytuje přehled o vývoji konzumace nadměrných dávek alkoholu u českých 16letých studentů v průběhu posledních přibližně 20 let, a to odděleně dle pohlaví (prevalence společně s 95% intervaly spolehlivosti). Na začátku sledovaného období došlo k výraznému nárůstu v prevalenci nadměrného pití. V průběhu dalších let došlo k postupné stabilizaci stavu s vrcholem v roce 2011 (prevalence 54,3 % pro obě pohlaví dohromady). V posledním sledovaném období (rok 2015) je pak vidět výrazný pokles, a to přibližně na úroveň před 15 lety (celková prevalence 41,9 %).

Z grafu 1 je zároveň vidět, že výskyt nadměrného pití byl v průběhu celého období vyšší u chlapců než dívek. Tyto rozdíly se ale postupně snižovaly, a to ve smyslu postupného přibližování se děvčat k chlapcům. V období 1999–2011 to byly právě dívky, které prevalenci nadměrného pití zvyšovaly nejvýrazněji. Relativní rozdíly mezi pohlavími se tak v daném ukazateli snížily z hodnoty 1,7 v roce 1995 (tj. míra u chlapců 1,7krát vyšší než u dívek) na 1,3 v roce 2015.

Obdobné výsledky jako předešlý graf poskytuje i analýza vývoje prevalence opití v období posledních 30 dnů, kterou prezentuje graf 2. V důsledku omezené srovnatelnosti dat z dřívějších let projektu ESPAD jsme se u tohoto ukazatele museli omezit na období posledních tří vln (2007–2015). Z vývoje prevalence je však vidět, že i v případě tohoto indikátoru došlo v posledním období k významnému poklesu. Zatímco v roce 2011 alespoň jedno opití uvedla celkově téměř pětina studentů (21,9 % pro obě pohlaví), v roce 2015 to bylo jenom 14,2 % (16,9 % chlapců a 11,7 % dívek). Grafy 1 a 2 tedy souhlasně poukazují na výrazný pokles prevalence nadměrné konzumace alkoholu u současných českých adolescentů.

Tabulka 2 podává přehled o rozdílech ve výskytu opakovaného pití nadměrných dávek alkoholu mezi studenty z jednotlivých typů škol. Pro účely kontroly prevalenčních měr na věk a pohlaví jsou data prezentována odděleně pro chlapce a dívky; v každém průřezovém období se přitom jed-

**Tabulka 3 / Table 3**

Výstupy z víceúrovňové ordinální logistické regrese (I. studenti ve II. školách). Závisle proměnná: Konzumace 5 a více sklenic alkoholu při jedné příležitosti za posledních 30 dnů, ČR, ESPAD 2015 (N=5 564)

Results of multilevel ordinal logistic regression (students [Level I] in schools [Level II]). Dependent variable: Consumption of five or more drinks on one occasion in the last 30 days, Czechia, ESPAD 2015 (N=5,564)

Fixní efekty		Model 1		Model 2		Model 3		Model 4	
		Socioekonomické zázemí		Rodinné vztahy a jejich struktura		Psychologické faktory		Konečný model	
		Koef.	Sig.	Koef.	Sig.	Koef.	Sig.	Koef.	Sig.
Práh	0 = Ani jednou	<b>0,47</b>	0,047	<b>0,68</b>	0,000	-0,23	0,092	<b>0,10</b>	0,660
	1 = Jednou	<b>1,40</b>	<0,001	<b>1,61</b>	<0,001	<b>0,71</b>	<0,001	<b>1,05</b>	<0,001
	2 = Dvakrát	<b>2,19</b>	<0,001	<b>2,40</b>	<0,001	<b>1,50</b>	<0,001	<b>1,85</b>	<0,001
	3 = 3–5krát	<b>3,32</b>	<0,001	<b>3,55</b>	<0,001	<b>2,64</b>	<0,001	<b>3,00</b>	<0,001
	4 = 6–9krát	<b>4,11</b>	<0,001	<b>4,33</b>	<0,001	<b>3,42</b>	<0,001	<b>3,79</b>	<0,001
Pohlaví	Ženské	<b>-0,32</b>	<0,001	<b>-0,35</b>	<0,001	<b>-0,38</b>	<0,001	<b>-0,39</b>	<0,001
	Mužské	Ref.	.	Ref.	.	Ref.	.	Ref.	.
Věk (Z-skóre)		<b>0,17</b>	<0,001	0,16	<0,001	0,16	<0,001	<b>0,16</b>	<0,001
Druh školy	Základní škola	0,03	0,854	0,06	0,663	0,03	0,851	-0,03	0,858
	Střední odborné učiliště	<b>0,70</b>	<0,001	<b>0,76</b>	<0,001	<b>0,68</b>	<0,001	<b>0,62</b>	<0,001
	Střední odborná škola	<b>0,41</b>	<0,001	<b>0,44</b>	<0,001	<b>0,38</b>	0,002	<b>0,35</b>	0,005
	Gymnázium	Ref.	.	Ref.	.	Ref.	.	Ref.	.
Zámožnost rodiny	Velmi bohatá	<b>0,62</b>	0,004	.	.	.	.	<b>0,74</b>	<0,001
	Dost bohatá	<b>0,39</b>	0,011	.	.	.	.	<b>0,58</b>	<0,001
	Spíše bohatá	<b>0,21</b>	0,056	.	.	.	.	<b>0,38</b>	<0,001
	Průměrná	0,11	0,247	.	.	.	.	<b>0,26</b>	0,007
	Spíše/dost/velmi chudá	Ref.	.	.	.	.	.	Ref.	.
Vzdělání matky	Nic z toho se nehodí/neví	0,22	0,306	.	.	.	.	.	.
	Ukončené vysokoškolské	0,17	0,359	.	.	.	.	.	.
	Nedokončené vysokoškolské	0,38	0,078	.	.	.	.	.	.
	Střední škola s maturitou	0,26	0,138	.	.	.	.	.	.
	Vyučená	0,23	0,170	.	.	.	.	.	.
	Základní (nebo nižší)	Ref.	.	.	.	.	.	.	.
Vzdělání otce	Nic z toho se nehodí/neví	-0,26	0,182	.	.	.	.	-0,16	0,387
	Ukončené vysokoškolské	<b>-0,47</b>	0,011	.	.	.	.	-0,28	0,111
	Nedokončené vysokoškolské	<b>-0,67</b>	0,002	.	.	.	.	<b>-0,46</b>	0,032
	Střední škola s maturitou	<b>-0,39</b>	0,029	.	.	.	.	-0,19	0,274
	Vyučen	<b>-0,28</b>	0,102	.	.	.	.	-0,10	0,560

## PŮVODNÍ PRÁCE

Fixní efekty		Model 1		Model 2		Model 3		Model 4	
		Socioekonomické zázemí		Rodinné vztahy a jejich struktura		Psychologické faktory		Konečný model	
		Koef.	Sig.	Koef.	Sig.	Koef.	Sig.	Koef.	Sig.
	Základní (nebo nižší)	Ref.	.	.	.	.	.	Ref.	.
Rodinná struktura domácnosti	Jiné	.	.	0,03	0,828	.	.	-0,04	0,781
	Jenom nevlastní rodič/e	.	.	<b>1,03</b>	<0,001	.	.	<b>0,99</b>	<0,001
	Jenom 1 vlastní rodič	.	.	-0,01	0,856	.	.	0,01	0,885
	1 vlastní a 1 nevlastní rodič	.	.	<b>0,24</b>	0,003	.	.	<b>0,23</b>	0,004
	Vlastní oba rodiče	.	.	Ref.	.	.	.	Ref.	.
Spokojenost se vztahem k matce	Nespokojen/zcela nespokojen, není	.	.	0,13	0,274	.	.	0,08	0,501
	Ani spokojen/a, ani nespokojen/a	.	.	<b>0,37</b>	0,001	.	.	<b>0,33</b>	0,004
	Spokojen/a	.	.	0,06	0,398	.	.	0,05	0,472
	Velmi spokojen/a	.	.	Ref.	.	.	.	Ref.	.
Spokojenost se vztahem k otci	Nespokojen/zcela nespokojen, není	.	.	<b>0,26</b>	0,005	.	.	<b>0,20</b>	0,032
	Ani spokojen/a, ani nespokojen/a	.	.	<b>0,29</b>	0,002	.	.	<b>0,25</b>	0,012
	Spokojen/a	.	.	<b>0,16</b>	0,024	.	.	<b>0,15</b>	0,040
	Velmi spokojen/a	.	.	Ref.	.	.	.	Ref.	.
Sociální odcizení (skóre na škále 0–9)		.	.	.	.	<b>0,10</b>	<0,001	<b>0,09</b>	<0,001
Spokojenost se životem (skóre na škále 0–6)		.	.	.	.	<b>-0,06</b>	0,003	<b>-0,05</b>	0,035
<b>Náhodné efekty</b>		Odhad	Sig.	Odhad	Sig.	Odhad	Sig.	Odhad	Sig.
Úroveň II (škola): Variance (intercept)		0,202	<0,001	<b>0,202</b>	<0,001	<b>0,201</b>	<0,001	<b>0,196</b>	<0,001

Poznámka: Koef. = regresní koeficient; Sig. = statistická významnost (signifikance); Ref. = referenční skupina; hodnoty parametrů s  $p < 0.05$  jsou zvýrazněny tučným písmem.

Pojem „sklenice alkoholu“ odpovídá 1 velkému pivu (0.5 l), 1 sklenici vína (0.2 l), 1 panáku destilátu (0.04 l) nebo 1 lahvi/plechovce alcopops (0.33 l).

Note: Koef. = regression coefficient; Sig. = statistical significance; Ref. = reference group; parameter values with  $p < 0.05$  are indicated in bold.

“Drink” is understood as equivalent to one large beer (0.5 l), one glass of wine (0.2 l), one “shot” of spirits (0.04 l), or one bottle/can of alcopops (0.33 l).

**Tabulka 4 / Table 4**

Výstupy z víceúrovňové ordinální logistické regrese (I. studenti ve II. školách). Závisle proměnná: Frekvence opití v posledních 30 dnech, ČR, ESPAD 2015 (N=5 485)

Results of multilevel ordinal logistic regression (students [Level I] in schools [Level II]). Dependent variable: Frequency of drunkenness in the last 30 days, Czechia, ESPAD 2015 (N=5,485)

Fixní efekty		Model 1		Model 2		Model 3		Model 4	
		Socioekonomické zázemí		Rodinné vztahy a jejich struktura		Psychologické faktory		Konečný model	
		Koef.	Sig.	Koef.	Sig.	Koef.	Sig.	Koef.	Sig.
Práh	0 = Nikdy	<b>1,27</b>	<0,001	<b>2,02</b>	<0,001	<b>0,94</b>	<0,001	<b>1,11</b>	<0,001
	1 = 1–2krát	<b>3,31</b>	<0,001	<b>4,07</b>	<0,001	<b>2,99</b>	<0,001	<b>3,17</b>	<0,001
	2 = 3–5krát	<b>4,57</b>	<0,001	<b>5,33</b>	<0,001	<b>4,25</b>	<0,001	<b>4,44</b>	<0,001
	3 = 6–9krát	<b>5,39</b>	<0,001	<b>6,15</b>	<0,001	<b>5,07</b>	<0,001	<b>5,26</b>	<0,001
	4 = 10–19krát	<b>6,22</b>	<0,001	<b>6,98</b>	<0,001	<b>5,90</b>	<0,001	<b>6,09</b>	<0,001
	5 = 20–39krát	<b>7,07</b>	<0,001	<b>7,83</b>	<0,001	<b>6,75</b>	<0,001	<b>6,94</b>	<0,001
Pohlaví	Ženské	<b>-0,38</b>	<0,001	<b>-0,41</b>	<0,001	<b>-0,44</b>	<0,001	<b>-0,43</b>	<0,001
	Mužské	Ref.	.	Ref.	.	Ref.	.	Ref.	.
Věk (Z-skóre)		0,02	0,629	0,03	0,600	0,02	0,713	0,02	0,662
Druh školy	Základní škola	-0,09	0,619	-0,06	0,729	-0,12	0,503	-0,11	0,533
	Střední odborné učiliště	<b>0,38</b>	0,022	<b>0,42</b>	0,008	<b>0,34</b>	0,028	<b>0,33</b>	0,046
	Střední odborná škola	0,17	0,281	0,16	0,295	0,09	0,538	0,10	0,504
	Gymnázium	Ref.	.	Ref.	.	Ref.	.	Ref.	.
Zámožnost rodiny	Velmi bohatá	0,37	0,229	.	.	.	.	0,52	0,098
	Dost bohatá	<b>0,80</b>	<0,001	.	.	.	.	<b>1,01</b>	<0,001
	Spíše bohatá	<b>0,45</b>	0,006	.	.	.	.	<b>0,64</b>	<0,001
	Průměrná	0,22	0,136	.	.	.	.	<b>0,36</b>	0,016
	Spíše/dost/velmi chudá	Ref.	.	.	.	.	.	Ref.	.
Vzdělání matky	Nic z toho se nehodí/neví	-0,28	0,358	.	.	.	.	.	.
	Ukončené vysokoškolské	-0,08	0,736	.	.	.	.	.	.
	Nedokončené vysokoškolské	-0,09	0,759	.	.	.	.	.	.
	Střední škola s maturitou	-0,12	0,612	.	.	.	.	.	.
	Vyučená	0,05	0,811	.	.	.	.	.	.
	Základní (nebo nižší)	Ref.	.	.	.	.	.	.	.
Vzdělání otce	Nic z toho se nehodí/neví	<b>-0,57</b>	0,029	.	.	.	.	<b>-0,65</b>	0,009
	Ukončené vysokoškolské	<b>-0,80</b>	<0,001	.	.	.	.	<b>-0,68</b>	0,003
	Nedokončené vysokoškolské	<b>-0,75</b>	0,009	.	.	.	.	<b>-0,66</b>	0,020
	Střední škola s maturitou	<b>-0,74</b>	<0,001	.	.	.	.	<b>-0,65</b>	0,003



Fixní efekty		Model 1		Model 2		Model 3		Model 4	
		Socioekonomické zázemí		Rodinné vztahy a jejich struktura		Psychologické faktory		Konečný model	
		Koef.	Sig.	Koef.	Sig.	Koef.	Sig.	Koef.	Sig.
	Vyučen	<b>-0,67</b>	0,002	.	.	.	.	<b>-0,54</b>	0,011
	Základní (nebo nižší)	Ref.	.	.	.	.	.	Ref.	.
Rodinná struktura domácnosti	Jiné	.	.	0,19	0,317	.	.	0,10	0,600
	Jenom nevlastní rodič/e	.	.	0,50	0,175	.	.	0,45	0,233
	Jenom 1 vlastní rodič	.	.	0,02	0,866	.	.	0,07	0,535
	1 vlastní a 1 nevlastní rodič	.	.	<b>0,24</b>	0,036	.	.	<b>0,23</b>	0,044
	Vlastní oba rodiče	.	.	Ref.	.	.	.	Ref.	.
Spokojenost se vztahem k matce	Nespokojen/zcela nespokojen, není	.	.	-0,03	0,878	.	.	-0,11	0,572
	Ani spokojen/a, ani nespokojen/a	.	.	<b>0,41</b>	0,008	.	.	<b>0,37</b>	0,019
	Spokojen/a	.	.	<b>0,20</b>	0,053	.	.	<b>0,19</b>	0,058
	Velmi spokojen/a	.	.	Ref.	.	.	.	Ref.	.
Spokojenost se vztahem k otci	Nespokojen/zcela nespokojen, není	.	.	<b>0,38</b>	0,003	.	.	<b>0,32</b>	0,020
	Ani spokojen/a, ani nespokojen/a	.	.	0,17	0,243	.	.	0,09	0,540
	Spokojen/a	.	.	<b>0,25</b>	0,018	.	.	<b>0,24</b>	0,022
	Velmi spokojen/a	.	.	Ref.	.	.	.	Ref.	.
Sociální odcizení (skóre na škále 0–9)	.	.	.	.	<b>0,12</b>	<0,001	<b>0,11</b>	<0,001	
Spokojenost se životem (skóre na škále 0–6)	.	.	.	.	<b>-0,07</b>	0,016	<b>-0,06</b>	0,045	
<b>Náhodné efekty</b>		Odhad	Sig.	Odhad	Sig.	Odhad	Sig.	Odhad	Sig.
Úroveň II. (škola): Variance (intercept)		<b>0,220</b>	<0,001	<b>0,223</b>	<0,001	<b>0,212</b>	<0,001	0,209	<0,001

Poznámka: Koef. = regresní koeficient; Sig. = statistická významnost (signifikance); Ref. = referenční skupina; hodnoty parametrů s  $p < 0.05$  jsou zvýrazněny tučným písmem.

Note: Koef. = regression coefficient; Sig. = statistical significance; Ref. = reference group; parameter values with  $p < 0.05$  are indicated in bold.

**Tabulka 5 / Table 5**

Příloha – definice otázek použitých v analýzách článku  
 Appendix – definitions of questions used in the analyses

<b>ZÁVISLE PROMĚNNÉ</b>
<b>A) Pití nadměrných dávek alkoholu</b> (v posledním měsíci)
Otázka: Mějte na mysli posledních 30 dní. Kolikrát jste vypil/a pět nebo více sklenic alkoholu za sebou (to znamená při jedné příležitosti)?
Odpovědi: a) Ani jednou; b) Jednou; c) Dvakrát; d) 3–5krát; e) 6–9krát; f) 10 a vícekrát
<b>B) Opití</b> (v posledním měsíci)
Otázka: Kolikrát jste za posledních 30 dnů byl/a opilý/á tak, že jste měl/a problémy s chůzí, s mluvením, zvracel/a nebo si nepamatoval/a, co se stalo?
Odpovědi: a) Nikdy; b) 1–2krát; c) 3–5krát; d) 6–9krát; e) 10–19 krát; f) 20–39 krát; g) 40 nebo vícekrát
<b>NEZÁVISLE PROMĚNNÉ</b>
<b>Vzdělání rodičů</b>
Otázka: Jaké vzdělání má 1) Váš otec; 2) Vaše matka?
Odpovědi: a) Základní (nebo nedokončené základní); b) Je vyučený/á; c) Ukončil/a střední školu s maturitou; d) Nedokončené vysokoškolské; e) Ukončené vysokoškolské; f) Nevím; g) Nic z toho se nehodí
<b>Zámožnost rodiny</b>
Otázka: Jak dobře je na tom Vaše rodina ve srovnání s jinými rodinami u nás?
Odpovědi: a) Je velmi bohatá; b) Je dost bohatá; c) Je spíše bohatá; d) Je tak asi průměrná; e) Je spíše chudší; f) Je dost chudá; g) Je velmi chudá
<b>Rodinná struktura domácnosti</b>
Otázka: Kdo z následujících lidí s Vámi žije v téže domácnosti? (Označte všechny osoby, které s vámi žijí v domácnosti.)
Možnosti: a) Žiji sám; b) Otec; c) Nevlastní otec; d) Matka; e) Nevlastní matka; f) Sourozenci (vlastní i nevlastní); g) Dědeček, babička; h) Jiní příbuzní; i) Jiní lidé než příbuzní
<b>Spokojenost se vztahem k matce/otci</b>
Otázka: Jak jste spokojen/a s Vaším vztahem 1) k matce; 2) k otci?
Odpovědi: a) Velmi spokojen/a; b) Spokojen/a; c) Ani tak, ani tak; d) Nespokojen/a; e) Zcela nespokojen/a; f) Nemám takovou osobu
<b>Spokojenost se životem (Diener, 1985)</b>
Otázka: Do jaké míry platí pro Váš život následující výroky?
1. Můj život se v mnoha ohledech blíží ideálu.
2. Moje životní podmínky jsou vynikající.
3. Jsem spokojený/á se svým životem.
4. Zatím se mi vždy podařilo dosáhnout těch důležitých věcí, které jsem v životě chtěl/a.
5. Pokud bych mohl/a svůj život prožít znovu, téměř nic bych neměnil/a.
Odpovědi: a) Rozhodně nesouhlasím; b) Nesouhlasím; c) Spíše nesouhlasím; d) Nemohu se rozhodnout; e) Spíše souhlasím; f) Souhlasím; g) Rozhodně souhlasím
<b>Sociální odcizení</b>
Otázka: Souhlasíte s následujícími názory?
1. Vedle zdraví jsou v životě nejdůležitější peníze.
2. Někdy mám pochybnosti, jestli má vůbec ještě něco smysl.
3. Už nezáleží moc na tom, jak poctivě člověk přijde k penězům, ale jak snadno.
4. V dnešní době musí člověk myslet hlavně na to, co je dnes, a nezapomínat se tím, co bude zítra.
5. I když se tvrdí opak, situace průměrného člověka se zhoršuje.
6. Sotva je správné přivést dítě na svět, když vyhlídky do budoucna jsou tak špatné.
7. Na úřadech se o problémy průměrného člověka v podstatě nezajímají.
8. Dnes už nevíte, na koho se můžete spolehnout.
9. Většinu lidí je jedno, co se přihodí druhému.
Odpovědi: a) Ano; b) Ne

ná o respondenty narozené v tom samém roce. Rozdíly mezi školami jsou testovány Pearsonovou  $\chi^2$  statistikou (všechny prezentované rozdíly jsou přitom vysoce signifikantní).

Z *tabulky 2* je názorně vidět, že typ navštěvované školy je u českých adolescentů výrazným diferenačním faktorem konzumace nadměrných dávek alkoholu. Nejrizikovější skupinou jsou v tomto ohledu zejména studenti odborných učilišť; tedy škol se studenty navštěvujícími obory relativně nižšího vzdělání, typicky bez maturity. Naopak u studentů gymnázií je výskyt nadměrné konzumace relativně nejnižší. Prevalence u žáků 9. tříd základních škol se pohybuje mezi oběma extrémy, což je výsledkem jejich smíšené struktury v daném ohledu (tj. i navzdory stejnému věku se budoucí „kariérní dráha“ těchto studentů začíná profilovat až v dalším školním roce). Faktor typu navštěvované školy je přitom zřetelný jak u chlapců, tak u dívek, a to v průběhu celého sledovaného období 1995–2015.

Následující dvě tabulky (*tabulka 3* a *tabulka 4*) prezentují výstupy z vícenásobné regresní analýzy. Příslušné (logitové) modely byly sestaveny za účelem identifikace dalších faktorů podmiňujících úroveň pití současných českých adolescentů (data za rok 2015). Jako závislé proměnné je nejdříve analyzována A) konzumace nadměrných dávek alkoholu na jedno posezení (viz *tabulka 3*), následně potom i B) četnost opití v období posledních 30 dnů (viz *tabulka 4*). Obě závislé proměnné jsou analyzovány na své původní ordinální škále; do regresních modelů je přitom zahrnuta 2úrovňová struktura vstupních dat (student – úroveň I; škola – úroveň II). Jako nezávislé proměnné jsou použity skupiny otázek vážících se ke třem vybraným okruhům rizikových faktorů: socioekonomické zázemí (model 1), struktura a vztahy uvnitř rodiny (model 2) a individuální psychologické faktory studenta (model 3); pro přesnou definici těchto proměnných viz *tabulka 5* (příloha). Vycházejíce z výsledků předešlé analýzy (*tabulka 2*), jsou *pohlaví*, *věk* a *druh navštěvované školy* zahrnuty do regresních modelů jako kontrolní (nezávislé) proměnné. Do výsledného modelu (model 4) jsou pak kromě těchto kontrolních faktorů zahrnuty taky všechny ostatní proměnné, které mají v předešlých třech modelech významný vliv na úroveň analyzovaného rizikového chování (nadměrná konzumace alkoholu/resp. opíjení se).

Výsledky vícenásobné regresní analýzy prezentované v *tabulkách 3* a *4* souhlasně poukazují na skutečnost, že konzumace nadměrných dávek alkoholu (viz *tabulka 3*), resp. opití (viz *tabulka 4*), je u současných českých adolescentů významně podmíněna všemi třemi okruhy rizikových faktorů. Kladné hodnoty (fixních) regresních koeficientů poukazují na fakt, že – v porovnání s referenční skupinou – se hodnota nezávisle proměnné váže na vyšší hodnoty závisle proměnné (četnost nadměrného pití tedy relativně „zvyšuje“); naopak, záporné hodnoty koeficientů indikují „negativní vztah“ (v porovnání s referenční skupinou je tedy

hodnota nezávisle proměnné korelována s relativně nižší četností nadměrného pití). Pro analyticky méně zkušené čtenáře poznamenáváme, že odhadnuté efekty jednotlivých nezávislých proměnných jsou v modelech již kontrolovány na vliv ostatních faktorů zahrnutých do (vícenásobné) regresní analýzy. Představují tedy „dodatečný vliv“ příslušné proměnné na úroveň pití, který je již „očištěn“ od vlivů ostatních faktorů zahrnutých do modelu – viz především výsledky u modelu 4 (výsledné modely). U *víceúrovňové* regresní analýzy rovněž platí, že efekt „kontextu konkrétní školy“ je v analýzách rovněž kontrolován (v naší analýze je tedy uvažován nejen „druh školy“, ale i její specifický „kontext“). Kromě samotného designu studie poukazuje na důležitost víceúrovňového přístupu také skutečnost, že variance uvedených náhodných efektů (tj. kontextů jednotlivých škol) je ve všech prezentovaných modelech vysoce signifikantní ( $p < 0.001$ ).

Jak jsme již uváděli výše, pohlaví je společně s druhem navštěvované školy výrazným faktorem vážícím se k výskytu nadměrného pití u současné české mládeže, což dokumentují i výsledky v *tabulkách 3* a *4*. Jako nejrizikovější se v tomto ohledu jeví chlapci z odborných učilišť, nejméně pak dívky studující na gymnáziích (porovnej i s výsledky v předešlé *tabulce 2*).

