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AIR POLLUTION AND RESPIRATORY SYMPTOMS IN PRESCHOOL CHILDREN

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Abstract. *A chohort study was carried out to determine impact of outdoor and indoor air pollution on excces of respiratory symptoms. A total of 663 preschool children (aged 1-7) from two areas with different levels of common air pollutant (sulfur dioxide and black smoke) were staded.*
Trained medical students interviewed parents at home and in kindergarten.The standard WHO questionnaires was used. It inquired about respiratory symptoms (cough, wheezing,phlegm) and respiratory illness (asthma, bronchitis, pneumonia), indoor air pollution (heating in home and passive smoking). Respiratory symptoms didn`t show more common occurrence in preschool children living in polluted area. Also indoor heating didn`t affect respiratory tract significantly. Passive smoking has significantly more influence on respiratory symptoms among preschool children.
Present finding suggest that passive smoking may be a significant etiologic factor in the occurrence of respiratory symptoms and illness. A clear effect of exposure to high sulfur dioxide concentration during the life has not been established.

INTRODUCTION

Air pollution has been documented to be associated with wide variety of adverse health impact in children. These include increases in acute respiratory disease morbidity, aggravation of asthma, increased prevalence of symptoms in children, lowered lung function when pollutant increase etc. Impacts are especially severe when high levels of outdoor pollution are combined with high levels of indoor pollution [15].

The level of risk posed by air pollution depends on several factors, including the amount of pollution in the air, the amount of air we breathe in a given time and our overal health.

Children greater vulnerability to air pollution stems from two basic differences between children and adults. First, because they breathe more air, relative to their body weights, than adults do and because children biochemical and physiological functions are

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not fully developed.

Respiratory diseases are the leading cause of diseases among preschool children in our country. In Niš and its suburbs percentage of respiratory diseases in total morbidity is between 74,91% (suburban) and 02,75% (urban area) in last ten years [10].

This study was undertaken to determine the relationship between respiratory symptoms and total air pollution (outdoor and indoor).

METHODS

Sites selected. Two areas-residental and suburban (control) in Niš were selected because of diferent level of common air pollutant (sulfur dioxide and smoke) in last seven years.

Study population. Preschool children are the most sensitive group (beside infants). The smal amount of work is done on this age group because in many countries there is no register of their names, addresses and age as there are for infants and schoolchildren. Cohorts of preschool children are particulary advantageous when studing respiratory symptoms and air pollution because they are unlikely to smoke cigarettes regulary, they have no serious exposure to occupational pollutants, they tend to have a stable residental history, and their respiratory system seem to be more sensitive to air pollution [13]. Also,data about respiratory symptoms can be usefull to identify potential risk factors developing in early life and predisposing to later chronic respiratory disease.

Assessment of health effects. Standard questionnaire for children prepared by WHO [15] was used in this study. Information on children is collected directly from parents in kindergarten or in home. Trained medical students have done interviews with parents. Questionaire includes questions about respiratory symptoms and other illnesses, indoor environmental determinants, family history of respiratory diseases and smoking habits of the parents.

Air monitoring. The outdoor concentrations of sulfur dioxide and black smoke were obtained from monitoring stations in two study areas. Daily average concentrations of particulates were measured using the black smoke method at two monitors. This method measures only black particles of less than 4,5 μm diameter. Sulfur dioxide average daily concentrations were obtained from the same sites using the acidimetric bubbler system.

Indoor air pollution. Since indoor heating is the mayor source of indoor air pollution, and because there were no indoor air monitoring data aviable in our town, the presence of indoor heating was used as a proxy for indoor air pollution in this study. Passive exposure to active cigarette smoking at home was also accounted for.

Statisical methods. Univariate associations were investigated by chi squares test for categorical data and t test for continuons data. The Mantel-Haenszeel test was used to investigate the effect of specific exposure on the prevalence of respiratory symptoms. 95% CI were estimated as suggested by Robins [1].

RESULTS

Sample caracteristic. Study was done on a random sample of preschool children in Niš. The total of 663 subjects participated the qustionnaire. There were 256 boys and 218 girls from two areas in Niš and its suburban areas with different levels of air pollution. In

residental area there were 256 boys and 218 girls (Table 1.) and in suburban area questionnaire has been done with 100 boys and 79 girls. Children were 1-7 years old, and 67% were 4-6 years old.

