

# Increasing Smoking Prevalence among Pupils of Several Croatian Secondary Medical Schools between 1990 and 2006

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## ABSTRACT

*Smoking among pupils of secondary medical schools is of particular public health interest because of their role in the health system in the future. The study was part of the survey of smoking among students of Croatian medium medical schools. Data of 3 survey periods were available (1990–2002–2006). Specific smoking trends among 14–18 year olds were examined using odds ratios and multiple regressions. Sex ratios were calculated for each survey period. Daily smoking prevalence in 1990 was 15.9% in boys and 14.1% among girls. Occasional smoking in 1990 occurred among 8.9% of boys and 15.0% of girls. Twelve years after, smoking prevalence increased for daily smoking in boys to 32.9% and among girls to 30.4%. Occasional smoking decreased to 6.3% in boys, and increased to 17.8% among girls. There were no remarkable changes in prevalence from 2002 to 2006. Among adolescents in Croatia, there was high risk for smoking among adolescent population. High smoking rate among pupils of medical schools predicts not only high mortality due to smoking over 20–30 years, but also implicates for bad habit among professional health workers, if no policy interventions were taken.*

**Key words:** age, gender, medical schools, prevalence, smoking

## Introduction

Daily smoking among adolescents is a significant public health problem. Smoking-related health problems are function of the smoking duration (years of smoking) and intensity of cigarettes use (number of cigarettes smoked)<sup>1–3</sup>. Most adult smokers began to smoke or were already addicted to nicotine before the age of 18<sup>4–5</sup>. Besides, a lot of adolescents want to quit smoking, but only a small number of them really succeed<sup>1,5</sup>. Tobacco control policies varied widely in European countries in the last 20 years<sup>6</sup>. The smoking prevalence among adolescents is important for policy makers to monitor their current policy and to make decisions for future policies. Information on recent smoking trends within a country and comparison of trends between countries is therefore urgently needed. This information is important to have a bench-

mark, in order for countries to see how large their smoking problem is compared with other countries. These data can also help to explain the observed differences and trends in smoking prevalence, by relating it to potentially relevant circumstances in the different social categories.

Relating smoking trends to education-specific policies regarding smoking can help policy-makers to determine which actions to take in order to reduce smoking. Studies gathering this information according to a standardized research protocol are rare.

According to the WHO European report on Tobacco Control Policy<sup>7</sup>, gender differences in smoking prevalence among young people in Europe are smaller than

those for adults. Similarities and differences in smoking trends among boys and girls need consideration for future developments<sup>8</sup>. Here, we present the results of a national study concentrating on the evolution of daily smoking prevalence among boys and girls in different high schools in Croatia.

## Methods

This was a two-town national research study conducted in secondary medical schools. The data of the three surveys were used (1990, 2002, and 2006). The target population of the study was young people from 15 to 18 and some older years old attending school. Cluster sampling by school was used as sampling method in the study for 2006 survey. Secondary schools participating in the 2006 survey were medical and non-medical (grammar and economics with concordance in gender distribution). Students of technical schools were excluded because of high rate of male students. The survey was approved by the Ethics Committee of the University of Rijeka, School of Medicine.

Detailed information on causality of non-response in all schools and all survey years was not available. Non-response rate at school-level varied between schools, survey years and their social context.

The self-administered anonymous questionnaire is completed in the classroom and consists of a standard questionnaire developed at the School of Medicine in Rijeka. Besides questions on smoking and other health-risk behaviors, there were also questions on health outcomes, individual and social resources, alcohol and other substances consumption. The question used in this paper remained unchanged over the all three survey periods.

## Statistical analyses

Over the 3 survey periods, prevalence for every type of smoking (Daily smoker; Occasional smoker; Never smoker; Ex smoker) among males and females are presented separately. Trends are examined using separate odds ratios and their 95% confidence interval with reference to previous survey year (2002 to 1990, and 2006 to 2002). An additional analysis focused on the smoking sex ratio (female prevalence of smoking / male prevalence of smoking), calculated for each survey period and type of smoking. Smoking rates between medical and non-medical schools were compared by odds-ratios for 2006 survey. Significant differences were analyzed using multiple regression, with type of smoking as a dependent variable and school, age and gender as predictor variables using Statistica 7.

