Susceptibility to smoking and associated factors among the youth in central and eastern European countries.

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Abstract

Background

Tobacco use among young people still remains a major public health problem. The aim of this study was to examine the association between a variety of factors and susceptibility to smoking initiation and experimentation among the youth from central and eastern European countries.

Methods

The data used in the current analysis, focusing on current non-smokers, is available from the Global Youth Tobacco Survey, which was performed in five countries (the Czech Republic (2016), $n = 3191$; Slovakia (2016), $n = 3178$; Slovenia (2017), $n = 2255$; Romania (2017), $n = 4681$; Lithuania (2018), $n = 2260$).

Results

Among the never smokers, nearly a quarter of the students were susceptible to smoking in 4 of 5 countries (16% of those susceptible to smoking were identified in Romania). Moreover, 60% of the students in the Czech Republic, Slovakia and Slovenia, and about 50% of the students in Lithuania and Romania were found to be vulnerable to smoking experimentation (an analysis among ever smokers). The multiple regression models provided results that are consistent among all the examined countries, with the following factors identified as significant correlates of smoking initiation and experimentation: being girls, having more money available for own expenses, experiencing exposure to passive smoking in public places, as well as indicating peer smoking. Moreover, adolescents who have declared lack of antismoking education and knowledge on harmful effects of passive smoking, those who saw people using tobacco on TV, in videos or in movies as well as advertising of tobacco products at point of sales were susceptible to smoking. Finally, the students who shared an opinion that smoking helped people feel more comfortable at celebrations, parties or in other social gatherings were at higher risk of smoking susceptibility.

Conclusions

A high proportion of the youth from central and eastern European countries is susceptible to smoking. Personal and social factors and those related to educational and policy issues were strongly and consistently correlated with smoking susceptibility. These factors should be considered when designing and implementing anti-smoking activities among young people.

Background

Tobacco use among young people remains a major public health problem worldwide. Adolescents are at risk of experimenting with various tobacco and nicotine products [1]. Data shows that 88% of current adult tobacco smokers start smoking before the age of 18 and that about one fifth of adolescents around the world smoke tobacco with multiple effects on their health (increased mortality and morbidity from non-communicable diseases (NCDs), reduced life expectancy), economy and social, peer and family integrity [2–5]. Moreover, existing studies indicate that individuals who started smoking at a younger age usually smoke more cigarettes per day, are at higher risk of nicotine addiction, are less likely to try to quit smoking or if they do so, they have less chance to quit comparing to those who start smoking as adults [6–8]. They are also prone to coexisting risky behaviours such as alcohol or illicit drugs use [9].

According to the WHO data, there are 1.4 billion tobacco users aged 15 years and above worldwide – 1.07 billion smokers and 367 million smokeless tobacco users. In addition, 24 million children aged 13–15 smoke globally, and 13 million use smokeless tobacco [10]. In Europe, adult and adolescent tobacco use is among the highest in WHO regions, with 28% and 17%, respectively. Tobacco consumption among young people is growing, in some countries, such as: Lithuania, Latvia and the Czech Republic, reaching almost similar rates as in adults [11]. The recent Global Youth Tobacco Survey (GYTS) conducted in central and eastern European countries indicates the following percentages of current smokers among 13–15 year old adolescents: the Czech Republic: 15%, Slovakia 17%, Lithuania 17%, Romania 9% and Slovenia 6% [12].

Considering all the above, preventing minors from starting is more effective and it costs less than helping users to quit. An important public health challenge is, therefore, to identify factors that influence propensity to smoke among young people and predict their likelihood

of smoking in the future [8]. Knowing them is crucial for development of effective preventive measures to reduce smoking among young people, and thus, reduce the frequency of smoking.

According to its definition, susceptibility to smoking is the lack of a firm commitment not to smoke and it is a strong predictor of regular smoking and addiction [13]. Studies indicate that the youth who are susceptible to smoking are more likely to experiment with tobacco and to become regular smokers compared to those non-susceptible ones. Moreover, susceptibility to smoking has been shown to be modifiable through interventions (which can either prevent the youth from becoming susceptible to smoking or prevent susceptible adolescents from progressing to regular smokers) [14]. Various factors are indicated as correlates of smoking susceptibility among the youth, including: individual characteristics (e.g. age, gender), social environment and social contexts (e.g. family, friends, school) [8, 15–21]. However, such factors can be region or country specific. GYTS, which has been conducted recently in central and eastern European countries, create a unique opportunity to evaluate or update the factors that predispose young people to be susceptible to smoking, which in turn can be useful for development and implementation of effective tobacco control strategies in these countries [12].

Thus, the aim of the study was to assess the association between a variety of factors and smoking susceptibility in the non-currently smoking youth from the Czech Republic, Slovakia, Lithuania, Slovenia and Romania.

Methods

Study design and population

The data used in the current analysis is from GYTS, a part of Global Tobacco Surveillance System (GTSS), which was developed to track tobacco use among young people and enhance the capacity of countries to design, implement and evaluate tobacco control and prevention programmes [12, 18]. GYTS is a cross-sectional, nationally representative school-based survey that collects data using standardized methodology for constructing the sample frame, selecting schools and classes and processing data. Following GYTS two-stage sample design, in all of the five countries (the Czech Republic (2016), Slovakia (2016), Slovenia (2017), Romania (2017), Lithuania (2018)) schools were selected with a probability proportional to the enrollment size and within these schools classes were randomly chosen. All of the students from the selected classes were invited to participate in the survey. The overall response rates were, as follows: the Czech Republic 78.3%, Slovakia 81.7%, Slovenia 68.0%, Romania 88.6%, Lithuania 82.7%. Taking into account the study purpose, so as to assess patterns of smoking susceptibility, the analysis was restricted to the current non-smokers understood as the students who did not smoke cigarettes in the past 30 days. The participants were also excluded in case of missing data for the smoking status or a dependent variable. That resulted in the following sample size considered in the current analysis: 3191 of 3926 students from the Czech Republic, 3178 of 3997 students from Slovakia, 2255 of 2629 students from Slovenia, 4681 of 5409 students from Romania and 2260 of 3030 students from Lithuania.

