

ORIGINALNI RAD – ORIGINAL ARTICLE

The influence of exposure to environmental tobacco smoke on the prevalence of allergic disease symptoms in children

Uticaj izloženosti duvanskom dimu na prevalenciju simptoma alergijskih oboljenja kod dece

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Summary **Introduction:** Prenatal and postnatal smoke exposure is generally considered to be a strong risk factor for the development of respiratory symptoms and asthma, particularly in early life. The children exposed to environmental tobacco smoke had statistically significant higher prevalence of symptoms of allergic diseases. **Objective:** The aim of this study was to determine the influence of environmental tobacco smoke exposure on the prevalence of allergic diseases symptoms in children aged 6 to 15 years in Republic of Srpska. **Methods:** Our study was conducted as a cross-sectional study and included 3,000 children aged 6 to 15 years from 13 primary schools in Republic of Srpska. The allergic diseases symptoms and environmental tobacco smoke exposures were assessed by questionnaire, which was completed by the parents. **Results:** Maternal smoking during pregnancy was reported by 9,2% participants. Children were classified into two groups according to smoking status of householders: none (54,8%), and > 1 (45,2%). Children were not exposed to environmental tobacco smoke (62,9%) or they spent a short time in these rooms (< 1 hour 17,4%; 1-5 hours 14,4%; > 5 hours 5,3%) in our study. Children exposed to environmental tobacco smoke were reported a higher prevalence of wheezing (9,5%), allergic rhinitis (28,0%) and eczema (6,9%) than unexposed children (7,7%, 21,4% and 3,9%, respectively). **Conclusion:** In summary, our results support the need for public policy to protect children from environmental tobacco smoke exposure in their environment. Additional studies are needed to clarify the association between environmental tobacco smoke exposure and childhood allergic diseases.

Key words: asthma, rhinitis, eczema, prevalence, tobacco smoke, children

Sažetak **Uvod:** Prenatalna i postnatalna izloženost duvanskom dimu generalno se smatra važnim faktorom rizika za razvoj respiratornih simptoma i astme, naročito u ranoj životnoj dobi. Deca izložena duvanskom dimu imaju statistički značajno veću prevalenciju simptoma alergijskih bolesti. **Cilj rada:** Cilj ove studije bio je utvrditi uticaj izloženosti duvanskom dimu u životnoj sredini na prevalenciju simptoma alergijskih bolesti kod dece u dobi od 6 do 15 godina u Republici Srpskoj. **Metode rada:** Naša studija provedena je kao studija preseka i obuhvatila je 3.000 dece uzrasta od 6 do 15 godina iz 13 osnovnih škola u Republici Srpskoj. Simptomi alergijskih bolesti i izloženost duvanskom dimu u životnoj sredini su procenjivani upitnikom, koji su popunjavali roditelji. **Rezultati:** Pušenje tokom trudnoće prijavilo je 9,2% učesnika. Deca su klasifikovana u dve grupe prema statusu pušenja ukućana: ni jedan (54,8%) i >1 (45,2%). Deca nisu bila izložena duvanskom dimu (62,9%) ili su u ovim prostorijama provodila kratko vreme (<1 sata 17,4%, 1-5 sati 14,4%, >5 sati 5,3%). Kod dece koja su bila izložena duvanskom dimu zabeležena je veća učestalost vizinga (9,5%), alergijskog rinitisa (28,0%) i ekcema (6,9%) od neizložene dece (7,7%, 21,4% i 3,9%, redom). **Zaključak:** Ukratko, naši rezultati podržavaju potrebu za javnom politikom sa ciljem zaštite dece od izloženosti duvanskom dimu u njihovom okruženju. Potrebne su dodatne studije kako bi se razjasnila povezanost između izloženosti duvanskom dimu i alergijskih bolesti u detinjstvu.

