

AIR POLLUTION EFFECT ON THE MALIGNANT DISEASE MORTALITY RATE IN THE CITY OF ZENICA

Smajil Durmišević
Zavod za javno zdravstvo ZDK
Fra Ivana Jukića 2, Zenica
BiH

Jasminka Durmišević Serdarević
Dom Zdravlja Zenica
Fra Ivana Jukića 2, Zenica
BiH

Kubat Safet
Zavod za javno zdravstvo ZDK
Fra Ivana Jukića 2, Zenica
BiH

Melita Lelić
Zavod za javno zdravstvo ZDK
Fra Ivana Jukića 2, Zenica
BiH

ABSTRACT

Aim and purpose: Proving the effects of airborne pollutants regarding the rate of mortality caused by malignant diseases as well as determining its incidence and prevalence.

Methods and materials: Research has descriptive-analytic character and it is retrospective regarding its type. The group used statistically in the research consists of residents of municipality Zenica, municipality Zavidovići, and air pollutants (sulphur dioxide and airborne particles). Cantonal public health office in Zenica conducted the research with the data assistance from: Metallurgic institute "Kemal Kapetanović", Cantonal and Federal statistics department, Federal public health office, and Municipal office Zenica. Specific questionnaires have been prepared for the use in the research. They are filled in from the existing bulletins, reports, yearbooks etc. Also the existing reports from the "Kemal Kapetanović" Institute, bulletins from the Cantonal public health office Zenica, and statistics reports from the Federal and Cantonal public health offices have been used. When determining the risk of disease, for the statistical analysis of data several methods were used: descriptive statistics methods, chi-squared test, and correlation tests.

Results: During the 30 years period of time, 100% of the population of all age groups from municipalities Zenica and Zavidovići were considered. After analysing the data with the Chi-squared test, correlation and disease risk outcomes, the results show that the air pollution has the effect on the mortality rate caused by malignant diseases. Air pollution dispersion is significantly higher in Zenica than in the control group, there is a high correlation between getting sick and dying.

Conclusions: City of Zenica has higher concentration of sulphur dioxide and airborne particles than in the city of Zavidovići. More people die from malignant diseases in Zenica than in Zavidovići.

Keywords: Lung and bronchial cancer, malignant diseases, air pollution, sulphur dioxide, airborne particles, mortality rate

1. INTRODUCTION

The city of Zenica metallurgic center, located between hills without much room to expand had had a bad air quality before the aggression on our country. All the beneficial factors for the development of bad air quality were present in Zenica at that time. Air pollution is present when the concentrations of certain pollutants reach levels which are causing the toxicity. About million people die or suffer serious health problems each year caused by the air pollution such as asthma, chronic obstructive lung

diseases, other respiratory diseases, cardiovascular diseases and cancers. Čatović, Đuković and Ferković have explored the influence of air pollution to the citizens of Tuzla in the period of 1984 – 1987. They established that the prevalence of all diseases was bigger in first and fourth quarter when the degree of the air pollution is the most intense. They have found that the frequency of the upper and lower respiratory path diseases is correlated with the percentage of days when the concentration of the pollutants (sulphur dioxide and soot) is over the limit. Krzyzanovski and associates have found in thirteen yearlong longitudinal study of the influence of air pollution on the workers in Krakov (1990) that even moderate concentrations of pollutants in the working environments have detrimental effects to the respiratory system.

2. AIM AND PURPOSE OF THE RESEARCH AND HYPOTHESES

The aim is to evaluate the movement of air pollution in Zenica for the 1983-2010 period i.e. in the conditions of steel factory integral work, and periods of minimal or without any work in the main plant, as well to determine the movement of the respiratory system cancer morbidity and mortality for the period mentioned. Furthermore, the aim is to evaluate and compare the amount of air pollution in quarters and to determine prevalence of the total diseases caused by the air pollution while comparing the effects of air pollution in Zenica on the malignant diseases with the municipalities without high air pollution. Research hypothesis is: The rise in the pollution in Zenica has substantially influenced the rise in morbidity and prevalence of malignant disease deaths