The Ministry of Health of each country (Public Health Authority of the Slovak Republic) handled scientific, ethical and technical coordination of the study. Ethical approvals were obtained from the relevant committees.

Questionnaire, dependent and independent variables

GYTS uses a standard, anonymous, self-administered questionnaire that produces estimates on tobacco use (smoking and smokeless), exposure to second hand smoke, tobacco use cessation, access and availability to tobacco, awareness of anti-tobacco information and exposure to tobacco marketing [18, 22]. The questionnaires and databases are publicly available at <https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html> [12]. The dependent variable considered in the current study was susceptibility to tobacco product use as adopted from Pierce et al. (1996) [13]. It is based on two questions: “If one of your best friends offered you a tobacco product, would you use it? (in Slovenia the following question was asked: “If one of your best friends offered you a cigarette or another tobacco product, would you use it? ”) and “At any time during the next 12 months do you think you will use any form of tobacco?” (in Slovenia the following question was asked: “At any time during the next 12 months do you think you will smoke tobacco?”). For each of the questions the following four answers were possible: “Definitely not”, “Probably not”, “Probably yes” and “Definitely yes”. The students who answered definitely not to both questions were coded as non-susceptible ones and all the other youth were considered as susceptible to smoking [7].

Table S1 presents independent variables together with the codes for original questions and the analysis variables. They include socio-demographic and economic data: sex, age, parental education, money available for own expenses; information related to second hand smoking; knowledge and attitudes regarding tobacco use, pro and anti-tobacco media and advertising, and antismoking education provided by the school or family.

Statistical analysis

STATISTICA version 10.0 (Dell Software, Arizona, CA, USA) was used to perform the statistical analysis. Similarly to the previously published studies in this field, the statistical analyses covered several steps [7, 18]. Initially, a descriptive analysis for all the variables involved in the analysis was completed. The univariable and multivariable logistic regression analyses with results being presented as odds ratios (OR) with 95% confidence intervals were applied to study the factors linked to susceptibility to smoking among the youth in the five central and eastern European countries. In the multivariable analyses, all the variables ($p < 0.1$) were simultaneously included. To test multicollinearity between the variables, the variance inflation factor (VIF) was calculated. A separate analysis was performed among the never (those who had never tried smoking in their lifetime) and ever smokers (those who had ever smoked even once one or two puffs in the past but are not current smokers). In that perspective susceptibility was used as a predictor for experimentation with tobacco products (the ever smokers) and smoking initiation (the never smokers) [7]. A p value of less than 0.05 was considered statistically significant.

Results

Characteristics of the students included in the current analysis are summarized in Table S2 - never smokers and Table S3 - ever smokers. Among the current non-smokers 59% (in Lithuania) to 79% (in Romania) of the students indicated the never-smoking status ($p < 0.001$). The rest experimented with tobacco smoking (ever smokers) (Table 1). Significant differences ($p < 0.001$) were observed between the countries with respect to the percentages of young people that were susceptible to smoking, from 23% in Romania to 38% in the Czech Republic (no differences were noted only between the Czech Republic and Slovakia, the

Table 1
Smoking experience and susceptibility to cigarette smoking

Characteristics*	Czech Republic	Slovakia	Slovenia	Lithuania	Romania
	N = 3191	N = 3178	N = 2255	N = 2260	N = 4681
	n (%)	n (%)	n (%)	n (%)	n (%)
Smoking experience ^a	1997 (62.5%)	1998 (62.9%)	1765 (78.3%)	1305 (59.1%)	3718 (79.4%)
Never smokers	1194 (37.5%)	1180 (37.1%)	490 (21.7%)	955 (41.9%)	963 (20.6%)
Ever smoker					
If one of your best friends offered you a cigarette or another tobacco product, would you use it?	2192 (68.8%)	2200 (69.4%)	1776 (79.0%)	1641 (73.4%)	3893 (83.3%)
Definitely not	698 (21.9%)	684 (21.5%)	223 (9.9%)	339 (15.1%)	516 (11.0%)
Probably not	277 (8.7%)	238 (7.5%)	215 (9.6%)	219 (9.8%)	214 (4.6%)
Probably yes	21 (0.6%)	50 (1.6%)	34 (1.5%)	38 (1.7%)	51 (1.1%)
Definitely yes	3 (0.1%)	6 (0.2%)	7 (0.3%)	23 (1.0%)	7 (0.1%)
Missing n (%)**					
At any time during the next 12 months do you think you will use any form of tobacco?	2360 (74.1%)	2352 (74.1%)	1699 (75.4%)	1640 (72.7%)	3906 (83.6%)
Definitely not	610 (19.1%)	579 (18.2%)	452 (20.1%)	375 (16.6%)	503 (10.8%)
Probably not	176 (5.5%)	196 (6.2%)	86 (3.8%)	215 (9.5%)	202 (4.3%)
Probably yes	43 (1.3%)	47 (1.5%)	15 (0.7%)	27 (1.2%)	61 (1.3%)
Definitely yes	2 (0.1%)	4 (0.1%)	3 (0.1%)	3 (0.1%)	9 (0.2%)
Missing n (%)**					
Susceptible to smoking ^b	1974 (61.9%)	2020 (63.6%)	1558 (69.1%)	1453 (64.3%)	3627 (77.5%)
No	1217 (38.1%)	1158 (36.2%)	697 (30.9%)	807 (35.7%)	1054 (22.5%)
Yes					
^a p<0.001; Czech Republic vs Slovakia (p > 0.05), Czech Republic vs Slovenia (p < 0.001), Czech Republic vs Lithuania (p < 0.001), Czech Republic vs Romania (p < 0.001), Slovakia vs Slovenia (p < 0.001), Slovakia vs Lithuania (p < 0.001), Slovakia vs Romania (p < 0.001), Slovenia vs Lithuania (p < 0.001), Slovenia vs Romania (p > 0.05), Lithuania vs Romania (p < 0.001); ^b p < 0.001; Czech Republic vs Slovakia (p > 0.05), Czech Republic vs Slovenia (p < 0.001), Czech Republic vs Lithuania (p > 0.05), Czech Republic vs Romania (p < 0.001), Slovakia vs Slovenia (p < 0.001), Slovakia vs Lithuania (p > 0.05), Slovakia vs Romania (p < 0.001), Slovenia vs Lithuania (p < 0.001), Slovenia vs Romania (p < 0.001), Lithuania vs Romania (p < 0.001)					
*percentages calculated for observed values; **percentages of total number of subjects					

