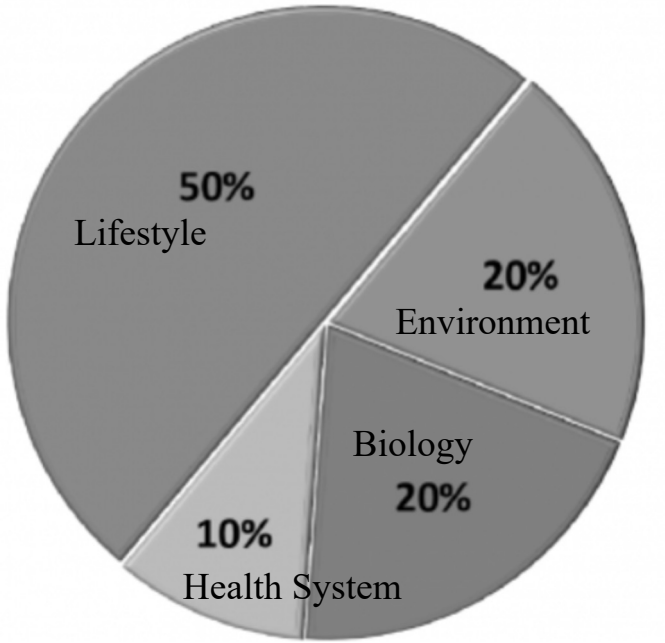
Wpływ zanieczyszczenia powietrza na występowanie chorób sercowo-naczyniowych - negatywne efekty zdrowotne stosowania paliw kopalnych

Łukasz Kuźma
Uniwersytet Medyczny w Białymstoku

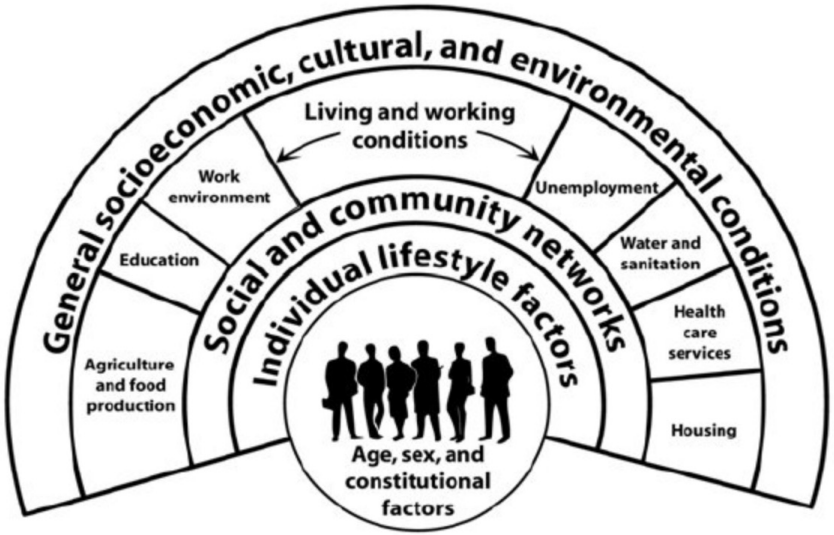
Seminarium naukowe:
5. Warsztaty naukowe CASE – Centrum Analiz Społeczno-Ekonomicznych
Podatki akcyzowe
31.05.2022
Warszawa

Conflict of interest

None declared.



