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Full Length Research Paper

The impact of air pollution on the prevalence of obstructive lung disease at children

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In this study has been established a direct correlation between the prevalence of obstructive lung disease at children and air pollution at the example of the Bosnian's municipalities Livno and Kakanj. For this study we've used data from the Hospital's protocol book of patients who were applied to a doctor, and for the air quality data were taken from the municipality Kakanj. This research was conducted on a sample of 5971 patients who were applied for medical help with some of the observed obstructive pulmonary disease (OPB) in period of 15 years. In the municipality of Kakanj with heavily polluted air the number of sick children from bronchitis is about ten times higher than in the municipality of Livno, where the air is clean. The results clearly show a direct link between air pollution and the proportion of children falling ill from OPB however, do not allow the adoption of direct conclusions about the effects of the concentration of a particular pollutant to living organisms.

Keywords: Obstructive pulmonary diseases, asthma, bronchitis, air pollution

INTRODUCTION

Diseases of the respiratory system have long been in first place in the structure of diseases of the population, especially children in different meridians of the world. The proportion of these diseases are undoubtedly linked with the quality of the environment, or with the situation, trends and patterns of industrial and energy development. It's good enough illustrate the many studies that were carried out in samples of the population living in urban areas in which the emission factor (including resource inputs) different pollutants very strong. A special risk group of patients at various respiratory diseases make people working in environmentally unfavorable working environment. To this should be added and air pollution in the so-called internal environment such as active and passive smoking, products of combustion in furnaces SO₂, NO₂, smoke and other parameters that determine the increase in sensitization of the respiratory

system (Breen et al., 2002; Celli, 1995; Compton et al., 2001; Halbert et al., 2003).

Epidemiological studies from many countries indicate that during the past 300 years there has been a significant increase in the prevalence of obstructive disease in the child population. According to the White Paper on allergy in Europe in 1997. for the past two decades, the percentage of asthmatic children and adolescents has doubled and even tripled. A similar phenomenon was registered in other industrialized countries in the world (USA, Australia, Japan). In most countries with high economic standard of childhood asthma prevalence rates ranging between 5 and 15% (Mannino et al., 2002; Mendell, 2007; Viegi et al., 2001).

The causes of such a large and rapid increase in the incidence of childhood asthma are still not sufficiently clear. Bearing in mind the short time interval in which

some of these changes, genetic factors could not be attributed to the dominant role, although there are more and more reports of poligenetic basis of asthma. Recently, increasing attention has been paid to risk factors from the environment and the so-called "Western style of life". Factors physiochemical the environment are numerous and it is difficult to identify their individual roles, because their effects are intertwined and merged. However, among the most important referred to allergens and other pollutants, and respiratory, mainly viral infections (Renzetti et al., 2009; Wilhelm et al., 2009; Prazina and Redžić, 2011).

This research was conducted in two Bosnia and Herzegovina's municipality first Livno that has a very clean air thanks to the favorable geomorphological position and favorable weather conditions and a lack of industry and the second Kakanj as examples of the town with extremely high air pollution due to activities primarily thermal power plants and other industrial facilities. The aim of the research is to attempt to link air pollution with OPB prevalence in children.

MATERIAL AND METHODS

For preparation of this work it has been used data from pediatric clinics KC Kakanj and Livno. Data were collected from the protocol book in which are registered all patients of school age who were applied for medical care. From the protocol has taken of all available data, which are relevant for this study pertaining to the type of illness, sex and age of the patients.

For this study have taken into account only patients born and residing in the territory of the mentioned towns. Age structure of patients is from 3 days to 18 years.

Data on air quality have been taken in the Municipality of Kakanj, which has its own mobile automtsku station for monitoring air quality, while in Livno not perform air quality measurements.

The method that has used in obtaining data on chronic pulmonary disease is a retrospective analysis of 15 years period (1997-2011). It have been observed the following forms of HB in the sample of the studied population.: (i) Bronchitis chronica simplex (ii) chronic obstructive bronchitis and (iii) Chronic Bronchitis mukopurulentna and (iv) Asthma bronhalae.

Collected data have analyzed by using statistical methods.

The aim of this study has been to determine the prevalence of asthma and bronchitis prevalence in the children population, and that it tries to be associated with an increase in air pollution.

Objectives and tasks of research

(i) To determine the proportion of patients from OPB, especially chronic bronchitis (HB) and asthma in an environments where the air is not polluted and in the ones with very polluted air;

(ii) To compare the incidence of OPB between environments with extremely clean and the ones with highly polluted air and to determine whether there is a correlation;

(iii) To identify the dominant exogenous factors and assess adequate ecological and health measures in order to better prevention and treatment OPB;

RESULTS AND DISCUSSION

This research was conducted on a sample of 5971 patients who have applied for medical attention with one of the OPB observed over a period of 15 years in the territory of Livno and Kakanj that inhabits at around 40.000 inhabitants so that from the obtained results can be drawn quite serious and relevant conclusions about the state and prospects of obstructive lung disease.

In the Municipality of Livno for the reserched period have been totally 481 patients of which 395 diagnosed with bronchitis and 86 with asthma, while in Kakanj municipality for the same period have been totally 5490 patients of which 5290 with bronchitis and 200 with asthma (Table 1).