Factors associated with susceptibility to tobacco products use among the never smokers

Among the never smokers close to one fourth were susceptible to smoking in 4 out of 5 countries (Table S2). A lower percentage of the students classified as susceptible to smoking was observed in Romania (16%). Results from the univariable analysis that was run to identify correlates of smoking susceptibility are presented in Table S4. The further analysis, using the multiple regression, provided the results that are consistent among all the countries (Table 2). The higher susceptibility to smoking was observed among girls from the Czech Republic (OR = 1.4; 95%CI 1.1–1.7) and from Slovenia (OR = 1.4; 95%CI 1.1–1.8). Having more money available for own expenses was a significant correlate of smoking susceptibility (the Czech Republic: OR = 1.5; 95%CI 1.1–1.9, Slovakia: OR = 1.6; 95%CI 1.2–2.0, Slovenia: OR = 1.6; 95%CI 1.3–2.1, Romania: OR = 1.5; 95%CI 1.2–1.9). The students who experienced exposure to passive smoking in public places were more susceptible to smoking in all the analyzed countries (the Czech Republic: OR = 1.6; 95%CI 1.3–2.0, Slovakia: OR = 1.3; 95%CI 1.0–1.7, Slovenia: OR = 1.4; 95%CI 1.0–1.9, Lithuania: OR = 1.4; 95%CI 1.0–1.8, Romania OR = 1.6; 95%CI 1.3–2.0). Moreover, the youth whose siblings or close friends smoked were more willing to initiate smoking in 4 countries (lack of the association was only noted

in Slovenia). Lack of discussion about health consequences of cigarette smoking during the classes (in all the countries except for Romania) and with family members (Slovenia: OR = 1.5; 95%CI 1.2-2.0 and Romania: OR = 1.5; 95%CI 1.2–1.8) increased the risk of being susceptible to smoking. The youth from Slovakia and Slovenia who were not aware of health consequences of passive smoking were at higher risk of smoking initiation (Slovakia: OR = 1.9; 95%CI 1.2–2.9, Slovenia: OR = 2.4; 95%CI 1.5-4.0). The adolescents who saw people using tobacco on TV, in videos or in movies (Slovenia: OR = 1.5; 95%CI 1.1–2.1 and Lithuania: OR = 1.6; 95%CI 1.2–2.2) or saw some advertisements or promotions of tobacco products at points of sale (Slovakia: OR = 1.5; 95%CI 1.1–1.9, Slovenia: OR = 1.5; 95%CI 1.2–1.9 and Romania: OR = 1.3; 95%CI 1.1–1.6) were more susceptible to tobacco products use. Finally, the adolescents who thought that smoking helped people feel more comfortable at celebrations, parties or in other social gatherings were more inclined to start smoking (the Czech Republic: OR = 1.3; 95%CI 1.1–1.7, Slovakia: OR = 1.4; 95%CI 1.1–1.8, Slovenia: OR = 1.5; 95%CI 1.2–1.9, Lithuania: OR = 1.9; 95%CI 1.4–2.6, Romania: OR = 1.6; 95%CI 1.3-2.0).

Table 2

Factors associated with susceptibility to smoking among never and ever smoking youth from five central and eastern European countries - multivariate logistic regression

Characteristics	Czech Republic		Slovakia		Slovenia		Lithuania		Romania	
	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers
OR (95%CI)										
Sex	1.00	1.00		1.00	1.00	1.00				1.00
Male	1.38 (1.11–1.72)	1.39 (1.08–1.77)		1.38 (1.07–1.79)	1.42 (1.11–1.81)	1.47 (1.00–2.16)				1.21 (0.91–1.60)
Female										
Age		1.00	1.00		1.00		1.00		1.00	1.00
13 years or younger		1.20 (0.88–1.62)	1.01 (0.77–1.33)		1.05 (0.75–1.48)		1.39 (0.95–2.04)		1.48 (1.18–1.86)	1.28 (0.93–1.78)
14 years										
15 years or older		1.01 (0.74–1.37)	1.28 (0.95–1.73)		1.10 (0.79–1.54)		1.25 (0.85–1.84)		1.12 (0.81–1.54)	1.11 (0.76–1.63)
Money available per week for own expenses	1.00	1.00	1.00	1.00	1.00	1.00			1.00	1.00
None or little	1.46 (1.14–1.86)	1.33 (1.01–1.74)	1.56 (1.21–2.02)	1.30 (0.99–1.72)	1.62 (1.25–2.09)	1.58 (1.03–2.43)			1.51 (1.22–1.86)	1.12 (0.84–1.50)
More										
Exposure to SHS at home	1.00		1.00		1.00	1.00	1.00		1.00	1.00
No	1.09 (0.81–1.46)		1.17 (0.90–1.52)		1.08 (0.81–1.42)	1.42 (0.95–2.12)	0.96 (0.70–1.31)		1.13 (0.87–1.47)	1.41 (0.99–1.99)
Yes										
Exposure to SHS in public places	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
No	1.57 (1.25–1.98)	1.66 (1.29–2.13)	1.31 (1.03–1.68)	1.28 (0.98–1.66)	1.39 (1.04–1.86)	1.32 (0.87–2.01)	1.36 (1.01–1.82)	1.27 (0.96–1.68)	1.61 (1.28–2.02)	2.22 (0.91–1.63)
Yes										
Parental smoking	1.00						1.00	1.00		
No (none)	1.00 (0.76–1.31)						1.01 (0.79–1.29)	0.90 (0.63–1.28)		
Yes (one or both)										
Peers smoking	1.00	1.00	1.00	1.00			1.00	1.00	1.00	1.00
No	2.24 (1.79–2.79)	1.76 (1.36–2.28)	1.72 (1.34–2.20)	2.21 (1.65–2.94)			2.48 (1.84–3.36)	2.34 (1.72–3.18)	2.14 (1.72–2.66)	2.24 (1.65–3.05)
Yes										

