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Original article ■

Household Environmental Tobacco Smoke Exposure and Respiratory Health in School Age Children

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SUMMARY

In the recent years the exposure to environmental tobacco smoke (ETS) has been an important public health hazard, especially in Serbia, a country with too many smokers. A common component of tobacco smoke is particulate matter less than 10 μ m in aerodynamic diameter (PM₁₀), which is considered to be the most dangerous air pollutant for health.

The aim of this paper was to investigate the association between respiratory symptoms and illnesses in schoolchildren in relation to their environmental tobacco smoke exposure.

We conducted an epidemiological study that included 708 participants (49.15 % male) aged 11-14 years from Niš, Serbia. The children were surveyed by original structured questionnaire, based on the instrument developed for similar investigations. Data about the prevalence of respiratory symptoms in the last 12-month period of life and lifetime prevalence of respiratory illnesses were obtained. The questionnaire also included items about other indoor environmental determinants. Tobacco smoke was the most prevalent source of indoor air pollution at children's home (60.73%). We found a significant association between ETS exposure and increased prevalence of dyspnea, wheezing, bronchitis and asthma among children.

It is necessary to inform parents in Serbia on the health effects of ETS exposure during childhood and to encourage them to change smoking habits in order to protect their children from ETS exposure at home.

Key words: environmental tobacco smoke, children, exposure, respiratory health

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INTRODUCTION

In the recent the years, the exposure to environmental tobacco smoke (ETS), also known as passive smoke, secondhand smoke or involuntary smoke, has been an important public health hazard (1). Smoking is responsible for 5 million deaths worldwide each year and is known to cause more and a greater variety of human disease than any other known toxin (2). Up to this date, 4.000 compounds, known to be associated with many adverse health effects, have been identified in tobacco smoke. Furthermore, tobacco smoking is certainly one of the most important sources of indoor particulate matter.

Serbia is one of the leading countries in smoking in Europe and worldwide (3). Children are particularly vulnerable to ETS. Prenatal and postnatal ETS exposure constitutes a determinant factor in respiratory morbidity in children and early lung function reduction. Various studies have demonstrated that ETS exposure adversely affects children's respiratory health by diminishing lung growth and increasing the risk of infections and respiratory symptoms, including wheezing and asthma exacerbation (4).

Children are exposed to tobacco smoke not only in their homes, but also in schools, restaurants, child care settings, cars, buses and other public places. However, parental smoking at home is likely the commonest source of children's ETS exposure in Serbia.

The aim of the present study was to investigate the association between respiratory symptoms and illnesses in schoolchildren in relation to their household ETS exposure.

METHODOLOGY

This epidemiological study included 708 children (49.15 % males) aged 11-14 years from three primary schools (classes 5-8) in the city of Niš (Serbia). The examinations took place at the schools after the parents were informed about the aims and performance of the study and had given their written consent. The procedure was approved by the Regional School Authorities of Niš (Serbian Ministry of Education). The data were analyzed during 2011.

The children were surveyed by original structured questionnaire, based on the instrument developed for similar investigations (5-7), adapted and validated for use in Serbia (8). The questionnaire was filled in by the children's parents in personal interviews. Data about the prevalence of respiratory symptoms (cough, phlegm, blocked-runny nose, wheezing and dyspnea) in the last 12-month period of life and lifetime prevalence of respiratory illnesses (asthma, pneumonia and bronchitis) were obtained. The questions about respiratory symptoms were as follows: Have you got coughs for >3 weeks in the last 12 months? Did you have phlegm in your nose or throat in the last 12 months when you did not have a

flu? Did you have wheezing in your chest in the last 12 months when you did not have a flu? Have you ever had attacks of shortness of breath in the last 12 months? In the past 12 months, have you had a problem with a runny or a blocked nose when you did not have a flu? Asthma was considered if an affirmative answer was given to the following questions: "has any doctor diagnosed your child with asthma?" and "has your son/daughter ever had asthma?". The same situation was with other respiratory illnesses.

ETS exposure was defined as any current exposure to cigarettes in the home. Our questionnaire also included items about other indoor environmental determinants (type of heating, keeping of pets, density of habitation, mold presentation in home).

In order to eliminate confounding from outdoor air pollution, the analysis were restricted to children who were at the same address from birth. According to the official data of the Public Health Institute Niš, the 10-year average concentrations of outdoor air pollutants monitored at the relevant background monitoring stations were similar.

A statistical package SPSS 10.0 was used for data analysis. Descriptive statistics was computed for all variables. Mantel-Haenszel chi-square test was used to compare frequencies of categorical variables between two groups. Student's t test was used to compare respiratory symptoms and disease frequencies between the groups. Statistical significance was set at the level of 0.05. The odds ratio and 95% confidence interval were calculated to evaluate the presence of associations between all symptoms and diseases in children and ETS exposure.

RESULTS

There were 708 complete questionnaires (response rate 92.9%). Of the final study sample, 430 children (60.73%) were ETS exposed and 278 (39.27%) were ETS non-exposed. Distribution of the children by gender and age is reported in Table 1.