Kromě těchto faktorů je významné také sociální a ekonomické zázemí rodiny, ze které daný student pochází. Výstupy regresních analýz prezentované v *tabulkách 3* a *4* souhlasně poukazují na skutečnost, že nízké vzdělání otce se společně s vyšší (finanční) zámožností rodiny váže na častější konzumaci nadměrných dávek alkoholu u českých nezletilých. Na jedné straně je tedy nižší vzdělání rodiče rizikovým faktorem nadměrného pití, na straně druhé jsou vysoké příjmy domácnosti rovněž rizikovým faktorem takového chování.

Struktura rodiny a vztahy s rodiči jsou u českých nezletilých také významným prediktorem nadměrné konzumace alkoholu. Vysoká spokojenost se svým vztahem k matce a otci je signifikantním protektivním faktorem před takovým chováním. Jako protektivní faktor se jeví také skutečnost, když daný adolescent pochází z úplné rodiny a bydlí společně s oběma vlastními rodiči.

Jako třetí oblast významných faktorů nadměrné konzumace alkoholu, které výsledky v *tabulkách 3* a *4* souhlasně dokládají, jsou individuální psychologické vlivy přítomné u daného jedince. Z nich jsme se zaměřili na efekty celkové spokojenosti se životem měřené na tzv. Dienerově škále životní spokojenosti (odvozené z vybraných 5 otázek podle Diener et al., 1985) a úroveň sociálního odcizení (součtové skóre ze skupiny 9 otázek – *tabulka 5*). Adolescenti, kteří jsou více spokojeni se svým životem, konzumují alkohol v nižší míře, než je tomu u jejich méně spokojených vrstevníků. Naopak u těch, u kterých jsou přítomny výrazné pocity sociálního odcizení, je četnost nadměrného pití vyšší.



#### ● 4 DISKUZE

Výsledky prezentovaných analýz přináší několik významných zjištění. Prvním je skutečnost, že u české mládeže dochází v posledním období k výraznému poklesu nadměrné konzumace alkoholu. Tento náhlý zvrat, který vystřídal předešlé dlouholeté období růstu již od vzniku samostatné České republiky, je nepochybně dobrou zprávou pro státní zdravotní politiku. Kromě dat ESPAD použitých v našem příspěvku potvrzují tento pozitivní trend i jiné obdobné studie vycházející z posledních vln mezinárodního projektu HBSC – Health Behaviour in School-aged Children (Csémy a Kázmér, 2017; Inchley et al., 2016).

Jak dokládají mezinárodní šetření, není významný pokles v prevalenci nadměrného pití specifickým jenom u českých mladistvých. K podobnému poklesu došlo v posledních letech i v mnoha jiných zemích Evropy (Kraus et al., 2016), mimo jiné také na Slovensku (Baška et al., 2016). K dlouhodobějšímu poklesu dochází i u adolescentů pocházejících z USA (Brooks-Russell et al., 2014; Johnston et al., 2017) nebo Kanady (Elgar et al., 2011).

Navzdory těmto pozitivním trendům však autoři příspěvku upozorňují, že je nutné dívat se na daný vývoj také kriticky. Vycházíme přitom z předpokladu, že v průběhu posledního desetiletí nedošlo v domácí zdravotní či protidrogové politice k tak průlomovým mezníkům, které by byly schopny tuto náhlou změnu v chování české mládeže dostatečně dobře vysvětlit. Při interpretaci pozorovaných změn proto autoři odkazují na širší procesy, které pravděpodobně stojí v pozadí příslušného vývoje.

Prvním z těchto procesů jsou změny ve vzorcích a způsobu trávení volného času. Dynamický rozvoj informačně-komunikačních technologií (ICT) a vznik nových elektronických médií, kterého jsme v současné době svědky, je spojen i s příchodem nových příležitostí „oddychu na síti“ (různé sociální sítě, videohry apod.). Rozvoj ICT je přitom nejrychleji přijímán u mladé a dospívající populace. Tyto nové vzorce chování však mohou vést i k relativně nižší socializaci („face-to-face“) a snižování počtu aktivit mimo domov, než tomu bylo u adolescentů před několika lety. Socializace a normativita v kruhu vrstevníků jsou přitom jedním z hlavních faktorů, které ovlivňují chování dospívajících osob (viz teorie sociálního učení, teorie plánovaného chování, teorie vrstevnických skupin apod.). Je tedy možné, že nedávný pokles v konzumaci alkoholu u českých adolescentů je spíše výsledkem substituce jedné formy rizikového chování za jinou (tj. trávení více času „ve virtuálním prostoru“).

Kromě způsobů trávení volného času však není možné zapomenout i na změny v dalších faktorech, které mají na úroveň užívání návykových látek přímý vliv. Jedním z nich je také vnímání rizik spojených s nadměrnou konzumací alkoholu. Nedávná studie od Chomynové et al. (2016) poskytuje přehled o vývoji vybraných indikátorů rizikového chování české mládeže, a to rovněž s využitím dat z projektu

ESPAD (1995–2015). Kromě výrazného poklesu v četnosti „chození večer ven za zábavou“ v období 2015 (pokles více než o polovinu oproti roku 2011) je zřetelný i mírný nárůst ve vnímání rizik spojených s konzumací nadměrných dávek alkoholu (Chomynová et al., 2016, p. 11–12). Lze tedy vidět, že objasnění faktorů stojících v pozadí změn v prevalenci rizikového chování současné české mládeže má komplexní charakter a bude potřebovat další cílený výzkum.

Navzdory výraznému poklesu nadměrného pití v posledních letech dokládají rovněž výsledky analýz faktorů spojených s takovýmto rizikovým chováním, že struktura těchto proměnných má v zásadě obdobný charakter, jakého jsme již byli svědky v předešlých obdobích (viz např. Kázmér et al., 2014). V daném případě se jedná hlavně o faktor druhu navštěvované školy, který byl zřetelný ve všech dosavadních vlnách studie ESPAD, a to shodně u obou pohlaví. Prevalence nadměrné konzumace alkoholu byla přitom u studentů středních odborných učilišť přibližně 2 až 3krát vyšší než u studentů gymnázií. Je tedy vidět, že aspirace dospívajících osob na jejich budoucí vzdělání je silným faktorem vážícím se na úroveň pití české mládeže. Výsledky analýz pro rok 2015 rovněž ukázaly, že kromě druhu navštěvované školy je také důležitý i specifický kontext *konkrétní* školy (tj. po kontrole na druh školy/resp. budoucí vzdělání studenta, je typické, že výskyt nadměrného pití se u nezletilých častokrát shlukuje uvnitř jednotlivých škol – viz vysoká signifikance tzv. náhodných efektů zmíněná v předešlé kapitole). Výsledky těchto zjištění je tedy, v širším smyslu, možné interpretovat jak ve prospěch (spíše selektivních) tendencí studentů orientovat svoje další studium na takový druh středních škol, který odpovídá aspiracím na jejich vzdělání, tak ve prospěch dodatečných (spíše kauzálních) souvislostí, vyplývajících ze vzájemné interakce studentů s ostatními vrstevníky studujícími na dané škole.

Co se týče analyzovaných rozdílů v pití mezi pohlavími, naznačují empirické výsledky, že v průběhu posledních 20 let docházelo k postupnému přibližování se dívek k chlapcům. Analýza těchto trendů již byla předmětem i jiných předešlých studií s obdobnými výsledky (Kuntsche et al., 2011; Simons-Morton et al., 2009). I navzdory skutečnosti, že příčiny snižujících se rozdílů v konzumaci alkoholu mezi dospívajícími dívkami a chlapci jsou stále ještě předmětem vědeckých diskusí, autoři se shodují v názoru, že tyto pozorované trendy pravděpodobně souvisí i s postupnými změnami ve společenských rolích, postojích a vzorcích chování vážících se k příslušnému genderu (postupná konvergence těchto sociálních konstruktů v širším smyslu).

Kromě již zmíněných faktorů genderu a charakteru školního prostředí identifikovaly výsledky našich analýz i další proměnné související s rozdílnou úrovní pití u současných českých adolescentů. Vedle individuálních psychologických vlivů (sociální odcizení, celková spokojenost se svým životem) se jako nezávislé potvrdily i faktory vztahu-



jíci se k charakteru rodinného prostředí, ze kterého daný student pochází.

Socioekonomický status rodiny, určený vzděláním rodičů a jejich (finanční) zámožností, se v našich analýzách jeví jako poněkud ambivalentní faktor. Čeští studenti, jejichž rodiče mají relativně nižší vzdělání, konzumují alkohol ve vyšší míře; což odpovídá chování vyplývajícímu z teoretických konceptů sociální kontroly a sociálního učení. Jak však ukazují i jiné zahraniční studie (Richter et al., 2006), vztah mezi socioekonomickým statutem a úrovní užívání návykových látek může mít i nelineární charakter, především u rodin s relativně vyššími příjmy. Vysoké příjmy mohou totiž u mladistvých následně zvyšovat finanční dostupnost návykových látek. Takovýmito závěrům odpovídají i výsledky naší studie.

Struktura rodiny a spokojenost se vztahem ke svým rodičům jsou rovněž významnými faktory. Nekonfliktní rodinné prostředí spojené s adekvátní výchovou pečujících rodičů, kteří se zajímají o problémy svých dospívajících dětí, je výrazným protektivním faktorem před rizikovým chováním, a to nejen v případě alkoholu. Brook et al. (1990) ve své teorii rodinné interakce („family interaction theory“) popisují, jak citová vazba mladistvých na své rodiče, rodinná podpora a rodičovský dohled mají, ve spojení s dalšími faktory, přímý vliv na úroveň rizikového chování adolescentů. Pro účely efektivních intervencí v oblasti primární prevence rovněž zdůrazňují, že rodinné vztahy vytváří jeden ze základních pilířů takovýchto preventivních aktivit.

Z výsledků naší studie je tedy celkově patrné, že při přípravě a tvorbě preventivních opatření zacílených na rizikovou konzumaci alkoholu v období dospívání jsou komplexní přístupy zcela na místě (viz např. Miovský et al., 2011). I v domácím českém prostředí platí, že kromě individuálních faktorů, operujících na úrovni konkrétního jedince, se jako významné jeví také faktory sociálního prostředí, ve kterém mladistvý dospívá. Vedle rodinného zázemí a vztahů s rodiči se z těchto sociálních vlivů dlouhodobě projevuje faktor školního prostředí. Další výzkum ukáže, zda snížení výskytu nadměrného pití u současných českých adolescentů bude mít dlouhodobější charakter, nebo se v daném ohledu jedná spíše o jev přechodný.

## ● 5 ZÁVĚRY

Pití alkoholu u nezletilých představuje závažné celospolečenské riziko, jehož důsledky na zdraví jedince se mohou projevit v pozdějších etapách jeho životní dráhy. I navzdory výraznému poklesu nadměrné konzumace alkoholu u českých nezletilých zůstává tato problematika i nadále výzvou pro státní zdravotní politiku. Kromě individuálních psychologických faktorů má na úroveň pití mladistvých výrazný vliv také charakter sociálního prostředí, ve kterém tyto osoby dospívají, a to jak ve smyslu rodinného prostředí, tak prostředí školy, kterou navštěvují. Článek podává jednoznačnou evidenci ve prospěch názoru, že pro účely realizace efektivní politiky v oblasti primární prevence rizikového chování je i v českém prostředí nutné vycházet z komplexních přístupů, které jednotlivé úrovně preventivních aktivit navzájem propojují a integrují.

**Role autorů:** L. K. navrhl strukturu příspěvku, provedl analýzy, zpracoval výstupy, jejich interpretaci a diskusi s literaturou. B. O. se podílela na přípravě rukopisu a diskusi s literaturou. Oba autoři přispěli ke vzniku článku a schválili jeho konečnou podobu.

**Konflikt zájmů:** Bez konfliktu zájmů.

**The role of the authors:** Ladislav Kázmér drafted the structure of the paper, performed the analyses, processed and interpreted the results, and prepared the Discussion and Literature sections. Barbora Orlicková was involved in the preparation of the manuscript and the Discussion and Literature sections. Both authors contributed to the article and approved its final version.

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## SOCIÁLNÍ FAKTORY UŽÍVÁNÍ NÁVYKOVÝCH LÁTEK U ČESKÝCH ADOLESCENTŮ – VLIV VRSTEVNICKÝCH SKUPIN, RODIČOVSKÝCH VAZEB A RODIČOVSKÉHO DOHLEDU

### SOCIAL FACTORS OF ADOLESCENT SUBSTANCE USE – EFFECTS OF PEERS, PARENTAL BONDING AND PARENTAL MONITORING

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**Abstrakt:** Příspěvek se zaměřuje na analýzu vztahu mezi vybranými sociálními faktory a výskytem rizikového užívání návykových látek u českých mladistvých. Využita jsou data z Evropské školní studie o alkoholu a jiných drogách, realizované na českých školách v roce 2011. Pomocí nástrojů víceúrovňového modelování je poukázáno na specifický vliv užívání návykových látek v prostředí vrstevnických skupin, kamarádů a přátel, se kterými se mladiství stýká a na významnou roli rodičovských vazeb a kontroly nad trávením jeho volného času. Uvedené faktory se jeví jako klíčové pro plánování a realizaci prevence rizikového chování české mládeže.

**Klíčová slova:** návykové látky; adolescence; sociální faktory; kvantitativní analýza; víceúrovňové modelování

**Abstract:** The paper aims at the analysis of the relationship between selected social factors and the prevalence of substance abuse among the Czech juveniles. Data from the Czech 2011 wave of the European School Survey Project on Alcohol and Other Drugs were used. Using a multilevel modelling framework, we point to the important role of both substance use among peer groups and friends the teenager socializes with, and the level of parental bonding and monitoring over his/her leisure time. These factors appear to be key for an effective planning and practice of prevention of risk behaviour among the Czech youth.

**Keywords:** substance use; adolescence; social factors; quantitative analysis; multilevel modelling

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## 1. Úvod, teoretické zarámování a cíle

Adolescence je specifickým formativním obdobím mladého jedince, pro které je charakteristické i získávání zkušeností s užíváním návykových látek; a to jak legálních (alkohol, tabák), tak častokrát i nelegálních (konopí). Navzdory skutečnosti, že tyto prvotní zkušenosti k dospívání do jisté míry přirozeně patří, pravidelné a intenzivní užívání návykových látek již od raného věku představuje pro tyto dospívající závažné zdravotní i sociální riziko (viz např. Newcomb, 1997).

Rozsáhlá literatura věnující se faktorům vzniku a prevenci užívání návykových látek v období adolescence (např. Miovský et al., 2010; Petriatis, Flay, & Miller, 1995; Schor, 1996) v zásadě rozlišuje mezi faktory i) individuálními, vyskytujícími se na úrovni daného jedince (např. pohlaví, věk, genetické predispozice, osobnostní rysy) a faktory ii) společenského prostředí, které tohoto jedince obklopuje. V případě sociálně podmíněných vlivů se zároveň rozlišuje i prostorové měřítko (úroveň), na kterém tyto kontextuální faktory operují (mikro-, mezo- a makrosociální úroveň). Povaha všech těchto faktorů může mít přítom jak rizikový, tak protektivní charakter (Jessor, Donovan, & Costa, 1991).

Z mikrosociálních faktorů se v literatuře rozlišují tři nejdůležitější okruhy, a to faktory i) rodinného prostředí, ii) prostředí školy a iii) vrstevnických skupin. Hranice mezi uvedenými okruhy přitom nejsou v sociálním prostředí adolescenta stanoveny pevně, ale navzájem se prolínají a uvedené faktory tak mezi sebou interagují. V případě faktorů rodinného prostředí se jedná třeba o sociální postavení rodiny ve společnosti, její materiální zabezpečení, rodinnou strukturu, vazby dospívajícího ke svým rodičům a sourozencům, emocionální podporu, rodičovský dohled, hodnoty a postoje nastavené rodičovskou výchovou, apod. Ze školních faktorů by bylo možné uvést například typ školy z pohledu budoucího profesního zaměření studentů, kurikulum a náročnost studia, institucionální zřízení (státní, soukromé školy), sociální strukturu studentů a spolužáků, hodnotové vzorce a sociální kontrolu vedenou ze strany pedagogického sboru či vedení školy. V případě efektu vrstevnických skupin se kromě již uvedených sociálně strukturálních charakteristik jedná především o jejich specifický normativní charakter, utvářející postoje a hodnotové orientace členů těchto skupin nejen k užívání návykových látek, ale i celkovému životnímu stylu a společnosti jako takové.

Všechny tyto zmíněné faktory jsou přitom přidruženou součástí procesů socializace a individualizace mladého jedince. Výčet výše uvedených faktorů určitě není konečný. Definitivní není ani úroveň, na které tyto faktory operují – jedna doména může skrze sociální vazby zasahovat i do prostorově vyšší úrovně (do úrovně komunity, města, regionu či celospolečenské úrovně). Je však celkově známo, že právě uvedené tři okruhy mikrosociálních faktorů mají pro úspěšnost těchto procesů zásadní význam.

Příspěvek je proto zaměřen na analýzu rozdílů v prevalenci rizikového užívání návykových látek u českých adolescentů, a to se zvláštním ohledem k vybraným typům mikrosociálních faktorů: i) rizikovému vlivu normotvorného prostředí vrstevníků ve vztahu k užívání návykových látek; ii) protektivnímu efektu rodičovského dohledu a vazeb dospívajících ke svým rodičům (tzv. rodičovský „monitoring“ a „bonding“). Součástí analýzy je i zahrnutí specifického efektu prostředí školy, kterou daný jedinec navštěvuje.

## 2. Data a metody

V příspěvku jsou využita data z české vlny Evropské školní studie o alkoholu a jiných drogách (ESPAD), realizované v roce 2011. Cílovou populací studie jsou osoby ve věku 15–16 let, tedy mladí dospívající, navštěvující první ročník střední, příp. i poslední ročník základní školy. Jedná se o celonárodní, průřezové šetření, reprezentativní z hlediska pohlaví studenta, typu navštěvované školy a krajů (pro bližší informace, viz Chomynová et al., 2014; Národní monitorovací středisko pro drogy a závislosti). Cílem projektu je poskytovat vysoce kvalitní a mezinárodně srovnatelná data o rizikovém chování adolescentů a zajistit tak dostupný a spolehlivý monitoring nad drogovou problematikou této věkové specifické skupiny.

## Závisle proměnné

Východiskem analýz byly otázky týkající se aktuálního užívání tří vybraných návykových látek (alkoholu, tabáku a konopí). V případě užívání tabáku se jednalo o frekvenci kouření cigaret v průběhu posledních 30 dnů. Respondenti odpověděli na 7stupňové Likertově škále – od i) „vůbec nekouřil/a“ až po vii) „kouřil/a více než 20 cigaret denně“. Ti, kteří uvedli kouření alespoň jedné cigarety každý den, byli v daném ohledu považováni za zdravotně rizikové osoby (denní kuřáci).

Podobně otázka týkající se rizikové konzumace alkoholu se dotazovala na výskyt a frekvenci konzumace pěti nebo více sklenic alkoholu za sebou při jedné příležitosti, a to v průběhu posledních 30 dnů. „Sklenice alkoholu“ přitom představovala jednu standardní dávku piva (0,5 l) nebo vína (2 dcl), nebo jednu skleničku destilátu (0,5 dcl). Studenti odpověděli na 6stupňové škále – od i) „ani jednou“ až po vi) „10krát a vícekrát“. Respondenti uvádějící alespoň tři takovéto konzumní příležitosti v průběhu posledního měsíce byli považováni za rizikové jedince (epizodické pití nadměrných dávek).

Ohledně konopí byla použita otázka na frekvenci jeho užívání v průběhu posledních 12 měsíců. Odpovědi byly 7stupňové – od i) „ani jednou“ po vii) „40 nebo vícekrát“. Respondenti, kteří v posledním roce uvedli užití konopí alespoň šestkrát (tedy v průměru alespoň jednou za dva měsíce), byli kódováni jako riziková uživatelé marihuany.

## Nezávisle proměnné

V analýze byly jako nezávislé proměnné použity dva kontrolní ukazatele (pohlaví a typ navštěvované školy) a skupina otázek vztahujících se ke třem výše zmíněným mikrosociálním faktorům.

Normotvorné prostředí vrstevníků ve vztahu k užívání návykové látky bylo měřeno následující sérií otázek: „Podle Vašeho odhadu, kolik z Vašich přátel: a) kouří cigarety; b) se občas opije; c) kouří mariuanu nebo hašiš?“ Odpovědi byly 5stupňové: i) nikdo; ii) málokdo; iii) několik; iv) většina; v) všichni.

Vazby na rodiče byly odvozeny z odpovědí respondentů týkajících se těchto dvou tvrzení: a) „Mí rodiče jsou na mě hodní a mají o mě starost“; b) „Dostává se mi emoční a citové opory od rodičů“. Odpovědi byly 5stupňové: i) vždy; ii) často; iii) někdy; iv) málokdy; v) nikdy. Každé z obou odpovědí bylo přisouzeno skóre od 0 („vždy“) po 4 („nikdy“). Úroveň rodičovských vazeb byla pak spočtena jako průměrné skóre z obou tvrzení a nabývala spojitéch hodnot na stupnici o až 4.

Úroveň rodičovského dohledu nad trávením volného času byla dotazována následující otázkou: „Vědí Vaši rodiče, kde trávíte sobotní večery?“; s odpověďmi: i) vždy; ii) většinou; iii) někdy; iv) obvykle ne.

## Analytický postup

Pro statistické testování a modelování vztahů mezi vybranými proměnnými byly aplikovány dnes již standardní postupy analýzy kategoriálních dat (viz např. Agresti, 2007). Jelikož původní databáze ESPAD 2011 obsahuje kromě rozsáhlé množiny sledovaných proměnných i výrazný počet respondentů, jejichž věk nespadá přímo do cílové skupiny projektu, samotné analýze předcházela výběr požadované podskupiny, splňující předem definovaná kritéria. V našem případě se jednalo o respondenty, kteří se narodili v roce 1995 (tj. explicitní kontrola na věk studenta) a zároveň uvedli úplné odpovědi na všechny tři otázky týkající se užívání vybraných návykových látek. Analýza se skládala ze tří navazujících kroků. První krok představovala základní popisná charakteristika vstupních proměnných, s přihlédnutím na rozbor případných rozdílů v jejich distribuci mezi chlapci a dívkami. Pro testování statistické významnosti těchto rozdílů byl použit Pearsonův chí-kvadrát test dobré shody.

Cílem druhého kroku bylo analyzovat vztahy mezi vstupními proměnnými navzájem a porovnat sílu těchto vazeb (velikost korelace) k rizikovému užívání vybraných tří návykových látek. Pro analýzu byl použit neparametrický ukazatel – Spearmanův pořadový korelační koeficient s Bonferonniho korekční procedurou pro vícenásobné testování hypotéz. Jelikož Spearmanův koeficient předpokládá ordinální sekvenci hodnot vstupujících proměnných, z analýzy v tomto druhém kroku byla vyloučena skupina studentů ze základních škol. Zbylá skupina středních škol byla seřazena do posloupnosti odpovídající relativním studijním předpokladům a náročnosti studia. Korelační koeficienty byly přitom spočteny odděleně pro chlapce i dívky.

Ve třetím kroku byla sestrojena série na sebe navazujících dvouúrovňových logistických modelů (tzv. binární logit s fixními a náhodnými efekty; studenti – úroveň I; škola – úroveň II). Závisle proměnnou představovalo rizikové užívání vybrané návykové látky – Modely 1 (Alkohol), 2 (Tabák) a 3 (Konopí). Fixní efekty nezávislých prediktorů byly v modelech testovány ve dvou krocích: i) nejprve efekt dvou kontrolních faktorů pohlaví a typu navštěvované školy (modely „a“); ii) následně efekty dalších přidávaných proměnných – užívání dané látky kamarády/přáteli, rodičovský dohled a vazby na rodiče (modely „b“). Účelem takového dvou-  
stupňové analýzy bylo sledovat vliv nově přidávaných fixních efektů na náhodnou komponentu regresního modelu; tedy na varianci náhodných efektů (úrovňových konstant), představující odhad nerovnosti ve výskytu užívání dané návykové látky mezi jednotlivými dotazovanými školami (úroveň II). Pokles v těchto nerovnostech byl dodatečně přepočten do procentuální podoby.

## 3. Výsledky

Tab. 1 poskytuje základní deskriptivní statistiku výběrového souboru a proměnných použitých v analýze. Celkově byly použity údaje o 4 939 dospívajících studentech narozených v roce 1995, z čeho 2 243 bylo chlapců a 2 696 dívek. Data jsou prezentována odděleně pro obě pohlaví, společně s Pearsonovou chí-kvadrát statistikou, testující rovnost distribuce vybraných proměnných mezi chlapci a dívkami. Tyto statistiky mají spíše doplňkovou popisnou úlohu; nicméně, lze z nich vyčíst několik předběžných údajů týkajících se výběrového vzorku.

V Tab. 1 lze z hlediska typu navštěvované školy vidět vyšší zastoupení chlapců studujících na středních odborných učilištích (SOU) oproti dívkám a naopak výraznou převahu dívek nad chlapci v případě studentů gymnázií a středních odborných škol (SOŠ).

Prevalence rizikové konzumace alkoholu a pravidelného užívání konopí byla asi 1,7krát vyšší u chlapců než u dívek (27,4 % vs. 16,3 %; resp. 14,5 % vs. 8,6 %). Prevalence denního kouření byla také u chlapců o něco vyšší (27,1 % vs. 24,5 %); nicméně, jak ukázaly pozdější analýzy pomocí regresních modelů, v daném případě byly tyto hrubé míry ovlivněny strukturou studentů podle již zmíně-

ného typu navštěvované školy (po kontrole na typ školy již rozdíly v kouření nebyly statisticky významné – viz i Model 2a v Tab. 3).

