

AIR POLLUTION RELATED DISEASES IN PRESCHOOL CHILDREN IN THE AREA OF ZENICA CITY

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ABSTRACT

Introduction: Environmental features of the city of Zenica cause an increased risk of air pollution-related diseases in preschool children. **Goal:** The purpose of this paper is to examine a correlation between the air pollution-related diseases in preschool children and the average values of monthly concentration of sulfur dioxide (SO₂) and total range of floating particles in the area of the city of Zenica in the years 2000 and 2007. **Methods:** Authors have examined, taking into account the number of initial medical visits to primary health centers, the correlation between the air pollution-related diseases and average values of monthly concentration of sulfur dioxide (SO₂) and the total range of floating particles in the year 2000 and 2007 prevailing in the area of the city of Zenica. **Results:** With the age group under examination, the statistical method produced a correlation level for the number of initial medical visits to primary health centers made as a result of air pollution-related diseases and average monthly concentration of SO₂ 0.971, as well as the total range of floating particles of 0.891. The increase in number of initial visits was observed relative to linear increase in SO₂ concentration and total floating particles, statistically presented as follows: $0 < R < +1$, with significant statistical variance ($p < 0,0001$) and increased relative risk of disease occurrence (RR=1.3609), with cumulative incidence (CI) of 1.2998 – 1.4249. **Conclusion:** In 2007, children between 1 and 6 years of age in the area of the city of Zenica were exposed to increased risk of air

pollution-related diseases, and statistically they more often fell ill from these diseases relative to the number of the same diseases recorded for the same age group in Zenica in the year 2000.

Keywords: Air pollution; medical visits; preschool children; Zenica

1. INTRODUCTION

Inhabitants of Zenica as a black metallurgy center of Bosnia and Herzegovina used to be exposed to a great risk of respiratory diseases as a result of technological processes prevailing in manufacturing plants that involved great level of air pollution. [1,2,3,4] Sulfur and sulfurous acid generated from sulfur oxides in the presence of water steam, irritates mucosa at the concentrations as low as 0.02 mg/l, and at 0.1 mg/l it leads to grave impairments of pulmonary parenchyma [5,6,7,8]. During the research of the impact of the air pollution on the health of Zenica's children, Čerkez and associates (1985) found a high correlation between the air pollution and respiratory diseases, be it in increased incidence of those diseases or the medical visits related to such diseases. This particularly refers to preschool children populations. The greater frequency was found of respiratory symptoms in relation to comparative environment.[9] Polish authors got similar results.[10] Ribić and associates monitored the incidence of respiratory diseases in urban children living in the town of Jajce, as an air polluted environment, and that in the surrounding rural areas over the period between 1984 and 1987. They found a significant difference between the number of incidences in the town compared to those in control group from rural areas, particularly with preschool children, whereas the difference in school children is somewhat lower. [11] Taking into account the fact that children of up to seven years of age continue to fall ill of respiratory system diseases most frequently, authors Bartoček-Brgić and Matković examined the impact of air polluted by sulfur dioxide and smoke on incidence of acute respiratory diseases in Rijeka's children in a one-year time interval from Sept. 1, 1981 to Aug. 31, 1982. The results of this research demonstrate that the incidence of acute respiratory diseases is in correlation with concentration of smoke and sulfur dioxide in the air. This research correlation is statistically significant both in terms of smoke ($p < 0,05$), as well as sulfur dioxide ($p < 0,05$). [12]

2.OBJECTIVE

The purpose of this paper is to examine a correlation between the air pollution-related diseases in preschool children and the average values of monthly concentration of sulfur dioxide (SO₂) and total range of floating particles in the area of the city of Zenica in the years 2000 and 2007.

3. METHODS

Authors have examined, taking into account the number of initial primary health centers checkups, the correlation between the air-pollution related diseases and average values of monthly concentration of sulfur dioxide (SO₂) and the total range of floating particles in the years 2000 and 2007 prevailing in the area of the city of Zenica. The calculation was of: the level of correlation between the phenomena under examination, significance of statistical variance (p), relative risk of increased disease occurrence rate (RR) and cumulative incidence (CI).