SHS – secondhand smoke

Characteristics	Czech Republic		Slovakia		Slovenia		Lithuania		Romania	
	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers
	OR (95%CI)									
Seen anyone smoking inside the school or outside on school property	1.04 (0.82–1.31)			1.26 (0.97–1.64)	1.08 (0.83–1.41)		1.29 (0.96–1.74)		1.19 (0.96–1.47)	
Yes	1.00			1.00	1.00		1.00		1.00	
No										
Knowledge about harmful effects of smoking	1.53 (0.97–2.42)						1.55 (0.91–2.62)	1.48 (0.95–2.29)		
No	1.00						1.00	1.00		
Yes										
Knowledge about harmful effects of SHS	1.50 (0.98–2.29)		1.87 (1.20–2.91)	1.42 (0.91–2.23)	2.44 (1.50–3.96)		1.39 (0.91–2.13)		1.14 (0.85–1.53)	2.26 (1.50–3.40)
No	1.00		1.00	1.00	1.00		1.00		1.00	1.00
Yes										
Seen people using tobacco when watched TV, videos or movies	1.19 (0.92–1.53)	1.16 (0.86–1.55)	1.18 (0.93–1.51)	1.18 (0.90–1.53)	1.51 (1.11–2.06)	2.06 (1.32–3.24)	1.59 (1.18–2.16)	1.37 (1.03–1.83)	1.21 (0.97–1.51)	
Yes	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
No										
Exposure to advertisements or promotions at points of sale	1.14 (0.91–1.42)	1.50 (1.17–1.92)	1.45 (1.13–1.86)	1.25 (0.95–1.63)	1.49 (1.15–1.91)			1.27 (0.92–1.76)	1.33 (1.09–1.62)	1.59 (1.17–2.17)
Yes	1.00	1.00	1.00	1.00	1.00			1.00	1.00	1.00
No										
Exposure to antismoking media messages			1.00							1.00
Yes			1.27 (1.00–1.61)							1.43 (1.07–1.92)
No										
School discussion about health effects of smoking	1.00	1.00	1.00		1.00		1.00	1.00		
Yes	1.31 (1.05–1.64)	1.29 (1.01–1.66)	1.32 (1.04–1.68)		1.31 (1.02–1.68)		1.93 (1.43–2.60)	1.42 (1.07–1.89)		
No										

Characteristics	Czech Republic		Slovakia		Slovenia		Lithuania		Romania	
	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers
	OR (95%CI)									
School discussion about the reasons why people use tobacco									1.00	
Yes									0.77 (0.62–0.95)	
No										
Antismoking education provided by family					1.00				1.00	
Yes					1.53 (1.18–1.96)				1.45 (1.15–1.83)	
No										
Difficulty of quitting smoking by smoker									0.96 (0.76–1.23)	
Not difficult									1.00	
Difficult										
Smoking helps people feel more comfortable or less comfortable at celebrations parties or in other social gatherings	1.32 (1.06–1.66)	1.48 (1.15–1.91)	1.42 (1.12–1.80)	1.28 (0.99–1.66)	1.47 (1.15–1.87)	1.51 (1.03–2.22)	1.88 (1.38–2.56)	1.38 (1.02–1.87)	1.60 (1.26–2.02)	
More comfortable	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Less comfortable or no differences										
People who smoke have more or less friends			0.85 (0.61–1.18)	0.73 (0.51–1.04)			0.78 (0.56–1.10)	0.89 (0.64–1.23)	1.36 (1.01–1.82)	1.09 (0.73–1.62)
More friends			0.67 (0.48–0.94)	0.57 (0.38–0.85)			0.66 (0.43–1.02)	0.76 (0.50–1.14)	0.74 (0.54–1.01)	0.68 (0.45–1.05)
Less friends			1.00	1.00			1.00	1.00	1.00	1.00
No differences										

Characteristics	Czech Republic		Slovakia		Slovenia		Lithuania		Romania	
	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers	Never smokers	Ever smokers
	OR (95%CI)									
Smoking makes young people look more or less attractive			1.36 (0.88–2.11)	0.89 (0.52–1.54)			0.91 (0.47–1.75)	1.30 (0.70–2.40)	1.12 (0.78–1.61)	1.12 (0.70–1.81)
More attractive			0.65 (0.50–0.85)	0.80 (0.60–1.07)			0.72 (0.51–1.01)	0.72 (0.53–0.97)	0.54 (0.42–0.70)	0.52 (0.37–0.73)
Less attractive			1.00	1.00			1.00	1.00	1.00	1.00
No differences										
SHS – secondhand smoke										

Factors associated with susceptibility to tobacco products use among the ever smokers