TABLE 1  
SMOKING IN MEDICAL SCHOOLS

Year	Smoking*	Total		Males		Females	
		N	%	N	%	N	%
	Grand Total	2136	100.00	406	100.00	1730	100.00
	1	580	27.15	111	27.34	469	27.11
	2	327	15.31	29	7.14	298	17.23
	3	1124	52.62	231	56.90	893	51.62
	4	105	4.92	35	8.62	70	4.05
1990	Total	439	100.00	113	100.00	326	100.00
	1	64	14.58	18	15.93	46	14.11
	2	59	13.44	10	8.85	49	15.03
	3	292	66.51	77	68.14	215	65.95
	4	24	5.47	8	7.08	16	4.91
2002	Total	917	100.00	158	100.00	759	100.00
	1	283	30.86	52	32.91	231	30.43
	2	145	15.81	10	6.33	135	17.79
	3	454	49.51	86	54.43	368	48.48
	4	35	3.82	10	6.33	25	3.29
2006	Total	780	100.00	135	100.00	645	100.00
	1	233	29.87	41	30.37	192	29.77
	2	123	15.77	9	6.67	114	17.67
	3	378	48.46	68	50.37	310	48.06
	4	46	5.90	17	12.59	29	4.50

\* 1=Daily smoker; 2=Occasional smoker; 3=Never smoker; 4=Ex smoker

## Results

### Smoking prevalence in boys

Table 1 shows the smoking prevalence classified by survey year, for boys and girls separately. Among boys, the lowest prevalence was in 1990. Looking at the trend from 1990 to 2006, we identified sharp increase to 2002, followed by a stabilization of smoking prevalence (Table 3). From 1990 to 2002 the increase was significant for daily smokers (OR=2.59; 99% CI=1.17–5.72), followed with non significant decrease in occasional smokers (OR=0.70; 99% CI=0.21–2.31), almost significant decrease in never smokers (OR=0.56; 99% CI=0.29–1.08) and non significant decrease in ex smokers (OR=0.89; 99% CI=0.25–3.14). From 2002 to 2006 decrease was non significant for daily smokers and never smokers. However, prevalence of occasional smokers and ex smokers increased non significantly.

### Smoking prevalence among girls

Among girls (Table 1, Table 3), the highest prevalence in 2002 in daily smoking was almost tripled than in 1990 (OR=2.66; 99% CI=1.69–4.21). Occasional smokers prevalence remained practically unchanged (OR=1.22; 99%CI=0.77–1.95). Increase in smoking prevalence was followed

by significant decrease in never smokers (OR=0.49; 99% CI=0.34–0.69) and non significant decrease in ex smokers (OR=0.66; 99% CI=0.28–1.53). From 2002 to 2006 stabilization (OR around 1) occurred in daily smoking, occasional smoking and never smoking. Increase (OR=1.38; 99%CI=0.67–2.83) in ex smokers was statistically non significant, but of particular public health importance for the future.

### Differences in smoking prevalence by gender

The sex ratios over the 3 survey periods are presented in Table 5 indicating that more boys were daily smokers than girls. Increasing value of ratios from 1990 to 2006 clearly indicated increase of smoking among girls close to prevalence in boys. The increase was more marked for occasional smoking habit in which case girls were more likely to declare themselves as »occasional smokers«. Never smokers among girls decreased from 1990 to 2002, and then increased in 2006. Continuous decrease in ratios for ex smokers indicated that more boys quitted smoking than girls.

### Differences in smoking prevalence among schools

The odds ratios between types of schools are presented in Table 4. Values less than one (1) indicated that

TABLE 2  
SMOKING IN NON-MEDICAL SCHOOLS

Year	Smoking*	Total		Males		Females	
		N	%	N	%	N	%
2006	Total	541	100.00%	79	100.00%	462	100.00%
	1	173	31.98%	29	36.71%	144	31.17%
	2	110	20.33%	8	10.13%	102	22.08%
	3	249	46.03%	42	53.16%	207	44.81%
	4	9	1.66%	0	0.00%	9	1.95%