Cljučne reči: astma, alergijski rinitis, ekcem, prevalencija, duvanski dim, deca

Introduction

Exposure to environmental tobacco smoke (ETS) is common in children and causes substantial morbidity (1). Prenatal and postnatal smoke exposure is generally considered to be a strong risk factor for the development of respiratory symptoms, allergic diseases and asthma,

particularly in early life (2). An ecological analysis of ISAAC Phase I data from 463 801 children aged 13–14 years in 155 countries and in 257 800 children aged 6–7 years in 91 centres in 38 countries, found an association between several factors including smoking by women during

pregnancy and the prevalence of symptom of three conditions in children (asthma, allergic rhinoconjunctivitis and eczema) (3). This is in agreement with the majority of published studies, which observe a clear damaging effect of parental smoking on the respiratory health of their children (4,5). The present results support the hypothesis that besides postnatal secondhand smoke exposure, intrauterine effects of maternal smoking contribute to the risk of wheezing in children (6).

Children are particularly vulnerable to exposure and are likely to suffer from both short- and long-term adverse consequences after early life tobacco smoke exposure (7). As they typically have little to no control over their environment, unlike adults, children have limited options for avoiding exposure to secondhand smoke and are unable to reduce the quantity of products inhaled (8). The World Health Organization estimates that approximately half of the children in the world are exposed to ETS, mostly in their homes (1). However, given how prevalent smoking is in some countries, ETS exposure is an important contributor to the burden of asthma and allergies in children in those countries (9).

The Aims

The aim of this study was to determine the influence of environmental tobacco smoke exposure on the prevalence of allergic diseases symptoms in children aged 6 to 15 years in Republic of Srpska.

Methodology

Our study conducted as a cross-sectional study and included 3,000 children aged 6 to 15 years from 13 primary schools in Republic of Srpska. Criteria for child's exclusion from the study were the age of the child under 6 years and above 15 years, the diagnosis of chronic respiratory disease (bronchopulmonary dysplasia, bronchiectasis, primary ciliary dyskinesia or cystic fibrosis). The study included children whose parents signed informed consent for this study. The agreements for visiting the schools were obtained by the Ministry of Education and Culture of Republic of Srpska and directors of the involved primary schools before the start of the study. The envelopes with written questionnaires distributed in schools in June 2014 in Banja Luka, Trebinje, Gacko and Bileca. In Bijeljina, Pale and Han Pijesak the questionnaire distributed in October 2014. We again visited all participating schools after 4 weeks, after they collected envelopes with filled questionnaires.

In our study, we use a questionnaire of the International Institute for Asthma and Allergy in Children (ISAAC). These questionnaires are designed for the multi-center studies concerning the prevalence of asthma, allergic rhinitis and eczema in children. In our study, all the questionnaires completed by parents/guardians because the envelopes with a questionnaire and informed consent submitted

together. Also parents/guardians signed the consent to participate in the study for their child.

We organized the lectures for teachers about the topic of the research and allergic diseases in children at the beginning of the study process. During lectures, teachers were able to ask all the questions about any doubts and uncertainties related to the research or their participation in the study. Each teacher gets the ten envelopes with a questionnaire and informed consent which they distributed to the children who are randomly enrolled in this study. Document Information for parents/guardians contained all the necessary information about the research. In any time during this study parents had the opportunity to ask any additional question to the main researcher either by the phone or by the e-mail. The main researcher named one person in every included school as the contact person to collect all the returned envelopes with the completed questionnaires.

The prevalence of asthma was defined by a positive response to the question about occurrences of the wheezing in the last 12 months according to the ISAAC methodology. The prevalence of diagnosed asthma from a doctor was defined as a positive responses to the question "does your child ever had asthma".