Zajímavé je, že konzumaci alkoholu a kouření cigaret u svých vrstevníků a přátel uváděly o něco častěji dívky než chlapci. Užívání konopí zas bylo častější v okolí chlapců. I v tomto případě se však jedná o hrubé ukazatele, ze kterých nelze odvozovat hlubší závěry.

U proměnných „vazby na rodiče“ a „rodičovský dohled“ byl výskyt v obou případech vyšší u dívek, což pravděpodobně souvisí s jejich relativní vulnerabilitou a konzervativnějšími přístupy rodičů k jejich výchově, než je tomu v případě chlapců.

Ve druhém kroku byly pomocí Spearmanových korelací analyzovány vztahy mezi všemi proměnnými navzájem. Výsledky v podobě korelační matice prezentuje Tab. 2, a to odděleně pro chlapce a dívky. V tomto kroku byly vybrány jenom studenti středních škol.

Z Tab. 2 lze vidět, že rizikové užívání jedné látky úzce souvisí i s intenzivním užíváním látky druhé. Korelační koeficienty jsou přitom poměrně silné v rozmezí hodnot od 0,24 do 0,36 (levý horní roh matice). Podobně je tomu i v případě užívání vybraných tří látek u kamarádů a přátel, s hodnotami korelací ještě o něco vyššími (0,33 až 0,44; proměnné (5) až (7) ve střední části tabulky). Je tedy vidět, že rizikové užívání návykových látek je navzájem propojeno a shlukuje se jak na úrovni jednotlivce – proměnné (1) až (3), tak na úrovni vrstevnických skupin, se kterými tento jedinec přichází pravidelně do kontaktu – proměnné (5) až (7).

Normativita vrstevníků ve vztahu k užívání látek se rovněž váže s jejich užíváním u samotného respondenta (korelační koeficienty od 0,26 až 0,42 u chlapců; 0,22 až 0,39 u dívek). S rizikovým užíváním je taky spojena nízká úroveň rodičovských vazeb a nedosta-  
tečný rodičovský dohled nad trávením volného času (koeficienty přibližně na úrovni 0,10–0,25 u chlapců; 0,12–0,23 u dívek). Síla těchto korelací je však ve srovnání s předešlými, normativními vlivy vrstevníků, značně menší.

Z hodnot korelačních koeficientů v Tab. 2 lze taky vyčíst, že užívání návykových látek významně souvisí i s typem školy, kterou studenti navštěvují; resp. s jejich studijními aspiracemi a budoucím profesním zaměřením – proměnná (4). Jelikož je tento ukazatel významně korelován i s ostatními (nezávislými) proměnnými (5) až (9), byl v regresních modelech použit společně s pohlavím jako další kontrolní proměnná.

Výsledky třetí, nejdůležitější části analýz, prezentuje Tab. 3. Efekty nezávislých proměnných na binární závisle proměnnou, tj. rizikové užívání i. alkoholu, ii. tabáku a iii. konopí, byly testovány pomocí série dvouúrovňových logitových modelů.



Tab. 1: Popisná charakteristika výběrového souboru a proměnných vstupujících do analýzy, chlapci, dívky, Česko, data ESPAD 2011 (N = 4 939)

		Chlapci	Dívky	Pearsonův chí-kvadrát test (p-hodnota)
Počet respondentů		2 243	2 696	-
Věk, průměr (min-max)		16.1 (15.6-16.5)	16.1 (15.6-16.5)	-
Typ školy	Gymnázium (%)	17.0	24.6	$\chi^2(3) = 166.9$ (p<0.001)
	SOŠ (%)	22.7	33.2	
	SOU (%)	30.1	19.1	
	Základní (%)	30.2	23.1	
Epizodické pití nadměrných dávek alkoholu (%)		27.4	16.3	$\chi^2(1) = 89.8$ (p<0.001)
Denní kuřáctví (%)		27.1	24.5	$\chi^2(1) = 4.3$ (p=0.038)
Pravidelné užívání konopí (%)		14.5	8.6	$\chi^2(1) = 42.9$ (p<0.001)
Prevalence opjení se u kamarádů/přátel	Nikdo (%)	3.0	1.9	$\chi^2(4) = 12.1$ (p=0.017)
	Málokdo (%)	12.8	12.7	
	Několik (%)	33.8	31.4	
	Většina (%)	40.1	43.4	
	Všichni (%)	10.2	10.6	
Prevalence kouření cigaret u kamarádů/přátel	Nikdo (%)	2.0	1.1	$\chi^2(4) = 13.4$ (p=0.009)
	Málokdo (%)	7.8	7.5	
	Několik (%)	38.7	35.6	
	Většina (%)	47.7	51.9	
	Všichni (%)	3.8	3.9	
Prevalence kouření konopí u kamarádů/přátel	Nikdo (%)	17.9	22.5	$\chi^2(4) = 25.1$ (p<0.001)
	Málokdo (%)	46.0	41.2	
	Několik (%)	27.1	28.3	
	Většina (%)	7.6	7.1	
	Všichni (%)	1.5	0.8	
Vazby na rodiče (rodičovská podpora)	Silné (%)	42.7	55.2	$\chi^2(4) = 82.5$ (p<0.001)
	Spiše silné (%)	35.6	27.5	
	Střední (%)	16.3	12.3	
	Spiše slabé (%)	3.7	3.9	
	Slabé (%)	1.8	1.0	
Rodičovský dohled	Vždy (%)	35.9	53.6	$\chi^2(3) = 174.7$ (p<0.001)
	Většinou (%)	38.1	31.4	
	Někdy (%)	18.5	11.1	
	Obvykle ne (%)	7.5	3.9	

Poznámka: Ročníková kohorta studentů narozených v roce 1995. Pearsonův chí-kvadrát test o rovnosti distribuce vybraných proměnných mezi chlapci a dívkami.

Do modelů byly nejprve zahrnuty jenom efekty kontrolních proměnných, tedy pohlaví a typu navštěvované školy (modely „a“). Ve výstupu z tohoto prvního kroku lze vidět, že výskyt epizodické konzumace nadměrných dávek alkoholu byl společně s pravidelným užíváním konopí u dívek významně nižší než u chlapců (Model 1a, Model 3a). V případě denního kouření již však rozdíly mezi pohlavími nebyly významné (Model 2a). Výraznější rozdíly byly pozorovány především mezi studenty z jednotlivých typů škol. Nejvyšší výskyt rizikového užívání byl přítomen u studentů odborných učilišť (SOÚ), následně pak u studentů středních odborných škol (SOŠ). Naopak, v případě gymnazistů se v daném ohledu jednalo o nejméně rizikovou skupinu.

Následně byly do regresní analýzy přidány efekty dalších proměnných – úroveň užívání látky kamarády a přáteli, vazby na rodiče a rodičovský dohled (modely „b“). Z výstupů lze vidět, že úroveň všech těchto mikrosociálních faktorů se výrazně váže k rizikovému užívání všech tří analyzovaných látek; tedy jak alkoholu, tak tabáku či konopí. Vyšší podíl kamarádů a vrstevníků užívajících danou látku je rovněž spojen s vyšším rizikem jejího užívání u dotazovaných studentů. Slabší vazby adolescentů na své rodiče a nízká úroveň rodičovského dohledu nad trávením volného času jsou spojeny s vyšší prevalencí takového rizikového chování.

Tab. 2: Korelační matice proměnných vstupujících do analýzy – Spearmanovy korelační koeficienty pořadí, vybrání jenom studentů středních škol (n = 3 639), chlapci, dívky, Česko, data ESPAD 2011

		Dívky (n2 = 2 073)								
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Chlapci (n1 = 1 566)	(1)	1	0.324*	0.237*	0.148*	0.217*	0.220*	0.204*	0.143*	0.196*
	(2)	0.363*	1	0.307*	0.296*	0.184*	0.392*	0.307*	0.124*	0.233*
	(3)	0.244*	0.344*	1	0.128*	0.138*	0.206*	0.351*	0.121*	0.191*
	(4)	0.203*	0.276*	0.122*	1	0.055	0.359*	0.147*	0.085*	0.126*
	(5)	0.255*	0.228*	0.227*	0.115*	1	0.332*	0.431*	0.043	0.160*
	(6)	0.265*	0.392*	0.198*	0.384*	0.394*	1	0.441*	0.102*	0.215*
	(7)	0.185*	0.189*	0.423*	0.148*	0.421*	0.403*	1	0.153*	0.260*
	(8)	0.126*	0.162*	0.103*	0.135*	0.048	0.115*	0.073	1	0.331*
	(9)	0.211*	0.245*	0.207*	0.157*	0.170*	0.191*	0.175*	0.302*	1

Poznámky:

1. Epizodické pití nadměrných dávek alkoholu;
2. Denní kuřáctví;
3. Pravidelné užívání konopí;
4. Typ školy – seřazeno následovně: 0 = Gymnázium, 1 = SOŠ, 2 = SOU;
5. Prevalence opjení se u kamarádů/přátel;
6. Prevalence kouření cigaret u kamarádů/přátel;
7. Prevalence kouření konopí u kamarádů/přátel;
8. Vazby na rodiče (rodičovská podpora) – seřazeno od 0 = Silné do 4 = Slabé;
9. Rodičovský dohled – seřazeno od 0 = Vždy do 3 = Obvykle ne;

\* p<0.05, p-hodnota s Bonferroniho korekční procedurou pro vícenásobné testování hypotéz

Tab. 3: Výstupy z dvouúrovňové binární logistické regrese (studenti – úroveň I; škola – úroveň II). Závisle proměnné: Rizikové užívání návykové látky (i. alkohol; ii. tabák; iii. konopí) [ano = 1 / ne = 0]. Česko, data ESPAD 2011

	Alkohol		Tabák		Konopí	
	Model 1a	Model 1b	Model 2a	Model 2b	Model 3a	Model 3b
	Poměry šancí	Poměry šancí	Poměry šancí	Poměry šancí	Poměry šancí	Poměry šancí
<b>Fixní efekty</b>						
Pohlaví (Chlapci = ref.) Dívky	ref.	ref.	ref.	ref.	ref.	ref.
	0.55***	0.59***	1.03	1.08	0.57***	0.58***
Typ školy (Gymnázium = ref.) Střední odborná škola Střední odborné učiliště Základní škola	ref.	ref.	ref.	ref.	ref.	ref.
	1.92***	1.59***	3.64***	1.86***	1.77**	1.13
	3.17***	2.48***	7.94***	3.36***	3.03***	1.49*
	1.30	1.32	2.90***	1.63**	1.25	0.90
Užívání látky kamarády/přáteli (Nikdo/Málokdo = ref.) Několik Většina Všichni	.	ref.	.	ref.	.	ref.
	.	1.65**	.	3.69***	.	7.74***
	.	3.87***	.	14.99***	.	27.98***
	.	6.74***	.	54.16***	.	75.92***
Vazby na rodiče (skóre od 0 = Silné do 4 = Slabé)	.	1.15***	.	1.16***	.	1.16**
Rodičovský dohled (Vždy = ref.) Většinou Někdy Obvykle ne	.	ref.	.	ref.	.	ref.
	.	1.82***	.	1.91***	.	2.22***
	.	2.56***	.	2.51***	.	2.77***
	.	2.98***	.	3.46***	.	2.65***
Konstanta	0.19***	0.04***	0.09***	0.01***	0.09***	0.02***
<b>Náhodné efekty</b>						
Úroveň II (škola): Variance (Konstanta)	0.173***	0.143**	0.302***	0.142**	0.356***	0.142
[% pokles ve „Variance (Konstanta)“]	[17.5%]		[52.9%]		[60.1%]	
<b>Popisná charakteristika regresních modelů</b>						
Počet respondentů (N)	4 866	4 866	4 880	4 880	4 865	4 865
Počet škol (M)	363	363	363	363	363	363
-2LL	4 792	4 386	5 160	4 464	3 288	2 504
AIC	4 803	4 413	5 173	4 490	3 300	3 339
BIC	4 842	4 497	5 212	4 574	2 531	2 615
LR test (stupně volnosti), p-hodnota	404.4 (7), p<0.001		697.2 (7), p<0.001		783.5 (7), p<0.001	

Poznámky: Alkohol ~ epizodické pití nadměrných dávek alkoholu; Tabák ~ denní kuřáctví; Konopí ~ pravidelné užívání konopí; ref. ~ referenční skupina; -2LL ~ -2krát log-likelihood; AIC ~ Akaikeho informační kritérium; BIC ~ Bayesovo informační kritérium; LR test ~ likelihood ratio test (srovnání modelu „b“ s předeslým modelem „a“); \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

Ve srovnání s předešlými modely „a“ poukazují modely „b“ mimo jiné i na výrazný pokles ve varianci náhodných efektů (úrovňových konstant). Z dat prezentovaných v Tab. 3 lze vidět, že dodatečně zahrnuté efekty normotvorného prostředí vrstevníků, společně s nízkou úrovní rodičovských vazeb a rodičovského dohledu, vysvětlily podstatnou část rozdílů ve výskytu rizikového užívání dané látky mezi jednotlivými dotazovanými školami (celkový počet škol M = 363). V případě alkoholu vysvětlily 17,5 % těchto rozdílů; u denního kouření 52,9 %; v užívání konopí až 60,1 %.

#### 4. Diskuse a závěry

Výsledky analýz jednoznačně poukázaly na silnou vazbu mezi rizikovým užíváním návykových látek u českých adolescentů s vybranými mikrosociálními faktory; konkrétně tedy se specifickou normativitou jejich užívání v prostředí vrstevníků, kamarádů a přátel, slabými vazbami na své rodiče a nízkou úrovní rodičovského dohledu nad trávením volného času mladistvých. Normativita v kruhu vrstevníků se jeví být na užívání vybraných látek navázána silněji, a tedy i rizikověji, než je tomu u zbylých dvou faktorů.

Výstupy z regresních modelů rovněž poukázaly na výrazné meziškolní rozdíly ve výskytu příslušného rizikového chování. Typ navštěvované školy byl i nadále výrazným diferenciacním faktorem; nieméně, významné rozdíly existovaly i mezi školami téhož typu (výše zmiňovaná variance náhodných interceptů/úrovňových konstant).

Skupina třech námi analyzovaných mikrosociálních faktorů poskytla důležitý vhled do podstaty těchto meziškolních nerovností. Analyzované faktory vysvětlily jejich výraznou část a poukázaly tak na klíčovou roli normativních a hodnotově orientovaných mechanismů při vzniku a prevenci rizikového užívání návykových látek. Jelikož jsou tyto hodnotové vzorce vytvářeny a nastavovány primárně v rodinném, a následně ve školním prostředí, integrativní přístupy zaměřené na vzájemné propojení strukturálně laděných strategií a intervencí, přemostující mezi (problémovým) rodinným a školním prostředím na jedné straně, a podporou individuálních a skupinových kompetencí náctiletých ve vztahu k rizikovému chování na straně druhé, můžou hrát pro plánování a realizaci efektivní protidrogové politiky zásadní roli. Výsledky našich analýz mluví jednoznačně ve prospěch takovéhoto komplexních přístupů.

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# What Affects What? Perceived Cannabis Availability and Its Use Among Czech Urban Youth—A Multilevel Sociogeographic Analysis

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## Abstract

**[AQ: 1]** Although there is already considerable research on the connection between the availability of substance and the prevalence of its use, the relative effect that one factor has on the other is rather unclear. The present study aims to scrutinize the mutual relationship between subjectively perceived cannabis availability and the prevalence of cannabis use among 15- to 16-year-old students, applying an integrative multilevel analytic framework. The Czech 2011 European School Survey Project on Alcohol and Other Drugs (ESPAD) dataset ( $N = 8,069$  respondents) entered multilevel regression analyses to examine the sociogeographical inequalities in both perceived availability and adolescent frequent cannabis use (individuals [Level 1] nested within schools [Level 2] and localities [Level 3]). At the same time, the mutual relationship of the two cannabis indicators was demonstrated. At the level of individuals (Level 1), the simultaneous equations modeling (SEM) approach was applied to estimate the relative effect of perceived cannabis availability on the frequency of cannabis use and compare it vice versa. Adolescents coming from highly urbanized areas perceived cannabis to be more readily available, and they had a higher prevalence of frequent cannabis use. The higher availability mediated the sociogeographic inequalities in cannabis use. The locality unemployment rate was unrelated to either of the two cannabis indicators. At the individual level of the adolescent respondent, the effect of perceived availability on cannabis use appears to be much stronger than that of the effect of cannabis use on perceived availability when reversed. Perceived availability was found to mediate sociogeographic inequalities in cannabis use among Czechs adolescents. If a higher availability increases opportunities for adolescent substance misuse, then alongside other preventive measures, a spatially integrated approach should be applied in the national drug policy.

## Keywords

cannabis use, perceived availability, adolescence, multilevel analysis, simultaneous equations models

## Introduction

### Background

Cannabis is the most frequently used illegal substance in Europe, with higher prevalence rates among adolescents and young adults (Hibell & Andersson, 2008; Vicente, Olszewski, & Matias, 2008). As adolescence is a specific period of transition in the individual's lifespan characterized by multiple physiological, psychological, and social stressors, young people are more prone to indulge in risk behaviors and thus represent more vulnerable groups in this respect than those older in age.

While gaining firsthand experience with psychoactive substances might be considered as a rather natural phenomenon associated with adolescence (de Looze, Janssen, Elgar, Craig, & Pickett, 2015; ter Bogt et al., 2014), early cannabis use on a frequent basis can have serious consequences for the

future mental and physical health of a young individual (Hall, 2009; Volkow, Baler, Compton, & Weiss, 2014). The research on determinants of the early onset of substance misuse, including frequent use of cannabis, is therefore particularly important for the public health agenda.

Several health risks are associated with cannabis use during adolescence, including the possible development of schizophrenia, anxiety, depression, suicidal tendencies, or drug dependence (Andréasson, Allebeck, Engström, &

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Rydberg, 1987; Arseneault et al., 2002; Copeland, Rooke, & Swift, 2013). The long-term effects of frequent cannabis use starting in adolescence were also found to increase the risk of altered brain development, cognitive impairment, reduced educational outcome, lower income, and lower life satisfaction (Fergusson & Boden, 2008; Volkow et al., 2014). In addition, cannabis as a psychoactive substance may serve as a potential gateway into other forms of illicit drug use with even more harmful consequences on an individual's health, (Fergusson, Boden, & Horwood, 2006; Kandel, 1975), particularly among individuals predisposed to substance misuse and addiction.

From a global perspective, the prevalence of illicit drugs seems to be higher in more developed countries (Degenhardt & Hall, 2012). In most of these countries, restrictions and measures targeted at decreasing the availability of psychoactive substances are considered to be particularly important in preventing substance use and its related problems among youths (Knibbe et al., 2005). As documented by international surveys (Currie et al., 2012; Hibell et al., 2012), however, Czech adolescents have the highest levels of both availability and prevalence of substance use compared to other European teenagers. This applies to illicit substances, especially cannabis, as well as licit substances in general (alcohol, tobacco). The high availability and prevalence of substance use is considered to be due to the specific socio-cultural environment of the Czech society, which is characterized by a high level of tolerance toward alcohol, tobacco, and cannabis consumptions (Csémy, Sovinová, & Procházka, 2012). A deeper understanding of the factors associated with the higher availability of drugs and their effects on substance use with a specific emphasize on the Czech adolescent population is, therefore, an issue that we focus on in the present article.

### *Multilevel Factors of Adolescent Cannabis Use*

Regarding early cannabis use, multiple risk factors have been documented in public health research (European Monitoring Center for Drugs and Drug Addiction [EMCDDA], 2008; Substance Abuse and Mental Health Services Administration [SAMHSA], 2014). These factors operate at multiple levels, ranging from the level of the individual (e.g., age, gender, personality traits), through factors of school (e.g., the type of school attended) and the influence of adolescent peers, to factors operating at higher levels of the community and society as a whole. Starting in adolescence, the factors operating at higher levels grow increasingly important, as individuals increase their independence on families, spending more time in new and broader social contexts (Tucker, Pollard, de la Haye, Kennedy, & Green, 2013).

In the epidemiology of substance use, gender is recognized as one of the key factors for inequalities in adolescent cannabis consumption operating at the individual level

(EMCDDA, 2008). Alongside biological differences (Fattore & Fratta, 2010), the higher prevalence of substance use among boys is considered to reflect a rather externalizing coping strategies with the adolescent transitional period; this contrasts with girls, where instead internalizing strategies are expected (Hurrelmann & Richter, 2006; Raithel, 2004; In: Pitel, Madarasová Gecková, Reijneveld, & van Dijk, 2013). Gender-differentiated attitudes toward substance misuse play a significant role as well (Mason, Mennis, Linker, Bares, & Zaharakis, 2014; Musher-Eizenman, Holub, & Arnett, 2003; Rienzi et al., 1996), including issues of unwanted loss of self-control resulting from intoxication among girls (Dahl & Sandberg, 2015). At the same time, cannabis use seen as a rebellious act might be attributed to a masculine behavior (Dahl & Sandberg, 2015). As documented by qualitative research studies, the gendered differences are particularly pronounced within frequent and intensive use of cannabis, rather than within experimental and occasional use (Measham, 2002; Warner, Weber, & Albanes, 1999).

In addition to gender, age is a significant predictor of cannabis use operating at the individual level as well. As adolescents' health-related behaviors, including substance use, significantly change during this developmental period, the specific importance of appropriately timing an intervention, with a specific focus on the age of adolescence, is emphasized within both public health and the drug policy agenda (Currie et al., 2012). For example, with respect to cannabis use, according to the results of the 2011 Czech European School Survey Project on Alcohol and Other Drugs (ESPAD) survey, 21% of all the surveyed adolescent respondents declared that their first cannabis use occurred by the age of 14 years, 38% by the age of 15 years, and 43% by the age of 16 years (thus, the lifetime prevalence of cannabis use among these students was 43% in 2011; see Chomynová, Csémy, Grolmusová, & Sadílek, 2014). Although these data apply only to first experiences with the substance, they point to the growing importance of contextually determined factors on adolescent behavior during this specific developmental period.

Within structurally determined factors, the research has mainly focused on the effects of the socioeconomic status (SES) of an adolescent's family, providing that adolescents from lower SES are characterized by a higher prevalence of cannabis use. In the meta-analysis, Lemstra et al. (2008) reviewed articles defining the family SES on the basis of parental income, parental education, employment status, and occupational classification. However, among adolescent students, the type of school attended may also be used as a proxy of students' own SES (Berten, Cardoen, Brondeel, & Vettenburg, 2012; Gecková, van Dijk, Groothoff, & Post, 2002). As documented by earlier studies, students' own educational levels, defined by attended school type, had a much stronger effect on substance use than the parental SES, including effects on the adolescent use of tobacco (Richter & Leppin, 2007), alcohol, cannabis, and other illicit drugs



(Berten et al., 2012; Kázmér & Orlíková, 2017; Vereecken, Maes, & De Bacquer, 2004).

There are two mechanisms going on behind the effect of school type on adolescent substance use. First, the selection of a school type influenced by parental SES, parental norms, and modes of behavior, as well as educational aspirations transmitted from parents to a young student, predicts the later SES and behaviors of an adolescent individual (Hagquist, 2000, 2007; Richter & Leppin, 2007). The second mechanism involves the effect of a specific school environment that may influence adolescent behavior through normative peer culture associated with substance use prevalent in schools with lower educational aspirations, less demanding school curricula, and lower educational motivations (Richter & Leppin, 2007). The two mechanisms are parallel and of a cumulative nature. The mechanisms indicate that students from disadvantaged backgrounds tend to cluster in lower SES school types, and being among substance-use favoring peers, they tend to adapt to the lifestyle of the social group prevalent in their educational track (Koivusilta, Rimpela, & Rimpela, 1999).

The specific focus of our study is the effects of risk factors operating at higher levels of both community and society, and we expand upon the theory behind them in greater detail in the next sections.

### Theoretical Frameworks

In the criminology literature, several theoretical frameworks underlie the importance of availability as a risk factor conducive for a delinquent behavior. For example, the Routine Activity Theory (RAT) stipulates three conditions for such a behavior to occur: (a) a motivated individual, (b) an absence of capable guardianship, and (c) the opportunity for a behavior, all coming together in time and space (Cohen & Felson, 1979). The RAT was developed as a macro-level theory, explaining the prevalence of delinquency in relation to the structural changes of social organization during the specific social and economic development of society. These changes are characterized by new forms of (routine) activities of everyday life, associated with a lowered guardianship over individual, thus increasing opportunities for delinquency.

The RAT was later expanded by Osgood, Wilson, O'Malley, Bachman, and Johnston (1996) into Routine Activity Theory of General Deviance (RATGD), which linked the previous macro-concept of routine activities with a deviant behavior at the individual level. The authors proved the significance of the role of routine activities as a mediator between structural variables and individual deviance. According to the RATGD, unstructured activities with peers and the absence of effective control authorities provide individuals opportunities for a given behavior (Osgood et al., 1996). At the same time, the RATGD included a wider range of behaviors outside the scope of delinquency, including alcohol and cannabis use among youth.

In epidemiology of substance use, the concept of availability was discussed particularly within the Smart's Availability-Proneness Theory (Smart, 1977), which stressed availability and access to substances as key factors in the development of substance misuse. The theory applies the proposition that drug use occurs when a prone individual is exposed to a high level of substance availability.

Complementing the abovementioned theories, which focus either on macro-societal contexts (Cohen & Felson, 1979) or on individual-level factors (Osgood et al., 1996; Smart, 1977), the Social Disorganization Theory (SDT) suggests that *residential* location and *neighborhood* socioeconomic characteristics may also play important roles for engagement in a risk and deviant behavior, independently from a person's individual characteristics (Sampson & Groves, 1989). The theory builds upon sociological research of urban communities and emphasizes the structural dimensions of neighborhood disadvantage (e.g., spatial concentration of poverty, high unemployment rates, the presence of lower social class, social segregation, and residential instability), as well as social interactional processes, in conjunction with institutional mechanisms, which transmit neighborhood-level factors into individual behavior (Sampson, Morenoff, & Gannon-Rowley, 2002).