\* 1=Daily smoker; 2=Occasional smoker; 3=Never smoker; 4=Ex smoker

TABLE 3  
ODDS RATIOS OF SMOKING TRENDS COMPARED TO PREVIOUS SURVEY YEAR IN MEDICAL SCHOOLS

Smoking*	Total			Males			Females		
	OR	95% CI		OR	95% CI		OR	95% CI	
2002 to 1990									
1	2.62	1.94	3.53	2.59	1.42	4.73	2.66	1.88	3.77
2	1.21	0.87	1.68	0.70	0.28	1.73	1.22	0.86	1.75
3	0.49	0.39	0.63	0.56	0.34	0.92	0.49	0.37	0.64
4	0.69	0.40	1.17	0.89	0.34	2.32	0.66	0.35	1.25
2006 to 2002									
1	0.95	0.78	1.17	0.89	0.54	1.46	0.97	0.77	1.22
2	1.00	0.77	1.30	1.06	0.42	2.68	0.99	0.75	1.31
3	0.96	0.79	1.16	0.85	0.54	1.35	0.98	0.80	1.21
4	1.58	1.01	2.48	2.13	0.94	4.83	1.38	0.80	2.39

\* 1=Daily smoker; 2=Occasional smoker; 3=Never smoker; 4=Ex smoker

**TABLE 4**  
ODDS RATIOS OF SMOKING RATES COMPARING MEDICAL TO NON-MEDICAL SCHOOLS IN 2006 SURVEY

Smoking*	Total			Males			Females		
	OR	95% CI		OR	95% CI		OR	95% CI	
1	1.10	0.87	1.40	1.33	0.74	2.39	1.07	0.82	1.38
2	1.36	1.03	1.81	1.58	0.58	4.27	1.32	0.98	1.78
3	0.91	0.73	1.13	1.12	0.64	1.95	0.88	0.69	1.11
4	0.27	0.13	0.56	0.00	–	–	0.42	0.20	0.90

\* 1=Daily smoker; 2=Occasional smoker; 3=Never smoker; 4=Ex smoker

**TABLE 5**  
FEMALE TO MALE SMOKING RATIOS IN MEDICAL SCHOOLS

Smoking	Year		
	1990	2002	2006
1	0.89	0.92	0.98
2	1.70	2.81	2.65
3	0.97	0.89	0.95
4	0.69	0.52	0.36

\* 1=Daily smoker; 2=Occasional smoker; 3=Never smoker; 4=Ex smoker

medical schools were at lower risk for smoking than non-medical schools. However, none of odds ratios was statistically significant.

### Regression

Type of school was identified as significant contributing factor for smoking prevalence (Table 6). Age had marked positive correlation but not significantly. Male gender was of low correlation. According to coding criteria for statistical analyze, negative regression means that older age, attending non-medical school and male gender contributed to smoking rate.

### Discussion

In countries of the European Union with membership before 2004, a discordant trend in daily smoking among adolescents has been observed<sup>9</sup>. Taking into account also some new member states, in 2002 the smoking prevalence among boys varied from 5.5% to 20.0%. Among girls, it varied from 8.9% to 24.7%<sup>10</sup>.

In 2002, the HBSC (Health Behavior in School-aged Children) survey done on a representative sample of pupils aged 11, 13 and 15 years in Croatia, showed 21% of boys and 9% of girls to have had their first experience of cigarettes at the age of 11 years. While at 13 years, 40% of boys and 34% of girls were experimenting with cigarettes by the age of 15 years 58% of boys and 63% of girls had experimented with them. These results also point to an increase in the frequency of cigarette experimentation among girls, and to a growing presence of smoking among females. The girls have caught up with boys even in regular smoking (17% of the girls and as many boys aged 15 years smoke daily). In occasional smoking, girls have even overtaken boys (at the age of 15 years 8% of girls and 6% of boys smoke at least once a week). Of the 58% of boys who had tried cigarettes by the age of 15 years, 13% did not go beyond experimenting. In contrast, of the 63% of the girls who had tried the cigarette at least once, only 4% did not continue smoking in any form whatsoever. Other girls adopt the smoking habits either as occasional or permanent (HBSC, Zagreb).

Among boys, the Nordic countries show a declining or stabilizing smoking trend; in the Western countries an initial increase is followed by a decrease in daily smoking; and in the Eastern European countries an increase is followed by stabilization in smoking prevalence between 1998 and 2002<sup>10</sup>.