In both areas,most of the hauseholds in which children are living have indoor heating (77%). Also, smoking is present in similar percentage in both areas, but there were differences in sex.Boys were much more exposed (77,86) than girls (49,49).

Air pollution level.In urban area air pollution concentrations,both for sulfur dioxide and black smoke,were significantly higher ($p<0,001$) than in suburban area in the last seven years. Mean concentration for sulfur dioxide in this period was in residental area 51 $\mu g/m^2$ and 23 $\mu g/m^2$ in suburban area (Table 2). In about 8,01% of days sulfur dioxide concentration above the limit value in residental area and only 1,71% in suburban area.

Table 1. Characteristics of children in the study according to age, sex, indoor heating and parenteral smoking

	Boy				Girl			
	Res.		Subur.		Res.		Subur.	
	N	%	N	%	N	%	N	%
Age								
1	6	2,35	2	1,82	7	3,21	4	5,06
2	22	8,59	14	12,88	23	10,55	7	8,87
3	35	13,67	16	14,75	36	16,51	16	20,25
4	66	25,78	13	11,81	41	18,80	13	16,46
5	57	22,27	24	21,38	59	27,08	19	24,05
6	58	22,65	35	31,81	39	17,89	16	20,25
7	12	4,69	6	5,45	13	5,96	4	5,06
Heating								
Indoor	184	71,87	86	78,18	165	75,68	52	65,82
Central	72	28,13	24	21,82	64	24,32	16	34,18
Passive smoking								
Yes	199	77,73	84	76,36	163	74,77	61	77,21
No	57	22,27	26	23,64	55	25,23	18	22,79

Black smoke concentration in both areas were very low.Mean concentration for seven years period, in residental area was 6 $\mu g/m^2$ and 1 $\mu g/m^2$ in suburban area. Only 1,71% of days were with black smoke concentrations above the limit value in residental area and 0,15% in suburban area.

Table 2. Mean concentration of sulfur dioxide and black smoke in residental and suburban areas,1992-1998.

Pollutant	Area		p-value
	Residental	Suburban	
Sulfur dioxide	57	23	<0,01
Black smoke	6	1	<0,01

Respiratory symptoms. Some of respiratory symptoms were more common in

residental area (cough, congestion and phlegm apart from cold), but some symptoms (congestion and phlegm with cold and wheezing) were more common in suburban area (Table 3.). The difference is not statisticaly significant (p> 0,05).

Table 3. Outdoor pollution and respiratory simptoms

Respiratory simptoms	Residental area		Suburban area		p-value
	N	%	N	%	
Cought					
With colds	433	91,35	168	88,88	0,326
Apart from colds	38	8,01	12	6,34	0,463
Congestion and/or phlegm					
With cold	217	45,78	93	49,20	0,425
Apart from cold	114	24,05	41	21,69	0,517
Wheezing					
With cold	182	38,92	78	41,26	0,494
Other illness					
Sinus trouble	9	1,89	4	2,11	0,855
Bronchitis and pneumonia	191	40,29	82	43,38	0,465
Asthma	5	1,05	6	3,11	0,539

Table 4. Indoor pollution and respiratory simptoms

Respiratory simptoms	Indor heating		p-value	Passive smokking		p-value
	N	%		N	%	
Cough						
With cold	451	90,38	0,6952	469	93,98	0,0164*
Apart from cold	42	8,41	0,4134	42	8,25	0,2084
Congestion and/or phlegm						
With cold	227	45,49	0,2281	180	35,36	0,0480*
apart from cold	117	23,44	0,9720	123	64,64	0,3847
Wheezing						
With cold	204	40,88	0,1388	204	40,88	0,1388
Other illness						
Sinus trauble	12	2,40	0,1305	11	2,20	0,4991
Bronchitis and pneumonia	200	40,00	0,2897	230	45,18	0,0001*
Asthma	7	1,40	0,2752	9	1,80	0,6896

Indoor heating also causes respiratory symptoms, but most symptoms are not significantly different from percent of symptoms occurring in children with central heating in home.

Respiratory symptoms were significantly more common in children exposed to parental smoking, expecialy cough, congestion and phlegm (Table 4.). Bronchitis and pneumonia are more detected by doctors in children whose parents smoke in home, which is significant for statistics.

