JEE Journal of Ecological Engineering

Journal of Ecological Engineering 2024, 25(2), 167–175
https://doi.org/10.12911/22998993/176249
ISSN 2299–8993, License CC-BY 4.0

Received: 2023.11.22
Accepted: 2023.12.06
Published: 2024.01.01

The Impact of Air Pollution on the Number of Diagnosed Respiratory and Cardiovascular Diseases

Monika Wierzbińska[1*], Aleksandra Kita[1]

[1] Institute of Environmental Protection and Engineering, University of Bielsko-Biala, ul. Willowa 2, 43-300 Bielsko-Biała, Poland

* Corresponding author's e-mail: mwierzbinska@ubb.edu.pl

ABSTRACT

Over the last few years, there has been a noticeable increase in interest in air quality issues in Poland. Information on this subject is increasingly appearing in the media and in public debate. However, it seems that awareness of the existence and importance of this problem is still too low in our society. In particular, few people have sufficient knowledge of the impact of air pollutants on health. Consequently, the problem of air pollution is very often underestimated. The increase in risk of occurrence of specific adverse health effects associated with exposure to air pollutants is usually relatively low (except in cases of high pollutant concentrations or people in high-risk groups). However, the prevalence of exposure as well as the association with common diseases result in the fact that the impact of air pollutants on health status of the population is significant. This paper attempts to analyse the relationship between ambient air quality and the number of people who visited a local health care facility and were diagnosed with respiratory and cardiovascular diseases. The analysis was performed based on the town of Żory located in the Silesian Voivodeship in southern Poland. Air pollutant concentrations of PM2.5, PM10 and SO_2 for the summer and heating seasons were obtained from the database of the monitoring station owned by the Chief Inspectorate for Environmental Protection. Information on the number of people who visited a physician on particular days and who were diagnosed with respiratory or cardiovascular diseases was obtained from the local health care facility "Medyk" in Żory. The analysis was conducted for the summer period from 01.06.2021 to 31.08.2021 and the heating season from 01.11.2021 to 15.01.2022. The analysis showed that the increased concentrations of particulate pollution did not result in an increase in the number of people who visited a physician with respiratory diseases. In the case of the heating period, incidents of above-normal concentrations of PM10 particulate matter may have had a noticeable impact on the increase in the number of patients who visited a physician with cardiovascular diseases. This increase in the number of patients occurred several days after the smog incidents which occurred in mid-December. However, no short-term link was observed between the increase in the number of patients with cardiovascular and respiratory diseases and the occurrence of elevated concentrations of sulphur dioxide in the air. Furthermore, higher concentrations of particulate and gaseous pollutants during the heating season resulted in more respiratory and cardiovascular diseases than during the summer season.

Keywords: air quality, low-stack emissions, respiratory and cardiovascular diseases.

INTRODUCTION

Over the last few years, there has been a noticeable increase in interest in air quality issues in Poland. Information on this subject is increasingly appearing in the media and in public debate. However, it seems that awareness of the existence and importance of this problem is still too low in our society. In particular, few people have sufficient knowledge of the impact of air pollutants on health. Consequently, the problem of air pollution is very often underestimated [https://depot.ceon.pl/bitstream/handle, https://depot.ceon.pl/handle].

One of the problems of polluted air is smog. This is an unnatural phenomenon of co-occurrence of pollution and fog. Smog is caused by human activity and unfavorable weather conditions. In Poland, the problem is London-type

smog. Especially during the heating season, there is a high concentration of pollutants such as suspended dust – particulate matter (PM) and sulfur dioxide in the air. PM is classified according its size into PM10 and PM2.5 (aerosol which aerodynamic diameter is less than 10 μm and 2.5 μm, respectively). These particles are especially hazardous to health because they are so fine that they can easily penetrate the respiratory tract and accumulate in the lungs. These pollutants come mainly from the burning of poor quality fuels, sulfurized coal or even waste. Smog is caused by low emissions, i.e. emissions from emitters with a height of less than 40 m.

Main causes of emission near the ground are:

- heating houses with poor quality fuels (coal and damp wood),
- no standards for fuels used in households,
- burning garbage, including plastic, old furniture, clothes and shoes, tires, and old railway wooden sleepers etc.,
- use of outdated masonry heaters in numerous private houses and industrial heating systems, which do not meet technical standards anymore, and in which the combustion of coal takes place in an inefficient way,
- inadequate insulation of houses and loss of energy in the heating process,
- transport emission, caused by the removal of particulate filters (the Diesel Particulate Filter) from cars' exhaustion systems,
- low and even declining popularity of renewable energy sources,
- fires of landfills most often caused by arsons [Burchard-Dziubińska 2019].

The degradation of the environment through, among other things, air pollution adversely affects people's health and incidence of diseases. Air pollutants pose serious health risks: they reduce human life expectancy and contribute to the incidence of many diseases. The latest Air quality in Europe - 2016 report, published by the European Environment Agency (EEA), estimates that air pollution is responsible for 467,000 premature deaths in Europe. The quality of the air we breathe has a key impact on the state of our health, which is fundamental to our functioning [Treder 2019].