According to the SDT's central concept of collective efficacy (Sampson, Raudenbusch, & Earls, 1997; Shaw & McKay, 1942), the protective effects of social ties and social cohesion are presumably more likely to manifest in a more rural and less urbanized neighborhood context. Contrasted to rural ones, in highly urbanized areas, rather higher anonymity and weaker informal social control is expected, including the possibly stronger influence of deviant and substance-using peer groups in the city (Donnermeyer, 1992; Wilson & Donnermeyer, 2006). Hence, more urbanized areas may provide adolescents with differentiated opportunities for a risk and/or deviant behavior, including a higher availability of illicit substances.

Spatially concentrated disadvantages and relative deprivation can also provide a differentiated context associated with higher rates of substance use. Deprivation may negatively affect social bonds between adolescents, their families, and schools. This can result in increased opportunities for bonding with deviant peers or other deviant individuals located close to adolescent (Oetting, Donnermeyer, & Deffenbacher, 1998). Congruently with the SDT, the possible lack of local institutional resources in deprived areas may result in both insufficient provision of prosocial activities for adolescents and a lack of control over individual and/or group behavior, thus increasing opportunities for deviance (Leventhal & Brooks-Gunn, 2000). In addition, the potential social exclusion present in highly deprived areas can result in an additional exposure to social stressors, which can lead to a higher prevalence of substance use in these areas as well. The possibly higher prevalence of substance use concentrated in disadvantaged areas (the so-called "disadvantage

hypotheses”) and was suggested by socioecological studies, including research on adolescent cannabis use (Hyman & Sinha, 2009; Karriker-Jaffe, 2011).

### *Previous Research on Availability and Adolescent Cannabis Use*

Regarding the availability of psychoactive substances, several approaches have been used to measure this concept, each emphasizing different aspects. Some apply retail prices, drug seizures, perceived availability by users, or the general level of drug consumption as a reflection of availability per se (EMCDDA, 2008). However, these approaches have not yet gained special merit and are instead considered complementary. Einstein (1981) emphasized the multidimensionality of the concept and distinguished between physical, social, economic, legal, and conceptual availability. However, Smart (1977, 1980) only distinguished the actual availability (measured, for example, by financial costs, time needed to buy drugs, number of nearby sellers, and/or places to buy) and the perceived availability (as a subjective estimate). In the context of illicit drugs, he recommended the latter approach due to the lack of information at hand on the actual availability of substances.

Given the clandestine nature of illicit drug markets, surveys among the adolescent population often rely on indicators of perceived, rather than actual, substance availability (Bjarnason, Steriu, & Kokkevi, 2010). At the same time, in large-sample population surveys, the perceived availability is typically measured by a single item with responses on a simple Likert-type scale (Hibell et al., 2012). Although this might indicate a certain reductionism, this simple measure is considered to result from multiple variables (Smart, 1980; ter Bogt et al., 2014; ter Bogt, Schmid, Gabhainn, Fotiou, & Vollebergh, 2006), comprising both subjective and objective factors within the individual estimation of the phenomena (e.g., exposure to the substance, price, various modes of access to drugs such as market purchase and/or self-supply modes, social networks, psychological factors, or specific sociocultural context). Building on this previous research, the present paper’s approach is based on adolescent perceptions as well. In the following text, the term “availability” refers to the concept of perceived availability.

Several studies examined the effects of the perceived availability on adolescent cannabis use (e.g., Castro, Valencia, & Smart, 1979; Knibbe et al., 2005; Maddahian, Newcomb, & Bentler, 1986; Smart, Adlaf, & Walsh, 1994). These studies generally anticipate that high rates of availability can lead to a high prevalence of substance use as well. However, from a rather critical perspective, in the case of *perceived* availability measured at the individual level of respondent, it could also be expected that, in addition, substance use itself elevates the subjective estimation of availability, as regular substance users probably know where and how to obtain it. Furthermore, these particular studies are

based on aggregate measures of both availability and substance use and do not distinguish between the effects operating at an individual level from those operating at higher, environmentally determined (sociogeographical) levels.

When reviewing the literature concerning the effects of perceived cannabis availability on substance misuse, it becomes apparent that only a few studies have taken these rather critical standpoints (Bjarnason et al., 2010; Piontek, Kraus, Bjarnason, Demetrovics, & Ramstedt, 2012; ter Bogt et al., 2006). By applying a multilevel analytical framework, the study by Bjarnason et al. (2010) examines the effects of the different rates of perceived availability on the prevalence of cannabis use among teenagers coming from 31 European countries. Adjusting for the individual covariates of respondents, the study underlines the importance of the societal level of substance availability on the frequency of cannabis use among the adolescent population. Although the authors overcome the methodological problems of potential fallacy inherent in previous ecological studies, the mutual relationship between the perceived availability of the substance and its use has not been examined any further. Furthermore, the study is rather extensive, and it does not elaborate on other specific factors (e.g., cultural, institutional, environmental) operating at lower, in-country levels. The authors, however, state the need for further research focusing on the specifics of each particular society.

Studies on sociogeographic inequalities in adolescent cannabis use are mostly cross-nationally oriented, drawing on international data from large prevalence surveys. Most of these studies are rather descriptive, applying a comparative framework for researching inequalities in prevalence rates among adolescents coming from various countries (e.g., Currie et al., 2012; Hibell et al., 2012; Hublet et al., 2015; Kokkevi, Gabhainn, Spyropoulou, & Risk Behaviour Focus Group of the HBSC, 2006; Kokkevi, Richardson, Florescu, Kuzman, & Stergar, 2007). However, an empirical examination of the factors driving the inequalities in prevalence rates has been the subject of only a few recent studies. In this respect, the cross-national studies conducted by ter Bogt et al. (2006), Piontek et al. (2012), and ter Bogt et al. (2014) underscore the significance of the structural factors operating at both individual and societal levels (factors of individual’s gender, family affluence vs. societal wealth, and the availability of cannabis measured at the aggregate country level).

Similar to the cross-national studies, little research has been devoted to studying the sociogeographic factors of adolescent cannabis use operating at the regional, *in-country* levels. Most of the recent research aimed to test the significance of the factors suggested either by the abovementioned SDT theory (Bernburg, Thorlindsson, & Sigfusdottir, 2009; de Looze et al., 2015) or by the disadvantage hypotheses (Fite, Wynn, Lochman, & Wells, 2009; Ford & Beveridge, 2006; Pedersen & Bakken, 2016; Snedker, Herting, & Walton, 2009; Tucker et al., 2013). However, relatively few

of the studies applied the rigorous multilevel analytical framework, and moreover, the empirical results are inconsistent. Some of the studies prove the significance of the factors operating at the examined in-country levels (de Looze et al., 2015; Fite et al., 2009; Tucker et al., 2013), and some of the studies do not prove it (Ford & Beveridge, 2006; Pedersen & Bakken, 2016) or even provide counterfactual results pertaining to the suggested hypotheses (Snedker et al., 2009); for a recent review, see Karriker-Jaffe (2011). Furthermore, most of these studies were conducted in the United States and in Canada, with only a couple of studies focusing on adolescents in European countries (Bernburg et al., 2009; Pedersen & Bakken, 2016).

Studies on urban–rural inequalities in adolescent cannabis use are even rarer. Some studies were conducted in the United States (Cronk & Sarvela, 1997; Donnermeyer, 1992; Van Gundy, 2006), in the United Kingdom (Miller & Plant, 1999), and later in other European countries (Kážmér, Džúrová, Csémy, & Spilková, 2014; Licanin et al., 2002; Pitel, Madarasová Gecková, van Dijk, & Reijneveld, 2011; Schmid, 2001; Spilková, Pikhart, & Džúrová, 2015). The studies from the United States emphasized lowering urban–rural inequalities in adolescent cannabis use from the mid-1970s through the 1990s (Cronk & Sarvela, 1997; Donnermeyer, 1992), with possibly higher rates of illicit substance use among adolescents in rural areas in recent periods (Coomber et al., 2011; Lambert, Gale, & Hartley, 2008; Martino, Ellickson, & McCaffrey, 2008; Van Gundy, 2006). Contrary to the United States, studies from Central Europe (Czechia, Slovakia, Switzerland, and Bosnia and Herzegovina) have found a higher prevalence of cannabis use among adolescents in urban areas as compared to those from rural ones. Therefore, more empirical research on this topic is needed as well.

### Aims of the Paper

Given both the abovementioned limitations of the previous research and inconsistencies in the empirical results, this article addresses the relationship between the perceived availability and frequency of cannabis use in the specific Czech multilevel perspective. The emphasis on adolescents coming from Czechia is reinforced by the specific position of the country, characterized by a high level of both availability and cannabis use among youths.

The analysis of this article is divided into three steps. In the first step, the relationship between availability and frequent cannabis use is examined at the Czech national level, applying the time series data available from cross-sectional surveys conducted since 1995. In the second step, sociogeographic inequalities in both cannabis indicators are examined with respect to the Czech in-country (regional) levels. In the final step, this article scrutinizes the mutual relationship between the perceived availability and frequency of cannabis use at the individual level of the adolescent respondent.

In the analyses of sociogeographic inequalities, integrative multilevel modeling is applied. The multilevel models are adjusted for a set of lower level sociodemographic confounders (the effects of *age*, *gender*, and *type of school attended*), which were identified in number of the previous Czech studies (see Chomynová et al., 2014; Csémy, Chomynová, & Sadílek, 2009; Csémy, Lejčková, Sadílek, & Sovinová, 2006). In the multilevel analysis, we use the terms “environmental” and “regional” to refer to sociogeographic inequalities operating at the level of Czech localities. The sociogeographical dimension is represented here by two particular measures: (a) degree of urbanization as measured by the population size of locality and (b) locality unemployment rate, as the measure of locality socioeconomic disadvantage.

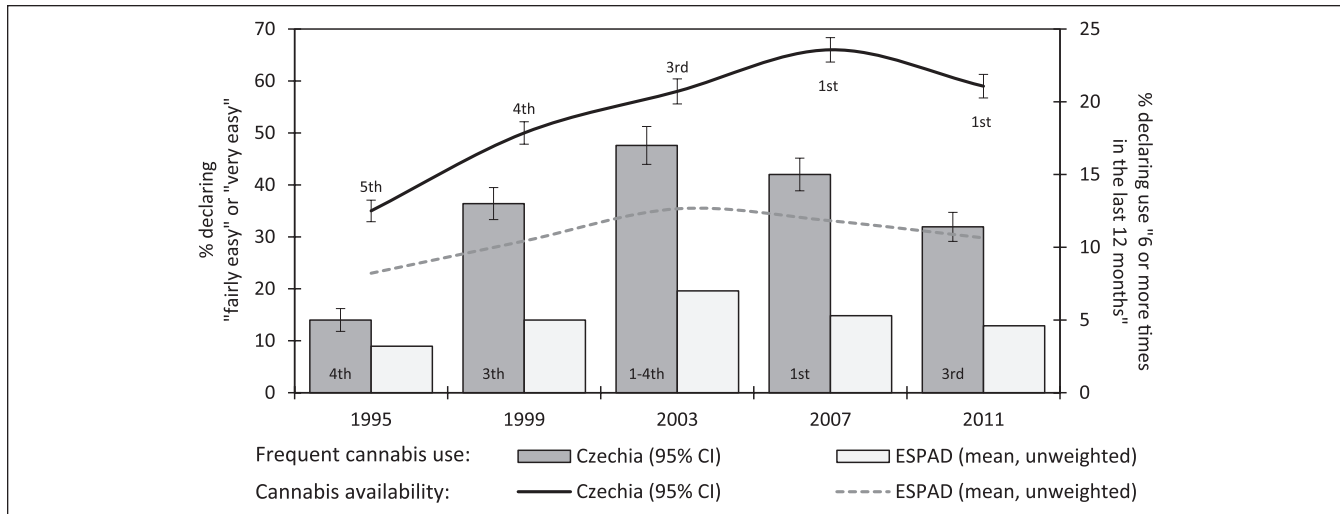
The results of multilevel models serve as a conceptual base to analyze the mutual relationship between the cannabis indicators at the individual level, conducted in the final part of the paper. As ordinary regression analysis cannot deal with reciprocal relationships between two or more dependent variables, we apply an approach based on simultaneous equations modeling (SEM). This makes it possible to estimate such a nonrecursive system of equations, provided that the identification problem is solved (Acock, 2013; Felson & Bohrnstedt, 1979). The results of the prior regression analyses are, therefore, presented and discussed in conjunction with the final SEM model.

## Data and Methods

### Sample and Design

In this article, individual respondent data on cannabis use indicators of the Czech school-aged population were analyzed. The data were obtained under the *European School Survey Project on Alcohol and Other Drugs* (ESPAD). As a main data source, the Czech cross-sectional dataset surveyed in 2011 was used. As an additional data source, a series of Czech national ESPAD reports published from 1995 to 2011 were applied too. The additional source was used for an introductory analysis of temporal changes of cannabis indicators among adolescent Czechs as compared to other European teenagers (1995–2011).

In Czechia, the National Monitoring Center for Drugs and Addiction, in collaboration with Prague Psychiatric Center, conducted the survey. Data collection took place in 113 localities (mean number of respondents per locality  $M = 71.4$ ,  $SD = 72.5$ ) and 364 schools of four different types (Chomynová et al., 2014). The following four school types are included: elementary schools (9th grade, 28.0% of students), secondary grammar schools (21.2% of students), secondary schools with leaving exams (28.1% of students), and vocational training schools (22.7% of students). Schools were randomly sampled according to the type of school and 14 administrative regions from the school register held by the Ministry of Education of the Czech Republic. The



**Figure 1.** Perceived cannabis availability (left axis) and prevalence of frequent cannabis use (right axis) among European adolescents, Czechia compared to other ESPAD countries, time series from 1995 to 2011.

Note. In labels, the Czech position among other ESPAD countries is presented. The number of countries participating in the ESPAD consortium was as follows:  $N_{1995} = 24$ ,  $N_{1999} = 30$ ,  $N_{2003} = 35$ ,  $N_{2007} = 34$ , and  $N_{2011} = 36$ . ESPAD = European School Survey Project on Alcohol and Other Drugs.

purpose of surveying was to ensure that data would be both nationally and regionally representative and thus would enable obtaining reliable estimates of substance use-related indicators of the Czech adolescent population.

In the analysis, a total sample of 8,069 Czech school-aged respondents (15.0-16.9 years) was used; only those with nonmissing data on both cannabis use and perceived cannabis availability were included. Regarding the introductory analysis of temporal changes of the cannabis indicators among Czech adolescents as compared to other European teenagers (1995-2011), we had to limit it to data provided by countries participating in each survey period of the ESPAD project (see note in Figure 1 for details).

### Ethical Considerations

The study was carried out as an anonymous questionnaire survey in school settings whereby student participation was voluntary. No ethical committee approval for the data collection was required; parental consent was not necessary as the age of the respondents was not below 15 years.

### Dependent Variables

In the analysis, two dependent variables were used: (a) subjectively perceived cannabis availability and (b) cannabis use in the last 12 months. These two variables were considered as mutually interconnected, one variable affecting the other and vice versa.

*Perceived cannabis availability* was questioned as follows: "How difficult do you think it would be for you to get marijuana or hashish (cannabis) if you wanted?" Answers varied between 1 = *impossible*, 2 = *very difficult*, 3 = *fairly*

*difficult*, 4 = *fairly easy*, 5 = *very easy*, and 6 = *Don't know*. Those reporting *fairly easy* or *very easy* were considered as cases reporting high levels of perceived availability. This coding was applied in Steps 1 and 2 of the statistical analysis. For construction of the simultaneous equations model in Step 3, an original ordinal scale between 1 and 5 was applied, ensuring that all of the information obtained in the data were used to estimate the parameters obtained by the simultaneous model.<sup>1</sup>

*Frequent cannabis use* was based on the question on cannabis use in the last 12 months: "On how many occasions (if any) have you used marijuana or hashish (cannabis) during the last 12 months?" with answers varying between "0 occasions," "1-2," "3-5," "6-9," "10-19," "20-39," and "40 or more." Students who reported cannabis use of 6 or more times during the last 12 months were coded as frequent cannabis users.<sup>2</sup> In Step 3 of the statistical analysis, the entire 7-point ordinal scale was applied to the simultaneous equations model, similarly to the previous case of perceived cannabis availability.

### Independent Variables

In the regression analysis, respondent's gender and age were used as conventional controlling variables. As the type of school attended by adolescent respondents was found to be strongly related to the prevalence of both licit and illicit substance use in all the previous Czech ESPAD surveys (Chomynová et al., 2014; Csémy et al., 2009; Csémy et al., 2006), the four different school types were included as controlling variables too.

To analyze sociogeographic inequalities in cannabis indicators, data on both population size of locality and locality



unemployment rate were obtained from the *2011 Population and Housing Census* of the Czech Republic and merged with the 2011 ESPAD dataset. In the analysis, the data were grand-mean centered. In the case of population size, the logarithmic transformation (common log) was applied, rather than the original values of the population size of locality.

Four independent variables (gender, age, type of school, and population size of locality—common log) were applied as instrumental variables in the SEM model, conducted in the last step of the analysis (Step 3). Two of them served for identification of perceived cannabis availability (population size of locality, age of respondent) and two for identification of cannabis use, respectively (gender and type of school attended). As the locality unemployment rate was found to be a nonsignificant predictor of neither of the two cannabis indicators, it was omitted from the SEM.

### Statistical Analysis

The analysis included three steps based on the spatial level of data aggregation: national, regional, and individual. In Steps 1 and 2, correlation and regression analyses were conducted in *Stata 15*; in Step 3, SEM was applied via *Stata's 15 Structural Equation Modeling Module* (StataCorp, 2017).

In Step 1, the introductory analysis of temporal changes of the two cannabis indicators from 1995 to 2011 was conducted, comparing Czech adolescents with other European countries. To show how the indicators relate to one another at the national level, the 1995-2011 time series of the Czech prevalence rates, and the Pearson correlation of the between-survey changes of the two cannabis indicators, was computed.

In Step 2, separate multilevel logistic regression models were constructed on the two binary indicators: high level of perceived cannabis availability (*fairly easy* or *very easy* = 1; *otherwise* = 0) and frequent cannabis use (*6 or more times* in the last 12 months = 1; *otherwise* = 0). There were three partial aims of the analysis in Step 2:

1. To identify sociogeographic inequalities in perceived cannabis availability and the prevalence of frequent cannabis use among Czech adolescents with respect to population size of the locality (*Models A1, A2, A3, and B1*).
2. To examine the effect of locality unemployment rate on both perceived cannabis availability and the prevalence of frequent cannabis use (*Models A1 and B3*).
3. To examine whether different levels of the perceived availability of the substance can explain the sociogeographic inequalities in frequent cannabis use (*Model B2*).

To control for intra-class correlation in response variables among students surveyed within the same school and/or

locality, the three-level data structure was applied in regression analyses<sup>3</sup>: *respondent* (Level 1) nested within *school* (Level 2) and *locality* (Level 3). The analysis was conducted by the *Stata's melogit* procedure.

At the individual level of the Czech adolescent respondent (Step 3), the relative effect of one dependent variable on another was examined (i.e., the effect of the perceived cannabis availability on the frequency of cannabis use as compared to the reverse direction). Here, the analysis was conducted via the nonrecursive system of SEM.

Identifying the nonrecursive SEM model was achieved through specifying five hypotheses and instrumental variables for the two dependent variables, as defined in the paragraph below. Four of the five hypotheses referred to results obtained in the previous regression analyses conducted in Step 2. To maintain the statistical efficiency in estimating the SEM regression coefficients, particularly those used to identify the two dependent variables via instrumental ones, a simple one-level SEM model was specified in Step 3, rather than a SEM with a complex multilevel structure. The validity of the one-level SEM builds upon the previous results obtained by multilevel regressions conducted in Step 2.<sup>4</sup> At the same time, as Pearson correlation coefficients between categorical variables can lead to biased parameter estimates in SEM models, polychoric (event polyserial) correlations between the input variables were calculated prior the SEM analysis, as suggested elsewhere (Browne, 1984; Kupek, 2006).

The following five hypotheses were simultaneously tested within the SEM model: Hypotheses 1 and 2 were considered as primary, while Hypotheses 3 through 5 were considered as secondary.

#### Primary hypotheses:

1. Although perceived cannabis availability and cannabis use are strongly interconnected, the effect of cannabis availability on its use should be more pronounced than the vice versa relation.
2. Living in localities with a larger population makes it easier to obtain the substance, which subsequently elevates the individual's frequency of cannabis use.

#### Secondary hypotheses:

3. Secondary school students from more educationally demanding schools use cannabis less frequently than those studying in less demanding (i.e., more practice-oriented) schools, which implicitly elevates the individual's perceived availability.
4. Boys, compared to girls, have a higher level of cannabis use, which implicitly elevates the perceived availability of the substance as well.
5. With an increase in age, the perceived cannabis availability increases too, which subsequently elevates the individual's frequency of cannabis use.

Hypotheses 2 through 5 identified the SEM model. As regards Hypothesis 3, schools were sorted by type following the relative study demands imposed on students. Elementary schools, however, had to be excluded from the SEM analysis.<sup>5</sup> This resulted in a smaller sample size in Step 3 ( $N = 5,806$ ).

The five SEM hypotheses were supplemented by additional assumptions regarding the covariance between the explanatory variables identified prior to the analysis: *population size of locality* (common log) with *type of school*, *gender* with *type of school*, *age* with *gender*.<sup>6</sup> As error terms are typically highly correlated in a nonrecursive SEM model, these were allowed to correlate freely as well (see  $e1$  vs.  $e2$  in Figure 3; for a methodological discussion, see, for example, Acock, 2013, pp. 72-73; Arbuckle, 2012, pp. 129-136). This correlation in error terms was set to account for any additional unobserved factors with an effect on both of the dependent variables not explicitly included in the analysis (i.e., other personal characteristics of the individual such as self-control over substance use, the specifics of his or her family background, and additional specific factors present in the given school and/or locality)<sup>7</sup>.

Apart from the correlation of error terms, the additional assumptions on covariance in explanatory variables are, however, descriptive in nature and do not affect the substantive results of the SEM analysis. These are only mentioned for the sake of completeness and to help the reader fully interpret the results of the covariance structure of the variables used in the SEM model.

## Statistical Results and Their Interpretation

### *Czechia as a Leading Country From the European Perspective*

In Figure 1, period-specific prevalence estimates, together with 95% confidence intervals of the two cannabis indicators from 1995 to 2011, are plotted. The specific position of Czech adolescents among other European youth is also depicted, by both the cross-national rank of the Czech respondents and the (unweighted) mean of prevalence estimates across all countries participating in the ESPAD project.

Although there are only a few period-specific measurements of the two cannabis indicators at the Czech national level, the parallel trends suggest a strong relationship between them. The high value of Pearson correlation of the between-survey changes of the indicators documents this suggestion as well:  $\text{Corr}[(\% \text{ Highly available}_w - \% \text{ Highly available}_{w-1}), (\% \text{ Frequent use}_w - \% \text{ Frequent use}_{w-1})] = 0.821$ ;  $w = 2, 3, 4, \text{ and } 5$ .

In the second step, a more detailed analysis of both perceived cannabis availability and frequent cannabis use was carried out at the Czech in-country level. Table 1 presents

descriptive statistics of the 2011 Czech national dataset and additionally the initial cross-tabulation of both cannabis indicators with independent variables.

Regarding the population size of locality, the level of cannabis availability continually increased from sparsely populated localities (60.5% within the category of <5,000 inhabitants) to the highest levels in the Capital City of Prague (73.0%; Table 1). The prevalence of frequent cannabis use was found to be higher only within the capital city (14.6%). The prevalence among adolescents from other localities with lower population size varied between 9.7% and 12%. With the locality unemployment rate, only minor differences in both cannabis indicators were observed. However, both cannabis indicators were significantly related to the sociodemographic variables (type of school, gender, and age), which could confound the initial results presented in Table 1.

A proper look at the significance of the sociogeographic factors provides results from multilevel models, which are discussed in the following Tables 2 and 3. Altogether, six consecutive multilevel logistic regressions were conducted: three for the perceived cannabis availability (Models  $A1$ ,  $A2$ , and  $A3$ ) and three for frequent cannabis use (Models  $B1$ ,  $B2$ , and  $B3$ ).

Table 2 summarizes the results of multilevel models conducted on *perceived availability*. The results indicate significant differences in availability at both the individual and regional (geographic) levels. Regarding the sociogeographic inequalities, the gradual increase in perceived availability with the population size of the locality (common log resp.; *Model A1*) was proved to be significant, even after adjustment for individual frequent cannabis use as a possible confounder (*Model A2* and *Model A3*).<sup>8</sup> Contrasted with the population size, locality unemployment rate was not significantly related to the perceived availability of cannabis (*Model A1*). According to the type of school attended, students from vocational training schools reported the highest level of perceived availability, which gradually decreased with study demands imposed on students attending other types of school, while among students of elementary schools, the level of perceived availability was seen to be the lowest. At the same time, while there were only 2-year variations in the age of student respondents, the level of perceived availability significantly increased with age as well (Models  $A1$  through  $A3$ ).

The strongest association of cannabis availability, nevertheless, was found with the frequent cannabis use itself (*Model A2*). In this regard, we point to the fact that gender differences in perceived availability were not significant after adjusting for frequent cannabis use (compare *Model A1* with *Model A2*, event *Model A3*). Similarly, adjusting for frequent cannabis use (Models  $A2$  and  $A3$ ), no significant differences were found between students from secondary schools with leaving exams as compared to vocational training schools. It is therefore probable that differences in perceived availability between these groups of students resulted

**Table 1.** Descriptive Statistics of the Czech 2011 Sample and Cross-Tabulation of Dependent Variables With Independent Predictors.