The prevalence of allergic rhinitis was defined by a positive response to the question about the presence of the sneezing, runny or blocked nose accompanied with itchy-watery eyes in the last 12 months. The presence of eczema in children in the last 12 months was defined by a positive response to the question about the presence of an itchy rash affected any of the following places: the folds of the elbows, behind the knees, in front of the ankles, under the buttocks, or around the neck, ears or eyes. Children with a positive response to the question "have you ever" had hayfever or eczema are grouped as children with the diagnosis of these diseases by a doctor. Maternal smoking habits during pregnancy were classified as no or yes. The daily ETS exposure was classified as none, less than 1 hour, 1 to 5 hours and more than 5 hours. Children were grouped as "none" and "more than one" according the number of household smokers. The descriptive statistic is used to summarize data as frequencies and percentages. The prevalence of allergic diseases is calculated as the ratio of the number of positive responses and the total number of analyzed subjects. Using Pearson's chi-square test, we analyzed the relationships between independent variables and the prevalence of allergic diseases. The criterion for statistical significance was $p < 0.05$. All statistical analyzes were performed using the statistical software package IBM SPSS Statistics 23.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the Ethical Review Board, Public Health Institute, Republic of Srpska and the Commission for the ethics of clinical trials involving human, Faculty of medicine, University of Novi Sad. Written informed consent was obtained from all subjects.

Results

The study was included 1975 children aged between 6 and 15. The overall response rate of study was 77,4%. Of all children included in the study 47,3% were boys and 52,7% girls. The average age of the children was 10,2 years (SD = 2,4). The prevalence of allergic diseases according to the gender and age groups was shown by Charts 1 and 2. Maternal smoking during pregnancy was reported by 9,2% participants. Children were classified into two groups according to smoking status of householders: none (54,8%), and > 1 (45,2%). Children were not exposed to ETS (62,9%) or they spent a short time in these rooms (< 1 hour 17,4%; 1-5 hours 14,4%; > 5 hours 5,3%) in our study. Children exposed to ETS were reported a higher prevalence of wheezing (9,5%), allergic rhinitis (28,0%) and eczema (6,9%) than unexposed children (7,7%, 21,4% and 3,9%, respectively) (Table 1). The difference for allergic rhinitis and eczema was statistically significant. The prevalence of wheezing (13,4%), allergic rhinitis (27,4%) and eczema (5,0%) was higher among children exposed in utero to maternal smoking than unexposed children (7,5%, 23,1% and 5,1%, respectively). But these difference was statistically significant only for wheezing in past 12 months. Children who lived with smokers had statistically significant higher prevalence of wheezing (9,6%), allergic rhinitis (26,4%) and eczema (6,9%) than children which household members were not smokers (6,7%, 21,2% and 3,5%, respectively). The association between ETS exposure, maternal smoking during pregnancy, number of household smokers and occurrence of allergic diseases was shown in Table 1.

Daily exposure to environmental tobacco smoke was associated with an elevated risk for the occurrence of allergic diseases (Table 2).

Figure 1. The prevalence of allergic diseases by age groups
Grafikon 1. Prevalencija alergijskih bolesti prema starosnim grupama

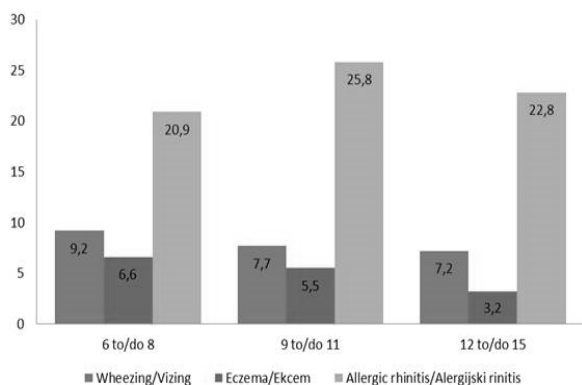
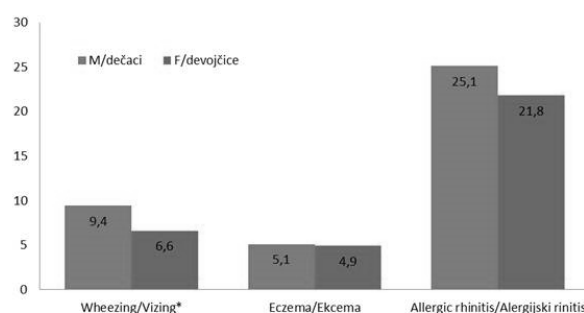