The increase in risk of occurrence of specific adverse health effects associated with exposure to air pollutants is usually relatively low (except in cases of high pollutant concentrations or people in high-risk groups). However, the prevalence of exposure as well as the association with common diseases result in the fact that the impact of air pollutants on health status of the population is significant [Krzyżanowski 2016].

More than 48,000 people in Poland die annually from diseases caused by air pollution. Children, the elderly and people already suffering from respiratory or cardiovascular diseases are particularly vulnerable to diseases related to exposure to harmful agents in the air. Inhalation of air with high levels of harmful substances causes health problems and, in an increasing number of cases, even contributes to death in the long term [Treder 2019]. The occurrence of episodes of high concentrations of particulate matter results in an increase in disease symptoms, mainly respiratory and cardiovascular diseases. Studies conducted by the Silesian Centre for Heart Diseases in Zabrze for the area of the Upper Silesian conurbation show that from 5 to 14 days after an exceedance of the notifiable level for PM10 particulate matter, the incidence of stroke increases significantly (by about 9%); 7 to 14 days after an episode of high particulate matter concentrations, the number of visits by patients with cardiovascular diseases to primary health care facilities also increases (by about 5%) [Treder 2019].

As a result of breathing polluted air, harmful substances present in the air are introduced into the respiratory system and alveoli. Above all, the intensity and level of exposure are strongly related to the particle size of the polluted air and the anatomy of the respiratory tract, pathological changes in the respiratory system and the general health of the person exposed to inhalation of polluted air [Dabriecki et al. 2018; Całka et al. 2020]. Air pollution from industrial dust and gases also leads to numerous bronchial diseases and lung cancer, Parkinson's disease, depression, but also – and this is not always remembered – is conducive to numerous cardiovascular diseases. An increasing number of studies results suggest that increased mortality may be caused not only by years of air pollution, but also by the exposure of susceptible and already sick people to several hours of significant levels of this pollution [Głuszek et al. 2019].

In recent years, there have been many publications on the impact of air pollution on the occurrence of respiratory diseases [Bălă et al. 2021, Priyankara et al. 2021, Chen et al. 2021, Yang et al. 2020, Kyung et al. 2020, Fasola et al. 2020, Peng et al. 2022] and cardiovascular diseases

[Al-Kindi et al. 2020, Miller et al. 2020, Grande et al. 2020, Hayes et al. 2020, Aryal et al. 2021, Brauer et al. 2021]. Mielecka-Kubień (2020) highlighted the impact of polluted air on the health of the population of the Silesian Voivodeship, as one of the most polluted voivodeships in Poland. The subject of that study was cities with a population of 100,000 or more, but this does not mean that similar problems do not occur in smaller towns and cities in Silesia.

This paper attempts to analyse the relationship between ambient air quality and the number of people who visited a local health care facility and were diagnosed with respiratory and cardiovascular diseases. The analysis was performed based on the town of Żory located in southern Poland.

CHARACTERISTICS OF THE TOWN OF ŻORY

Żory is a town with poviat rights, it is one of the towns belonging to the Rybnik Coal Mining District. It is located in Upper Silesia on the Rybnik Plateau by the Ruda River. The town borders with the poviats of Mikołów, Pszczyna and Rybnik as well as with the cities of Jastrzębie-Zdrój and Rybnik. The contemporary landscape includes today's numerous development zones for living or economic purposes, i.e. industrial facilities with infrastructure and office and welfare facilities, landfills associated with KWK "Żory", "Fandom" SA restructured former house factory, ZTS "Krywałd-Erg" plastics factory, roads and railway lines. In economic terms, the town is nowadays classified as a rural and manufacturing town [http://bip.zory.pl/?p=document&action=show&id=12441&bar_id=5149].

The town of Żory is geographically located in the south-western part of the Plateau, which is a fragment of the Silesian Upland. In morphological terms, the described area has an undulating structure, with elevations reaching about 286 m above sea level. The centre of the town is connected with the proglacial valley and the valley of the Ruda River. At present, the entire area is in some places strongly anthropogenically transformed, which can be linked to mining and coal extraction activities. The hydrological axis is the Ruda River, a tributary of the Oder.

Five public roads run through the town of Żory: A1 motorway, national road no. 81, voivodeship road no. 924, voivodeship road no. 932, voivodeship road no. 935 and 2 railway lines: LK 148 and LK159 [https://www.polskawliczbach.pl/Zory].

Żory is located in the Silesian Voivodeship, which means that the town lies in one of the most polluted voivodeships in Poland. According to a report by the World Health Organisation, Żory was ranked as the 49th most polluted town in the European Union in 2016. The Chief Inspectorate for Environmental Protection has a measuring station on the territory of Żory where current values of concentrations of carbon monoxide, sulphur dioxide, PM10 and PM2.5 particulate matter can be read. During the heating season, London-type smog occurs in the town. During this period, there are often days when limit values for particulate air pollutants, mainly from low emissions, are exceeded. Low emissions, which are the cause of smog, are mainly determined here by heating homes with poor quality solid fuels. This results in poor air quality in Żory [https://smogmap.pl/zory].