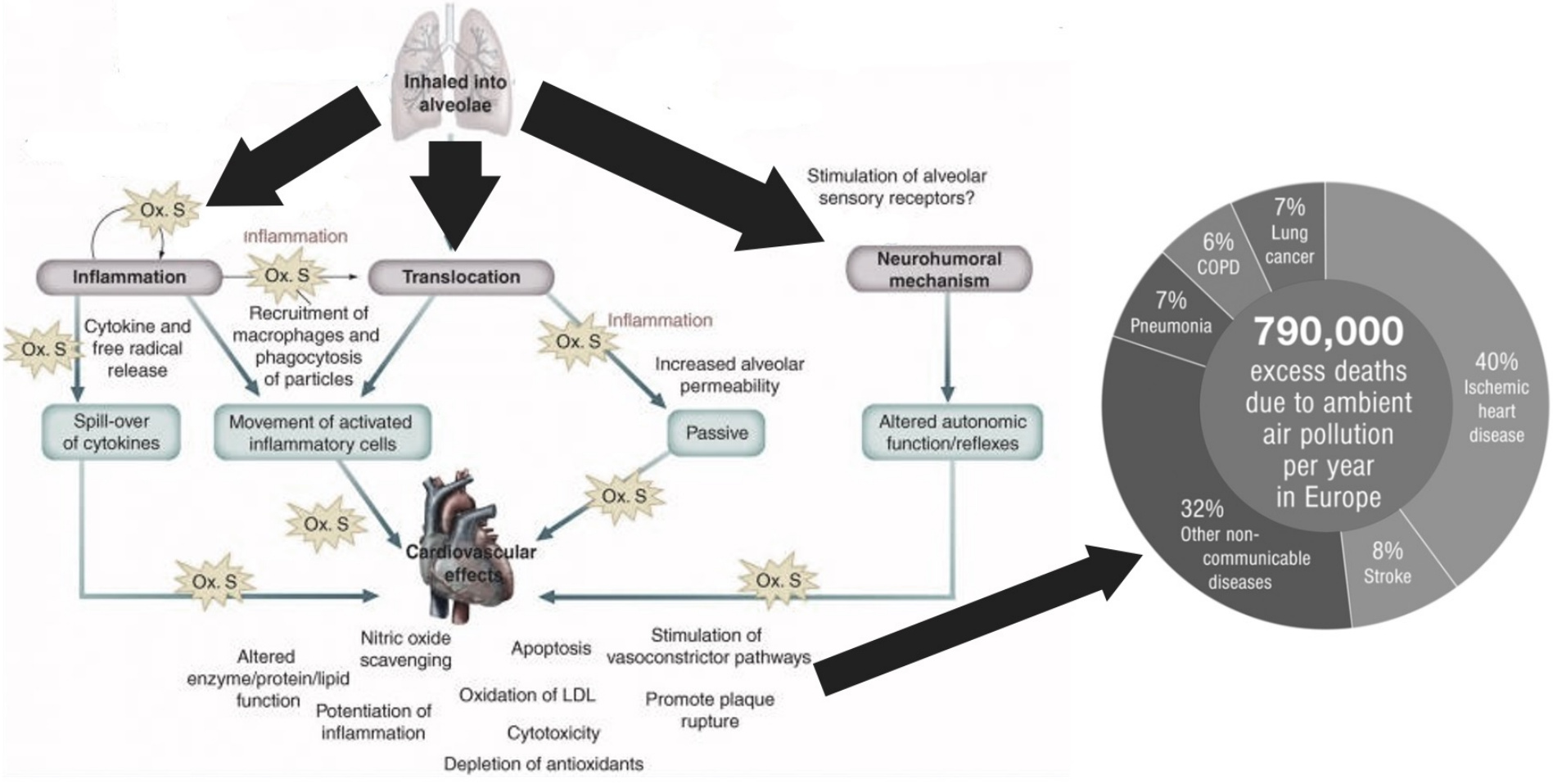
Lalond (1974)



Dahlgren and Whitehead (1991)