4.RESULTS

4.1.Correlation between the number of air pollution-related initial medical visits and average monthly concentration of SO₂ and total range of floating particles in Zenica

Table 1. Correlation between concentration of the tested pollutants and a number of initial medical visits for an age group

Air pollutants examined	Medical visits	Correlation
Monthly average of SO ₂ concentration	A number of medical visits per 1,000 inh. of the age group, per month	0,971*
Monthly average of the total range of floating particles	A number of medical visits per 1,000 inh. of the age group, per month	0,891*

* Correlation is significant at the **0,01** level (1-tailed).

Statistical research have demonstrated linear increase in medical visits of children aged between 1 and 6, compared to linear increase in concentrations of SO₂ and total range of floating particles.

This statistical ratio could be expressed as follows: $0 < R < +1$. There is a statistical correlation between the two phenomena.

Having analyzed the resulting coefficients of linear correlation between a number of monthly medical visits of this age group and a monthly SO₂ concentration, we found that the number of medical visits significantly correlates at the 0.01 level with average SO₂ (r=0,971) concentration and average total floating particles (r=0,891) concentration.

A degree of high correlation (r = +/- 0,70 – 1,00) indicates the number of medical visits as measured up with the average SO₂ (r = 0,901) concentration and average total floating particles (r = 0,891) concentration.

4.2. Relative risk of air pollution-related diseases incidence in 2000 and 2007

Table 2 – Number of children hit by air pollution-related diseases and number of healthy children aged between 1 and 6 in the territory of Zenica city in 2000 and 2007

Year	Age group: 1 – 6 years of age	
	a	b
2007.	2292	2594
2000.	c	d
	2063	3922

Legend: a = diseased exposed; c = diseased unexposed;
 b = healthy exposed; d = healthy unexposed.

Based on the statistical analysis of the number of air pollution-related incidences with the citizens of urban Zenica aged between 1 and 6 in 2000 and 2007, the following results have been obtained:

1. There is a significant statistical difference in air pollution-related incidences between the two examined groups ($p < 0,0001$)

2. Relative risk of increased air pollution-related incidence rate in this group of Zenica's examinees in 2007 was 1,3609; with statistical probability of 95%; statistical variation that may be expressed as: $1,30 < RR < 1,42$.

In 2007, children between 1 and 6 years of age in the area of the city of Zenica were exposed to increased risk of air pollution-related diseases, and statistically they more often fell ill from these diseases relative to the number of the same diseases recorded for the same age group in Zenica in the year 2000.

5. DISCUSSION

The results of this research show the increased number of medical visits of this age group as a result of air pollution-related diseases in 2007, which is in correlation with the increased monthly concentration of SO₂ and total range of floating particles that year. With the age group under examination, the statistical method produced a correlation level for the number of initial visits to primary health centers made as a result of air pollution-related diseases and average monthly concentration of SO₂ + 0.971, as well as the total range of floating particles of 0.891. The increase in number of initial visits was observed relative to linear increase in SO₂ concentration and total floating particles, statistically presented as follows: $0 < R < +1$, with significant statistical difference ($p < 0,0001$) and increased relative risk of incidence (RR=1,3609), with cumulative incidence variation (CI) of 1,2998 – 1,4249. If we compare a relative risk of increased air pollution-related incidence rate in this group of Zenica's examinees in 2007 (RR=1,36) and relative risk of this disease incidence in 1989 (RR=1.26), which was a year remarkable for high concentrations of SO₂ and total floating particles in the air of urban Zenica, in statistical terms we may even observe an increased relative incidence rate in 2007 compared to that of 1989.

6. CONCLUSIONS

Iron and steel industry has always been intrinsically related to human environment. Due to emissions of large quantities of sulfur dioxide and other pollutants into atmosphere, the air quality in Zenica had a negative impact on public health.

In 2007, children between 1 and 6 years of age in the area of the city of Zenica were exposed to increased risk of air pollution-related diseases, and statistically they more often fell ill from these diseases relative to the number of the same diseases recorded for the same age group in Zenica in the year 2000.

A deep geographical ravine of Zenica's relief has poor air ventilation which makes the pollutants remain in the lower atmospheric layers for a prolonged time. Meteorological conditions for pollutants dispersion in Zenica are very poor. With the renewed start-up of the black metallurgy facilities, one could reasonably expect frequent episodes of high-level pollution under adverse weather conditions, particularly in late autumn or in winter time. In view of health and medical-ecological aspects, restarting of the black metallurgy facilities threatens to jeopardize the health of Zenica's inhabitants once again.

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