3. MATERIAL AND METHODS

Research study encompassed three periods of air pollution influence on the appearance of malignant disease deaths in Zenica. The type of research is retrospective encompassing three research periods: the first period from the start of 1986 until the end of 1989, the second period from the beginning of 1996 until the end of 1999, and the third period from 2006 until the end of 2010. Determining the concentration of sulphur dioxide in air is based on British standards BS 1747 (1969). Data on the daily average concentrations of sulphur dioxide in Zenica are taken from monthly reports of the Metallurgic institute “Kemal Kapetanović” in Zenica which are delivered monthly to the cantonal public health office in Zenica. Average concentrations during the month, and the year were attained by mathematic calculations. Average value for sulphur dioxide in the city is 90 $\mu\text{g}/\text{m}^3$ while in suburban areas the concentration of sulphur dioxide is 60 $\mu\text{g}/\text{m}^3$. Average daily values of sulphur dioxide in the air mustn't surpass the concentration of 125 $\mu\text{g}/\text{m}^3$ for more than three days in the year. For the statistical data processing of statistical significance of work results we will use the descriptive statistical methods, H-square test as well as descriptive methods (grouping, tabling, graphic presentations, central tendency calculations, measure of variability and relative numbers), accurately depending on the nature of collected data and its distribution and methods of RR (Relative Disease Risk), as well as correlation method.

4. RESULTS

Results of the statistic data processing on air pollution with sulphur dioxide and airborne particles in the area of Zenica and municipality of Zavidovići, and the results on the significance about the differences between the researched years of 11 given i.e. 87/88/89-97/98/99 and 2006/07/08/09/10.

For the statistic significance calculation between given researched years, H-square test was used. H-square test estimate was done in all 11 testings for 3 degrees offset, so the border value of H-square was 7,815 with meaning level $P=0.05$. There is a statistical significance because during the time of intensive work of the pollutant there is significant difference in the periods of 1987/88/89 as well as in 2008/09/10. The results show that the higher concentration of pollutants in the municipality of Zenica was at the time of intensive work of the main pollutant. According to H-square test there is significant difference in the number of diseases and number of deaths from the malignant lung and bronchi diseases between municipalities of Zenica and Zavidovići which in turn suggests that sulphur dioxide and airborne particles which are present in greater amount in the municipality of Zenica affect the higher rate of malignant diseases morbidity and mortality. Statistical significance is noticed in ten out of fourteen tests.



Figure 1. Year average of airborne particles

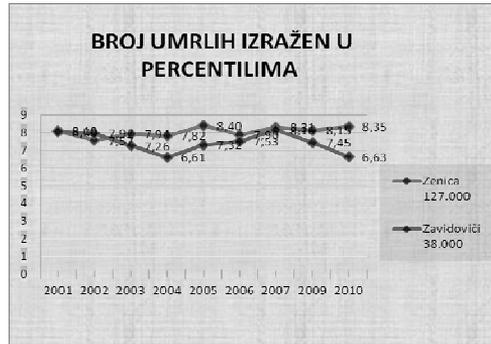


Figure 2. Number of deaths in percent

There is a big correlation between number of deaths from malignant diseases on one hand and the concentrations of sulphur dioxide and airborne particles on the other, which in turn strengthens the ability to prove the study. Correlation is monitored through all three statistically significant periods. It is evident for the number of deaths from malignant diseases, where there is weak and medium correlation between the numbers of ill on the one hand and the trend of air pollution on the other. The correlation in Zavidovići is impossible to show mathematically because the result in the denominator is always a zero because in the estimate study the amount of pollution is constant with statistically insignificant deviations.

5. DISCUSSION

Studies showing the strong effect of harmful sulphur dioxide influence on the general population health are rather current. Negative effects of sulphur dioxide are still being researched while many contemporary studies from the developed countries analyse this issue multifragmentally. Current information from Washington, published by Ministry of Energy in January, 2001 showed that the sulphur dioxide has many negative effects on humans. According to IARC based in Lyon, which made the classification of cancerogenic pollutants says that the sulphur dioxide is in the third category or probable cancerogenic substances together with airborne particles. According to that elevated concentration of sulphur dioxide in the air especially in the pre-war period when it exceeded allowed values even three times, it is significant that it had reflected on the elevation in number of deaths from malignant diseases. Also the study done by Imamović from 1982 proved the connection of air pollution with the mortality rate but evidently on the elevation of malignant diseases and other morbid states. Constant rise of the emissions of this gas affect the change of climate conditions which in turn brings many negative effects. This study does not only talk about negative effects of sulphur dioxide on health of general population but also about the effects of this gas developed in industrial and urban environments which is connected with the serious organic diseases, especially respiratory, especially malignant because air pollution affects macro and micro climate and changes its genetic composition which means that the airborne particles represent not only current effects and acute diseases but also through the change in geologic soil composition has longterm malignant consequences on people as well on those who already have malignant disease making the mortality rate higher.