About 60% of the students in the Czech Republic, Slovakia and Slovenia and about 50% of the students in Lithuania and Romania were susceptible to smoking experimentation (the analysis among the ever smokers) (Table S3). Generally, the factors predisposing to smoking experimentation were similar to those important for smoking initiation in the univariable (Table S4) and multivariable (Table 2) analyses. Girls were more susceptible to smoking experimentation (the Czech Republic: OR = 1.9; 95%CI 1.1–1.8, Slovakia: OR = 1.4; 95%CI 1.1–1.8, Slovenia: OR = 1.5; 95%CI 1.0–2.2). The ever smokers from the Czech Republic and from Slovenia who declared more money available for their expenses were at higher risk of smoking susceptibility comparing to those with no or little money available (the Czech Republic: OR = 1.3; 95%CI 1.0–1.7, and Slovenia: OR = 1.6; 95%CI 1.0–2.4). The smoking siblings or a smoking friends were identified as correlates of smoking susceptibility in all the countries except for Slovenia. The adolescents who have not discussed health consequences of tobacco smoking during the school curriculum (the Czech Republic: OR = 1.3; 95%CI 1.0–1.7, Lithuania: OR = 1.4; 95%CI 1.1–1.9), those who saw people using tobacco on TV, in videos or in movies (Slovenia: OR = 2.1; 95%CI 1.3–3.2, Lithuania: OR = 1.4; 95%CI 1.0–1.8) as well as advertising of tobacco products at points of sale (the Czech Republic: OR = 1.5; 95%CI 1.2–1.9, Romania: OR = 1.6; 95%CI 1.2–2.2) were at risk of smoking experimentation. All the students, except for Romanian ones, who shared an opinion that smoking helped people feel more comfortable at celebrations, parties or in other social gatherings were at higher risk of smoking susceptibility. Finally, the youth from Lithuania and Romania who thought that smoking tobacco made young people look less attractive had a lower risk of smoking experimentation (Lithuania: OR = 0.7; 95%CI 0.5–1.0, Romania: OR = 0.5; 95%CI 0.4–0.7).

Discussion

Our results indicate that nearly a quarter of the students were susceptible to smoking initiation in 4 out of 5 analyzed countries (with slightly lower percentages observed in Romania). A substantial proportion of the adolescents were also susceptible to smoking experimentation (from 49–61%). The correlates of susceptibility to smoking are consistent across all the analyzed countries. The current results present target groups, such as girls, and priorities, such as strengthening knowledge and attitudes towards smoking, for preventive measures to be taken to decrease percentage of the youth who initiate or experiment with smoking.

The earlier analysis, based on GYTS in 168 countries, has indicated that around 1 in 8 never-smoking young people worldwide is susceptible to smoking, with the highest percentage of the youth declaring smoking susceptibility reported in America and Europe [18]. This is proven by the WHO estimates indicating that smoking prevalence among adolescents and adults in Europe is among the highest in WHO regions [23]. Another assessment based on GYTS data from 25 European countries has also confirmed high susceptibility to smoking among adolescents [24]. Moreover, the study conducted in a rural area of Poland (between 2014 and 2015) based on GYTS questionnaire indicated 22% of never smokers and 57% of ever smokers susceptible to smoking, which is similar to the results obtained within the current assessments [7]. Some differences between the studies concerning proportion of those susceptible to smoking can result from several reasons, among which social and cultural norms, tobacco industry influence and legislation as well as preventive activities are the most frequently pointed ones. Moreover, age of a youth, definition of a current non-smoking status, susceptibility to smoking (focusing only on cigarettes or on any tobacco products; types of questions used for assessment) and time period of the study are among other factors.

Consistently, in all the analyzed countries, girls were more susceptible to smoking initiation and experimentation than boys. In some studies, similar results have been observed [25–29], whereas in others, including that conducted in Poland among a rural population, boys have been more susceptible to smoking [7, 30–33]. Earlier analyses of GYTS data from European countries (including all 5 countries involved in the current analysis) have also confirmed a similar pattern of smoking susceptibility among the never-smoking youth to the one observed in the current assessments [24]. The differences between the countries in the obtained results can be explained by general differences between the countries and the time when the studies were conducted, which in turn, can show target groups for tobacco industry (which are currently girls) and how the youth are susceptible to tobacco marketing [30].

Pocket money turned out to be a risk factor for smoking susceptibility in our study. This finding is in line with GYTS results from Greece, Cyprus or Bangladesh [34–37]. Parents should pay more attention to how their children's pocket money is used. Furthermore, the role of this factor in susceptibility to smoking needs to be considered together with teenagers' easy access to tobacco products.

We found that adolescents whose siblings or closest friends are smokers were at higher risk of smoking initiation or experimentation comparing to those with non-smoking peers. In the study conducted in Poland, friends' smoking status was a stronger predictor of susceptibility to smoking than the parental smoking status [7, 18]. Other studies also indicate that the strongest determinant of current smoking is peer influence [34, 35, 38–42]. Studies indicate that people tend to choose their friends based on shared characteristics, including tobacco smoking. However, having close friends who smoke does not need to mean that they cause a person to smoke. On the other hand, strong commitment not to smoke if offered a cigarette by a friend is crucial as a protective factor for not starting smoking [7]. There is also a need for peer education to help them quit smoking or at least abstinent from smoking in front of non-smokers. Creating a non-smoking fashion among young people seems to be most desirable. This has been also proven by our results that indicate that those who declared that tobacco helped people feel more comfortable at celebrations, parties or in other social gatherings were at higher risk of smoking susceptibility. Moreover, the youth who thought that people who smoke had fewer friends and that smoking made the youth less attractive had a lower risk of smoking susceptibility. So efforts should focus on changing such perceptions, norms and acceptance of smoking.

Exposure to passive smoking in public places was associated with increased susceptibility to smoking among the studied population, which is in agreement with other studies in this field and supports the need to create smoke-free environments worldwide together with effective enforcement of existing legislation [18].