Figure 2. The prevalence of allergic diseases by gender
Grafikon 2. Prevalencija alergijskih bolesti prema polu



* $p < 0.05$

Table 1. Association between tobacco smoke exposure with asthma, allergic rhinitis and eczema

Tabela 1. Povezanost izloženosti duvanskom dimu sa astmom, alergijskim rinitisom i ekcemom

	Asthma/Astma		Allergic rhinitis/ Alergijski rinitis		Eczema/Ekcem		
	Wheezing in past 12 months/ Vizing u poslednjih 12 meseci	Diagnosed asthma/ Dijagnoza astme	Dry cough at night/ Suv kašalj noću	Allergic rhinitis in past 12 months/ Alergijski rinitis u poslednjih 12 meseci	Diagnosed allergic rhinitis/ Dijagnoza alergijskog rinitisa	Typical localization/ Tipična lokalizacija	Diagnosed eczema/ Dijagnoza ekcema
No. smokers in household/ Br. ukućana pušača	$p=0,019$	$p=0,093$	$p=0,250$	$p=0,007$	$p=0,072$	$p=0,001$	$p=0,265$
none/ni jedan	6,7%	2,9%	14,1%	21,2%	17,8%	3,5%	13,7%
> 1	9,6%	4,3%	15,9%	26,4%	21,0%	6,9%	15,5%
Daily ETS exposure/ Dnevna izloženost duvanskom dimu	$p=0,168$	$p=0,757$	$p=0,572$	$p=0,001$	$p=0,139$	$p=0,004$	$p=0,272$
yes/da	9,5%	3,5%	15,9%	28,0%	21,4%	6,9%	15,7%
no/ne	7,7%	3,8%	14,9%	21,4%	18,6%	3,9%	13,8%
Maternal smoking during pregnancy/ Pušenje majke tokom trudnoće	$p=0,012$	$p=0,014$	$p=0,283$	$p=0,438$	$p=0,292$	$p=0,636$	$p=0,188$
no/ne	7,5%	3,2%	14,6%	23,1%	19,1%	5,1%	14,2%
yes/da	13,4%	7,3%	18,4%	27,4%	22,3%	5,0%	17,9%

Table 2. Association between daily environmental tobacco smoke exposure with asthma, allergic rhinitis and eczema
Tabela 2. Povezanost dnevne izloženosti duvanskom dimu sa astmom, alergijskim rinitisom i ekcemom

	Asthma	Allergic rhinitis	Eczema
	Wheezing in past 12 months/ Vizing u poslednjih 12 meseci	Allergic rhinitis in past 12 months/ Alergijski rinitis u poslednjih 12 meseci	Typical localization/ Tipična lokalizacija
Daily ETS exposure/ Dnevna izloženost	$p=0,042$	$p=0,013$	$p=0,003$
none/nema	7,7%	21,5%	3,9%
< 1 h	8,2%	30,1%	6,3%
1 - 5 h	9,9%	21,2%	6,1%
> 5 h	13,3%	31,6%	11,2%

Discussion

Studies have shown that the large number of children are still exposed to secondhand tobacco smoke in their environment (about 44%) (10). Results of our study also showed that a large number of children (37,1%) was exposed to environmental tobacco smoke. The true prevalence of home ETS is likely higher than reported, because parents' response can be a reason for underestimated true exposure (11). Smoking by younger participants (6-10 years) is unlikely, by it is more likely in the elder participants (13-15 years). About 14% of children aged 13 to 15 are active smokers worldwide, reaching a prevalence of 40% in some countries (8). Nearly 25% of the children have smoked their first cigarette before the age of 10 years (8,12). Certainly, the lack of our study is the collection of data on exposure to tobacco smoke by the participants themselves.