Independent variables	% within sample	Dependent variables	
		Cannabis availability (% fairly easy/very easy within category)	Frequent cannabis use (% 6 or more times within category)
Age (years)			
15-16	33.1	61.2	9.2
16-17	66.9	70.4	12.0
Gender			
Females	53.5	65.6	8.4
Males	46.5	69.3	14.2
Type of school			
Elementary	28.0	59.6	8.6
Secondary grammar	21.2	66.2	6.8
Secondary with leaving exam	28.1	70.1	10.9
Vocational training	22.7	74.4	18.4
Population size of locality <sup>a</sup>			
<5.000	2.9	60.5	12.0
5.000-9.999	11.6	63.3	10.7
10.000-19.999	22.7	65.2	9.7
20.000-49.999	29.2	67.3	11.1
50.000-99.999	6.1	69.5	11.1
Regional centers	19.1	70.3	11.3
Capital city of Prague	8.3	73.0	14.6
Locality unemployment rate <sup>b</sup> , in %			
5.5-10.4	60.0	66.9	11.7
10.4-18.0	40.0	68.0	10.1
Total (N = 8,069)	100.0	67.3	11.1

Note. Difference in the level of cannabis availability presented here as compared to that of the period plotted for 2011 in Figure 1 was due to (a) different age of the population exposed (in Figure 1, birth-cohort 1995 only) and (b) different handling of the “Don’t know” responses (for a discussion, see also Note 1).

<sup>a</sup>M (SD) population size across 113 localities:  $M = 42 \times 10^3$  ( $SD = 127 \times 10^3$ ).

<sup>b</sup>M (SD) unemployment rate across 113 localities:  $M = 10.4$  ( $SD = 2.6\%$ ).

rather from the different rates of cannabis use as opposed to differences in availability as such. These preliminary results on the structure of the relationship between variables are examined by the SEM approach in the next section (Step 3 of data analysis).

The multilevel logistic regression approach was analogically applied for *frequent cannabis use* (Table 3). Yet, results of the analysis were slightly different than those described above in Table 2. Most of the sociogeographic inequalities in frequent cannabis use in *Model B1* (Capital City of Prague vs. other localities) were explained after adjustment for perceived availability of the substance (*Model B2*). Nonetheless, the strong association between frequent use and perceived availability persisted (odds ratios [ORs] > 10 in *Model B2*, as well as in *Model A2* in Table 2). As presented by *Model B3*, locality unemployment rate was unrelated to the prevalence of frequent cannabis use after adjusting for sociodemographic confounders.

The results in Table 3 also show that differences in frequent cannabis use between genders and different types of school remained significant in all three multilevel models.

This is congruent with previous findings in Table 2 that different levels of perceived availability between boys and girls on one hand and different types of schools on the other hand were primarily related to different levels of cannabis use. Regarding the effect of age on adolescent frequent cannabis use, no significant effect was found among 15- to 16-year-old respondents, as opposed to the previous analysis in Table 2. Again, these preliminary results on the probable structure of relationships between variables are examined by the SEM approach in the next section.

Furthermore, Figure 2 summarizes sociogeographic inequalities for both perceived cannabis availability and frequent cannabis use with respect to the population size of localities, which was found to be significantly related to the analyzed cannabis indicators. The data represent marginal percentages (with 95% confidence intervals) as predicted by multilevel logistic models, adjusted for adolescent age, gender, and type of school attended. This comprehensive overview addresses the significance of the sociogeographical differentiation of the cannabis indicators, from sparsely populated localities to more densely populated areas.<sup>9</sup>

**Table 2.** Multilevel Binary Logistic Regression.

Dependent—perceived availability	Model A1			Model A2			Model A3 (nonusers only)		
	Exp (B)	95% CI	Sig.	Exp (B)	95% CI	Sig.	Exp (B)	95% CI	Sig.
Fixed effects									
Intercept	2.69***	[2.346, 3.086]	<.001	2.16***	[1.885, 2.480]	<.001	1.71***	[1.462, 1.997]	<.001
Gender									
Male	1.16**	[1.053, 1.284]	.003	1.09	[0.985, 1.204]	.095	1.06	[0.952, 1.194]	.268
Female	Ref.			Ref.			Ref.		
Age (Z-score, 1 SD increase)	1.10**	[1.027, 1.174]	.006	1.21**	[1.053, 1.394]	.007	1.08*	[1.003, 1.166]	.042
Type of school									
Elementary	0.59***	[0.491, 0.715]	<.001	0.67***	[0.553, 0.806]	<.001	0.67***	[0.538, 0.827]	<.001
Secondary grammar	0.68***	[0.573, 0.801]	<.001	0.78**	[0.664, 0.926]	.004	0.81*	[0.665, 0.976]	.028
Secondary with leaving exam	0.80**	[0.687, 0.943]	.007	0.88	[0.752, 1.031]	.114	0.88	[0.732, 1.053]	.160
Vocational training	Ref.			Ref.			Ref.		
Population size of locality, mean-centered (common log, increase by 1) <sup>a</sup>	1.21**	[1.087, 1.350]	.001	1.18**	[1.064, 1.313]	.002	1.13*	[1.019, 1.260]	.022
Locality unemployment rate, mean-centered (increase by 1%)	1.02	[0.999, 1.048]	.063	—	—	—	—	—	—
Frequent cannabis use									
Yes	—	—	—	10.38***	[7.600, 14.185]	<.001	—	—	—
No	—	—	—	Ref.			—	—	—
Random effects	Variance <sup>b</sup> (SE)	95% CI		Variance <sup>b</sup> (SE)	95% CI		Variance <sup>c</sup> (SE)	95% CI	
Random intercept									
Level 3—Locality	0.014 (0.017)	[0.001, 0.153]		0.007 (0.019)	[0.000, 1.409]		0.008 (0.018)	[0.000, 0.700]	
Level 2—School	0.062 (0.024)	[0.029, 0.134]		0.054 (0.026)	[0.021, 0.138]		0.054 (0.026)	[0.021, 0.138]	
Sample size	N = 8,069			N = 8,069			N = 5,548		

Note. Dependent variable—perceived cannabis availability (*fairly easy* or *very easy* = 1; *otherwise* = 0), Czechia, 2011. Ref.—reference group.

<sup>a</sup>The increase in common logarithm (log 10) of the population size of locality by 1 corresponds to comparing two localities, whose population size ratio equals 10 (e.g., 1,000 vs. 100; 10,000 vs. 1,000, etc.)

<sup>b</sup>Random intercept variance of the baseline model corresponding to Models A1 and A2 (three-level logit adjusted to *age* and *gender* only): Var[Level 2] = 0.083; Var[Level 3] = 0.024. Likelihood-ratio test versus one-level logistic model:  $\chi^2(df) = 39.9(2)$ ;  $p < .001$ .

<sup>c</sup>Random intercept variance of the baseline model corresponding to Model A3 (three-level logit adjusted to *age* and *gender* only): Var[Level 2] = 0.064; Var[Level 3] = 0.019. Likelihood-ratio test versus one-level logistic model:  $\chi^2(df) = 22.9(2)$ ;  $p < .001$ . In Model A3, only respondents with no cannabis use in the last 12 months were included.

\* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

### Perceived Cannabis Availability and Cannabis Use at the Individual Level

To estimate the mutual relative effect of perceived availability on the frequency of cannabis use at the individual level (Level 1), the SEM approach was applied in the third step. Table 4 presents polychoric (event polyserial) correlations between input variables as applied in the SEM analysis. Figure 3 presents the structure of the model itself. Unstandardized regression coefficients obtained by the SEM model, as well as identification diagnostics and model fit statistics, are available in Table 5; standardized regression weights are available in Figure 3. All regression weights are significant at  $p < .05$  with a considerably good model fit,  $\chi^2(5) = 5.753$ ,  $p = .331$ ; root mean square average (RMSA) = 0.005, and stable

parameter estimation process (stability index of 0.427 well between  $-1$  and  $+1$ ). Identification diagnostics support conditions for both exogeneity (overidentification tests are not significant) and strength of instrumental variables ( $F$ -statistics of weak identification tests well above 10).

According to the SEM model, there is significant mutual relationship between perceived cannabis availability and its use: higher perceived availability leads to higher levels of cannabis use, which in turn elevates the perceived availability. Nevertheless, the relative effect of cannabis availability on cannabis use, as estimated by standardized regression weights, is significantly higher than the effect of cannabis use on perceived availability when reversed,  $0.90 > 0.48$  in Figure 3; test of equality of standardized regression weights:  $\chi^2(df) = 4.20(1)$ , two-tailed  $p$  value = .040.



**Table 3.** Multilevel Binary Logistic Regression.

Dependent—frequent cannabis use	Model B1			Model B2			Model B3		
	Exp(B)	95% CI	Sig.	Exp(B)	95% CI	Sig.	Exp(B)	95% CI	Sig.
Intercept	0.16***	[0.128, 1.188]	<.001	0.02***	[0.014, 0.028]	<.001	0.14***	[0.117, 0.179]	<.001
Gender									
Male	1.67***	[1.433, 1.952]	<.001	1.63***	[1.392, 1.904]	<.001	1.70***	[1.456, 1.989]	<.001
Female	Ref.			Ref.			Ref.		
Age (Z-score, 1 SD increase)	1.03	[0.930, 1.141]	.570	1.01	[0.913, 1.124]	.807	1.02	[0.925, 1.137]	.633
Type of school									
Elementary	0.44***	[0.324, 0.586]	<.001	0.51***	[0.378, 0.679]	<.001	0.44***	[0.325, 0.584]	<.001
Secondary grammar	0.34***	[0.260, 0.452]	<.001	0.37***	[0.280, 0.484]	<.001	0.33***	[0.255, 0.440]	<.001
Secondary with leaving exam	0.58***	[0.460, 0.730]	<.001	0.60***	[0.475, 0.749]	<.001	0.58***	[0.462, 0.726]	<.001
Vocational training	Ref.			Ref.			Ref.		
Population size of locality									
Capital City of Prague	1.47*	[1.078, 1.995]	.015	1.35	[0.995, 1.820]	.054	—	—	—
Otherwise	Ref.			Ref.			—	—	—
Perceived cannabis availability									
Fairly easy or Very easy	—	—	—	10.30***	[7.539, 14.083]	<.001	—	—	—
Otherwise	—	—	—	Ref.			—	—	—
Locality unemployment rate, mean-centered (increase by 1%)	—	—	—	—	—	—	0.97	[0.928, 1.016]	.203
Random effects	Variance <sup>a</sup> (std. error)	95% CI		Variance <sup>a</sup> (std. error)	95% CI		Variance <sup>b</sup> (std. error)	95% CI	
Random intercept									
Level 3—Locality							0.103 (0.046)	[0.430, 0.246]	
Level 2—School	0.293 (0.063)	[0.192, 0.447]		0.246 (0.061)	[0.151, 0.401]		0.197 (0.062)	[0.107, 0.364]	
Sample size		N = 8,069			N = 8,069			N = 8,069	

Note. Dependent variable frequent cannabis use (Yes = 1; No = 0), Czechia, 2011; Ref.—reference group; Models B1 and B2 are two-level only. <sup>a</sup>Random intercept variance of the baseline model corresponding to Models B1 and B2 (two-level logit adjusted to age and gender only): Var[Level 2] = 0.464. Likelihood-ratio test versus simple logistic model:  $\chi^2(df) = 88.9(1); p < .001$ . <sup>b</sup>Random intercept variance of the baseline model corresponding to Model B3 (three-level logit adjusted to age and gender only): Var[Level 2] = 0.368; Var[Level 3] = 0.095. Likelihood-ratio test versus simple logistic model:  $\chi^2(df) = 95.1(2); p < .001$ . \* $p < .05$ . \*\* $p < .01$ . \*\*\* $p < .001$ .

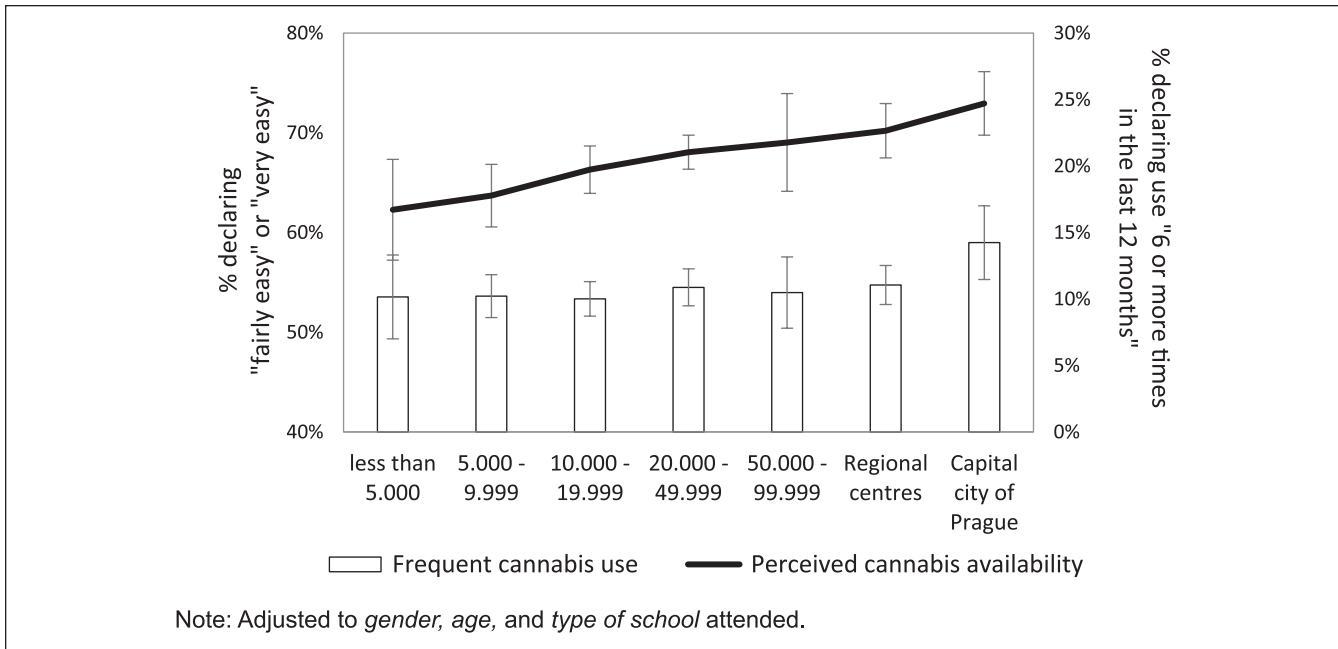
The level of perceived cannabis availability is predicted by both the population size of the locality (common log) and the age of the respondent. Students in large Czech cities report higher levels of perceived availability of the substance. The higher the age of the adolescent, the higher the perceived availability as well. The SEM model also supports the hypotheses on cannabis availability as a mediator of the effect of both locality population size and age of respondent on the level of adolescent cannabis use (Table 5 and Figure 3).

The level of adolescent cannabis use is predicted by gender and type of school attended. In comparison to boys, girls have lower level of cannabis use. Adolescents from schools with higher relative study demands consume cannabis less often compared to those with lower study demands. The mediation of differences in cannabis availability among genders on one hand and among different types of school on the other hand by different levels of cannabis use is also supported by the SEM model (Table 5 and Figure 3).

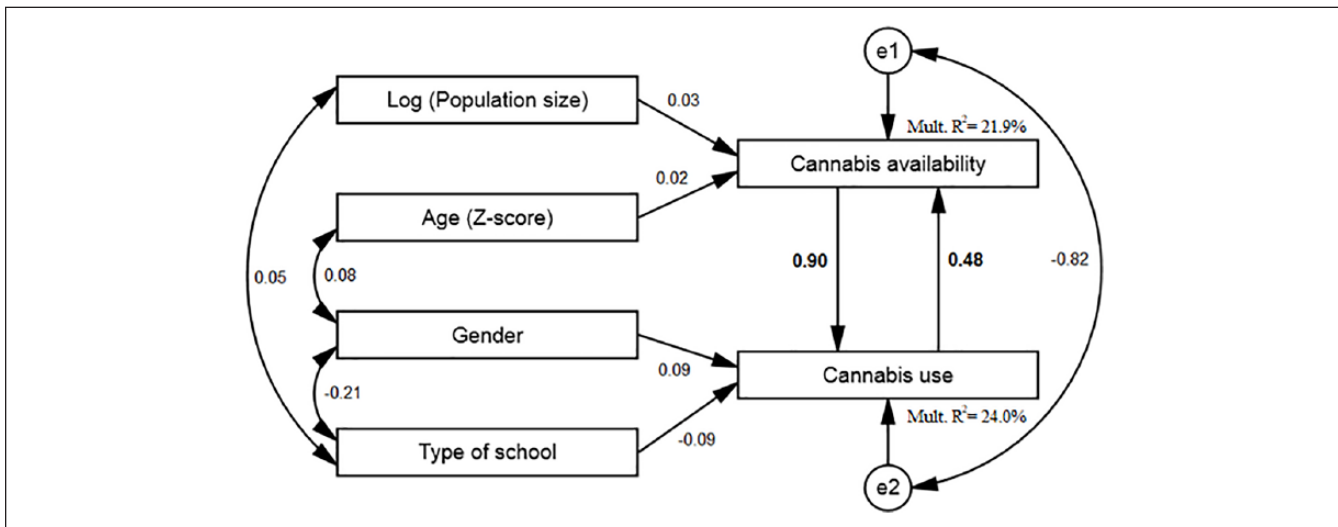
## Discussion

In general, our analyses have emphasized the importance of the specific focus on substance availability as a mediating factor between characteristics of the environment and the level of adolescent substance use. This was achieved by an analysis of the effect of a subjectively assessed level of cannabis availability on the frequency of cannabis use carried out with an integrative multilevel perspective.

Regarding the analysis carried out at the Czech national level, the changes in aggregate rates of both perceived cannabis availability and frequent cannabis use were strongly correlated (Pearson  $r = 0.821$ ). Although the association between the indicators is rather well-documented in the research literature (e.g., Bjarnason et al., 2010; Freisthler, Gruenewald, Johnson, Treno, & Lascala, 2005; Hibell & Andersson, 2008; Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2016; Piontek et al., 2012; Smart, 1977; ter



**Figure 2.** Perceived cannabis availability (left axis) and frequent cannabis use (right axis) by population size of locality, marginal percentages, 95% CI, and Czechia, 2011 (N = 8,069).



**Figure 3.** Standardized regression weights between perceived cannabis availability and cannabis use as outputs of the SEM analysis, Czechia, 2011 (N = 5,806).

Note. Cannabis perceived availability and Cannabis use—sorted ascending; age and population size of locality (log 10)—sorted ascending; gender (females = 0, males = 1); type of school—sorted ascending by relative study demands (i.e., vocational training schools—lowest, secondary grammar schools—highest); all parameter estimates are significant at  $p < .05$  (see also Table 5). SEM = simultaneous equations modeling.

Bogt et al., 2006), we conducted the analysis to examine the results from the national perspective with those obtained at lower levels of spatial aggregation and examined with a specific sociogeographic focus on the particular country, an aspect which is rather understudied.

In Czechia, issues of substance availability are especially important for the future health of the young generation. As presented in the introductory analysis (Figure 1), levels of

both perceived cannabis availability and frequent cannabis use have been increasing continuously since the establishment of the Czech Republic in the early 1990s. Since the mid-2000s, Czech adolescents have even reported the highest levels of perceived availability in Europe and they also have one of the highest prevalence of frequent cannabis use.

Thus, Figure 1 suggests that the issues of cannabis availability and its use among adolescents is particularly relevant

**Table 4.** Polychoric/Polyserial Correlations Between SEM Input Variables, Czechia, 2011 ( $N = 5,806$ ).

Variable	1	2 <sup>a</sup>	3	4	5	6 <sup>a</sup>
1 Type of school	1	−0.018	−0.214	−0.192	−0.089	0.052
2 Age (Z-score) <sup>a</sup>	−0.018	1	0.082	0.039	0.035	0.012
3 Gender	−0.214	0.082	1	0.188	0.091	−0.021
4 Cannabis use	−0.192	0.039	0.188	1	0.467	0.040
5 Cannabis perceived availability	−0.089	0.035	0.091	0.467	1	0.051
6 Population size of locality (log 10) <sup>a</sup>	0.052	0.012	−0.021	0.040	0.051	1
SD	0.780	1.000	0.498	1.529	1.153	0.643

Note. Cannabis perceived availability and cannabis use—sorted ascending; age and population size of locality (log 10)—sorted ascending; gender (females = 0, males = 1); type of school—sorted ascending by relative study demands (i.e., vocational training schools—lowest, secondary grammar schools—highest). SEM = simultaneous equations modeling.

<sup>a</sup>Polyserial correlations.

**Table 5.** Simultaneous equations modeling (SEM)—maximum likelihood estimates, Czechia, 2011 ( $N = 5,806$ ).

Dependent variables—(a) cannabis perceived availability and (2) cannabis use		Estimate	SE	Sig.
Regression weights (unstandardized)				
Cannabis perceived availability	→ Cannabis use	1.19	0.270	<.001
Cannabis use	→ Cannabis perceived availability	0.36	0.036	<.001
Population size of locality (log 10)	→ Cannabis perceived availability	0.06	0.020	.003
Age (Z-score)	→ Cannabis perceived availability	0.02	0.009	.050
Gender	→ Cannabis use	0.27	0.055	<.001
Type of school	→ Cannabis use	−0.18	0.036	<.001
Population size of locality (log 10)	→ Cannabis use	Constrained to 0	—	—
Age (Z-score)	→ Cannabis use	Constrained to 0	—	—
Gender	→ Cannabis perceived availability	Constrained to 0	—	—
Type of school	→ Cannabis perceived availability	Constrained to 0	—	—
Covariance				
e1	↔ e2	−1.25	0.283	<.001
Population size of locality (log 10)	↔ Type of school	0.02	0.006	<.001
Age (Z-score)	↔ Gender	0.04	0.006	<.001
Gender	↔ Type of school	−0.08	0.005	<.001
Identification diagnostics				
Instrumented variable		(a) Cannabis perceived availability	(b) Cannabis use	
Sargan overidentification test: $\chi^2(df)$ ; $p$ value		0.013(1); $p = .909$	0.017(1); $p = .896$	
Weak identification test: $F(df_1, df_2)$ ; $p$ value		11.53(2, 5,801); $p < .001$	184.37(2, 5,801); $p < .001$	
Stability index			0.427	
Model fit statistics				
$\chi^2(df)$ ; $p$ value			5.753(5); $p = .331$	
RMSA (90% confidence interval); $p$ close			0.005 (0.000–0.019); 1.000	
Comparative fit index			1.000	
Consistent AIC: default/saturated model			160.4/203.0	
BIC: default/saturated model			144.4/182.0	
Bentler–Raykov squared multiple correlation		(a) Cannabis perceived availability	(b) Cannabis use	
		0.219	0.240	

Note. Identification diagnostics computed on individual data through an application of the Stata's *ivreg2* procedure (Baum et al., 2010). SEM = simultaneous equations modeling; AIC = Akaike information criterion; BIC = Bayesian information criterion; RMSA = root mean square average.

to the national drug policy. This can be attributed to the specific sociocultural environment of the Czech Republic, which is characterized by a high level of tolerance toward substance use (Csémy et al., 2012). With reference to the

concepts proposed by both RAT (Cohen & Felson, 1979) and RATGD (Osgood et al., 1996), the sociocultural specifics can also be viewed in conjunction with the structural changes in the social and economic organization of Czech society that

took place during the transitional periods of 1990s and early 2000s. The cultural specifics can reinforce the effects of structural changes and contribute to an increase in both the opportunities and prevalence of substance use among adolescents.

Although there has been a considerable decrease in the analyzed cannabis indicators in recent years (Figure 1; Kázmér et al., 2017), the relative position of Czechia among other ESPAD countries did not significantly change. Nevertheless, from a critical research perspective, one could also question whether the recent decline in perceived cannabis availability (2011 vs. 2007, Figure 1) reflected a real decrease in the availability of the substance or whether the rate from 2011 was instead confounded by a relatively lower level of cannabis use among adolescent respondents surveyed during that period. If the latter is true, what is the effect of one variable on another? And how should public health professionals interpret such results? We focused on such questions in the last step of the analysis (the SEM model).

Regarding the Czech regional level, the perception of cannabis availability was significantly related to the population size of the locality. Similarly, Czech adolescents from the capital city (i.e., those from the most urbanized areas) were at a higher risk of frequent cannabis use than those who came from sparsely populated localities. At the same time, the higher level of perceived availability was found to mediate sociogeographic inequalities in cannabis use.

The link between a locality's degree of urbanization and higher availability of drugs resulting in a higher prevalence of adolescent substance use in these areas can be explained by social-interactive and institutional mechanisms (Sampson et al., 2002) differentiated between urban and rural spaces. The effects of lowering informal social control on adolescent behavior (Sampson & Groves, 1989), combined with higher anonymity and possibly stronger influence of city peer culture (Donnermeyer, 1992; Wilson & Donnermeyer, 2006), can lead to increasing opportunities for both the prosocial and deviant behavior of adolescents living in these areas. We apply this explanation to the Czech regional contexts, particularly on adolescents living in the Capital City of Prague.

Regarding the relationship between urbanization and the prevalence of adolescent risk behavior, however, it should be noted that although drug use is often seen especially as an urban problem (Cronk & Sarvela, 1997), the empirical research evidence on urban-rural differences in adolescent cannabis use in the last decades suggests that this is a rather more complex issue.

In the United States, the differences in cannabis use between urban and rural adolescents began diminishing during the 1980s, becoming nonsignificant in the 1990s (Cronk & Sarvela, 1997; Donnermeyer, 1992; Van Gundy, 2006). Similar results were obtained in the United Kingdom (Miller & Plant, 1999). Evidence from Central European countries,

however, shows significant differences between urban and rural adolescents. Some previous studies on risk behavior among Czech adolescents found that cannabis use was higher in the Capital City of Prague; that is, in the most urbanized areas of the country (Kázmér et al., 2014; Spilková et al., 2015). In Slovakia, Pitel et al. (2011) also showed that the prevalence of adolescent substance use including cannabis was higher in highly urbanized areas, particularly among girls. Similar conclusions were found also in studies in Bosnia and Herzegovina (Licanin et al., 2002) and in Switzerland (Schmid, 2001). It thus seems that urban-rural differences in adolescent cannabis use are more pronounced in the context of Central European populations. At the same time, it can be expected that these differences will diminish in the future, following the example set by other Western societies (the United Kingdom and the United States).