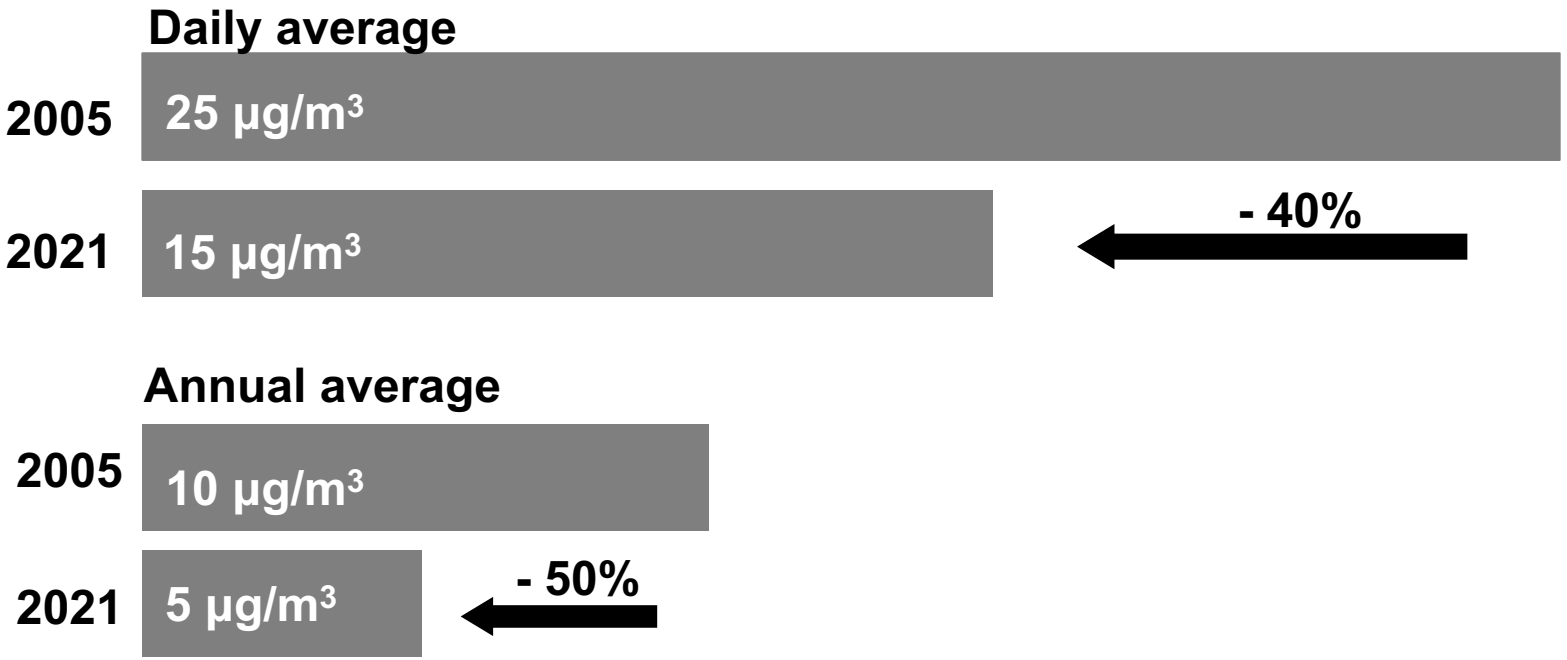
693 days

Wats N et al. The Lancet Countdown on health and climate change : from 25 years of inaction to a global transformation for public health, Lancet, 2021



Cardiovascular disease burden from ambient air pollution in Europe reassessed using novel hazard ratio functions
Leliveld et. al. 2019 European Heart Journal

WHO guidelines for $PM_{2.5}$

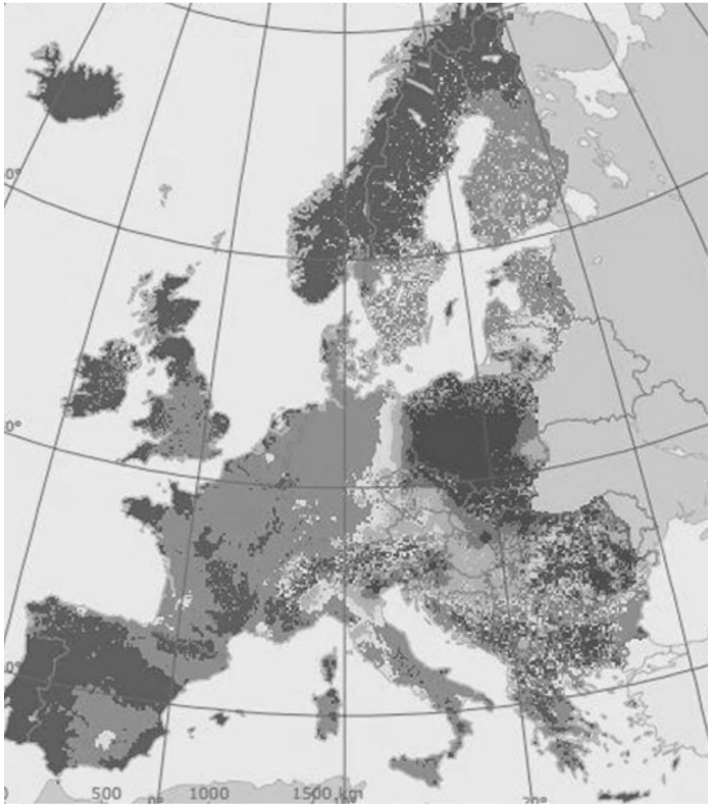


Air quality guidelines: particulate matter ($PM_{2.5}$ and PM_{10}), ozone, nitrogen dioxide, sulfur dioxide and carbon monoxide 2021. WHO

Polish smog

Specific geographic location of Eastern Europe, especially at times of frosty Russian weather conditions characterized by high pressure, cold air and sunshine, favor the formation of the phenomenon known as "**Polish smog**".

The air pollution, rich in compounds such as $PM_{2.5}$, PM_{10}, and polycyclic aromatic hydrocarbons (benzo(a)pyrene) from low emission associated with household heating with solid fuels (coal, wood, and often also waste), imposes detrimental effects on health and life of the population, in particular in the context of cardiovascular effects.