6. CONCLUSIONS

These tests have shown interconnectedness of the amount of sulphur dioxide concentration and rate of incidence of those with malignant diseases in examined researched variables due to the emission. In two examined groups of Zenica as experimental and Zavidovići group as a control one, we conclude that the city of Zenica has six times higher concentration of pollutant matter than in Zavidovići i.e. sulphur dioxide and airborne particles. Correlation between the rise of concentrations of sulphur dioxide and total airborne particles on one side and the rate of deaths from malignant diseases on the other side is determined. We can see that the rate of deaths is higher with persons who already have

malignant disease. We conclude that the air pollution affects the mortality rate as well as disease incidence from malignant diseases, and disease rate from malignant diseases of lungs and bronchi. We conclude that there is a high correlation between the number of deaths from malignant diseases on one side and the concentration of sulphur dioxide and airborne particles on the other side which in turn proves the study. Correlation was followed through all three statistically significant periods. It is proven that the risk of disease is higher in Zenica than in Zavidovići, by using cohort studies of determining relative risk of illness. The risk of exposing is significantly higher in Zenica, while the same applies to the relative risk.

7. REFERENCES

- [1] Dobrinka Božović-Ćosović, Jelena Stanić, Vladičić Ana, Rađen Mirjana (2011): Lung carcinoma on pulmonary ward of the K.C. I-Sarajevo hospital -Foča in the period 01.01.2010-31.12.2010, Časopis udruženja pulmologa Republike Srpske, str. 11 (1): 193-196
- [2] D. Popovac(2011): Bolesti pluća, Tumori pluća i medijstinuma. Časopis udruženja pulmologa Republike Srpske ; 11 (1): str.431
- [3] V. Danilović(2011): Plućne bolesti Tumori pluća, Časopis udruženja pulmologa Republike Srpske ; 11 (1): str. 662-664
- [4] Stefanović i saradnici(2011): Plućne bolesti. Časopis udruženja pulmologa Republike Srpske ; 11 (1): str.313
- [5] Jandrić K., Stanetić M., Gajić S., Davidovac A. et al. (2005): Dijagnoza i neke karakteristike bronhopulmonog karcinoma, Majski pulmološki dani, str. 25-27
- [6] Vujović Z., Jelačić Đ. (2010): Bronhoskopija u dijagnostici karcinoma pluća u Opštoj bolnici Sombor 2004- 2009. Godina, Majski pulmološki dani, str. 181-183
- [7] Hotić-Lazarević S., Kecman-Prodan S., Kecman D., Duka S. (2009): Učestalost karcinoma pluća u opštini Prijedor u periodu 2004-2008.godina, Majski pulmološki dani, str. 221-225
- [8] C. Michael Gibson (2011): Wiki Doc Resources for Lung cancer, Retrieved March
- [9] Humphrey L., Teutch S., Johnson M. (2011): Lungcancer Screening with Sputum Cytologig Examination, Chestradiography, and Computed Tomography, Retrieved March
- [10] Manser R., Irving LB., Stone C., Abramson MJ et all.(2010) Screeing Cochrane Collaboration and published in *The Cochrane Library; issue 1, 1-15*
- [11] Milroy R. (2006): New American College of Chest Physicians Lung Cancer Guidelines, Chest;
- [12] Winslow T. (2010): Lung Cancer Screening Using Hekical CT vs. Chest X/ray Reduce Deaths Current and Former Heavy Smokers, Chest,
- [13] Durmisevic S, Durmisevic-Serdarevic J, Durmišević J. Movement Trend of Air Quality in the Zenica City Area (1987 – 2008). 13th International Reaserch/ Expert Conference “Trends in the Development of machinery and Associated Technology” TMT 2009,Hammamet, Tunisia, 16-21 October, 2009. In: Proceedings of the Proceedings of the 13th International Reaserch/Expert Conference “Trends in the Development of machinery and Associated Technology TMT 2009, University of Zenica, Faculty of Mechanical Engineering in Zenica, Hammamet, Tunisia 2009: 757-760