Contrary to the population size of a locality, the environmental disadvantage, as measured by the locality's unemployment rate, was unrelated to either perceived availability or adolescent frequent cannabis use, after adjusting for sociodemographic confounders. Previous studies examining the effects of spatially concentrated disadvantages on adolescent cannabis use yield conflicting empirical results (Karriker-Jaffe, 2011; Snedker et al., 2009; Tucker et al., 2013). The recent review, which was conducted only on rigorous multilevel studies (Karriker-Jaffe, 2011), hypothesized that these findings might indicate that factors of spatially concentrated disadvantage might have a differentiated effect on adolescent cannabis use as contrasted to adult substance use. This might be in terms of both (a) the different populations exposed (adolescents vs. adults) and (b) the type of psychoactive substance used (e.g., cannabis vs. alcohol). Either way, results of our study did not support the significance of the spatially concentrated disadvantage on cannabis use among the Czech adolescent population and thus expand the mixed literature on this topic.

Apart from sociogeographic inequalities, other important risk factors can be attributed to the individual-level, sociodemographic characteristics of Czech adolescents. Type of school attended and gender were strong predictors of frequent cannabis use. These factors were the subject of several previous Czech studies (Chomynová et al., 2014; Csémy et al., 2009; Csémy et al., 2006; Kázmér et al., 2014).

The gender inequalities in adolescent cannabis consumption are arguably related to differentiated attitudes toward health-related behaviors. Although in Czechia in recent times, the prevalence of the adolescent experimental use of cannabis between genders has gradually converged (Kázmér et al., 2017), in the case of *frequent* (and possibly risky) cannabis use, the gender-specific attitudes probably still play an important role (Dahl & Sandberg, 2015; Warner et al., 1999). Similar gender-specific patterns in the frequent cannabis use among adolescents were documented in other studies as well (in Slovakia by Pitel et al., 2013; in the United States by Chen, Martins, Strain, Mojtabei, & Storr, 2018; Johnson



et al., 2015; among European adolescents by ter Bogt et al., 2014).

Regarding the perceived availability, our analysis showed that the higher levels among boys were mediated by higher rates of frequent use of the substance. Hence, it is plausible that among boys, higher perceived availability was rather resulting from more frequent socializing among other cannabis-using peers (Chen et al., 2018; Dahl & Sandberg, 2015; Kázmér, 2018). The higher perceived availability, in turn, provides more opportunities for active cannabis consumption and can contribute to higher rates of frequent use among boys as well (the reciprocal relationship as presented by the SEM model).

Along with gender, school attendance is an important factor to adolescent health behavior. On one hand, in Czech society, the type of school attended may serve as a proxy of the socioeconomic status of the teenager's family. Private schools and excellent grammar schools bring a certain prestige to the student, while vocational training schools may relate to certain disadvantages and a lower socioeconomic status. On the other hand, there is also considerable evidence that adolescent cannabis use is associated with low educational attainment and even school dropout (Dewey, 1999; Fergusson, Horwood, & Beautrais, 2003). Research evidence from longitudinal studies suggests that both socioeconomic background and cognitive impairment caused by an early and frequent onset of cannabis use contribute to differences in cannabis use reported by young adults at different educational levels (Fergusson et al., 2003; Lynskey & Hall, 2000; McCaffrey, Pacula, Han, & Ellickson, 2010; Silins et al., 2014). Although it is still not well known whether frequent cannabis use is a cause or a consequence of poor schooling outcomes—or whether both outcomes instead reflect common risk factors—our results are congruent with findings that an early inclination to cannabis is higher in students with lower educational aspirations.

At the same time, and similarly to the case of gender, the higher levels of perceived cannabis availability among adolescents from educationally less demanding schools were found to be mediated by higher rates of frequent cannabis use. Thus, the higher availability among these students was found to be fairly implicit and probably result from more frequent contacts with other cannabis-using peer groups as well.

Regarding the effect of age, the results of analyses showed that although there was only a 2-year variation in age of respondents (15.0-16.9), the level of perceived availability was significantly correlated to this age difference. This is in line with the growing importance of peer effects during adolescence, as young people spend more time in new and broader social contexts (Tucker et al., 2013). However, this does not necessarily mean that during the 2 years, the prevalence of frequent cannabis consumption increases rapidly. It rather points to the significance of intensifying socializing with peers and/or other individuals close to an adolescent,

which may, implicitly, increase opportunities for substance use and deviance.

Our results from the advanced SEM approach provided new insights into the relationship between the cannabis indicators at the individual level as well (Tables 4 and 5, Figure 3). In research, the nonrecursive SEM analysis is typically used to estimate the direct effect of one dependent variable on another in the situations, when a reverse relationship between two or more variables is assumed (e.g., in econometrics, when estimating the effect of demand on supply and vice versa). As opposed to the longitudinal data analysis, the SEM approach is particularly suitable for an analysis of cross-sectional data (i.e., when information on the temporal ordering of the variables is unavailable; Felson & Bohrnstedt, 1979). The applicability of the SEM analysis, however, presumes that the identification problem of such an SEM model is solved.

The identification of the SEM can be achieved by using an appropriate instrumental variable(s) for the two dependent variables. To obtain an unbiased estimate of the direct effect of the first dependent variable, controlled for the reverse effect of the second one, the instrumental variable *must not be directly* correlated with the second dependent variable included in the SEM model (Berry, 1984). In the case of our SEM analysis, the specification of hypotheses and the identification of dependent variables via instrumental variables referred to preliminary results obtained in the prior multilevel regression models.

Although the “true value” of substance availability within the given environment is rather unobserved (latent), the subjective assessment of the phenomena is considered to be a valid indicator of this latent construct (Einstein, 1981; Johnston et al., 2016; Piontek et al., 2012; Smart, 1977, 1980; ter Bogt et al., 2014; ter Bogt et al., 2006). This consideration was also reinforced by our SEM analysis, showing that the effect of perceived cannabis availability on the individual frequency of cannabis use was found to be significantly higher than the effect of cannabis use on perceived availability in the reverse direction (standardized regression weights: 0.90 vs. 0.48). In terms of our SEM model, higher availability leads to higher levels of cannabis use, while cannabis use, in turn, elevates perceived subjective availability (i.e., adolescents who frequently use cannabis probably have more knowledge of how and where to obtain the substance than those who do not frequently use it). In our model, perceived availability was predicted by population size (as a proxy for rather “distal” environmental factors) and the age of adolescents, whereas cannabis use was related more to gender and the type of school attended (i.e., rather individual-level “proximal” factors). As far as the authors know, this is the first study that attempts to estimate the relative effect of perceived substance availability on adolescent substance use and compare it in the opposite direction. In a similar vein, although differences in cannabis use between the genders and various types of school attended are well

documented in the research literature, the mediation of the link between perceived availability and these (sociodemographic) factors via active consumption of the substance is rather new.

## Strengths and Limitations

For the study, data from a large international survey with unified methodology were used, which had been validated several times in the past. At the same time, an integrative multilevel perspective on the phenomena from a country-specific context was employed. The multilevel analysis was facilitated by detailed, spatially referenced data with a representative share of all administrative regions of the country. However, the most significant limitations that should be mentioned include the following: (a) the data were self-reported which can result in certain response bias related to memory and/or social desirability factors and (b) the survey was school-targeted, and possible selection bias resulting from school absenteeism should be also taken into account. Regarding the sociogeographic factors analyzed in the study, future research should focus on a wider range of variables, including both objective and subjective measures of the localities' social and economic environment. At the same time, a longitudinal study design could help revalidate empirical results on the mutual relationship between the cannabis indicators obtained from the cross-sectional SEM model. Similar studies on adolescents coming from other European countries would be beneficial as well.

## Conclusion

Over the long term, Czech adolescents report both the highest rates of perceived cannabis availability and frequent cannabis use in Europe. The significant effects of higher perceived availability on the frequency of cannabis use were found at the national, regional, and individual levels. In Czechia, significant sociogeographic inequalities in both perceived availability and frequent cannabis use were identified. Controlling for sociodemographic confounders, the level of perceived availability increased with population size of locality (i.e., degree of urbanization). Similarly, the highest prevalence of frequent cannabis use was found among adolescents from the Capital City of Prague. Higher levels of perceived availability mediated sociogeographic inequalities in adolescent cannabis use. At the individual level, perceived availability was found to be a more pronounced factor for cannabis use than the effect of cannabis use on its perceived availability in the opposite direction. Thus, if a high availability leads to higher levels of adolescent cannabis consumption, then creating both socially and spatially targeted interventions could, alongside other preventive measures, help reduce health-related risks associated with the early substance misuse, especially among adolescents coming from the most urbanized areas of the country (Capital City of Prague).

## Declaration of Conflicting Interests [GQ: 2]

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## Notes

1. Respondents answering “Don’t know” (12.3% of the sample) were randomly redistributed among other levels with probabilities following the same statistical distribution as that of data initially evaluated with Levels 1 to 5 only. Hence, the statistical results of analyses congruent with the “Missing Completely at Random (MCAR)” approach are presented in this article.

Another approach might assume that those answering “Don’t know” considered cannabis rather as “neither easy nor difficult” to obtain; thus, restructuring of the ordinal sequence of responses on perceived availability with the “Neither/nor” option located between “Fairly easy” and “Fairly difficult” is also possible. We would like to emphasize that both approaches were considered within the statistical analysis and yield equivalent results in all models conducted in Steps 2 and 3. However, to preserve the presentational clarity of rather complex statistical outputs, in this article, we limit this to those obtained through the first approach.

2. In the research literature, there are several definitions of frequent cannabis use among adolescents, and none have gained a standardized merit. The cutoff score of “6 or more times” in the last 12 months is in line with the recent Czech study by Kázmér et al. (2014). An analogous measure (5 or more times in the past year) was used in the study by Caldeira et al. (2008) to select adolescents considered to be “at-risk” of having cannabis use disorders and other cannabis-related problems. The longitudinal study by Perkonig et al. (2008) also demonstrated the significance of the measure as a predictor of regular use of cannabis from adolescence into young adulthood. In a similar vein, the EMCDDA (2008) states that in researching adolescent cannabis use, last year’s prevalence is a more appropriate measure for frequent (and potentially risky) cannabis use compared to the prevalence in last month, as among adolescent respondents aged 15-16 years, last month’s prevalence can be identical with the first cannabis experience of one’s lifetime (Hibell & Andersson, 2008). Nevertheless, we would like to state that within our study, sensitivity analysis on the results of the sociogeographic inequalities in cannabis use with the different coding scheme of “frequent use” was conducted as well (more specifically, the coding schemes of “at least once in the last 12 months,” “3 or more times in the last 12 months”—as well as “10 or more times” and “20 or more times” in the last 12 months—were applied to examine the possible sensitivity). However, the sensitivity analysis yielded results that were analogous to those presented in this article. Hence, statistical results on the sociogeographic inequalities in the prevalence of frequent cannabis use, as presented in Step 2, were found not to be a matter of the coding scheme.
3. In the case of cannabis use in Models *B1* and *B2*, only two-level data structure was applied (see Table 3). This was due to

- the fact that a higher prevalence of frequent cannabis use was identified only within the largest city of the Czech Republic: the Capital City of Prague. To preserve the statistical significance of parameter estimates identified within the regression analysis, a more parsimonious two-level approach was applied here (*students* nested within *schools*), that is, controlling for the specific school context only. To advocate this approach, we note that the explicit interest in “the effect of the capital city” on the prevalence of adolescent cannabis use results in an unnecessary need to control for the “Prague-specific context,” as this context alone is the subject tested by the Models *B1* and *B2*.
4. Specifically, the one-level SEM was meant to maintain the statistical efficiency for identifying the cannabis indicators as dependent variables via both population size of locality (common log) and type of school attended. It was found that the SEM model with a complex (three-level) multilevel structure would remove a significant portion of variability of the two instrumental variables, which would otherwise be used for efficient identification of cannabis indicators. Therefore, more parsimonious one-level SEM was applied in Step 3. The one-level SEM might be problematic, if one would “suspect” that, within a complex three-level model structure, and the effects of either population size of locality or type of school attended were found to be nonsignificant predictors of the two respective cannabis indicators. However, as presented by multilevel regression models conducted in Step 2 of the analyses, this was not the case in our study.
  5. Elementary schools are part of compulsory education in Czechia, which lasts for 9 school years. Entrance to secondary school is one of the first crucial moments for the future career orientation of the adolescent. In elementary schools, students are, however, still mixed in this respect. Therefore, regarding the third hypothesis, it is not meaningful to include elementary schools in an ordinal sequence with other types of school.
  6. In Czechia, the more educationally demanding schools are typically more prevalent in larger cities, a factor related to their selective nature. It is also typical that the genders are not equally represented among secondary students; a higher proportion of boys can be found in vocational training schools and a higher percentage of girls is found in the other types of schools. In regards to covariance between the age and gender of adolescent respondents, boys were identified as slightly older than girls with an age difference of 0.04 years—approximately circa 2 weeks.
  7. This approach is analogous to the so-called seemingly unrelated regressions analysis. The significance of the covariance in error terms was explicitly tested before the SEM analysis and yield highly significant results—minimum value of discrepancy between saturated model and model with  $Cov(e_1, e_2) = 0$ :  $\chi^2(1) = 15.6, p < .001$ .
  8. The adjustment for individual frequent cannabis use was conducted to control for potentially “confounding” responses on perceived availability by frequent user(s) surveyed in a given locality. Although there is some computational difference between Models *A2* and *A3*, they present congruent results on the sociogeographic inequalities in the dependent variable, although from two distinctive analytical approaches. While in Model *A2* the presence of a possible confounder (frequent cannabis use) is controlled statistically by its inclusion among other independent variables, in Model *A3* it is controlled explicitly by removing students from the dataset whose responses on the dependent variable were considered as being “confounded” (cannabis users in the last 12 months).
  9. Figure 2 provides the sociogeographical inequalities in the two cannabis indicators with respect to seven population-size-categories of the Czech localities. The categories are identical to those presented in the initial cross-tabulation of the cannabis indicators in Table 1. In Czechia, the categories are standardly applied in the sociogeographic research of a phenomenon and its population-size-related inequalities. Localities in the first category (less than 5,000 inhabitants) are typically rural areas. Increasing the categories, localities acquire on a higher degree of urbanization. In 2011, the population of the Capital City of Prague was 1.2 million.

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## Article

# Changing trends in adolescent alcohol use among Czech school-aged children from 1994 to 2014

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## Significance for public health

Substance use during the period of adolescence is one of the most significant priorities of the public health agenda. The study provides with a unique 20-year time series of data on adolescent alcohol use since the establishment of the Czech Republic in the early 1990s. Detailed analysis stratified by genders and specific age-groups of adolescents is conducted. The analysis confirmed significant changes in adolescent alcohol use. After a long period of continuous increase, which was present particularly among girls, a sharp drop across genders and all age-groups was recorded. The drop is in contrast with a steady and continuous decline recorded in most of the countries of Western Europe and North America. The specific factors and institutional settings present in Czechia are discussed.

## Abstract

**Background:** For an efficient planning of public health policy, the regular monitoring over health-related behaviors among vulnerable population groups is necessary. The aim of this study is to examine the temporal trends in alcohol use among the Czech adolescent population.

**Design and methods:** Data from the Health Behaviour in School-aged Children (HBSC) project conducted in Czechia from 1994 to 2014 were used. Adolescent alcohol use was assessed via two indicators: i) weekly alcohol use (beer, wine, and/or spirit), ii) repeated lifetime drunkenness (having been drunk on two or more occasions in life). Trends in alcohol use were modelled separately for boys and girls. Binary logistic regression was conducted with survey period as an independent predictor of the alcohol indicator.

**Results:** There were significant changes in adolescent alcohol use since 1994. Between 1994 and 2010, there was a gradual upward in the prevalence. However, in the recent period of 2014, an unprecedented drop in alcohol use was recorded.

**Conclusions:** Despite the significant drop in the prevalence of alcohol use among the Czech youth in recent years, alcohol drinking in adolescence remains an important challenge for the national health policy. Further research will show whether these changes in adolescent health-related behavior are of a temporary or a permanent nature.

## Introduction

Alcohol is the most widely used psychoactive substance in the developed world, responsible for a significant portion of avoidable morbidity and mortality in Europe, as well as for social inequalities in health in general.<sup>1-3</sup> Adverse health effects of alcohol use include a higher risk for emergence of a range of chronic diseases, including diseases of the digestive system, cardiovascular and

cerebrovascular diseases, several sites of cancer, mental and behavioral disorders, and external causes of morbidity and mortality. The acute alcohol-related risks comprise alcohol poisoning, fatigue, reduced immunity and proneness to infectious diseases, unintended injuries, as well as aggressive behavior and victimization. As documented by the international research conducted by WHO, in the European Union, alcohol consumption is the third most important risk factor for ill health and premature death.<sup>4</sup>

Alcohol-related risks are of a cumulative nature. The lower the age of initiation with alcohol use, and the higher the overall volume consumed within an individual's lifespan, the higher the risks of alcohol-induced ill health, as well as risks of transition from a regular drinking patterns into harmful alcohol use and possible dependence at a later age. Given this cumulateness and specific vulnerability of an adolescent population to alcohol use, both regular monitoring of underage drinking and implementation of preventative measures are of the most significant priorities of public health policy in European countries.

Among the Czech adult population, alcohol consumption is high with a relatively steady trend since the establishment of the Czech Republic in the early 1990s.<sup>2,5</sup> As the young generation adopts norms, values and attitudes – including health-related patterns of behavior – not only from their parents, but also from the society as a whole,<sup>6</sup> the importance of monitoring the prevalence of alcohol use among Czech adolescents should be highlighted even more.

There are several approaches to measure substance use prevalence in a specific study group. The approaches range from objective measures of alcohol biomarkers, conducted by an expertized staff and examined in a controlled study environment, to self-reported measurements, relying on participants' memory, self-reflexion and willingness to answer truthfully. The latter approach is typically applied in large-sample surveys, where the objective measurement would be costly or complicated to obtain. Due to the specific status of the adolescent population, and relative ease of self-reported measurement acquisition, the latter approach is favored in adolescent substance use prevalence surveys, applied within large-sample school-targeted research designs worldwide; e.g. in studies like Monitoring the Future in the United States,<sup>7</sup> ESPAD in Europe,<sup>8</sup> ASSAD in Australia,<sup>9</sup> etc. Despite its self-reported nature, the approach is considered as a good indicator of adolescent risk behaviors, including measurement of adolescent alcohol use.<sup>10-12</sup>

Since the early 2000s, a continuous decline in alcohol use among adolescents from the Western European and Scandinavian countries was recorded.<sup>8,13,14</sup> Similar trends were documented in the US,<sup>7,15</sup> Canada<sup>16</sup> and Australia,<sup>9,17</sup> as well. However, the widespread decrease was not equally present in all countries of the Central and Eastern Europe.<sup>14</sup> In Czechia, a continuous increase in adolescent alcohol use between 1995 and 2011 was documented,



with no signs for decline.<sup>18</sup> This increasing trend was apparent particularly among the Czech adolescent girls.<sup>19</sup>

Surprisingly, the results of the recent international European School Survey Project on Alcohol and Other Drugs (ESPAD), conducted with European adolescents in 2015, pointed to the significant general decrease in both alcohol and tobacco use also among the adolescents from the Central and Eastern European countries, including Czechia.<sup>8,20</sup> For example, the prevalence of last month alcohol intoxication among the adolescent Czechs unexpectedly dropped from 21.3% on 14.7% , the last month binge drinking (5 or more drinks of alcohol during one occasion) from 54.0% on 41.9%.<sup>18</sup> Those new trends in adolescent substance use took a significant interest of the Czech public health professionals, which led to an intensive scientific debate on the topic.<sup>21</sup>

Given the unexpected changes in the prevalence of substance use among adolescent Czechs documented by the recent ESPAD project, in this study, we aim to analyze the temporal trends based on the data provided by another survey aimed at adolescent population – the Health Behaviour in School-aged Children. The data cover time period overlapping with the one provided by the ESPAD. As alcohol use is generally more prevalent among older adolescents, the analyses are conducted separately for both different age groups and genders. This brings a deeper insight into the phenomenon, as compared to that provided by the ESPAD, where only one age-specific group is available.

To large extent, the results of both the ESPAD and HBSC studies are congruent. After a long period of continuous and steady increase in alcohol use, a significant drop among the adolescent Czechs was confirmed. The drop was apparent across both genders and all the age groups, pointing to the significant changes in health-related behaviors among the contemporary Czech youth.

## Design and methods

Nationally representative data from the series of cross-sectional surveys, conducted in the Czech Republic, focusing on adolescent health conditions were applied, surveyed within the international project of Health Behaviour in School-aged Children (HBSC). Since the Czech Republic has been participant of the HBSC consortium since 1994, all the data available until the recent HBSC survey in 2014 were used.

As regards the level of alcohol use, two sets of questions were available within the Czech HBSC dataset, fully comparable between the survey periods. The first set of questions asked on the frequency of use of three types of alcoholic beverages – beer, wine, and spirits. The questions were formulated as follows: “*At present, how often do you drink anything alcoholic, such as beer, wine or spirits?*” with answer categories “1 = never”, “2 = rarely”, “3 = every month”, “4 = every week”, and “5 = every day”. From this set of questions, we derived a dichotomized variable as a first indicator of adolescent alcohol use called “*weekly alcohol use*”, where 1 = use of any alcoholic beverage weekly or daily, 0 = otherwise. The second question was about the frequency of lifetime drunkenness: “*Have you ever had so much alcohol that you were really drunk?*” The answers regarding being drunk two times or more often were coded as cases of repeated lifetime drunkenness. To simplify, this indicator is in the text referred briefly as “*repeated drunkenness*”.

Both sets of questions were asked to 11-, 13- and 15-year old student respondents. Questions were collected through self-completion questionnaires, together with a range of other health-related indicators, administered in the classroom. In all HBSC surveys, student’s participation was voluntary. Therefore, no special

approval or parental permission was required for the study.

The analysis was conducted in several steps. In the first step, gender- and age-specific prevalence estimates of alcohol use with the corresponding 95% confidence intervals were calculated for both sets of questions (*weekly alcohol use; repeated drunkenness*). These were calculated for each survey period between 1994 and 2014. In order to visually assess the temporal trends in adolescent alcohol use, prevalence estimates for the both sets of questions were plotted to graphs separately for boys and girls.

The graphs revealed two substantial characteristics of trends in alcohol use, important for the next step of analyses: a) there was an increasing trend in both alcohol indicators between 1994 and 2010; b) however, in 2014, a significant drop was recorded.

In the last step of analyses, we were interested in both a) to make some generalizations of temporal trends of adolescent alcohol use, and b) to test for statistical significance of trends through the regression modelling approach. As the graphical visualization of data revealed a significant breakthrough between 2010 and 2014, we decided to split the regression analysis into separate models for two consecutive time periods: 1994-2010 and 2010-2014. Hence, we conducted a series of logistic regression models with a survey period as a predictor of two respective alcohol indicators used in the study (*weekly alcohol use; repeated drunkenness*).

The regression models were defined as follows:

A) Model for 1994-2010:

$$\text{Log} [\pi/(1-\pi)] = \text{Constant} + \beta * (\text{Period}), \text{Period} \in \{0, 4, 8, 12, 16\};$$

B) Model for 2010-2014:

$$\text{Log} [\pi/(1-\pi)] = \text{Constant} + \beta * (\text{Period 2014}), \text{Period 2014} \in \{\text{No}=0, \text{Yes}=1\}$$

where  $\pi$  states for the prevalence (%) of adolescent alcohol users, resp. student drunkenness. In model A, *Period* is a number of years since the first HBSC survey in 1994. In model B, *Period 2014* is a binary variable testing for decline in alcohol consumption between 2010 and 2014.

We stated that questions on alcohol were asked to 11-, 13- and 15-year-old respondents. However, as the level of alcohol use was very low among the 11-year olds, we decided to conduct both graphical assessment and regression analyses only among 13- and 15-year-old students, and to keep prevalence rates computed for the 11-year olds only for illustrative purposes.

## Results

Table 1 provides with the description of the dataset compiled from the last six HBSC surveys conducted in the Czech Republic from 1994 to 2014. Data are presented separately by the gender and age of respondents. Number of participants varied between 3585 in 1994 and 5055 in 2014, with a proportional share of boys and girls, as well as all three age groups (the 11-, 13- and 15-year olds) surveyed in each HBSC study. Summing up through all the six HBSC survey periods, the total sample size used in our study was 26589 student respondents (13021 boys and 13568 girls).

Table 2 summarizes age- and gender-specific prevalence estimates of adolescent alcohol use from 1994 to 2014, computed for two indicators – weekly alcohol use and repeated drunkenness. Comparing the prevalence rates between age groups it is apparent, how the proportion of students consuming alcohol increases with their age. For example, in 2010, 6.2% of the 11-year-old Czechs declared weekly alcohol use. However, among the 13-year olds, the proportion was 2.5-times higher (15.9%) and among the 15-

year olds it was almost 6-times (36.4%) higher. Regarding the repeated drunkenness in 2010, differences between age groups were pronounced even more (2.9% among the 11-year olds, 15.3% among the 13-year olds, and 43.0% among the 15-year olds).