Background

Journal of Epidemiology and Community Health, Wojtyniak et al. 1996

Short term effect of air pollution on mortality in Polish urban populations

Positive associations between mortality and SO_2 and CO in Lodz and Cracow and between cardiovascular mortality and SO_2 in Cracow.

Epidemiological Review, Rabczenko et al. 2005

Short-term effect of air pollution with SO_2, CO, NO_2 on mortality of Polish population

In Krakow, Łódź, Poznań and Wrocław statistically significant increase of mortality from all causes was associated with increase in SO_2, CO and NO_2.

International Journal of Environmental Research and Public Health, Nahorski et al. 2017

Burden of Mortality and Disease Attributable to Multiple Air Pollutants in Warsaw, Poland

Local emissions of air pollution cause approximately 1600 attributable deaths per year.

POLISH ARCHIVES OF
Internal Medicine
POLSKIE ARCHIWUM MEDYCYNY WEWNĘTRZNEJ

Effect of short-term fluctuations in outdoor air pollution on the number of hospital admissions due to acute myocardial infarction among inhabitants of Kraków, Poland

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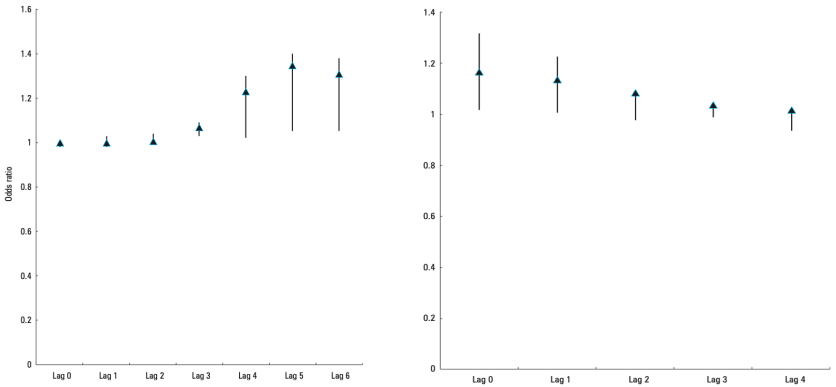

PATIENTS AND METHODS Data on hospitalizations, daily pollutant concentrations, infections, and meteorological parameters were collected from December 2012 to September 2015. Data were assessed using a time-series regression analysis with a distributed lag model.

RESULTS An increase of 10 μg/m^3 in $PM_{2.5}$ levels was associated with a higher risk of hospital admission due to MI (odds ratio [OR], 1.32; 95% CI, 1.01–1.40; $P = 0.0002$). For PM_{10} the effect was observed only with a simultaneous decrease of 1°C in the mean daily temperature (OR, 1.08; 95% CI, 1.01–1.17; $P = 0.03$). Significant effects were observed at lags 5 and 6. The effect of NO_2 was significant at lags 0 and 1, but only in patients aged 70 years or older (OR, 1.13; 95% CI, 1.01–1.23; $P = 0.007$) and those with pulmonary disorders (OR, 1.12; 95% CI, 1.01–1.31; $P = 0.01$).

CONCLUSIONS In all age groups, the short-term elevation in $PM_{2.5}$ levels was associated with an increased number of daily hospital admissions for MI, whereas for PM_{10} the effect was significant only with a simultaneous decrease in temperature. The effect of NO_2 was observed only in older individuals and patients with pulmonary disorders. A negative clinical effect was more delayed in time in the case of exposure to PM than to NO_2.

CARDIOLOGY JOURNAL
Impact Factor: 1.669

Impact of air pollution on hospital patients admitted with ST- and non-ST-segment elevation myocardial infarction in heavily polluted cities within the European Union

Paweł E. Buszman[1, 2], Kamil Derbisz[1], Przemysław Kwasiborski[1], Patrycja Chrząszcz[1], Magdalena Mularska[1], Dominika Baron[1], Anna Sobieszek[1], Artur Mendyk[1], Paweł Skoczylas[3], Marek Cisowski[1], Piotr P. Buszman[1, 2], Krzysztof Milewski[1, 4]