Among girls, similar daily smoking trends can be found, with only a few exceptions. First, no country in the study (Hublet et al., 2006) shows a continuous decline in daily smoking prevalence among girls. Second,

**TABLE 6**  
RESULTS OF MULTIPLE REGRESSION OF SIGNIFICANCE FOR SMOKING BETWEEN MEDICAL AND NON-MEDICAL SCHOOLS (DATA FOR 2006)

Predictors	Beta	Standard Error of Beta	B	Standard Error of B	t-value	p-value
School*	-0.059759	0.021372	-0.328377	0.117439	-2.79614	0.005215
Age	-0.038924	0.021377	-0.079003	0.043388	-1.82084	0.068763
Gender	0.008589	0.020981	0.053561	0.130832	0.40938	0.682296

\* statistically significant

Austria and Hungary show an increasing smoking trend among girls, while among boys stabilization is observed. Third, Hungary is the only country in this study where smoking prevalence among girls has increased since the last two surveys<sup>10</sup>.

High increase rate of smoking in Croatia from 1990 to 2002 may be effect of war crisis on ex-Yugoslavian territory. Among girls smoking has increased more than in boys, partially due to fact that more boys quit smoking than girls.

We must state that cross-national data of adolescent substance use should be interpreted cautiously<sup>11</sup>. When comparing data from cross-national surveys the list of problems includes differences in population focus, differences in sampling method, a different survey context and question wording. The HBSC study attempts to control these problems by adapting standardized methods<sup>8</sup>.

The ESPAD (European School Survey Project on Alcohol and Other Drugs) study done in 1995, 1999 and 2003 on Croatia's 16-year-olds, showed 69% of boys and 70% of girls to have smoked at least one cigarette in their lives. Data on an 8-year period point to experimentation with cigarettes by boys stagnating and by girls increasing. While in 1995, 70% of boys and 67% of girls tried at least one cigarette, in 1999, 70% of boys, respectively 69% of girls did so. The finding that an individual has smoked 40 or more times in his life indicates greater regularity of the habit. In 2003, this level of smoking was found in 32% of the boys and 29% of the girls. Greater regularity of smoking is still rising. This is particularly true for girls (while in 1995, 18% of the girls and 27% of boys had smoked 40 times or more in their lives, in 1999, 25% of the girls and 31% of boys had).

Thirty-six percent of boys and 37% of girls said to have smoked in the past month. On this criterion, Croatia is classed in the same group of European countries as Greenland, Great Britain and Ireland where smoking is becoming more common among young girls and more frequent than in boys. Compared to other ESPAD countries, Croatia reported smoking to be more common than their average (4% more in one's life and 1% more in the past month), with smoking still being on a mild increase, especially among girls.

National sample permits an observation of trends in the incidence of smoking in class one and two of the secondary school. Whereas in the first class of secondary school 33% of boys and 31% of girls smoked in the past month, in the second class 43% of boys, respectively 40% of girls did so. The increase with age as well as the rise in the number of pupils saying that they smoked more than five cigarettes every day (20% of the boys and 18% of girls in the first, and 31% of the boys and 25% of girls in the second class) points to this age being crucial for the development of the smoking habit. It also indicates that the habit could stabilize and last for years until adulthood.

Despite the legal ban in Croatia on the sale of tobacco products to anyone below 18 years of age, in the national survey 93% of the subjects said cigarettes were easy or almost easy for them to purchase (ESPAD 2003).

This variation between countries is not easy to explain. Policy differences as well as social and cultural differences can play a role as well as different study methodology<sup>10</sup>.

Differences between the findings of the two surveys stem from differences in the age of subjects and years when the surveys were conducted. While the ESPAD survey comprised slightly older pupils (born in 1987 and having a mean age of 15.8 years), the HBSC survey covered younger subjects (mean age 15.5 years). Besides, the HBSC survey was done in 2002, a year earlier than the ESPAD survey.

A WHO and CDC (Atlanta) »Global survey of the prevalence of the smoking habit among youths«, in which Croatia took part in 2002, found that 59.9% (62.5% of boys and 56.3% of girls) of youths aged 13–15 years tried to smoke at least once. More than a third of young people (39.1%, i.e. 41.1% of boys and 37.3% of girls) had attempted to smoke by the age of 10 years. In the past month, 16.6% of youths (18.7% of boys and 14.3% of girls) smoked cigarettes<sup>12</sup>.

The results of the HBSC and GYTS studies show that weekly smoking prevalence rates in 15-year old boy were especially high (>30%) in some eastern European countries. The highest smoking prevalence rates (>30%) among 15-year old girls were found mostly in western European countries<sup>13</sup>.