Comparing prevalence estimates between the genders, boys had generally higher rates of alcohol use than girls in both indicators during the whole period 1994-2014. However, these inequalities were more pronounced at the beginning of the study period. Later, the relative differences between genders gradually reduced with rather converging prevalence rates in both alcohol indicators. For example, the proportion of 15-year-old students declaring weekly alcohol use was twofold higher among boys than girls in 1994 (38.3% vs. 18.5%). In 2010, this relative difference reduced on 1.4 (42.2% vs. 30.8%).

In the next step of analysis, temporal trends in alcohol use were plotted to graphs. Figures 1 and 2 show temporal changes in both alcohol indicators among 13- and 15-year-old students during 1994 and 2014, separately by gender. The corresponding 95% con-

fidence intervals of prevalence estimates are also plotted.

From both Figures 1 and 2 it is apparent that adolescent alcohol use had been gradually increasing by the year 2010, particularly among girls. For example, among 15-year-old students, the prevalence of repeated drunkenness between 1994 and 2010 increased twice among girls (from 19.2% to 39.6%) and 1.3-times among boys (from 35.5% to 46.4%). However, in 2014 there was a significant drop in alcohol use, recorded by both alcohol indicators used in the analysis. This was present among both boys and girls and all the age groups surveyed within the HBSC project. For example, the prevalence of weekly alcohol use among 15-year olds decreased by index 0.37 among girls (from 30.8% in 2010 to 11.3% in 2014) and by index of 0.45 among boys (from 42.2% in 2010 to 18.8% in 2014).

Finally, temporal trends in alcohol use were tested by logistic regression models. The binary indicators of both weekly alcohol use and repeated drunkenness were used as dependent variables; the HBSC period was used as an independent predictor of the bina-

**Table 1. Sample structure for the study, by gender, age and period, Czech Republic, HBSC data 1994-2014.**

Gender	Age group	Period					
		1994	1998	2002	2006	2010	2014
Boys	11 y.o.	539	586	826	765	719	738
	13 y.o.	644	646	780	804	669	818
	15 y.o.	606	607	806	842	747	852
	Total boys	1789	1839	2412	2411	2135	2408
Girls	11 y.o.	555	598	865	744	707	836
	13 y.o.	646	644	881	797	787	903
	15 y.o.	595	622	854	823	775	908
	Total girls	1796	1864	2600	2364	2269	2647
Total	11 y.o.	1094	1184	1691	1509	1426	1574
	13 y.o.	1290	1290	1661	1601	1456	1721
	15 y.o.	1201	1229	1660	1665	1522	1760
	Total sample size	3585	3703	5012	4775	4404	5055

**Table 2. Adolescent alcohol use prevalence estimates (%), by gender, age and period, Czech Republic, HBSC (1994-2014).**

Gender	Age group	Period					
		1994	1998	2002	2006	2010	2014
Weekly alcohol use							
Boys	11 y.o.	12.2	15.2	10.2	9.8	8.1	3.3
	13 y.o.	17.5	16.4	23.1	16.8	18.2	7.5
	15 y.o.	38.3	32.0	40.1	38.2	42.2	18.8
Girls	11 y.o.	6.8	7.5	4.3	3.8	4.2	2.9
	13 y.o.	7.9	9.3	9.3	11.9	14.0	3.1
	15 y.o.	18.5	19.1	29.5	26.5	30.8	11.3
Total	11 y.o.	9.5	11.3	7.2	6.8	6.2	3.0
	13 y.o.	12.7	12.9	15.8	14.4	15.9	5.2
	15 y.o.	28.5	25.5	34.6	32.4	36.4	14.9
Lifetime drunkenness (2 or more times)							
Boys	11 y.o.	5.0	6.1	2.7	2.7	4.6	2.0
	13 y.o.	13.1	14.4	11.9	12.9	16.6	7.0
	15 y.o.	35.5	36.5	37.5	36.5	46.4	31.6
Girls	11 y.o.	3.1	2.0	0.9	0.8	1.2	0.6
	13 y.o.	7.0	6.4	6.3	10.3	14.2	4.9
	15 y.o.	19.2	22.5	29.0	30.5	39.6	28.6
Total	11 y.o.	4.0	4.1	1.8	1.8	2.9	1.3
	13 y.o.	10.0	10.4	8.9	11.6	15.3	5.9
	15 y.o.	27.4	29.4	33.1	33.5	43.0	30.1

ry indicator. The regression models were split into two consecutive time-periods (1994-2010 and 2010-2014), and conducted separately for 13- and 15-year-old students – both for total prevalence and gender-specific trends. The results are presented in Tables 3 and 4.

The results of regression analyses generally confirmed previous findings from Figures 1 and 2. The prevalence of alcohol use among adolescents experienced significant changes in the Czech Republic during the period 1994-2014. At first, there was a gradual increase from 1994 to 2010, which was more pronounced among girls. However, there was a significant drop in this respect between years 2010 and 2014. This decline was significant across both genders and age groups surveyed in the study.

## Discussion and Conclusions

The results of the study lead to a discussion in at least three interrelated aspects. First, it is essential to reflect the significant changes in temporal trends of alcohol use among the Czech adolescent population. The results of our analysis revealed a significant increasing trend of both adolescent weekly alcohol use and repeated drunkenness from 1994 to 2010, which was followed by a steep decrease in 2014, as compared to the previous HBSC round conducted in 2010.

The results of our study confirm the significant changes in adolescent alcohol use provided by the recent ESPAD study. Studies

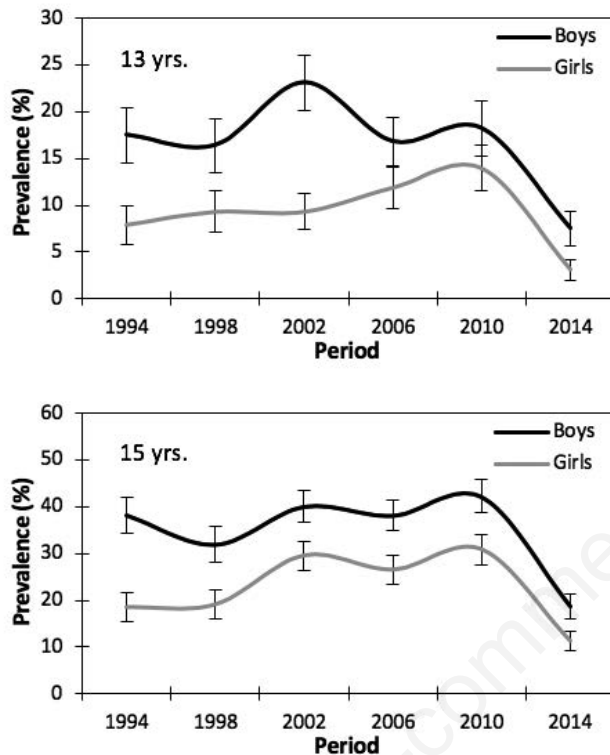


Figure 1. Trends in weekly alcohol use (%; 95% CI), by age and gender, Czech Republic, HBSC (1994–2014).

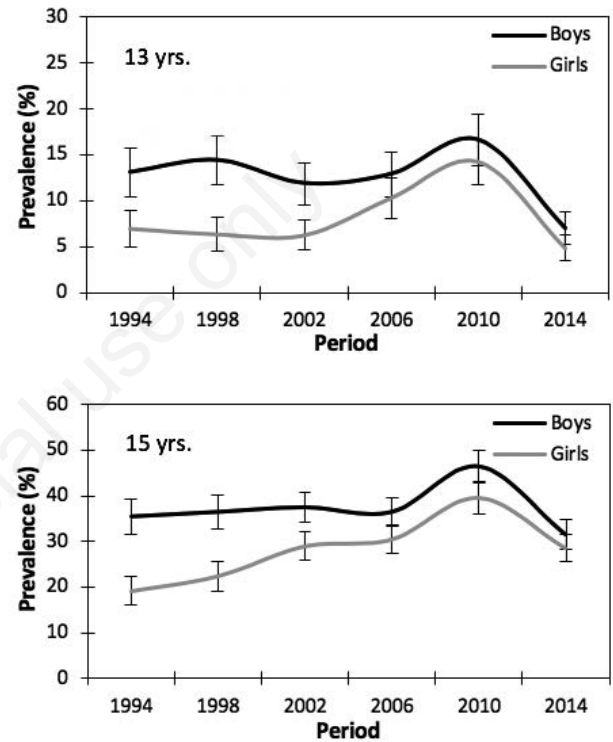


Figure 2. Trends in repeated lifetime drunkenness (%; 95% CI), by age and gender, Czech Republic, HBSC (1994–2014).

Table 3. Binary logistic regression, by gender and age. Dependent variable – weekly alcohol use (Yes = 1; No = 0), Czech Republic, HBSC (1994-2014).

Gender	Age group	Model 1994–2010			Model 2010 vs. 2014		
		Independent <sup>a</sup>	Beta (SE)	Sig.	Independent <sup>b</sup>	Beta (SE)	Sig.
Boys	13 y.o.	Time period	0.00 (0.008)	0.785	2014	-1.02 (0.167)	<0.001
		Constant	-1.50 (0.078)	<0.001	Constant	-1.50 (0.100)	<0.001
	15 y.o.	Time period	0.01 (0.006)	0.018	2014	-1.15 (0.115)	<0.001
		Constant	-0.60 (0.064)	<0.001	Constant	-0.32 (0.074)	<0.001
Girls	13 y.o.	Time period	0.04 (0.010)	<0.001	2014	-1.62 (0.218)	<0.001
		Constant	-2.49 (0.107)	<0.001	Constant	-1.82 (0.103)	<0.001
	15 y.o.	Time period	0.04 (0.007)	<0.001	2014	-1.25 (0.130)	<0.001
		Constant	-1.44 (0.076)	<0.001	Constant	-0.81 (0.078)	<0.001
Total	13 y.o.	Time period	0.02 (0.006)	0.009	2014	-1.25 (0.130)	<0.001
		Constant	-1.91 (0.062)	<0.001	Constant	-1.66 (0.072)	<0.001
	15 y.o.	Time period	0.03 (0.005)	<0.001	2014	-1.18 (0.085)	<0.001
		Constant	-0.98 (0.048)	<0.001	Constant	-0.56 (0.053)	<0.001

<sup>a</sup>Time period is a continuous variable representing number of years since the baseline period 1994. <sup>b</sup>Reference year = 2010.

conducted on the Czech ESPAD data revealed both the continuous increasing trend in adolescent last month binge drinking and alcohol intoxication, for the period of 1995-2011, and a sharp decline recorded in 2015 compared to 2011.<sup>18</sup> Similarly to our study, the prior increase in alcohol use was more pronounced among girls, which led to converging the levels between genders.<sup>19</sup> The subsequent drop in adolescent alcohol use during 2011 and 2015 was reported proportionally among both boys and girls.<sup>18,19</sup>

The general downward trend in adolescent alcohol use was documented also in other European countries,<sup>20</sup> as well as among adolescents from the US,<sup>7</sup> Canada<sup>14,16</sup> or Australia.<sup>9</sup> Compared to the Czech Republic, the downward trend was not steep but gradual and long-term. Therefore, the case of the Czech adolescents seems to be rather specific and there is a need for closer discussion on the phenomena.

The second aspect is to discuss the factors that might contribute to recent decline in alcohol use. The explanation lies in a rather complex mixture of several factors. In this respect, it is important to note that from 2010 no political measures have been introduced in the Czech Republic that would alter the availability of alcohol. Nor did any massive campaign take place that could significantly affect the attitudes of young people towards alcohol use. In a similar vein, there were no major public health interventions in substance use prevention, which could possibly outweigh the practice common in previous years.<sup>21</sup>

Specific explanation for the recent decline in alcohol use concerns the changing preferences of leisure activities among the contemporary Czech youth.<sup>22</sup> Easy access to the Internet, and increasing availability of computers, tablets or smartphones leads to the situation, when young people spend hours on digital technologies. As documented by both the HBSC and ESPAD data, there was a gradual increase in total time spent on computer and use of e-media among adolescents across the European countries in the last decade, including Czechia.<sup>23,24</sup> At the same time, these activities are more frequent during weekends and linked to leisure preferences and new lifestyle patterns of the contemporary youth.

The recent study by Chomynová and Kázmér<sup>22</sup> (in review) provides empirical evidence of the changing preferences of leisure among the adolescent Czechs, particularly with respect to the significantly lowered frequency of going out with friends and peers during out-of-school time. Interestingly, the lowered frequency explained major part of recent decline in adolescent alcohol use (51-99% of declines in the prevalence of alcohol intoxication and binge drinking between periods of 2011 and 2015), which is prob-

ably also related to the spread of new digital technologies. However, while the total time “spent in a virtual space” among the Czech youth is growing, authors of this study are of the opinion that it would be yet premature to talk about replacing one form of risk behavior (alcohol use) with another (excessive use of digital technologies). Furthermore, it turns out that the unprecedented changes do not concern only alcohol but also the use of other substances, e.g. adolescent tobacco smoking and marijuana use.<sup>18,25,26</sup> In this regard, results of both HBSC and ESPAD yielded congruent findings and confirmed the general decrease of substance use among Czech adolescents in the recent periods. For example, the current smoking prevalence rates among 15-year-old students, derived from the recent Czech HBSC surveys, dropped from 25.0% in 2010 to 13.3% in 2014, proportionally in both genders.<sup>25</sup> The last month prevalence of tobacco smoking dropped from 42.3% in 2011 to 29.9% in 2015 (the Czech ESPAD surveys).<sup>18</sup> Similarly, the prevalence of lifetime marijuana use among 15-year-old respondents, as reported by the HBSC, declined from 30.5% in 2010 to 23.1% in 2014, as reported by the ESPAD from 42.3% in 2011 to 36.8% in 2015 (in the ESPAD, the prevalence of marijuana use and/or hashish together).<sup>18,26</sup> Since the use of one type of a substance is usually correlated to the use of other substance(s),<sup>27</sup> these findings point to rather general decrease of adolescent substance use. At the same time, these findings are concordant to the above-mentioned hypothesis on ongoing changes in leisure time preferences among the contemporary Czech youth, resulting in an overall decrease of substance use in this specific population group.

From the cross-European perspective, in Scandinavian countries, where a continuous decline in adolescent alcohol use since early 2000s was documented, broader social and political factors linked to an efficient policy measures are considered as possible underlying causes, including lower availability of alcohol beverages, better parental supervision over the children leisure activities, and the reduced opportunities for alcohol drinking, when young people go out for fun.<sup>28,29</sup> Worldwide, socio-cultural factors and possible generational shift in health-related norms are discussed, as well.<sup>17,30</sup> However, regarding the Czech adolescents, we consider these eventual factors rather secondary.

The third aspect is the narrowing gap in alcohol use between adolescent boys and girls. The phenomenon was discussed on the example of several developed countries of Europe and North America by the study of Kuntsche *et al.*,<sup>31</sup> applying the HBSC data from 1998 to 2006. The authors conclude that shrinking of gender inequalities in health-related behaviors is part of a more general

**Table 4. Binary logistic regression, by gender and age. Dependent variable – repeated lifetime drunkenness (Yes = 1; No = 0), Czech Republic, HBSC (1994-2014).**

Gender	Age group	Model 1994–2010			Model 2010 vs. 2014		
		Independent <sup>a</sup>	Beta (SE)	Sig.	Independent <sup>b</sup>	Beta (SE)	Sig.
Boys	13 y.o.	Time period	0.01 (0.009)	0.191	2014	-0.97 (0.173)	<0.001
		Constant	-1.94 (0.090)	<0.001	Constant	-1.61 (0.105)	<0.001
	15 y.o.	Time period	0.02 (0.006)	<0.001	2014	-0.63 (0.104)	<0.001
		Constant	-0.67 (0.065)	<0.001	Constant	-0.15 (0.073)	0.048
Girls	13 y.o.	Time period	0.06 (0.011)	<0.001	2014	-1.17 (0.186)	<0.001
		Constant	-2.88 (0.123)	<0.001	Constant	-1.80 (0.103)	<0.001
	15 y.o.	Time period	0.06 (0.007)	<0.001	2014	-0.49 (0.104)	<0.001
		Constant	-1.45 (0.075)	<0.001	Constant	-0.42 (0.074)	<0.001
Total	13 y.o.	Time period	0.03 (0.007)	<0.001	2014	-1.06 (0.126)	<0.001
		Constant	-2.33 (0.072)	<0.001	Constant	-1.71 (0.073)	<0.001
	15 y.o.	Time period	0.04 (0.005)	<0.001	2014	-0.56 (0.074)	<0.001
		Constant	-1.03 (0.048)	<0.001	Constant	-0.28 (0.052)	<0.001

<sup>a</sup>Time period is a continuous variable representing number of years since the baseline period 1994. <sup>b</sup>Reference year = 2010



long-term process of convergence of gender-defined social roles.

Finally, it is important to assess the changing patterns of alcohol use among the adolescent Czechs, as compared to other countries participated in the HBSC study. Although the substantial decline recorded in 2014 is a positive trend for the national health policy, adolescent Czechs still remain above the HBSC average in both alcohol indicators. Compared to the Czech Republic, for the age of 15, the 2014 prevalence rates of weekly alcohol use across all HBSC countries was 9% for girls and 16% for boys, and rates of the repeated lifetime drunkenness were 20%, and 24% respectively.<sup>32</sup> Moreover, the adolescent Czechs have higher rates in both indicators compared to their immediate neighbors, *i.e.* adolescents from Germany, Poland, Slovakia and Austria. Therefore, the recent decline in adolescent alcohol use is not a reason for satisfaction. On the contrary, it is necessary to critically assess the national drug policy and look for more effective measures aimed at reducing alcohol consumption among the vulnerable groups of the Czech society.

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## **Title**

### **LEISURE-TIME SOCIALIZING WITH PEERS AS A MEDIATOR OF RECENT DECLINE IN ALCOHOL USE IN CZECH ADOLESCENTS**

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## **Authors' contribution:**

PCH was responsible for the ESPAD survey methodology compliance and survey data collection, and drafted the literature review. LK drafted the analytical framework, performed statistical analyses and interpretation of results. Both authors drafted the paper, had full access to the survey data and contributed to the final revision of the manuscript.

## Abstract

**Background:** Leisure-time activities and socializing with peers are associated with substance use behaviour among adolescents. Recently, significant declines in adolescent alcohol use were observed, but little research has been devoted to explain the ongoing changes.

**Aims:** The aim of the paper was to analyze to what extent the changes in unorganized leisure time activities, especially declines in out-of-school socializing with peers, affected the recent changes in adolescent alcohol use in the Czech Republic.

**Sample and Methods:** Samples of 15-16-year-old adolescents, surveyed in 2011 ( $N_1=3,710$ ) and 2015 ( $N_2=2,738$ ) waves of the *European School Survey Project on Alcohol and Other Drugs* (ESPAD), were analysed. Structural equation model was constructed to test the mediating effect of changes in the frequency of going out with friends on observed decline in adolescent binge drinking and alcohol intoxication. To account for possible gender-specific effects, the analysis was carried out separately for boys and girls.

**Results:** Results of the mediation analysis showed that the decline in frequency of going out with friends explained a major part of the decline in alcohol use between 2011 and 2015. The mediating effect was confirmed in both binge drinking and alcohol intoxication, and was more pronounced among girls (65.4%–99.6%) compared to boys (51.1%–62.7%).

**Conclusion:** Recent declines in unorganized socializing with peers in leisure time have significantly affected the levels of alcohol consumption in Czech adolescents. However, the substitution of face-to-face peer socializing by digital media activities may bring new health-related risks for adolescent behaviour.

**Keywords:** adolescents – alcohol use – leisure time – mediation analysis – ESPAD



## Introduction

In recent years, the levels of alcohol use among adolescents have started to decline in Europe. As suggested by data from the *European School Survey Project on Alcohol and Other Drugs (ESPAD)*, targeting 15-16 year-old European students, there has been an overall decline in both lifetime and current alcohol use, and to a certain extent in binge drinking as well. This decline was observed after a peak in mid-2000's in majority of European regions (The ESPAD Group, 2016), including Central and Eastern European countries (Kraus et al., 2018). These new trends described by the ESPAD study are in line with findings observed in other studies carried out among European youth as well, such as cross-national *Health Behaviour in School-Aged Children* (Inchley et al., 2016), and studies from different cultural context, such as *Monitoring the Future Study*, focusing on adolescents from the US (Johnston et al., 2018).

In the Czech Republic, a traditionally high-level alcohol consumption country (World Health Organization, 2018), the changes in adolescent alcohol use were observed only in the period between 2011 and 2015. After a period of continuous increase in the levels of adolescent alcohol consumption between 1995 and 2011 (Kázmér and Orliková, 2017), the prevalence of last month alcohol use among 15-16 year-olds dropped from 79% to 68.5%, binge drinking of 5 or more glasses of alcohol in the past month from 54% to 41.9%, and frequent binge drinking from 21.2% to 12.1%; thus reaching levels far below those observed at the beginning of the study in mid-1990's (Chomynová et al., 2016). Similar declines in adolescent alcohol consumption were confirmed by recent data surveyed within the Czech HBSC study as well (Kázmér and Csémy, 2019).

Since decades, available research has focused on predictors of adolescent substance use in terms of risk and protective factors, targeting at multiple factors operating at the individual, family, school, community, or societal levels (Jessor, 1991, Brooks et al., 2012, Patrick and Schulenberg, 2014, Petit et al., 2013, Aura et al., 2016, Petraitis et al., 1995). These include peer culture and norms, parental monitoring, and control over adolescent leisure time operating at rather micro-societal level, compared to legislative and institutional settings, socio-cultural factors and common attitudes towards health-related behaviour operating at rather macro-societal level. The explanation of the mechanisms working through these predictors, as well as their multilevel structure, present frequent research topics based on theoretical concepts included in e.g. peer-cluster theory (Oetting and Beauvais, 1987), theory of planned behaviour (Ajzen, 1985, Ajzen and Driver, 1992), social-learning theories (Akers, 1977, Krohn et al., 1982), or social-control theory (Elliott et al., 1985, Elliott et al., 1989).

Only little research has been devoted so far to explain the recent declines in adolescent alcohol use in terms of temporal changes in the risk and protective factors (Batthacharya, 2016, Bendtsen et al., 2014, Gilligan et al., 2012, Pennay et al., 2015, Pennay et al., 2018, Raitasalo et al., 2018). These studies focused on effects of several factors operating at both micro and macro-societal levels, widely questioned in professional and public discussions, such as: (i) implementation of more restrictive alcohol policies, (ii) rise of availability of new technologies, including online gaming and Social Media, (iii) decreasing social acceptance of alcohol consumption associated with a greater awareness of alcohol-related harms, (iv) improvement of adolescents well-being and satisfaction with life, (v) increasing levels of parent monitoring and control, and (vi) decreasing affordability of alcohol for adolescents due to higher prices of alcoholic beverages. However, the authors concluded

that none of the hypotheses alone could fully explain the declines in alcohol use. In a recent qualitative study among adolescents, Törrönen et al. (2019) stressed the impact of social mechanisms on declining alcohol use, such as changing cultural position of drinking, lower peer pressure and more time available for competing activities.

As documented by the ESPAD survey, the sudden and unexpected decline in adolescent alcohol use occurred in Czechia in line with significant changes in preferred leisure time activities among adolescents as well (Chomynová et al., 2016). In this respect, earlier studies on adolescents' leisure have proved the association of the preferred leisure activities with adolescent risk behaviour (Caldwell and Baldwin, 2003, Mahoney and Stattin, 2000, Sharp et al., 2011), including substance use (Lee and Vandell, 2015, Medrut, 2015), aggressive behaviour, and delinquency (Svensson and Oberwittler, 2010). All these studies emphasized the role of social context, in which the leisure activities take place, as the key factors of initiation and development of risk behaviour.

As regards context, leisure activities can be further distinguished into the organized, or professional adult-guided activities, and unorganized, or spontaneous (mostly "street") activities (Zeijl, 2011). The organized activities are considered to decrease risks of adolescents' involvement in substance use (Badura et al., 2017, Badura et al., 2018). On the other hand, unorganized hanging out with friends was found to be associated with higher prevalence of alcohol use (Caldwell and Darling, 1999, Koutra et al., 2012, Llorens et al., 2011, Tomcikova et al., 2013, Spilková, 2015, Finlay et al., 2012), as well as use of other substances (Kokkevi et al., 2007, Kuntsche et al., 2009). These findings support the concepts outlined by routine activity theory (Osgood et al., 1996) stating that in the presence of (deviant) peers, and absence of authorities that may provide a form of social control, individuals are more prone to engage in risk behaviours if they lack structured (i.e. organized) activities providing them with time available for the risk behaviour.

In the Czech Republic, significant changes in preferred leisure activities have recently been observed especially with regard to the frequency of going out with friends in evenings (for discos, bars and parties), and frequency of going around with friends to shopping centres, streets, and parks. These, rather unorganized activities, experienced an unexpected drop between 2011 and 2015 (e.g. the percentage of adolescents frequently going out with their friends in the evenings at least once a week decreased to less than half from 35.4% to 16.5%). On the other hand, the involvement of adolescents in organized leisure activities (e.g. active sport and exercising activities, hobbies like playing instruments, singing or drawing on regular basis) have remained stable over the last two decades (Chomynová et al., 2016).

Given both the observed changes in unorganized leisure activities and the lack of research focusing on explanations of the current declines in adolescent alcohol use, we aim to examine in this paper to what extent the decline in unorganized leisure time spent with peers affected the recent changes in adolescent alcohol use in Czechia. The results of our analyzes should help to understand the complexity of the processes standing behind the steep decline, particularly with respect to changes concerning adolescent lifestyle and preferred modes of leisure time.

## Data and Methods

### Sample

Large-sample data collected within the frame of the *European School Survey Project on Alcohol and Other Drugs* (ESPAD) were used in this study. The ESPAD is an international cross-sectional questionnaire survey focusing on substance use among nationally representative samples of 15–16-year old students in 35 European countries (The ESPAD Group, 2016).

