

## ACUTE RESPIRATORY DISEASES AMONG SCHOOL CHILDREN IN THE CONNECTION TO THE AIR POLLUTION

Smajil Durmisevic  
Cantonal Public Health Institute Zenica  
Fra Ivana Jukica 2, Zenica  
Bosnia and Herzegovina

Jasminka Durmisevic-Serdarevic  
Health Centre Zenica  
Fra Ivana Jukica 2, Zenica  
Bosnia and Herzegovina

### ABSTRACT

*The ambient air in Zenica being heavily polluted under the influence of the dirty metallurgic technologies in this town caused the great risk to the respiratory diseases on its citizens.*

*The task of this work was to investigate the possible correlation of the morbidity in non-specific acute respiratory diseases among school children of 7 to 14 years of age, with mean concentrations of sulfur dioxide (SO<sub>2</sub>) in ambient air of the two towns - Zenica and Zavidovići.*

*The retro-prospective study was established in the two groups of school children - exposed and non-exposed to the air pollution within the period between 1987. and 1999. There were followed the incidence of acute non-specific respiratory diseases in the comparison to the levels of air pollution.*

*In statistical analysis it was found that there is the positive degree of the level of +0,727369 in the correlation between the quarterly mean concentrations of the SO<sub>2</sub> in the ambient air and the incidence of the non-specific respiratory diseases; there were the linear ups of the incidence of the diseases parallel with the linear ups of the concentrations of the SO<sub>2</sub>, statistically expressed like:  $0 < R < +1$ .*

*The marked connection was found between the incidence of acute non-specific respiratory diseases among school children and the mean concentrations of SO<sub>2</sub> in ambient air of the two towns.*

**Keywords:** air pollution, acute respiratory diseases, school children

### 1. INTRODUCTION

Residents of Zenica, as a centre of black metallurgy, were exposed to high risks of respiratory disease, as a result of technological processes of production which were great environmental pollutants. [1, 2, 3, 4] Sulfuric acid, which are products of sulfur oxides with steam, act irritating on mucus tissue in concentrations as low as 0.02 mg/l, and at concentrations of 0.1 mg/l lead to heavy damage in lung parenchyma. [5, 6, 7, 8] Examining influence of air pollution on school children health in Zenica, Cerkez and colleagues (1985.) have established a high correlation between air pollution and respiratory diseases, in increase of incidence of those disease and visits to doctors because of these diseases. That was largely evident among school population. Greater incidence of respiratory symptoms was found in relation to control environment. [9] Similar results were obtained by Polish authors. Ribic and colleagues tracked occurrence of respiratory disease among children in city of Jajce, as an environment with high air pollution, and surrounding rural areas, from 1984. to 1987. They found a significant difference of numbers of cases in the city and in the control group from rural areas, especially among school population, while with school population that difference was narrower. [10]

Respecting the fact that children suffer from respiratory diseases more frequently than any other age group, authors Bartocek-Brgic and Matkovic examined influence of sulfur dioxide and smoke pollution on occurrence of acute respiratory diseases between children in city of Rijeka, in a period of from 1.9.1981. to 31.8.1982. Results from this work indicated that incidence of acute respiratory diseases in correlation with concentration of smoke and sulfur dioxide in the air. In this research that correlation is statistically significant, for smoke ( $P < 0.05$ ) as well as for sulfur dioxide ( $P < 0.05$ ). [11]

## 2. GOAL

Goal of this work is to examine correlation between occurrence of acute nonspecific respiratory disease among children from city of Zenica and Zavidovici, at the age of seven to fourteen years, and daily concentration of sulfur dioxide ( $\text{SO}_2$ ) at these locations.

## 3. METHODS

Research was of retrospective-prospective study type with two groups of children, exposed and not exposed to pollution of air with sulfur dioxide, in period from 1987. to 1999. These factors were monitored: incidence of acute respiratory nonspecific diseases and daily concentrations of  $\text{SO}_2$ .