METHODOLOGY

The data used for the analysis, such as concentrations of air pollutants PM2.5, PM10 and SO_2 for the summer season and winter season (heating period) were obtained from the monitoring station located in Żory in the Generał Władysław Sikorski residential neighbourhood. The measuring station is owned by the Chief Inspectorate for Environmental Protection. For the heating season, data were obtained from two sources. Information on SO_2 concentrations was collected from the measuring station owned by the Chief Inspectorate for Environmental Protection (GIOŚ). Data on concentrations of PM2.5 and PM10 particulate matter were obtained from the official website of the town of Żory. These data as daily averages were collected daily in the period from 01.06.2021 to 31.08.2021 (summer season) and from 01.11.2021 to 15.01.2022 (heating season).

In addition to air pollutant concentrations, information was also collected during the same study period on the number of people who visited the local health care facility and who were diagnosed with cardiovascular and respiratory diseases. This information came from the "MEDYK" health care facility located in Żory at Osiedle Księcia Władysława 27. On the basis of data thus collated, charts were drawn up and analysed for correlations between the concentrations of

selected air pollutants and the incidence of cardiovascular and respiratory diseases.

RESULTS AND ANALYSIS

Figures 1-2 show the relationship between the number of patients diagnosed with cardiovascular diseases (Fig. 1) or respiratory diseases (Fig. 2) and the concentration of PM2.5 and PM10 particulate matter in the air during the summer season.

The highest concentration of PM2.5 was recorded on 17.07.2021. Its value amounted to 23 μg/m^3. The lowest value of 5.6 μg/m^3 of this pollutant was recorded on 17.08.2021. The highest value of PM10 concentrations was observed on 14.07.2021 and its value amounted to 35 μg/m^3. The lowest value of PM10 concentrations of 9.5 μg/m^3 occurred on 08.08.2021. The highest number of patients (36) diagnosed with cardiovascular diseases was recorded on 28.06.2021. The highest number of patients (25) diagnosed with respiratory diseases was recorded on 21.06.2021. The limit values for particulate matter concentrations (D_{24} = 50 μg/m^3) were not exceeded during this period [Regulations 2012]. The highest number of patients suffering from cardiovascular and respiratory diseases was recorded in the second half of June. The values of particulate matter concentrations in this period were higher than in other periods of the summer season for a longer time, even though the highest concentrations of

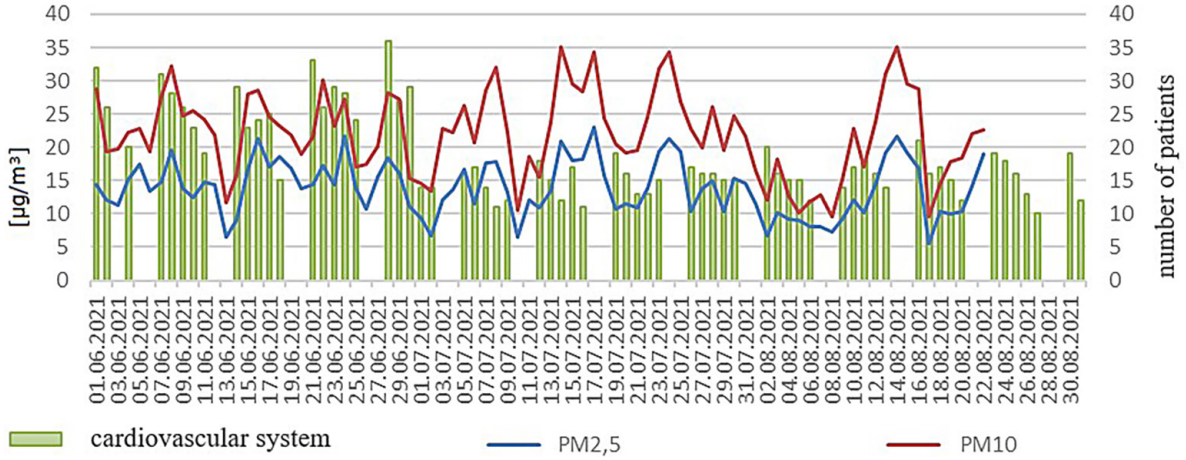

Fig. 1. Overview of the number of patients diagnosed with cardiovascular diseases together with concentrations of PM2.5 and PM10 particulate matter during the summer season