Table 2 shows the basic characteristics of examined children. The children exposed to ETS had better educated parents and statistically lower density of habitation than non-exposed children. There were no statistically significant differences in ETS exposure during pregnancy, type of heating, dampness/mold damage, keeping pets and parental history of allergic disease between examined groups.

Schoolchildren in Niš were exposed to different sources of indoor air pollution at their homes, but ETS was the most prevalent source - 60,7% (Table 3). Almost two thirds of participants were ETS exposed at their homes.

Table 4 shows the prevalence of respiratory symptoms and disease in the children under study. We found a positive association between ETS exposure and the occurrence of some investigated respiratory sym-

ptoms and/or diseases. The prevalence of individual symptoms in children exposed to ETS in their homes ranges from 13.5% (dyspnea) to 35.1% (wheezing), while in the non-exposed group it spans from 8.3% (dyspnea) to 18.7% (cough). The prevalence of respiratory symptoms was higher among children who are ex-

posed to ETS, but statistical significance was found only in respect to respiratory symptoms such as dyspnea and wheezing. The prevalence of respiratory diseases was also higher in children exposed to ETS, but statistical significance was confirmed only for bronchitis and asthma.

Table 1. Distribution of children by gender and age

Characteristics of children	Total (n=708)	ETS-exposed (n=430)	ETS non-exposed (n=278)
Male/Female, n	348/360	202/228	146/132
Age, yrs (mean \pm SD)	12.96 \pm 1.54	12.78 \pm 1.56	12.95 \pm 1.52
11 yr, n	218	120	98
12 yr, n	214	108	106
13 yr, n	158	110	48
14 yr, n	118	92	26

Table 2. Characteristics of examined schoolchildren

Characteristics	Exposed (n=430)	Non-exposed (n=278)	P*
Parental education level			
Elementary	65(15.12%)	86 (30.93%)	p<0.05
Above elementary	365(84.88%)	192 (69.06 %)	
ETS exposure during pregnancy	93 (21.62%)	63 (22.66%)	p>0.05
Density of habitation (person/room) (mean\pmSD)	0.82 \pm 0.32	0.88 \pm 0.29	p<0.01
Wood or coal heating	86 (20.0%)	71 (25.53)%	p>0.05
Dampness/mold damage	42(9.76%)	25(8.99%)	p>0.05
Pets	107(24.88 %)	70(25.18 %)	p>0.05
Parental history of allergic disease	84(19.53 %)	50(17.98 %)	p>0.05

* Mantel-Haenszel chi-square test

Table 3. Children's exposure to different sources of indoor air pollution

Source of indoor air pollution	Total number of children (n= 708)
ETS exposure	430 (60.7%)
Pets	170(24.1 %)
Wood or coal heating	157 (22.2%)
Excessive textile presence and/or old mattresses	155 (21.9%)

Table 4. Exposure to ETS and children's respiratory health

Symptoms and diseases	Exposed		Non-exposed		X ²	OR	CI
	Yes	No	Yes	No			
Nasal congestion	94	336	49	229	1.88	1.24	0.91-1.69
Dyspnea	58	372	23	255	4.53*	1.63	1.03-2.58
Wheezing	151	279	32	246	49.02*	3.05	2.15-4.33
Cough	97	333	52	226	1.51	1.21	0.9-1.6
Bronchitis	60	370	18	260	9.62*	2.34	1.3-3.57
Asthma	34	396	11	267	4.42*	2.08	1.03-3.88
Pneumonia	58	372	31	247	0.84	1.21	0.8-1.82

*p<0.05

DISCUSSION

Based on the results of the present study, ETS exposure represents an important determinant of childhood respiratory health in Serbia. In this epidemiological study, we found that passive smoking, as the most important source of indoor air pollution, was significantly associated with increased prevalence of respiratory symptoms (dyspnea, wheezing) and bronchitis and asthma in the children aged 11-14 years in Niš. Our results are compatible with the results found in other epidemiological studies involving children of the same age (9, 10). Some authors found that ETS can cause chronic respiratory symptoms in children like cough, phlegm and wheezing (11). A similar proportions of exposed children (64,3%) was obtained for any current ETS exposure in the study conducted in Novi Sad, Serbia (12). Likewise, the high prevalence of smoking families in the study conducted in Belgrade (77%) suggests a strong correlation between children with asthma and smoking families (13). Nowadays, laws prohibit smoking in public places in Serbia, such as schools and restaurants, and the home is becoming the primary source of second-hand smoke exposure for children.

The children's health effects of environmental tobacco smoke have received considerable attention in the recent years because it was found that especially sidestream smoke (i.e. smoke released between puffs when cigarette smolders) contains higher levels of harmful substances. However, only few studies in Serbia have investigated children's exposure to this environmental risk factor. On the other hand, there are conflicting results between epidemiological studies. In the study of Gilliland et al. (14), current ETS exposure is associated with wheezing, but not with doctor-diagnosed asthma among schoolchildren in California. Genetic variations can influence the susceptibility of an individual to a disease. In that sense, polymorphism is an important concept, but environmental factors determine who among the susceptible individuals actually developed diseases and ETS operates as a cofactor with other environmental agents.