## 4. RESULTS

### 4.1. Average annual concentrations of $\text{SO}_2$

Table 1. Average annual concentrations of  $\text{SO}_2$  in Zenica and Zavidovici

The year of investigation	ZENICA			ZAVIDOVICI		
	Average annual concentrations of $\text{SO}_2$ in $\mu\text{g}/\text{m}^3$ of air					
	concentration	border values for urban areas	% of border values	concentration	border values for urban areas	% of border values
1987.	210	110	190,9	41	110	37,27
1988.	177	110	160,9	39	110	35,45
1989.	190	110	172,7	38	110	34,55
1997.	53	110	48,18	33	110	30,00
1998.	62	110	56,36	42	110	38,18
1999.	52	110	47,27	35	110	31,82

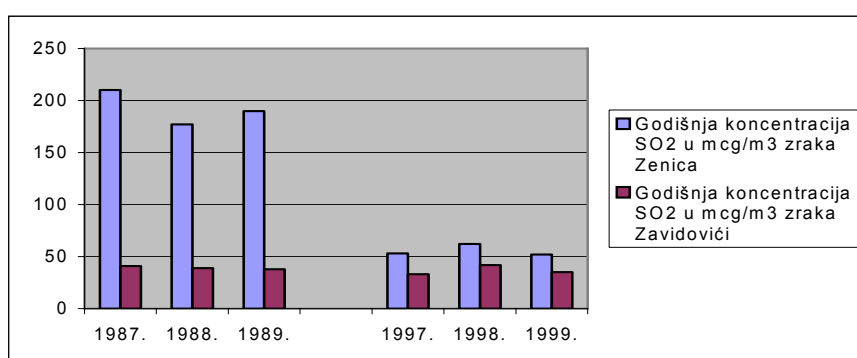


Figure 1. Average annual concentrations of  $\text{SO}_2$  in Zenica and Zavidovici

### 4.2. Correlation between incidence of acute nonspecific respiratory diseases and average quartile concentrations of $\text{SO}_2$ in Zenica

By statistical analysis level of correlation was found of + 0.727369

Research showed that there is a linear increase of incidence of acute nonspecific respiratory diseases among school children age 7 to 14 years in correlation to linear increase in concentration of  $\text{SO}_2$ . This statistical relation can be shown as  $0 < R < +1$ . There is a statistical link between these two occurrences.

### 4.3 Occurrence of acute nonspecific respiratory diseases in school children age 7 to 14 years in Zenica and Zavidovici

Table 2. Number of school children suffering from acute nonspecific respiratory diseases and number of healthy school children age 7 to 14 years in are of Zenica and Zavidovici, shown in four quartiles in the year 1989.

Municipality	The group of age: 7 to 14 years The year of investigation: 1989.			
	THE FIRST QUARTER		THE SECOND QUARTER	
ZENICA	a	b	a	b
	11096	11220	8216	14100
ZAVIDOVICI	c	d	c	d
	2820	7142	320	9642
ZENICA	THE THIRD QUARTER		THE FOURTH QUARTER	
	a	b	a	b
ZAVIDOVICI	7676	14640	13892	8424
	c	d	c	d
ZAVIDOVICI	440	9522	1516	8446

LEGEND: a = the exposed ill children in Zenica      c = non exposed ill children in Zavidovici  
b = the exposed healthy children in Zenica      d = non exposed healthy children in Zavidovici

On basis of statistical analysis of numbers of cases of acute nonspecific respiratory diseases among school children from Zenica and Zavidovići, age 7 to 14 years, in the year 1989. following results were found.

1. There is a significant statistical difference of occurrence of acute nonspecific respiratory diseases between these two groups. ( $P < 0.001$ ).
2. Relative risk of high incidence of acute nonspecific respiratory diseases in group from Zenica, in the year 1989 was 8.10, with statistical probability of 95%, with statistical variation that can be expressed as  $7.90 < RR < 8.95$ .

In the year 1989 children age 7 to 14 years were exposed to increased risk of developing acute nonspecific respiratory diseases, and statistically significantly more developed those diseases in contrast to the same age group in Zavidovici.

### 5. DISCUSSION

Residents of Zenica were exposed to increased risk of developing respiratory diseases because of industrial complexes of technology with high pollution. [1, 2, 3, 4]. Cerkez, Zarković and Imamovic established in 1985 a high correlation between air pollution and respiratory diseases, especially in school population. Greater occurrence of respiratory symptoms was found in contrast to control environment. [9] Data coincided with results of our research. Results of our research are in a correlation with researches of occurrence of diseases in city of Jajce and among school children from rural areas around Jajce. [10] In our research we found that air concentrations of SO<sub>2</sub> are in correlation with occurrence of acute respiratory diseases among school population. Very similar findings were established by author Bartocek-Begic and colleagues in their research in area of Rijeka (11).

### 6. CONCLUSIONS

Steel and iron industry has always been strongly related to living environment. With emission of large amounts of sulfur dioxide and other pollutants in the atmosphere, quality of air in Zenica has had a negative impact on health of residents.