DISCUSSION

Respirathory disease is a major cause of illness among preschool children in our country. Surveys have shown high prevalence of respiratory symptoms althought these symptoms are mostly caused by minor ilnesses, they are liable to persist into adult life and may presage the development of chronic disease. Therefore, it is important to study respiratory symptoms in childhood and discover which evironmental factors are involved, particulary those that are potentially modifiable as indoor and outdoor air pollution.

Our founding suggests that there are no signifficat differences in respiratory symptoms occurence among preschool children living in two areas with signifficantly difference levels of common air pollutant (sulfur dioxide and black smoke).

The proportion of children with respiratory symptoms were similar in both areas with higer percentage for bronchitis,pneumonia and asthma in suburbs.

APHEA project, done in 12 European cities, shows that the increase of 50 μg in one day pollutant level was associated with an increase in the daily morbidity and morality of 3% for sulfur dioxide and 3% for black smoke [12]. In Athens and French sities [7,9] studies indicated that the effect of sulfur dioxide are more pronouncesed than that of particles(measured as black smoke). Several epidemiological studies have associated the occurence of respiratory symptoms and illness in communities with combined exposure to sulfur dioxide and particulate.

In this study the prevalence of respiratory symptoms is very high. Cough was reported in 91,35% of children in urban area and 88,88% children in suburban. Wheezing was reported in 38,92% (urban) and 41,20% cdhildren in suburban area. Percent are very high compared with surveys [1] in South Wales and Scotland (15-19%).

It is at first suprising that the prevalence of wheeze,congestion and phlegm tended to be higher in suburban area than in residental area. Some other studies [8] report that children in inner cities had more common respiratory symptoms than other children,but this does not necessarily conflict with the present findings. It seems likely that respiratory symptoms differ in their epidemiological and aetiological associations.

Indoor pollution shows greater influence on respiratory symptoms. Percentage of children with respiratory symptoms and illnesses was associated with indoor heating but differences were not statisticaly significant. The 62,3 % of household use electric stoves that do not have a great impact on indoor air pollution. Only 12,1% use coal and 21,4% are wood burning stoves that produce high indoor concentration of particulates and other combustion related pollutants.

Passive smoking is an important cause of respiratory symptoms in preschool children, as has been shown in numerous other studies [4,5,6,]. The prevalence of cough is associated with parental smoking and it is statisticaly significant,as a prevalence of congestion, and phlegm, bronchitis and pneumonia.

A lot of studies [6] suggest that parental smoking in early years of life may result in small but persistent deficits in lung function. Very important factor is also maternal smoking during pregnancy. Results from longitudinal studies are suggesting small deficit in lung growth in relation to current exposure.

CONCLUSION

This study shows that among preschool children indoor air pollution exposure (specially for parental smoking) is associated with the prevalence of respiratory symptoms.Passive smoking may be a significant etiologic factor in the occurence of respiratory symptoms and illness.A clear effect of exposure to common outdoor air pollutants during the life has not been established.

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AEROZAGADJENJE I RESPIRATORNI SIMPTOMI KOD DECE PREDŠKOLSKOG UZRASTA

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U cilju procene uticaja ukupnog aerozagadjenja (spoljnjeg i unutrašnjeg) na pojavu respiratornih simptoma kod dece predčkolskog uzrasta, radjena je retrospektivna kohortna studija.Ukupno je ispitano 663 dece predškolskog uzrasta starosti od jedne do sedam godina u stambenoj zoni grada Niša i predgradju. Intervjue sa roditeljima radili su studenti Medicinskog

fakulteta posle obuke, u obdaništima i domovima ispitivane dece. Za ispitivanje je korišćen upitnik Svetske zdravstvene organizacije. Ovaj upitnik sadrži pitanja o respiratornim simptomima i preležanim bolestima, kao i o zagadjenju vazduha u prostorijama (grejanju i pušenju roditelja).

Učestalost respiratornih simptoma nije pokazalo statistički značajnu povezanost sa nivoom aerozagadjenja u delu grada u kome deca žive. Takodje nije dokazana ni statistički značajna povezanost pojave respiratornih simptoma sa loženjem u prostorijama, ali je izloženost pasivnom pušenju statistički značajno uticalo na pojavu respiratornih simptoma kod dece.

Ovo istraživanje je pokazalo da pasivno pušenje može biti značajan faktor u pojavi respiratornih simptoma i bolesti. Nije utvrdjena značajna povezanost izmedju pojave respiratornih simptoma i izloženosti visokim koncentracijama sumpor dioksida.