In the Czech Republic, a stratified random sample of schools was carried out to ensure for representativeness of elementary and secondary schools in all of the 14 regions of the country. In each school, one class was randomly selected to participate in the survey. For purposes of this paper, two ESPAD datasets from recent 2011 and 2015 collection waves were used. In 2011, a total of 10,052 self-completed questionnaires were collected in 364 schools, out of them 3,710 students aged 15-16 years were analysed. In 2015, a total of 6,707 questionnaires were collected in 209 schools, providing a sample of 2,738 students aged 15-16 years (Chomynová et al., 2016). The data collection of both recent ESPAD waves was administered by the Czech *National Monitoring Centre for Drugs and Addiction*.

### Measures

#### *Dependent variables*

In the analysis, a set of four indicators on adolescent alcohol consumption was examined:

- i) binge drinking in the past month (DV1);
- ii) alcohol intoxication in the past month (DV2);
- iii) alcohol intoxication in the last year (DV3);
- iv) alcohol intoxication in lifetime (DV4).

Binge drinking was defined as having five or more glasses of standard alcoholic beverages (beer, wine, pre-mixed drinks or spirits) on one occasion in the last 30 days. The self-reported responses were measured on 6-point Lickert scale (ranging from 'None' to 'Ten and more times').

Alcohol intoxication was defined as an occurrence of negative consequences from drinking alcohol, such as staggered walking, not being able to speak properly, throwing up, or not remembering what happened, questioned separately in lifetime, last 12 months and last 30 days. The responses were measured on 7-point scale (ranging from 'None' to 'Fourty and more times').

The entire Lickert scale entered the analysis, i.e. the full information provided by adolescent respondents was retained. The same definitions of alcohol indicators and response scales were used in both ESPAD waves in 2011 and 2015. Hence, the full comparability of the data between ESPAD waves was retained as well.

#### *Mediating variables*

Changes in unorganized socializing with peers were hypothesized as a mediator of recent declines in adolescent alcohol use. The unorganized socializing with peers was defined for the purposes of the analysis as going out with friends in the evenings and going around with friends for fun:

- i) 'How often (if any) do you go out in the evening (to a disco, cafe, party, etc.)?' further on referred to as Leisure 1;

- ii) *'How often (if any) do you go around with friends to shopping centres, streets, parks – just for fun?'* further on referred to as Leisure 2.

The self-reported responses were provided on 5-point Lickert scale: *'Never' – 'A few times a year' – 'Once or twice a month' – 'At least once a week' – 'Almost every day'*. Similarly to the alcohol indicators described above, the mediating variables entered analysis on the entire Lickert scales, with the same definition in 2011 and 2015.

#### *Independent and controlling variables*

The key independent variable, which mediation we focused on, was the effect of survey year (2011 vs. 2015) on alcohol-use indicators; i.e. the between-survey decline in adolescent alcohol consumption. It was treated as a binary variable with 2011 being the reference.

Age was explicitly controlled via selection of respondents reaching 16 years in the year of the ESPAD data collection. To account for possible gender-specific factors related to adolescent alcohol use, the analysis was carried out separately for boys and girls.

#### **Ethical considerations**

The ESPAD study is an international cross-sectional questionnaire survey in school settings, the emphasis is placed on anonymity and voluntary participation. No ethical committee approval was required in the Czech Republic in 2011 and 2015 as it was already the fifth and sixth wave of data collection within this international project, respectively. The participating respondents were aged over 15 years, thus parental consent for students' participation was not required. The researchers followed all relevant legislation in the Czech Republic with regard to personal data protection, i.e. no personal data identifying individual students were collected. Students returned the questionnaires in provided envelopes, and only aggregated results are presented here, to guarantee the anonymity of the respondents.

#### **Data analysis**

Prior to the analysis, the 2011 and 2015 Czech ESPAD data on adolescent alcohol use and selected variables were merged into one master dataset. On the merged dataset, the structural equation model (SEM) was constructed in Stata 15 statistical module (StataCorp, 2017). The model was conducted to test for the following hypotheses:

- i) frequency of unorganized socializing with peers significantly predicts the level of adolescent alcohol use;
- ii) changes in the frequency of socializing with peers mediate recent declines in adolescent alcohol use;
- iii) differences between genders exist in both the alcohol use level and the preferred leisure time activities, thus the mediating effect on decline in alcohol use is different among boys and girls.

The definition of the SEM model used for mediation analysis is presented in Figure 1. It was conducted step-by-step on all of the four alcohol-use indicators (dependent variables).

The changes in socializing with peers were measured by the two above-mentioned indicators of the frequency of going out with friends. To account for unobserved relationship between the mediating variables, covariance between error terms was imposed on their residuals. This covariance turned



out to be highly significant [Chi-square (df) > 300 (1);  $p < 0.001$ ] and it substantially improved the overall model fit.

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Insert Figure 1 about here

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Testing of the SEM started with parameter estimates allowed to vary freely across genders. Subsequently, parameter constraints were imposed to test for gender-specific differences in regression weights of the SEM paths. The Chi-square score tests for group-invariance (StataCorp, 2017) and goodness-of-fit statistics (Chi-square discrepancy, RMSEA, CFI) were used to assess the fit of each model with particular restrictions.

The gender-specific regression weights turned out to be statistically redundant in the case of path from 'Leisure 2' to 'Alcohol'. Therefore, the more parsimonious SEM model was retained for the final report of the statistical results.

#### *Parameter estimation method and missing values*

In the master dataset, the percentage of missing responses was generally very low, ranging between 0.17% (11 missings on gender) and 2.09% (135 missing values on past month alcohol intoxication). To account for possible selection bias in parameter estimates resulting from the missing responses, first, maximum likelihood with missing-values estimation method was applied on the SEM models. The results were subsequently compared with those obtained via asymptotically distribution-free (ADF) method (StataCorp, 2017). As the results were equivalent, and the ADF method is considered more appropriate for statistical inference based on Lickert-scaled data (Browne, 1984), the ADF parameter estimates were reported. In order to obtain robust standard errors corrected for within-school clustering in the surveyed variables, bootstrap procedure with 50 replications was applied as well.

## **Results**

In Table 1, descriptive statistics of variables used for mediation analysis are presented. The statistical distribution is evaluated on non-missing data of the master dataset, which comprised responses from 6,448 Czech adolescents surveyed in 2011 and 2015.

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Insert Table 1 about here

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Table 2 provides pairwise correlations between the SEM input variables, reported separately for boys and girls. Correlations estimated among boys are presented in lower diagonal of the matrix, upper diagonal presents correlations among girls. The gender-specific mean scores and SD's of the Lickert-scaled variables are reported as well.

Among both genders, negative correlations between ‘Survey year’ and the four alcohol-use variables (DV1–DV4) indicate significant decline in adolescent alcohol use during 2011 and 2015 (all the correlations are significant at  $p < 0.001$ ). In a similar vein, the negative correlation coefficients of ‘Survey year’ with both ‘Leisure1’ and ‘Leisure 2’ point to a substantial decline in an unorganized hanging out with peers between 2011 and 2015. The positive correlations of the two leisure-variables with alcohol-use, ranging from 0.117 to 0.469 among boys, and from 0.120 to 0.427 among girls, indicate a strong relationship to adolescent alcohol use as well.

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Insert Table 2 about here

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Table 3 provides results from the mediation analysis, conducted consecutively on alcohol-use indicators from DV1 through DV4. The parameter estimates and goodness-of-fit statistics were derived from the two-group SEM model stratified by genders. The estimated percentage of the mediated decline in alcohol use during 2011 and 2015 is presented as well (the ratio of the indirect effect of the ‘Survey year 2015’ to its total effect).

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Insert Table 3 about here

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The SEM analysis confirmed significant mediation of recent decline in alcohol use through changes in the frequency of unorganized socializing with peers (the significance of estimated indirect effects in Table 3;  $p < 0.001$ ). The frequency of going out with friends in leisure time significantly predicted adolescent involvement with alcohol. However, the frequency of such an unorganized hanging out with peers declined substantially between 2011 and 2015 as well. These changes accounted for a major portion of the recent declines in adolescent alcohol use.

Among boys, these changes accounted for 51.1%–62.7%, depending on alcohol indicator entering the SEM. Hence, among boys, partial mediation was confirmed. Among girls, the mediation was more pronounced – accounting for 65.4%–99.6% depending on the alcohol indicator analysed. Given the non-significance of parameter estimates of direct paths from ‘Survey year 2015’ to ‘Alcohol-use’ among girls ( $p > 0.05$ ), rather full mediation was corroborated among them; particularly with respect to the last year alcohol intoxication (DV2): Beta (SE) = 0.00 (0.04);  $p = 0.987$ .

Comparing the standardized regression coefficients in Table 3, the effect of unorganized socializing with peers on alcohol use was more pronounced in the case of ‘Leisure 1’ indicator (going out in the evenings to a party, disco and/or bars) as compared to ‘Leisure 2’ (going out with friends just for fun to parks, streets, and/or shopping centres). Similarly, decline in the frequency of unorganized socializing between 2011 and 2015 was more pronounced in ‘Leisure 1’ compared to ‘Leisure 2’, as depicted by the standardized coefficients in Table 3.

## Discussion

In this paper we aimed to analyze to what extent the changes in unorganized leisure time activities, especially declines in the frequency of going out with friends, affected the recent changes in adolescent alcohol use in Czechia. Results of the mediation analysis showed that decline in frequency of unorganized socializing with peers explained a major part of the declines. The mediating effect was confirmed in all the four alcohol indicators surveyed in the ESPAD study. With respect to gender, the mediating effect was more pronounced among girls (65.4%–99.6%) compared to boys (51.1%–62.7%).

The results are in line with the above cited research showing that adolescent frequent involvement in going out for parties and fun increases the risk of alcohol intoxication. Nevertheless, the more important finding of our study includes the fact that the significant *decline* in this risk factor accounted for major changes in adolescent alcohol use. In a similar study by Raitasalo et al. (2018), conducted among Finnish adolescents, temporal changes in unorganized going out with friends explained considerably less of the decline than our study (about 25–27%). Their study concluded that changes in the perceived availability of alcohol had the strongest explanatory power in explaining declines in adolescent alcohol use.

Apart from the changes in the frequency of unorganized socializing with friends, one could also discuss whether the decline in alcohol use among the Czech adolescents could be explained by temporal changes in other substance-use related factors. In some European countries, especially Scandinavian ones, the declines in adolescent alcohol use have been discussed in the context of more restrictive alcohol policies (Raitasalo et al., 2018, Gilligan et al., 2012, Bendtsen et al., 2014). In the Czech Republic, however, no political measures have been introduced in the last decade that could have a significant impact on the availability of alcohol. Similarly, no massmedia prevention campaigns took place nor major public health interventions were implemented that might have changed the attitudes of young people towards alcohol (Hnilicova et al., 2017, Mravčík et al., 2017).

As regards possible effect of other risk factors, several studies argued that normative nature of alcohol consumption among peer groups is a strong psychosocial predictor of both adolescent alcohol use and alcohol intoxication (Fletcher et al., 1995, Thorlindsson and Bernburg, 2006, Goldberg-Looney et al., 2016, Llorens et al., 2011). Similarly, research focusing on the combined influence of peer pressure and leisure boredom proved its significance on adolescent risk behaviours (Wegner and Flisher, 2009, Hendricks et al., 2015, Sharp et al., 2011); as adolescents who lack new experience, interests and/or impulses in their leisure time are more likely to engage in substance use. In fact, leisure boredom may be seen as a predictor of frequent hanging around with peers in an unorganized way, as the most widely reported explanation for boredom and substance-related experiments by adolescents is that “there was nothing else to do” (Caldwell et al., 2017, Weybright et al., 2015). Unfortunately, neither questions on substance use among peers, nor scales on leisure boredom were included in the Czech ESPAD study. However, we would like to emphasize that there were no major changes in the support and financial investment into extracurricular leisure time activities in the Czech Republic in the last decade (MŠMT ČR, 2019). Therefore, we consider the eventual effect of these factors to the recent decline in adolescent alcohol use as rather implausible.

Unlike the unorganized leisure activities, the organized ones are considered to have a protective effect on adolescents' involvement in risk behaviours, mostly due to supervision of adults (Sharmin et al., 2017, Yap et al., 2017, Ryan et al., 2010). As already mentioned above, no significant changes in adolescent involvement in organized forms of leisure-time activities (active sport, exercise, regular hobbies, etc.) took place in recent decades in the Czech Republic, as shown by the results of the previous Czech ESPAD studies. In a similar vein, the level of parental monitoring also did not significantly change between 2011 and 2015 (Chomynová et al., 2016), and thus it cannot explain the recent changes in alcohol use among the Czech youth either.

In the context of recent changes in leisure-time preferences, it should be noted that these have been accompanied by a gradual increase in frequent Internet use in the last decade, now showing a vast majority of the Czech adolescents being online daily (Sigmundová et al., 2017, Spilková et al., 2017). In 2015, 87% of the Czech 15-16 year-olds reported being daily users of Internet, with 41.5% of students reported being online daily for 4 hours or more (Chomynová et al., 2016). Although some effect of changes in the frequency of use of ICT resulting in declines in going out with friends in the leisure time might be plausible for an explanation of the recent decline in adolescent alcohol use, the Czech ESPAD study did not provide data on time spent online in 2011. Thus, in this respect, it is not possible to evaluate the effect of eventual increase of ICT between the survey data collection years. Nevertheless, even though the widespread use of the Internet and smartphones can sometimes be referred to as a potential explanation of the changes in alcohol consumption among adolescents, earlier studies showed that the declines in alcohol use in some countries started already before the widespread of the Internet (Twenge and Park, 2017), hence, suggesting that this theory alone is not enough to explain the ongoing changes.

## **Limitations and Conclusions**

As ESPAD is a cross-sectional school survey, several methodological limitation should be noted for this study, including i) possible selection bias resulting from surveying only the youth that was present at school on the day of the data collection; ii) not reaching students in special schools or with special education needs, nor children living in institutional settings; iii) the self-reporting design of the ESPAD questionnaire, which might possibly bias the data on adolescent alcohol use.

Results presented here are limited to the population of Czech adolescents. Further analyses should be carried out to analyse temporal trends in leisure-time activities in countries experiencing similar declines in adolescent alcohol use. Such analyses would show whether the level of alcohol use among youth was primarily driven by factors similar to those in the Czech Republic, or whether it was rather influenced by other factors operating at macro level (e.g. institutional changes, alcohol policy measures, changing alcohol-related attitudes through new social norms and/or generational shift in health-related behaviours).

In our paper, we tried to estimate the sole effect of declines in frequent going out with friends in leisure time on changes in adolescent alcohol use, and showed that decline in unorganized socializing with peers explained major part of the declines in alcohol use. Future research may focus on the gender differences observed and their underlying factors, taking into account more universal changes in adolescent lifestyles ongoing in line with the widespread use of the Internet as well. The



focus on increasing time spend on ICT could also be beneficial in the sense that substitution of face-to-face contacts by socializing online may bring new risks for the future health of adolescent population.

## Declaration of conflict of interest

The authors declare no conflict of interest.

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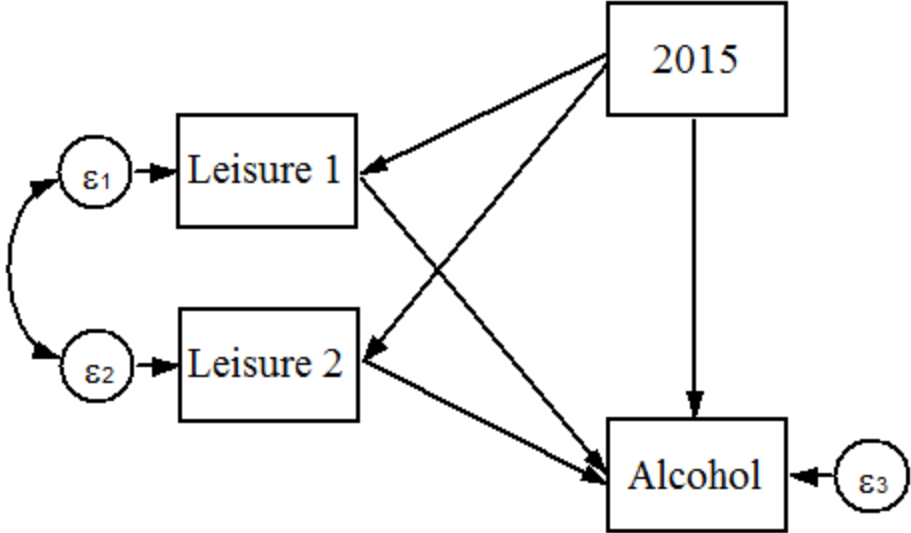
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Figure 1. Definition of the structural model used for mediation analysis, by gender



Legend:

- Leisure 1 - going out with friends in evenings (for a disco, cafe, party)
- Leisure 2 - going around with friends for fun to shopping centers, streets, and/or parks
- 2015 - survey year 2015 (ref. = 2011)
- Alcohol - adolescent alcohol use (DV1 – DV4)
- $\epsilon_1 - \epsilon_3$  - residuals

Table 1. Descriptive statistics of the dataset and variables used in analysis, adolescents aged 15–16 years, N = 6,448 observations, Czechia, ESPAD 2011 and 2015

Variable	%; Mean (Std. dev.)	Min-Max
Survey year		
2011	57.5%	0
2015	42.5%	1
Gender		
Boys	47.7%	0
Girls	52.3%	1
Age	16.0 (0.3)	15.5–16.4
Lifetime alcohol intoxication	2.1 (1.4)	1–7
Alcohol intoxication in the past year	1.7 (1.0)	1–7
Alcohol intoxication in the past 30 days	1.2 (0.6)	1–7
Binge drinking in the past 30 days	2.0 (1.3)	1–6
Going out with friends in evenings (for a disco, cafe, party)	2.7 (1.1)	1–5
Going around with friends for fun to shopping centers, streets, and/or parks	3.7 (1.1)	1–5

Table 2. Pairwise correlations between variables used in the analysis, by gender

Gender / Variable		Girls (n <sub>2</sub> = 3,367)						Mean (SD)	
		(1)	(2)	(3)	(4)	(5)	(6)		(7)
Boys (n <sub>1</sub> = 3,070)	(1) Lifetime alcohol intoxication [DV 1]	1	0.837	0.498	0.517	0.427	0.236	-0.131	1.99 (1.20)
	(2) Alcohol intoxication in the past year [DV 2]	0.876	1	0.581	0.479	0.386	0.227	-0.088	1.61 (0.90)
	(3) Alcohol intoxication in the past 30 days [DV 3]	0.603	0.687	1	0.412	0.248	0.120	-0.084	1.19 (0.53)
	(4) Binge drinking in the past 30 days [DV 4]	0.547	0.511	0.409	1	0.43	0.231	-0.125	1.86 (1.23)
	(5) Going out with friends in evenings [Leisure 1]	0.458	0.417	0.273	0.469	1	0.355	-0.220	2.74 (1.02)
	(6) Going around with friends for fun [Leisure 2]	0.233	0.199	0.117	0.212	0.357	1	-0.106	3.88 (0.98)
	(7) Survey year (2011 = 0; 2015 = 1)	-0.198	-0.157	-0.102	-0.175	-0.242	-0.043	1	0.43 (0.50)
Mean (SD)		2.28 (1.49)	1.82 (1.14)	1.29 (0.68)	2.23 (1.44)	2.71 (1.10)	3.50 (1.18)	0.42 (0.49)	N = 6,437

Table 3. Mediation of recent decline in adolescent alcohol consumption (2011 vs. 2015) via socializing with peers in leisure time, ADF method, Czechia, ESPAD (2011, 2015)

Endogen. var.	←	Exogen. var.	Gender	Alcohol use indicators (DV1 - DV2)					
				Lifetime alcohol intoxication (DV1)			Last year alcohol intox.(DV2)		
				Coef. (SE) <sup>+</sup>	p-Value	Std. Coef.	Coef. (SE) <sup>+</sup>	p-Value	Std. Coef.
Leisure 1	←	Survey year 2015	Boys	-0.54 (0.05)	<0.001	-0.24	-0.54 (0.03)	<0.001	-0.24
			Girls	-0.45 (0.05)	<0.001	-0.22	-0.45 (0.05)	<0.001	-0.22
Leisure 2	←	Survey year 2015	Boys	-0.10 (0.05)	0.041	-0.04	-0.10 (0.04)	0.012	-0.04
			Girls	-0.21 (0.04)	<0.001	-0.11	-0.21 (0.05)	<0.001	-0.11
Alcohol indicator	←	Leisure 1	Boys	0.54 (0.02)	<0.001	0.40	0.38 (0.02)	<0.001	0.37
			Girls	0.45 (0.02)	<0.001	0.39	0.31 (0.02)	<0.001	0.36
	←	Leisure 2 [*]	Boys	0.11 (0.01)	<0.001	0.09	0.08 (0.01)	<0.001	0.08
			Girls	0.11 (0.01)	<0.001	0.09	0.08 (0.01)	<0.001	0.09
	←	Survey year 2015	Boys	-0.29 (0.05)	<0.001	-0.10	-0.15 (0.04)	0.001	-0.06
			Girls	-0.08 (0.05)	0.088	-0.03	0.00 (0.04)	0.987	0.00
Covariance (e1, e2)									
e.Leisure 1	↔	e.Leisure 2	Boys	0.44 (0.03)	<0.001	.	0.44 (0.03)	<0.001	.
			Girls	0.33 (0.02)	<0.001	.	0.33 (0.02)	<0.001	.
<b>Mediation of the effect of 'Survey year 2015' on 'Alcohol-use indicator'</b>									
Mediated indirect effect			Boys	-0.31 (0.03)	<0.001	-0.10	-0.22 (0.02)	<0.001	-0.09
			Girls	-0.23 (0.03)	<0.001	-0.09	-0.16 (0.02)	<0.001	-0.09
Total effect			Boys	-0.60 (0.06)	<0.001	-0.20	-0.36 (0.05)	<0.001	-0.16
			Girls	-0.31 (0.05)	<0.001	-0.13	-0.16 (0.04)	<0.001	-0.09
Indirect effect / Total effect [%]			Boys	51.1%			59.4%		
			Girls	73.1%			99.6%		
<b>Goodness of fit statistics</b>									
Chi-square (df), p-Value				0.096 (1), p = 0.756			2.082 (1), p = 0.149		
RMSEA (90% CI)				0.000 (0.000–0.032)			0.019 (0.000–0.055)		
Comparative fit index				1.000			0.999		
Number of observations				6,344			6,252		

Notes:

Leisure 1 = Going out with friends in evenings (for a disco, cafe, party)

Leisure 2 = Going around with friends for fun to shopping centers, streets, and/or parks

[\*] identifies parameter estimates constrained to be equal across groups.

<sup>+</sup> bootstrapped standard errors, number of replications = 50.

Table 3 cont.

Endogen. var.	←	Exogen. var.	Gender	Alcohol use indicators (DV3 - DV4)					
				Last month alcohol intox. (DV3)			Binge drinking (DV4)		
				Coef. (SE) <sup>+</sup>	p-Value	Std. Coef.	Coef. (SE) <sup>+</sup>	p-Value	Std. Coef.
Leisure 1	←	Survey year 2015	Boys	-0.55 (0.04)	<0.001	-0.25	-0.55 (0.04)	<0.001	-0.25
			Girls	-0.45 (0.04)	<0.001	-0.22	-0.45 (0.04)	<0.001	-0.22
Leisure 2	←	Survey year 2015	Boys	-0.10 (0.06)	0.063	-0.04	-0.11 (0.04)	0.012	-0.05
			Girls	-0.22 (0.04)	<0.001	-0.11	-0.21 (0.04)	<0.001	-0.11
Alcohol indicator	←	Leisure 1	Boys	0.16 (0.02)	<0.001	0.25	0.56 (0.03)	<0.001	0.43
			Girls	0.12 (0.01)	<0.001	0.23	0.48 (0.02)	<0.001	0.40
	←	Leisure 2 [*]	Boys	0.02 (0.01)	0.108	0.03	0.09 (0.02)	<0.001	0.07
			Girls	0.02 (0.01)	0.108	0.03	0.09 (0.02)	<0.001	0.07
	←	Survey year 2015	Boys	-0.05 (0.03)	0.038	-0.04	-0.19 (0.05)	<0.001	-0.07
			Girls	-0.03 (0.02)	0.157	-0.03	-0.07 (0.04)	0.067	-0.03
Covariance (e1, e2)									
e.Leisure 1	↔	e.Leisure 2	Boys	0.45 (0.03)	<0.001	.	0.45 (0.02)	<0.001	.
			Girls	0.33 (0.02)	<0.001	.	0.33 (0.02)	<0.001	.
<b>Mediation of the effect of 'Survey year 2015' on 'Alcohol-use indicator'</b>									
Mediated indirect effect			Boys	-0.09 (0.01)	<0.001	-0.06	-0.31 (0.03)	<0.001	-0.11
			Girls	-0.06 (0.01)	<0.001	-0.05	-0.24 (0.03)	<0.001	-0.10
Total effect			Boys	-0.14 (0.03)	<0.001	-0.10	-0.51 (0.06)	<0.001	-0.17
			Girls	-0.09 (0.02)	<0.001	-0.08	-0.31 (0.05)	<0.001	-0.12
Indirect effect / Total effect [%]			Boys	62.7%			62.0%		
			Girls	65.4%			76.1%		
<b>Goodness of fit statistics</b>									
Chi-square (df), p-Value				0.081 (1), p = 0.776			2.039 (1), p = 0.153		
RMSEA (90% CI)				0.000 (0.000–0.031)			0.018 (0.000–0.055)		
Comparative fit index				1.000			0.999		
Number of observations				6,247			6,353		

## Notes:

Leisure 1 = Going out with friends in evenings (for a disco, cafe, party)

Leisure 2 = Going around with friends for fun to shopping centers, streets, and/or parks

[\*] identifies parameter estimates constrained to be equal across groups.

<sup>+</sup> bootstrapped standard errors, number of replications = 50.