Exposure to ETS may have negative effects on the respiratory health in children through several mechanisms similar to active smoking. Tobacco smoke in the environment is derived from main-stream and side-stream smoke. Main-stream smoke emerges into the environment after having been first drawn through the cigarette, while side-stream smoke, which accounts for about 85% of the smoke in a room occupied by a ciga-

rette smoker, is emitted from the burning cone. In addition, ETS causes fine PM indoor pollution exceeding outdoor limits while new engines and fuels have reduced PM by cars (14). Even moderate levels of particulate matters are associated with an increased risk of developing upper respiratory symptoms in childhood (15). The lower respiratory tract may be more sensitive to environmental tobacco smoke, since direct exposure induces cellular alterations and mucous production that predispose to frequent illness. Since tobacco smoke has been linked with various health effects, it is very important to analyse its composition. Detailed elemental and morphological characterisation of tobacco smoke particles is fundamental, as the existing information is scarce.

Some methodological limitations need to be kept in mind when interpreting these study results. Respiratory illnesses status was assigned on the basis of parental report of physician diagnosis of asthma, pneumonia and bronchitis and symptoms based on parental recall. Exposure to ETS was assessed retrospectively, using questionnaire responses and was not validated by objective measurements. We were unable to investigate any dose-response relationship because we do not have information on the intensity and the duration of exposure. We used the presence of a person who smoked as a surrogate for passive smoking among children, which might have led to underestimation of the strength of the association between environmental tobacco smoke and respiratory health.

Our findings have clinical and public health significance (16, 17). They could be of value for local and national policy makers by helping them recognize the problem. Since the primary source of childhood ETS exposure is the home, policies concerning tobacco smoke must not only alert the parents for the increased morbidity caused by childhood ETS exposure, but also develop strategies to diminish tobacco smoke in the home environment and protect children. The data gained in our study is very relevant to many developing countries, where little effort has been expended on protecting women and children from passive smoking.

Many parents misperceive the risks to their children of passive smoking. Health care workers and other who care of children must try to limit as much as possible, the exposure of children to the cigarette smoke produced by others. Even though there are laws in Serbia that protect non-smokers from ETS exposure in public and work places, there aren't any measures to protect children in their homes. Therefore, the involuntary ETS exposure persists and cause significant morbidity among children. One of the most important challenges for the future is the development of effective preventive measures that are suitable to different cultures and socio-economic groups in Serbia. Pregnant women and parents of young children must be top targets for intervention.

CONCLUSIONS

To conclude, the present data support experimental and epidemiological findings according to which ETS has negative effects on children's respiratory health.

Education about the health consequences of tobacco use ETS exposure among children is urgently needed in Serbia, a country with too many smokers.

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IZLAGANJE DUVANSKOM DIMU U ŽIVOTNOJ SREDINI I ZDRAVLJE RESPIRATORNOG SISTEMA KOD DECE ŠKOLSKOG UZRASTA

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Sažetak

Poslednjih godina izlaganje duvanskom dimu u životnoj sredini predstavlja važan javno-zdravstveni rizik, naročito u Srbiji, koja ima veliki broj pušača. Uobičajni sastojci duvanskog dima su čestice sa aerodinamičkim prečnikom manjim od 10 μ m (PM₁₀), koji su po zdravlje najopasniji zagađivači vazduha.

Cilj ove studije bio je da ispita međuzavisnost između respiratornih simptoma i oboljenja kod školske dece i izloženosti duvanskom dimu u životnoj sredini.

Epidemiološka studija je obuhvatila 708 učesnika (49.15% muškog pola) uzrasta 11-14 godina iz Niša (Srbija). Deca su anketirana uz pomoć originalnog upitnika, koji je sastavljen na osnovu formiranih za slična istraživanja u svetu. Prikupljeni su podaci o prevalenci respiratornih simptoma kod dece u poslednjih 12 meseci, kao i prevalenca respiratornih oboljenja. Upitnik je sadržao i stavke o drugim unutrašnjim determinantama životne sredine. Dim cigareta bio je najznačajniji izvor unutrašnjeg aerozagađenja u domovima dece (60.73%). Zabeležili smo statistički značajnu povezanost između izlaganja duvanskom dimu i povećane prevalencije dispneje, vizinga, bronhitisa i astme kod ispitanika. Neophodno je informisati roditelje u Srbiji o zdravstvenim posledicama izlaganja duvanskom dimu u toku detinjstva i ohrabriti ih da promene pušačke navike, kako bi smanjili izlaganje svoje dece duvanskom dimu u kućnim uslovima.

Ključne reči: duvanski dim u životnoj sredini, deca, izloženost, zdravlje respiratornog sistema