The children exposed to ETS had statistically significantly higher prevalence of wheezing in our study (8,2 – 13,3%) than unexposed children (7,7%). In our study children who spent more than 5 hours in the smoking room had statistically significantly higher prevalence of wheezing in the past 12 months. The results of the Gonzalez-Barcala study also show that the prevalence of asthma symptoms increases with the exposure to parental smoking (4). The results of studies that investigated the effect of ETS on the prevalence of asthma or wheezing are certainly more uniform than studies that investigated the effect of ETS on the prevalence of rhinitis or eczema. In our study, exposure to ETS was statistically significantly influenced on the prevalence of rhinitis and eczema symptoms. Children who did not stay in a smoking room had statistically significantly lower prevalence of symptoms of rhinitis (21.5%) and eczema (3.9%) compared to children who stayed longer than 5 hours in those rooms (31.6 % and 11.2% respectively). Passive smoking was associated with an increased risk for eczema and rhinitis in study by Saulyte et al (8). Graif et al reported a dose-response association between smoking and atopic eczema compared to those not smoking (13). Numerous studies did not observe any association between eczema or rhinitis and ETS exposure (14,15). Association between ETS and symptoms of rhinitis did not reach statistical significance in study by Mitchell et al (9).

The prevalence of mothers smoking during pregnancy was 9,2% in our study. The number of mothers smoking during pregnancy does not significantly deviate from the results of the available epidemiological studies (16,17). Maternal smoking in utero was reported in 12,7% of families in study by Thacher et al (18). Smoking during pregnancy statistically significantly influenced the wheezing prevalence and asthma diagnosis in children in our study. Gilliland et al also found relation between tobacco smoke exposure in utero with asthma diagnosis and wheezing in children (16). The results of epidemiological studies indicate that children of mothers who were smoking during pregnancy have

significantly higher prevalence of wheezing and asthma diagnosis during childhood (19,20,21). Australian study reported an elevated risk for asthma associated with maternal smoking during pregnancy (22). Studies suggest that mothers smoking during pregnancy affects the lung development, decreasing pulmonary function and increased the bronchial hyperresponsiveness in children (1,20,21). Evidence of the effects of in utero exposure to maternal smoking on rhinitis and eczema is inconsistent. In our study, the influence of the smoking during pregnancy on the prevalence of rhinitis or eczema was not statistically significant. The same results were shown in study by Thacher et al (18). Results of their study indicated an elevated risk for rhinitis primarily related to postnatal ETS exposure (18). However, the ISAAC study reported an elevated risk of rhinitis in children aged 9-11 years who had been exposed to in utero maternal smoking (23). Yi et al found eczema to be highly correlated with in utero exposure to maternal smoking (24).

Some limitations of this study deserve to be mentioned. The allergic diseases symptoms and ETS exposures were assessed by questionnaire, which was completed by the parents. The limitation was also absence of data on smoking by the participants themselves. Regarding ETS exposure, parents may underreport smoking habits, especially in the context of children's exposure, because of the known negative effects of tobacco smoke. It might lead to some exposure misclassification but is unlikely to result in any systematic bias. Selection bias is also unlikely as the response rate from centers included in these analyses was high. The strength of our study is mainly the use of a validated ISAAC questionnaire and the large sample of randomly selected children and adolescents included in the study.

In summary, our results support the need for public policy to protect children from ETS exposure in their environment in which they are likely to have little control. Also, this study provided that additional studies are needed to clarify the association between ETS exposure and childhood allergic diseases.

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Primljeno/Received: 12.03.2018.

Prihvaćeno/Accepted: 28.03.2018.

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