Lack of knowledge about harmful effects of passive smoking and lack of training in the field of health consequences of tobacco smoking in the school curriculum is an additional, important factor of susceptibility to cigarette smoking. Similar results have been observed in other assessments in this field [7, 43]. Imparting knowledge about harmfulness of smoking has been one of the key tobacco control strategies.

Despite the existing legislation, our results, being in agreement with similar studies in this field, indicate that presence of smoking in movies is associated with an increased risk of smoking initiation, experimentation and tobacco consumption in adolescents [44–46]. Tobacco use by celebrities in the mass media should be reduced as media play an important role in shaping personality, especially in adolescents and young adults [47]. It has been also shown that susceptibility to smoking is influenced by exposure to advertising at points of sale [48–50]. Advertising at points of sale still remains a challenge. The results of research suggest that the complete ban on tobacco advertising in points of sale is significantly related to the reduced experimental smoking among adolescents and that this relationship is visible for both sexes [51]. Tobacco industry promotion efforts can be prevented by developing and implementing comprehensive bans along with stronger regulations, including enforcement of law, of tobacco company practices in accordance with WHO Framework Convention on Tobacco Control (FCTC) [52].

The current analysis has several strengths. GYTS is a cross-sectional, nationally representative survey and covers a large number of respondents from an adolescent population, assuring reliability and validity of the results. The protocols and questionnaires in all the analyzed countries were based on GYTS standards developed by experts in the field, which enables a direct comparison between the countries and trends assessments. Moreover, susceptibility to smoking was assessed by two questions which constitute frequently used and reliable measure of predisposition to smoking initiation and experimentation. Finally, the analysis considers a number of various potential correlates of susceptibility to smoking including socio-demographic, economic factors, information related to second hand smoking, knowledge and attitudes regarding tobacco use, pro and anti-tobacco media, advertising and educational issues related to health consequences of smoking. Limitations of the study also need to be pointed out. Firstly, due to the cross-sectional nature of the study, claims of causation cannot be made about the observed relationships between susceptibility to smoking and the studied variables. Secondly, all the estimates in our assessment were based on self-reports, which might be affected by reporting bias. Moreover, some differences in the response rates exists between the countries (from 68% in Slovenia to 89% in Romania), which may bias the obtained

results. The willingness to participate in the study can be determined by each country's socio-cultural norms, the level of trust and acceptance of being interviewed on sensitive issues. GYTS questionnaire contains some core questions. Additional questions can be selected or added by the experts depending on the country or specific issues studied. That is why some of the variables were not available in all the analyzed populations. Finally, our analysis did not control for other substances use such as alcohol or illicit drugs, which are also indicated to be associated with smoking. Despite the limitations stated above, this study provides an important insight into the prevalence and factors associated with susceptibility to smoking in central and eastern European countries. These correlates are crucial for effectiveness of prevention strategies to be taken among the youth.

Conclusions

Nearly a quarter of the students were susceptible to smoking initiation in 4 out of 5 analyzed countries (16% of susceptible to cigarette smoking were identified in Romania). A substantial proportion of adolescents was also susceptible to smoking experimentation. The results obtained within this analysis are consistent across all the analyzed countries and they indicate target groups, such as girls, and priorities, such as strengthening knowledge and attitudes towards smoking, for interventional activities aimed at decreasing percentage of the youth who initiate or experiment with smoking.

Declarations

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Authors' contribution

DK conceived the original idea for the analysis, co-drafted the paper and intellectually contributed to the development of the final manuscript. KP participated in the interpretation of the results and manuscript preparation. MZ undertook the literature search and co-drafted the manuscript.

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The questionnaires and databases are publicly available at <https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html>. The analysis and manuscript preparation was supported by the Medical University of Lodz (503/6-024-01/503-61-001-19-00).

Availability of data and materials

The questionnaires and databases are publicly available at: Global Tobacco Surveillance System Data (GTSSData): <https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html> Accessed 10 October 2020.

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations, including Declaration of Helsinki.

The GYTS in all countries was performed under the supervision of World Health Organization and the United States Centers for Disease Control and Prevention. The Ministry of Health of each country (Public Health Authority of the Slovak Republic) handled scientific, ethical and technical coordination of the study. Following the legal rules in each country, if required, written informed consent was obtained from all subjects or, if subjects are under 16, from a parent or legal guardian.

All analyses in this study were performed on publicly available, de-identified data, which was Institutional Review board waived as nonhuman research.

GYTS in Slovakia (2016) was approved by the Ethics Committee of the Jessenius Faculty of Medicine, Comenius University in Bratislava, Slovakia. Taking into consideration legislation of the Czech Republic, Slovenia, Lithuania and Romania anonymous questionnaire surveys did not require ethics committee approval.

The data from anonymous questionnaires were used in the surveys. There was no need for access of the clinical/personal patient data thus administrative permissions and/or licenses were not required.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interest.