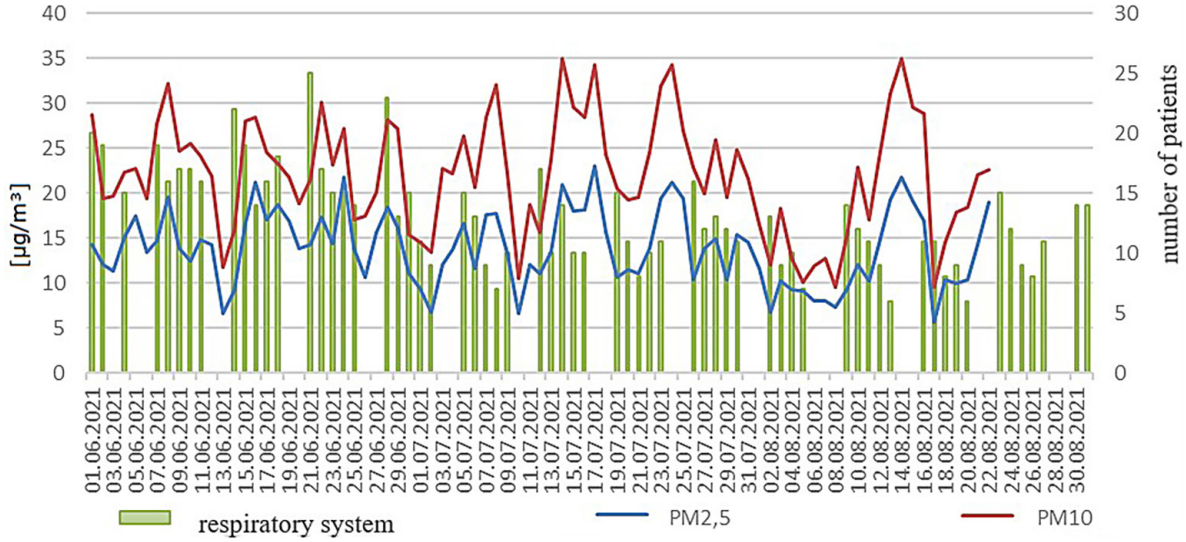

Fig. 2. Overview of the number of patients diagnosed with respiratory diseases together with concentrations of PM2.5 and PM10 particulate matter during the summer season

these pollutants were recorded in the first half of July. The recorded maximum values of PM2.5 and PM10 concentrations were within the "good" range of the Air Quality Index developed by the Chief Inspectorate for Environmental Protection. The air quality for this category is satisfactory, with air pollution causing low or no risk of health hazards. Staying outdoors is advisable, any activity can be carried out without restrictions. Particulate matter is mainly emitted by burning coal in individual heating systems and by vehicle exhaust systems. Concentrations of particulate matter were not exceeded throughout the summer months because there was no need to heat homes, offices or industrial premises. In addition, modes of transport that allow outdoor activities such as bicycles are chosen more often in summer than in winter, which also reduces air emissions.

Figures 3-4 show the relationship between the number of patients diagnosed with cardiovascular diseases (Fig. 3) and respiratory diseases (Fig. 4) and the concentration of sulphur dioxide in the air during the summer season. The highest SO_2 concentration value amounted to 9.4 μg/m^3 and was recorded on 01.06.2021. The lowest SO_2 concentration value was recorded on 29.08.2021 and amounted to 2.2 μg/m^3. The highest number of patients diagnosed with cardiovascular diseases was recorded on 28.06.2021 (36). The highest number of patients diagnosed with respiratory diseases (25) was recorded on 21.06.2021. Throughout the summer period, sulphur dioxide concentrations were not exceeded (D_{24} = 125 μg/m^3) [Regulation 2012] and according to the Air Quality Index, sulphur dioxide concentrations were in the "very good" range. The air quality for

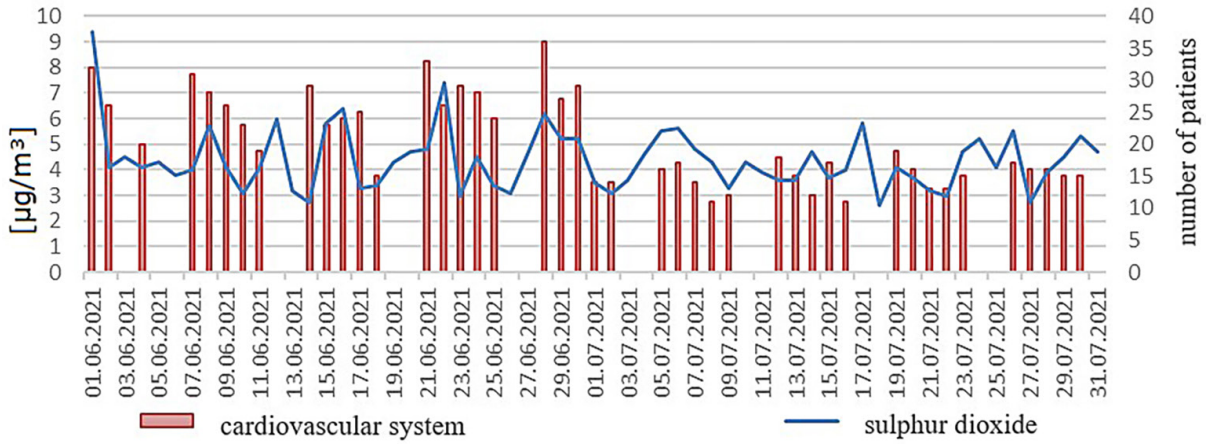

Fig. 3. Overview of the number of patients diagnosed with cardiovascular diseases together with SO_2 concentrations during the summer season