Research has shown a correlation between concentrations of SO<sub>2</sub> and rate of incidence of acute nonspecific respiratory diseases in researched variables, which were made from chosen age groups of residents in Zenica and Zavidovici.

On the basis of tracking rate of incidence of acute nonspecific respiratory diseases in age group 7 to 14 years and concentrations of SO<sub>2</sub> in Zenica, in prospective and retrospective part of the study, a statistical link was established between these two occurrences ( $p < 0.001$ ).

In the researched age group a significant statistical difference was found in occurrence of acute nonspecific respiratory diseases between school children in Zenica and Zavidovici in period from 1987 – 1989 ( $p < 0.001$ ), while there was no that difference in period from 1997 – 1999 ( $p > 0.05$ ).

Levels of relative risk of developing diseases were increased in this age group in Zenica, in all time intervals. (1987 – 1989, and 1997 – 1999).

Results of these researches are shedding light on a very actual epidemiological problem. Only explanation from high incidence of acute nonspecific respiratory diseases, in retrospective and prospective part of the study, in population of Zenica, is that this occurrence can be related to high concentrations of SO<sub>2</sub>, as an irritant which affects the breathing pathways also as a mean of influencing development of irritant processes and processes of over sensitiveness.

Geographically, deep Zenica valley has a low air circulation levels which is enabling that pollutants stay in lower levels of atmosphere for prolonged time. Meteorological conditions of dispersion of pollutants in Zenica are very unappealing. There was a regular episode of high levels of air pollution, because of meteorological conditions, during late fall and winter.

Today's reactivation of Iron production again threatens to endanger health of Zenica residents.

## 7. REFERENCES

- [1] Duran, F., et al.: Stanje zagađenosti zraka u Zenici, prvi Jugoslavenski kongres o očuvanju čistoće vazduha, Zbornik radova, 84/962, Zenica, 1989.
- [2] Duran, F.: Specifičnosti zagađenosti zraka u gradu Zenici za period 1986. – 1996., Metalurški institut «Kemal Kapetanović», Zenica.
- [3] Đorđević, D., et al.: Pregled stanja zagađenosti vazduha sa SO<sub>2</sub> i dimom u većim industrijskim mjestima, sa posebnim osvrtom na epizode visoke koncentracije u cijeloj SFRJ, prvi jugoslavenski kongres o očuvanju čistoće vazduha, Zbornik radova, 20/231, Zenica, 1989.
- [4] Durmišević, S.: Uticaj zagađenja zraka na zdravlje stanovnika Zenice, Seminarski rad, Medicinski fakultet Sarajevo, Institut za higijenu i zaštitu životne okoline, Sarajevo 1997.
- [5] Durmišević, S.: Ispitivanje aerozagađenja na zdravlje stanovništva Zenice, Specijalistički rad, Medicinski fakultet Sarajevo, Institut za higijenu i zaštitu životne okoline, Sarajevo, 1999.
- [6] Kristiforović-Ilić, M., et al.: Djelovanje zagađenja vazduha na zdravlje čoveka, U: Komunalna higijena, prometej, Novi Sad, 1998: 184 – 188.
- [7] Etikna, EI., Etikna, IA.: Chemical mixtures exposure and children's health, Chemosphere, 31(1):2463-74, 1995 Jul.
- [8] Huttemann, U.: Pneumological aspects of environmental medicine. Medical relevance of environmental pollution of outdoor air, Zeitschrift Fur Arztliche Fortbildung Und Qualitätssicherung, 91(1): 27-30, 1997 Feb.
- [9] Čerkz, F., et al.: Ispitivanje zdravstvenih efekata aerozagađenja u Zenici i prezentacija prospektivnih savremenih modela, Prvi Jugoslavenski kongres o očuvanju čistoće vazduha, Zbornik radova, 59/671, Zenica, 1989.
- [10] Ribić, E., Ribić, E.: Praćenje respiratornih oboljenja u uslovima različitog aerozagađenja, Prvi Jugoslavenski kongres o očuvanju čistoće vazduha, Zbornik radova, 70/802, Zenica, 1989.
- [11] Bartoniček-Brgić, V., Matković, N.: Uticaj onečišćenja zraka sumpornim dioksidom i dimom na pojavu akutnih respiratornih bolesti kod djece Rijeke, Prvi Jugoslavenski kongres o očuvanju čistoće vazduha, Zbornik radova, 70/802, Zenica, 1989.