References

1. Gorini G, Gallus S, Carreras G, Cortini B, Vannacci V, Charrier L, Cavallo F, Molinaro S, Galeone D, Spizzichino L, De Mei B, Pacifici R, Faggiano F; MADES Working Group. A long way to go: 20-year trends from multiple surveillance systems show a still huge use of tobacco in minors in Italy. *Eur J Public Health*. 2019;1;29(1):164-169.
2. Global Youth Tobacco Survey Collaborative Group: Preventing tobacco use among youth and young adults: a report of the surgeon general. Available from: http://www.cdc.gov/tobacco/data_statistics/sgr/2012. Accessed 02 January 2021.
3. Ranabhat ChL, Kim ChB, Park MB, Jakovljevic Situation, Impacts, and Future Challenges of Tobacco Control Policies for Youth: An Explorative Systematic Policy Review. *Front Pharmacol*. 2019;10:981.
4. Noncommunicable diseases: Campaign for action – Meeting the NCD targets. World Health Organization. 2017. <http://www.who.int/beat-ncds/en/>. Accessed 02 January 2021.
5. Committee on the Public Health Implications of Raising the Minimum Age for Purchasing Tobacco Products; Board on Population Health and Public Health Practice; Institute of Medicine; Bonnie RJ, Stratton K, Kwan LY, editors. Public Health Implications of Raising the Minimum Age of Legal Access to Tobacco Products. Washington (DC): National Academies Press (US); 2015 Jul 23. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK310412/>. Accessed 02 January 2021.
6. Pierce JP, Gilpin EA. How long will today's new adolescent smokers be addicted to cigarettes? *Am J Public Health* 1996;86:253–6.
7. Polańska K, Wojtyśiak P, Bąk- Romaniszyn L, Kaleta D. Susceptibility to Cigarette Smoking Among Secondary and High School Students From a Socially Disadvantaged Rural Area in Poland. *Tob Induc Dis*. 2016;14:28.
8. Rao S, Aslam SK, Zaheer S, Shafique K. Anti-smoking initiatives and current smoking among 19,643 adolescents in South Asia: findings from the Global Youth Tobacco Survey. *Harm Reduction Journal* 2014;11:8.
9. Kandel DB. The parental and peer contexts of adolescent deviance. An algebra of interpersonal influences. *J Drug Issues*. 1996;26:289–315.
10. World Health Organization 2019. WHO Report on the Global Tobacco Epidemic, 2019. WHO, Geneva. <https://www.who.int/teams/health-promotion/tobacco-control/who-report-on-the-global-tobacco-epidemic-2019>. Accessed 02 January 2021.
11. World Health Organization. (2015). WHO global report on trends in prevalence of tobacco smoking 2015. World Health Organization. <https://apps.who.int/iris/handle/10665/156262>. Accessed 02 January 2021.
12. Global Tobacco Surveillance System Data. Available at: <https://www.cdc.gov/tobacco/global/gtss/gtssdata/index.html>. Accessed 10.01.2021.
13. Pierce JP, Choi WS, Gilpin EA, Farkas AJ, Merritt RK. Validation of susceptibility as a predictor of which adolescents take up smoking in the United States. *Health Psychol*. 1996;15:355–61.
14. Meschack AF, Hu S, Pallone UE, McAlister AL, Gottlieb N, Huang P. Texas tobacco prevention pilot initiative: Process and effects. *Health Educ Res*. 2004;19(6):657–68.
15. Aslam SK, Zaheer S, Rao S, Shafique K. Prevalence and determinants of susceptibility to cigarette smoking among school students in Pakistan: secondary analysis of Global Youth Tobacco Survey. *Subst Abuse Treat Prev Policy*. 2014;9:1–10.
16. Hock LK, Ghazali SM, Cheong KC, Kuay LK, Li LH, Ying CY, et al. Correlates of susceptibility to smoking among secondary school students in Kota Tinggi district, Johor, Malaysia. *Asian Pac J Cancer Prev*. 2013;14(11):6971–8.
17. Azagba S, Asbridge M. School connectedness and susceptibility to smoking among adolescents in Canada. *Nicotine Tob Res*. 2013;15(8):1458–63.