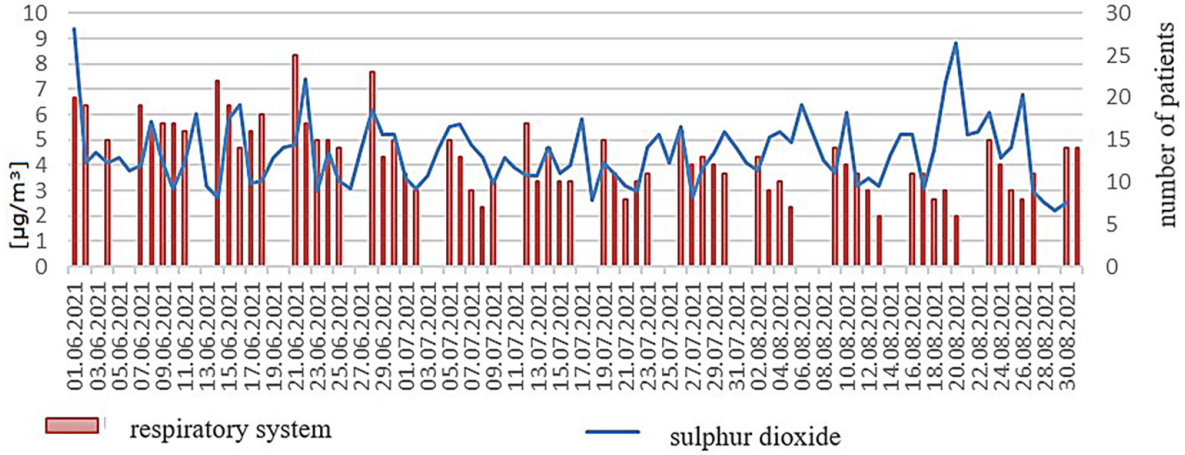

Fig. 4. Overview of the number of patients diagnosed with respiratory diseases together with SO_2 concentrations during the summer season

this category is very good, air pollution is not a health hazard, conditions are very favourable for all outdoor activities. Such low sulphur dioxide values can be attributed to the lack of need to heat buildings. Sulphur dioxide is mainly emitted during the combustion of sulphurised coal in boilers. In summer, there is no need to heat homes, offices or industrial premises. Figures 5-6 show the relationship between the number of patients diagnosed with cardiovascular diseases (Fig. 5) and respiratory diseases (Fig. 6) and the concentration of particulate pollutants PM2.5 and PM10 in the air during the heating season. The highest value of PM2.5 concentration was observed on 14.12.2021 (104 μg/m^3). The lowest concentration value of this pollutant amounted to 8 μg/m^3 and was recorded on 02.12.2021. The highest value of PM10 concentration was recorded on 14.12.2021 and it amounted to 141 μg/m^3, while the lowest value of this pollutant was recorded on 02.12.2021 (10 μg/m^3). The highest number of patients diagnosed with cardiovascular diseases (25) visited the health care facility on 29.11.2021. The highest number of patients diagnosed with respiratory diseases was recorded on 15.11.2021, there were 33 of these patients. For the highest particulate matter concentrations observed, the Air Quality Index indicates poor air quality. Sick

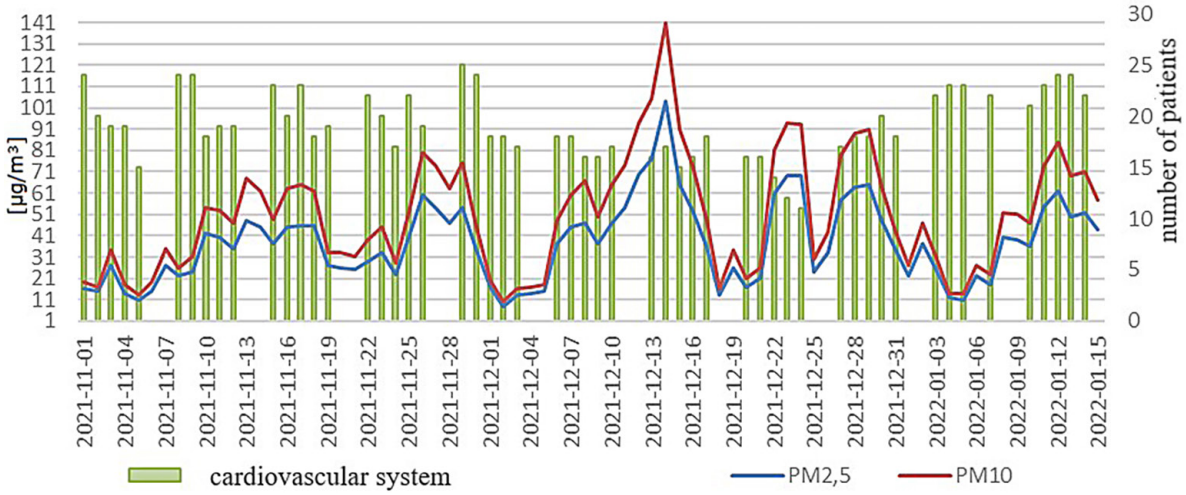

Fig. 5. Overview of the number of patients diagnosed with cardiovascular diseases together with PM2.5 and PM10 concentrations during the heating season