Literature on smoking trends using the same methods over different periods and in different countries is very scarce<sup>7</sup>. We used the same method for all three surveys, but different schools only in 2006 survey. Some lower smoking rate among students of medical schools indicated that anti-smoking campaign has some positive effects. However, the result might be obscured by unknown trends of smoking rate among students of other schools in previous surveys.

A weakness in large scale school-based studies is the self-report of substance use. In general, self-reported smoking prevalence has been considered as a good indicator of the actual smoking status, compared with biochemical validated smoking prevalence especially in Epidemiology<sup>14,15</sup>. But it may still give an underestimation of the problem in adolescents<sup>15</sup>. Although the questionnaire had to be completed anonymously, cultural differences in answering questions (especially questions with a social stigma) can be a problem (like tobacco use in some countries and certain periods for girls and/or boys)<sup>10</sup>.

This study focuses not only to daily smoking among adolescents, but also to occasional, non-smokers and ex-smokers. When daily smoking is declining, this behavior can be overtaken by occasional smoking. Smoking among adolescents may well show important fluctuations in regularity, from weekly to daily smoking<sup>10,16</sup>. However, occasional smoking can lead to habit of daily smoking. Since daily smoking is defined as an important part of nicotine dependence<sup>17</sup>, and well analyzed in the article of Hublett A et al. (2006), we have decided to use this indicator in order to get a clear picture of the current

and future burden of smoking on the Croatian public health, as well as for purpose to compare the situation between Croatia and other European countries.

Smoking of medical professionals is of particular importance. Probably is impossible to have only non-smokers among medical professions (nurses, technicians, physicians), but the system must stimulate non-smoking. Smoking medical professional can not promote non-smoking culture with same level of competence as non-smoker.

## Conclusion

According to results of our study, in Croatia smoking rate among adolescents is the highest compared to other

European countries<sup>10</sup>, but without further increase during recent years. Students of secondary medical schools smoked less than students of non-medical schools. Increase of smoking rate was more prevalent among girls. Quitting of smoking was more prevalent among boys. As smoking-attributable mortality is most closely related to smoking patterns from thirty or more years earlier and not to the current smoking prevalence<sup>18</sup>, the results in this study predict a high burden on the Croatian health care system over the next 20–30 years. Policy makers must be encouraged to initiate effective strategies for smoking control as proposed by the World Bank<sup>19</sup>. Special emphasize must be given to reduction of smoking among medical professionals<sup>20</sup>.

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## POVEĆANA PREVALENCIJA PUŠENJA MEĐU UČENICIMA NEKOLIKO HRVATSKIH MEDICINSKIH ŠKOLA U PERIODU OD 1990.–2006. GODINE

### SAŽETAK

Pušenje među učenicima nekoliko srednjih medicinskih škola je od posebnog javnozdravstvenog interesa zbog njihove uloge u zdravstvenom sustavu u budućnosti. Studija je bila dio ispitivanja među učenicima hrvatskih srednjih medicinskih škola. Bili su raspoloživi podaci za tri perioda i to 1990, 2002 i 2006 godinu. Specifični trend u pušenju među učenicima od 14 do 18 godina je ispitivan pomoću vjerojatnosti odnosa (OR) i višestruke regresije. Odnosi što se tiče spolova su ispitivani za svaku period studije. Prevalencija, što se tiče svakodnevnog pušenja, u 1990. godini je bila 15,9% za muški rod i 14,1% za ženski rod. Povremeno pušenje u 1990. godini se zbililo kod 8,9% za muški rod i 15,0% za ženski rod. Dvanaest godina kasnije, prevalencija za svakodnevno pušenje se povećala kod muškog roda na 32,9% a kod ženskog roda na 30,4%. Povremeno pušenje se smanjilo na 6,3% kod muškog roda i povećalo na 7,8% među ženskim rodom. Nije bilo značajnije promjene u prevalenciji od 2002. do 2006. godine. Među adolescentima u Hrvatskoj, postoji visok rizik za pušenje. Visoki odnos za pušenje među učenicima medicinskih škola predviđa ne samo visok mortalitet zbog pušenja idućih 20–30 godina, nego i implicira lošu naviku među zdravstvenim profesionalcima, ukoliko se ne poduzmu intervencijske mjere.