18. Veeranki SP, Mamudu HM, Anderson JL, Zheng S. Worldwide never-smoking youth susceptibility to smoking. *J Adolesc Health*. 2013;54:144–50.
19. Chen W, Bottorff JL, Johnson JL, Saewyc EM, Zumbo BD. Susceptibility to smoking among White and Chinese nonsmoking adolescents in Canada. *Public Health Nurs*. 2008;25:18–27.
20. Nuno VL, Zhang Q, Harris RB, Wilkinson-Lee AM, Wilhelm MS. Smoking susceptibility among students followed from grade six to eight. *Addict Behav*. 2011;36:1261–6.
21. Wilkinson AV, Waters AJ, Vasudevan V, Bondy ML, Prokhorov AV, Spitz MR. Correlates of susceptibility to smoking among Mexican origin youth residing in Houston, Texas: A cross-sectional analysis. *BMC Public Health*. 2008;8:337.
22. Tobacco questions for surveys of youth (TQS-Youth): a subset of key questions from the Global Youth Tobacco Survey (GYTS) ISBN 978-92-4-151557-3 © World Health Organization 2019.
23. Bafunno D, Catino A, Lamorgese V, Pizzutillo P, Di Lauro A, Petrillo P, Lapadula V, Mastrandrea A, Ricci D, Galetta. Tobacco control in Europe: A review of campaign strategies for teenagers and adults. *Crit Rev Oncol Hematol*. 2019;138:139-147.
24. Baska T, Warren CW, Basková M, Jones NR. Prevalence of youth cigarette smoking and selected social factors in 25 European countries: findings from the Global Youth Tobacco Survey. *Int J Public Health*. 2009;54(6):439–45.
25. Aslam SK, Zaheer S, Rao S, Shafique K. Prevalence and determinants of susceptibility to cigarette smoking among school students in Pakistan: secondary analysis of Global Youth Tobacco Survey. *Subst Abuse Treat Prev Policy*. 2014;9:1–10.
26. Chen PL, Huang WG, Chao KY. Susceptibility to initiate smoking among junior and senior high school nonsmokers in Taiwan. *Prev Med*. 2009;49:58–61.
27. Castrucci BC, Gerlach KK, Kaufman NJ, Orleans CT. The association among adolescents' tobacco use, their beliefs and attitudes, and friends' and parents' opinions of smoking. *Matern Child Health J*. 2002;6:159–67.
28. Unger JB, Stoddard CA, Nezemi E, Chou CP. Identification of adolescents at risk for smoking initiation: Validation of a measure of susceptibility. *Addic Behav*. 1997;22:81–91.
29. Leatherdale ST, Broen SK, Cameron R, McDonald PW. Social modeling in the school environment, student characteristics, and smoking susceptibility: A multi-level analysis. *J Adolescent Health*. 2005;37:330–6.
30. Hock LK, Ghazali SM, Cheong KC, Kuay LK, Li LH, Ying CY, et al. Correlates of susceptibility to smoking among secondary school students in Kota Tinggi district, Johor, Malaysia. *Asian Pac J Cancer Prev*. 2013;14(11):6971–8.
31. Azagba S, Asbridge M. School connectedness and susceptibility to smoking among adolescents in Canada. *Nicotine Tob Res*. 2013;15(8):1458–63.
32. Gritz ER, Prokhorov AV, Hudmon KS, et al. Predictors of susceptibility to smoking and ever smoking: A longitudinal study in a triethnic sample of adolescents. *Nicotine Tob Res*. 2003;5:493–506.
33. Jeganathan PD, Noran HH, Al Sadat N, Chinna K. Smoking stage relations to peer, school and parental factors among secondary school students in Kinta, Perak. *Asian Pac J Cancer Prev*. 2013;14:3483–9.
34. Rachiotis G, Barbouni A, Basagiannis A, Katsioulis A, Kostikas K, Mouchtouri V, Merakou K, et al. Prevalence and Determinants of Current Cigarette Smoking and Secondhand Smoking Among Greek Adolescents: The Global Youth Tobacco Survey (GYTS) 2013 Study. *BMJ Open*. 2020;10(2): e034760.
35. Rachiotis G, Muula AS, Rudatsikira E, et al. Factors associated with adolescent cigarette smoking in Greece: results from a cross sectional study (GYTS study). *BMC Public Health*. 2008;8:313.
36. Christophi CA, Savvides ECG, Warren CW, et al. Main determinants of cigarette smoking in youth based on the 2006 Cyprus GYTS. *Prev Med*. 2009;48:232–6.
37. Khan JK, Raheem E, Daniel M. The prevalence and correlates of tobacco use among 7-9 th grade students in Bangladesh. *Children and Youth Services Review*. Elsevier 2019; vol. 104(C), pages 1-1.
38. Huong LT, Vu NT, Dung NN, Xuan LT, Giang KB, Hai PT, Huyen DT, Khue LN, Lam NT, Minh HV, Nga. Cigarette Smoking Among Adolescents Aged 13-15 in Viet Nam and Correlates of Current Cigarette Smoking: Results From GYTS 2014 Data. *Asian Pac J Cancer Prev*. 2016;17(S1):17-23.
39. Duko B, Yirdaw Melese Y, Ebrahim. Determinants of Cigarette Smoking Among Adolescents in Ethiopia: A Cross-Sectional Study. *Tob Induc Dis*. 2019;17:62.
40. Mamudu HM, Veeranki SP, John RM. Tobacco Use Among School-Going Adolescents (11-17 Years) in Ghana. *Nicotine & Tobacco Research*. 2013;15(8):1355-64.

41. Veeranki SP, Mamudu HM, John RM, Ouma AEO. Prevalence and correlates of tobacco use among school-going adolescents in Madagascar. *Journal of Epidemiology and Global Health*. 2015; 5(3):239-47.
42. Agaku IT, Alpert HR, Vardavas CI, Adisa AO, Connolly GN. Use of smokeless tobacco and cigarettes among Nigerian youths: implications for tobacco control policies in Africa. *Journal of Substance Use*. 2014;19(1/2):75-80.
43. Dereje N, Abazinab S, Girma A. Prevalence and Predictors of Cigarette Smoking among Adolescents of Ethiopia: School Based Cross Sectional Survey. *J Child Adolesc Behav*. 2014; 3:182.
44. Charlesworth A, Glantz SA. Tobacco and the movie industry. *Clin Occup Environ Med*. 2006; 5(1): 73-84.
45. Charlesworth A, Glantz SA. Smoking in the movies increases adolescent smoking: a review. *Pediatrics* 2005;116(6): 1516-1528.
46. Long TK, Son PX, Giang KB, Hai PT, Huyen DT, Khue LN, Nga PT, Lam NT, Minh HV, Huong le TT. Exposure to Tobacco Advertising and Promotion among School Children Aged 13-15 in Vietnam - an Overview from GYTS 2014. *Asian Pac J Cancer Prev*. 2016;17(S1):49-53.
47. Lalithambigai G, Rao A, Rajesh G, Ramya S, Mithun Pai Predictors of Cigarette Smoking Among Young Adults in Mangalore, India. *Asian Pac J Cancer Prev*. 2016;17(1):45-50.
48. Bogdanovica I, Szatkowski L, McNeill A, Spanopoulos D, Britton J. Exposure to point-of-sale displays and changes in susceptibility to smoking: findings from a cohort study of school students. *Addiction* 2015;110(4):693–702.
49. Braun S, Kollath-Cattano C, Barrientos I, Mejia R, Morello P, Sargent J, et al. Assessing tobacco marketing receptivity among youth: integrating point of sale marketing, cigarette package branding and branded merchandise. *Tob Control* 2015;25(6):648–655.
50. Pierce JP, Sargent JD, White MM, Borek N, Portnoy DB, Green VR, et al. Receptivity to Tobacco Advertising and Susceptibility to Tobacco Products. *Pediatrics* 2017;139(6):e20163353.
51. Shang C, Huang J, Li Q, Chaloupka FJ. The Association between Point-of-Sale Advertising Bans and Youth Experimental Smoking: Find
52. World Health Organization (WHO). WHO Framework Convention on Tobacco Control, Geneva, Switzerland. https://www.who.int/tobacco/framework/WHO_FCTC_english.pdf. Accessed 02 January 2021.

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