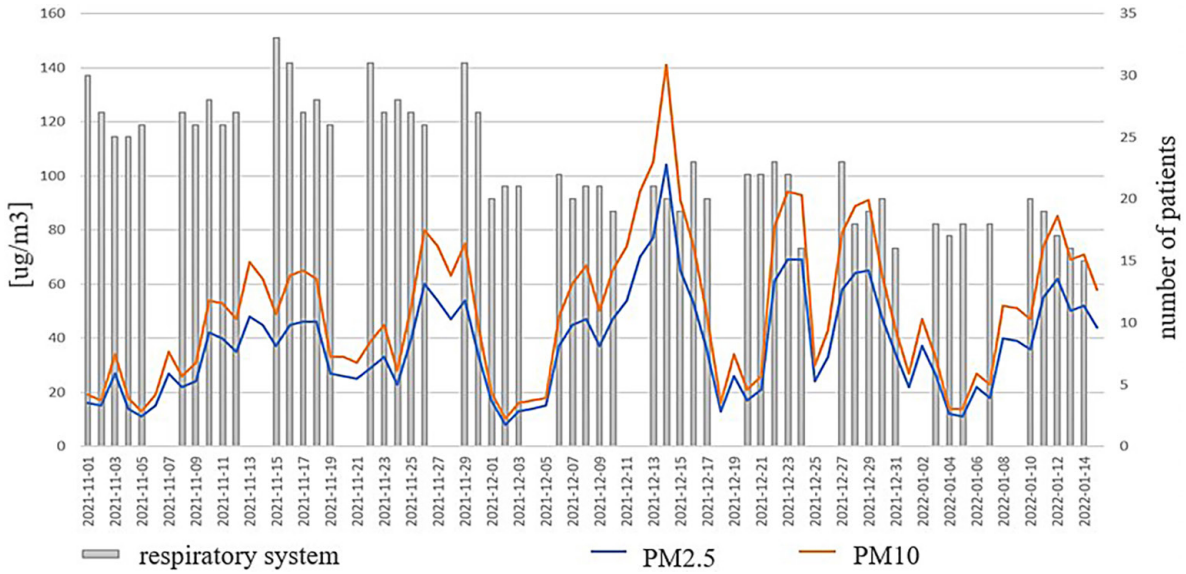

Fig. 6. Overview of the number of patients diagnosed with respiratory diseases together with PM2.5 and PM10 concentrations during the heating season

people, the elderly, pregnant women and young children should avoid being outdoors during this time. The rest of the population should minimise any outdoor physical activity, especially activity requiring prolonged or increased physical exertion. The highest number of patients was diagnosed in the second half of November with both cardiovascular and respiratory diseases. In the first half of November, an increase in particulate matter concentrations was noticeable. However, no consistent relationship was observed between smog incidents and the increasing number of patients during this time. It is clear that respiratory and cardiovascular diseases are caused by different factors. It is therefore difficult in this case to demonstrate a link between poor air quality and increased incidence of respiratory and cardiovascular diseases in the local population.

Figures 7-8 show the relationship between the number of patients diagnosed with cardiovascular diseases (Fig. 7) and respiratory diseases (Fig. 8) and the concentration of sulphur dioxide in the air during the heating season. In the analysed winter period, the highest value of SO_2 concentration was recorded on 23.12.2021 and amounted to 36.1 µg/m^3. The lowest value of this pollutant was recorded on 17.12.2021 and amounted to 6.1 µg/m^3. The highest number of patients diagnosed with respiratory diseases was recorded on 29.11.2021, the number of patients on that day was 25. The highest number of patients diagnosed with respiratory diseases was recorded on 15.11.2021, the number

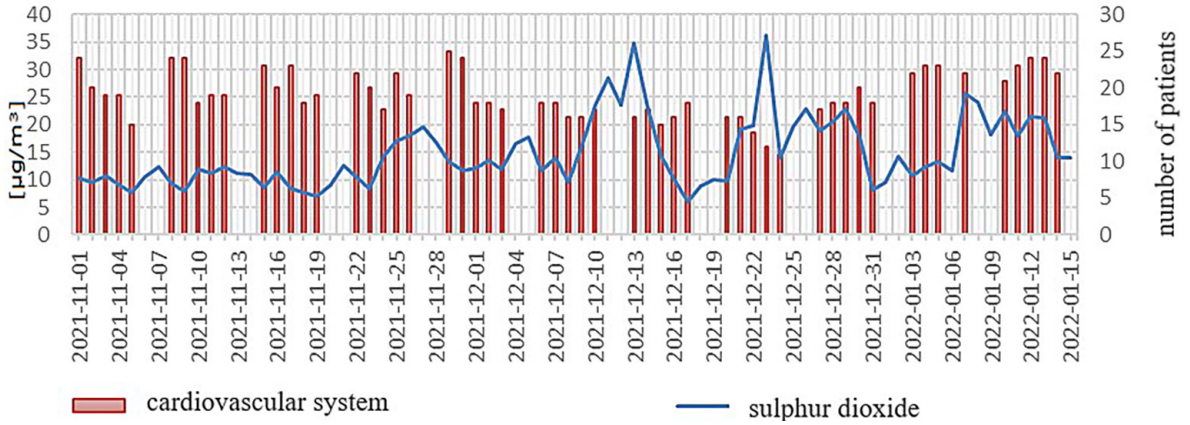

Fig. 7. Overview of the number of patients diagnosed with cardiovascular diseases together with SO_2 concentrations during the heating season