Related to the measurement of air quality in Kakanj municipality, which is have been done by the municipality since 2005 it has led to the data presented in Table 2.

In municipality Livno unfortunately do not perform measurements of air quality because there is no need due to the air throughout the year is clean although it would be important to do a certain period of measurement for these and similar research.

Results of measurements do not allow the adoption of direct conclusions about the effects of the concentration of a particular pollutant to living organisms. Possible effects depend not only on the dose of pollutants but also on many other factors such as climate, diet, predisposition, age, simultaneous influence of other pollutants, etc.

Therefore, it is important to provide evidence on the effects of pollutants on humans, animals, plants or objects, in order to undertake activities on the reduction of emissions. It have been compared OPB prevalence in children in two municipalities with approximately the same number of inhabitants and similar parameters that can significantly affect the outcome of research in

Table 1. The frequency of bronchitis and asthma in children in the municipality of Livno and Kakanj in the period from 1997 to 2011

| Year | Livno | | Kakanj | |
|----------------|--------------|-------------|---------------|--------------|
| | Bronchitis | Asthma | Bronchitis | Asthma |
| 1997 | 22 | 14 | 283 | 3 |
| 1998 | 32 | 15 | 232 | 0 |
| 1999 | 2 | 22 | 327 | 7 |
| 2000 | 45 | 9 | 536 | 0 |
| 2001 | 32 | | 299 | 10 |
| 2002 | 25 | 22 | 196 | 48 |
| 2003 | 19 | | 316 | 24 |
| 2004 | 32 | 2 | 290 | 5 |
| 2005 | 32 | 1 | 295 | 21 |
| 2006 | 9 | | 246 | 0 |
| 2007 | 9 | | 252 | 0 |
| 2008 | 21 | | 427 | 43 |
| 2009 | 46 | 1 | 669 | 28 |
| 2010 | 31 | | 530 | 11 |
| 2011 | 38 | | 392 | 0 |
| SUM | 395 | 86 | 5290 | 200 |
| Average | 26,33 | 5,73 | 352,66 | 13,33 |

Table 2. Average annual concentrations of pollutants measured in Kakanj

| Year | The average concentrations of pollutants | | | | | | |
|------|--|----------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------------------------|-----------------------|
| | CO Mg/m ³ | NO µg/m ³ | NO ₂ µg/m ³ | NO _x µg/m ³ | O ³ µg/m ³ | SO ₂ µg/m ³ | Čađ µg/m ³ |
| 2005 | 0,5 | 8 | 12 | 20 | | 33 | 121 |
| 2006 | 0,5 | 9 | 14 | 23 | | 30 | 69 |
| 2007 | 0,4 | 9 | 23 | 31 | | 50 | 98 |
| 2008 | 0,6 | 12 | 27 | 39 | | 41 | 100 |
| 2009 | 0,9 | 9 | 22 | 30 | 40 | 42 | 50 |
| 2010 | 1 | 14 | 23 | 38 | 36 | 98 | 55,5 |
| 2011 | 1,3 | 20 | 33 | 55 | 30 | 148 | 68 |

addition to the difference in air quality. On the one hand we have the municipality Livno with very clean air thanks to its favorable geographical position and meteorological conditions and compare it with the municipality Kakanj with very high air pollution. The largest polluter in the municipality Kakanj is thermal power plant Kakanj that emits large amounts of polluted pollutants. The situation is compounded by the fact that the mentioned plant is situated close to the village, only a few hundred meters from the first house. When we compare the results obtained on the number of children suffering from OPB in these two municipalities are huge difference. In municipality Kakanj number of children suffering from bronchitis are about ten times higher than in Livno.

This difference is undoubtedly in direct correlation with the quality of air in mentioned environments as no other factor that could be identified that could affect the

difference in the number of people affected by OPB. The number of children suffering from asthma in the both environments are very small, especially when it comes to Livno where for a period of 15 years have identified only 86 patients while in Kakanj that number is two and a half times higher.

From this position it is very difficult to say what the individual impact of certain pollutants on OPB prevalence in children because it would have required additional extensive research but bearing in mind some other researches, we can say that the influence of sulfur dioxide and dust dominant. Interactive synergy of pollutants and the impact of other factors such as the influence of genetics further complicates the situation so that it will take more researches to determine it.

The population of Kakanj is jeopardized by the increasing environmental pollution especially when it

comes to the air with frequent incidents overdraft maximum allowable concentrations of pollutants especially in winter. Particularly vulnerable and endangered are children population. It would be necessary to find ways to significantly reduce air pollution by using filters and other necessary measures in the production process to reduce pollution of air.

CONCLUSION

This research has specified the number of children suffering from OPB in the municipalities of Livno and Kakanj as examples of living environments with clean and very polluted air. The results clearly show a huge difference in the number of patients which is undoubtedly associated with the condition and quality of the environment and in particular air. Number of sick children from bronchitis is about 10 times higher in Kakanj and urgent measures should be taken to alleviate this problem. It is especially worrying trend of increasing pollution from year to year and therefore the number of diseases.

On the basis of this study shows it isn't possible to determine the individual effect of certain pollutants on OPB prevalence at children but the results can serve as a good starting point for research in that direction.

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