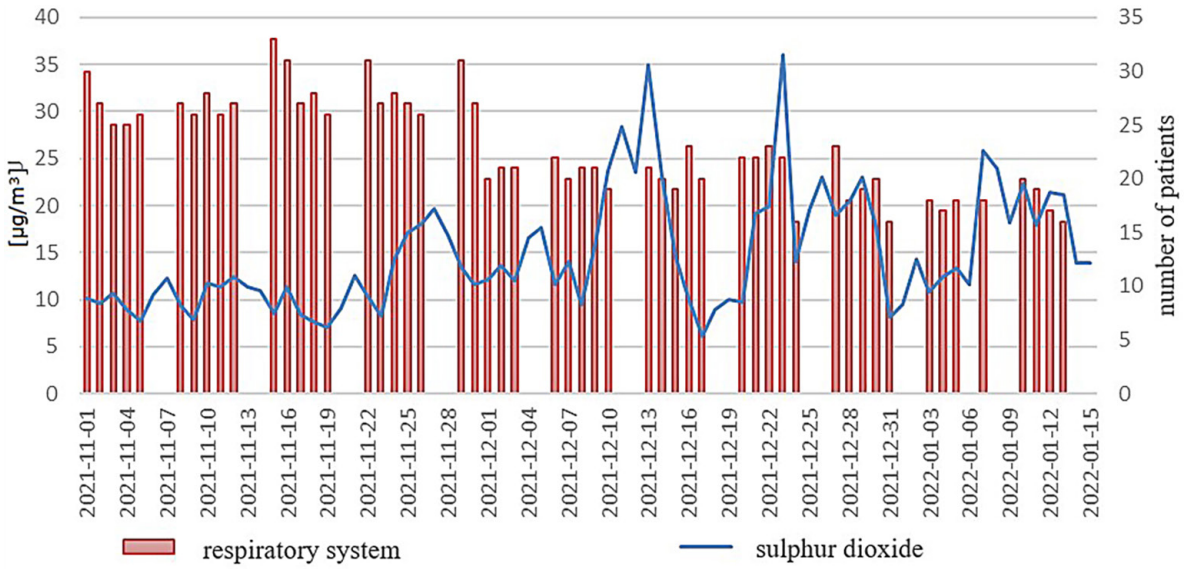

Fig. 8. Overview of the number of patients diagnosed with respiratory diseases together with SO_2 concentrations during the heating season

of patients on that day was 33. According to the Air Quality Index, the highest observed value of SO_2 concentration falls within the "good air quality" range. The air quality measured for this pollutant is satisfactory, air pollution causes no or low health risks. As far as SO_2 exposure is concerned, it is possible to stay outdoors and perform any activity, without restrictions. Analysing the above results, it is difficult to find a link between elevated SO_2 concentrations and the number of people who contracted respiratory or cardiovascular diseases during this period.

It seems that only in the case of the heating period incidents of above-normal concentrations of PM10 (and PM2.5) may have had a noticeable impact on the increase in the number of patients who visited a physician with cardiovascular diseases. The increase in the number of patients occurred several days after the smog incidents which occurred in mid-December. No increase in the number of patients with respiratory diseases was observed during this time, which is a phenomenon that is not confirmed by literature. It is therefore necessary to continue the study and extend the period of analysis.

CONCLUSIONS

The analysis of incidence of respiratory and cardiovascular diseases in Żory inhabitants together with the immission of PM2.5 PM10 and SO_2 in the air during the summer season from 01.06.2021 to 31.08.2021 and the heating season from 01.11.2021 to 15.01.2022 led to the formulation of the following conclusions. Increased concentrations of particulate pollution did not result in an increase in the number of people who visited a physician with respiratory diseases. In the case of the heating period, incidents of above-normal concentrations of PM10 (and PM2.5) particulate matter may have had a noticeable impact on the increase in the number of patients who visited a physician with cardiovascular diseases. The increase in the number of patients occurred several days after the smog incidents that occurred in mid-December. Higher concentrations of particulate and gaseous pollutants during the heating season cause more respiratory diseases than cardiovascular diseases compared to the summer season. No short-term relationship was observed between the increase in cardiovascular and respiratory diseases and the occurrence of elevated concentrations of sulphur dioxide in the air. During the study period, the lowest values of concentrations of particulate and gaseous pollutants were recorded during the summer season in August, while the highest values were recorded during the heating season in November and December.

REFERENCES

1. Al-Kindi S.G., Brook R.D., Biswal S., Rajagopalan S. 2020. Environmental determinants of cardiovascular disease: lessons learned from air pollution. Nature Reviews Cardiology, 17(10), 656-672.
2. Aryal A., Harmon A.C., Dugas T.R. 2021. Particulate matter air pollutants and cardiovascular disease: Strategies for intervention. Pharmacology & therapeutics, 223, 107890.
3. Bălă G.P., Râjnoveanu R.M., Tudorache E., Motișan R., Oancea C. 2021. Air pollution exposure – the (in) visible risk factor for respiratory diseases. Environmental Science and Pollution Research, 28, 19615-19628.
4. Brauer M., Casadei B., Harrington R.A., Kovacs R., Sliwa K. 2021. WHF Air Pollution Expert Group. 2021. Taking a stand against air pollution – the impact on cardiovascular disease: A joint opinion from the World Heart Federation, American College of Cardiology, American Heart Association, and the European Society of Cardiology. Circulation, 143(14), e800-e804.
5. Burchard-Dziubińska M. 2019. Air pollution and health in poland: anti-smog movement in the most polluted polish cities. Ekonomia i środowisko, 2(69), 76-90. https://doi.org/10.34659/2019/2/22
6. Całka M., Pawlica P.J. 2020. Health consequences of air pollution, Journal of Life and Medical Sciences, Nauki Przyrodnicze i Medyczne, 1(27), 13-21.
7. Chen T., Wang K., Ma X., Wei X., Wang W., Huang P., Zhao Z. 2021. Acute respiratory response to individual particle exposure (PM1. 0, PM2. 5 and PM10) in the elderly with and without chronic respiratory diseases. Environmental Pollution, 271, 116329.
8. Dąbrowiecki P., Chciałowski A., Mazurek H. 2018. Deposition of pollutants, mechanisms of toxic action and the role of human defense mechanisms. [in] Smog. Health consequences of air pollution. (red.). Mazurek H., Badyda A. PZWL Wydawnictwo Lekarskie. Warszawa, 57-59. (in Polish)
9. de Bont J., Jaganathan S., Dahlquist M., Persson Å., Stafoggia M., Ljungman P. 2022. Ambient air pollution and cardiovascular diseases: An umbrella review of systematic reviews and meta-analyses. Journal of internal medicine, 291(6), 779-800.
10. Fasola S., Maio S., Baldacci S., La Grutta S., Ferrante G., Forastiere F., BEEP Collaborative Group.

2020. Effects of particulate matter on the incidence of respiratory diseases in the pisan longitudinal study. International Journal of Environmental Research and Public Health, 17(7), 2540.

11. Głuszek J., Kosicka T. 2019. Effects of air pollution on cardiovascular diseases. Choroby Serca i Naczyń, 16(3), 201–206. DOI: 10.5603/ChSiN.2019.0030 (in Polish)
12. Grande G., Ljungman P.L., Eneroth K., Bellander T.. Rizzuto D. 2020. Association between cardiovascular disease and long-term exposure to air pollution with the risk of dementia. JAMA neurology, 77(7), 801-809.
13. Hayes R.B., Lim C., Zhang Y., Cromar K., Shao Y., Reynolds H.R., Thurston G.D. 2020. PM2.5 air pollution and cause-specific cardiovascular disease mortality. International journal of epidemiology, 49(1), 25-35.
14. Krzyżanowski M. 2016. Circulatory and respiratory effects of particulate air pollution. Lekarz Wojskowy, 1, 17-22. https://issuu.com/medycynapraktyczna/docs/__lw_2016_01 (in Polish)
15. Kyung S.Y., Jeong S.H. 2020. Particulate-matter related respiratory diseases. Tuberculosis and respiratory diseases, 83(2), 116.
16. Mielecka-Kubień Z., Wójcik A. 2020. Air pollution and the health of residents of large cities in the Silesian Voivodeship, Wiadomości Statystyczne. Statystyka w praktyce. The Polish Statistician, 65(6), 39–51. DOI: 10.5604/01.3001.0014.2344 (in Polish)
17. Miller M.R., Newby D.E. 2020. Air pollution and cardiovascular disease: car sick. Cardiovascular Research, 116(2), 279-294.
18. Peng W., Li H., Peng L., Wang Y., Wang W. 2022. Effects of particulate matter on hospital admissions for respiratory diseases: an ecological study based on 12.5 years of time series data in Shanghai. Environmental Health, 21(1), 1-12.
19. Priyankara S., Senarathna M., Jayaratne R., Morawska L., Abeysundara S., Weerasooriya R., & Bowatte G. 2021. Ambient PM2. 5 and PM10 exposure and respiratory disease hospitalization in Kandy, Sri Lanka. International journal of environmental research and public health, 18(18), 9617.
20. Rozporządzenie Ministra Środowiska z dnia 24 sierpnia 2012 r. w sprawie poziomów niektórych substancji w powietrzu. Dz.U. 2012, poz. 1031 (tekst jednolity Dz.U. 2021, poz. 845).
21. Treder M. 2019. Smog of health safety sanctions in Poland. Rocznik Bezpieczeństwa Międzynarodowego , 11 (1), 190-204. (in Polish)
22. Yang L., Li C., Tang X. 2020. The impact of PM2. 5 on the host defense of respiratory system. Frontiers in cell and developmental biology, 8(91).
23. https://www.polskawliczbach.pl/Zory
24. http://bip.zory.pl/?p=document&action=show&id=12441&bar_id=5149
25. https://depot.ceon.pl/bitstream/handle/123456789/15434/ksi%c4%85%c5%bcka%20o%20zdrowiu.pdf?sequence=1&isAllowed=y
26. https://depot.ceon.pl/handle/123456789/15434
27. https://smogmap.pl/zory/?fbclid=IwAR3GyGTDc79Dfv9kC6zJHGjCNCUxAEtT8KeV5-8D5VaED-dOMYWaHSRN36U