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[2]Andrzej Frycz Modrzewski Krakow University, Faculty of Medicine and Health Sciences, Krakow, Poland
[3]University of Social Sciences, Poland
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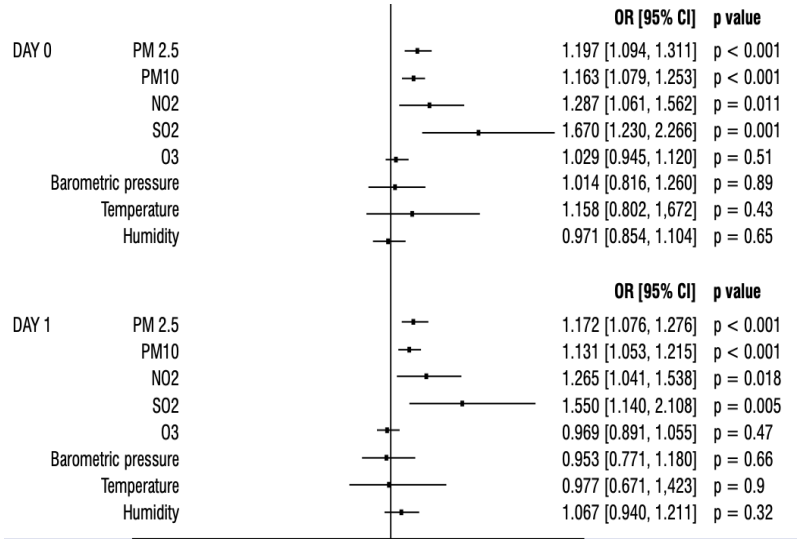
Conclusions: *The most important pollutants triggering acute myocardial infarction occurrence in the population of southern Poland, both on the day of air pollution and the following day are particulate matters (PM2.5, PM10) and gaseous pollutants including NO2 and SO2. These pollutants should be regarded as modifiable risk factors and thus, their reduction is a priority in order to decrease total morbidity and mortality in Poland.* (Cardiol J 2020; 27, 5: 541–547)



International Journal of Hygiene and Environmental Health

Exposure to air pollution—a trigger for myocardial infarction? A nine-year study in Bialystok—the capital of the Green Lungs of Poland (BIA-ACS registry)

Łukasz Kuźma [a], Szymon Pogorzelski [a], Krzysztof Struniawski [a], Hanna Bachórzewska-Gajewska [a, b], Sławomir Dobrzycki [a]

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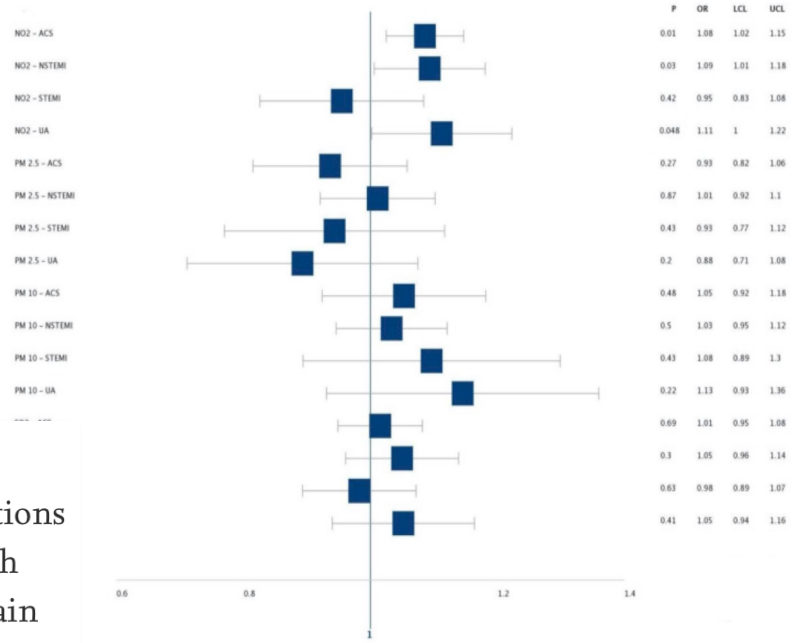

Conclusion

The study showed that the effects of air pollution and weather conditions on the number of ACS hospitalizations are also observed in cities with moderately polluted or good air quality. NO_2 was identified as the main air pollutant affecting the incidence of ACS.

ORIGINAL ARTICLE

POLISH ARCHIVES OF
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Effect of air pollution on the number of hospital admissions for acute coronary syndrome in elderly patients

Łukasz Kuźma[1], Szymon Pogorzelski[1], Krzysztof Struniawski[1], Sławomir Dobrzycki[1], Hanna Bachórzewska-Gajewska[1,2]

1 Department of Invasive Cardiology, Medical University of Bialystok, Bialystok, Poland
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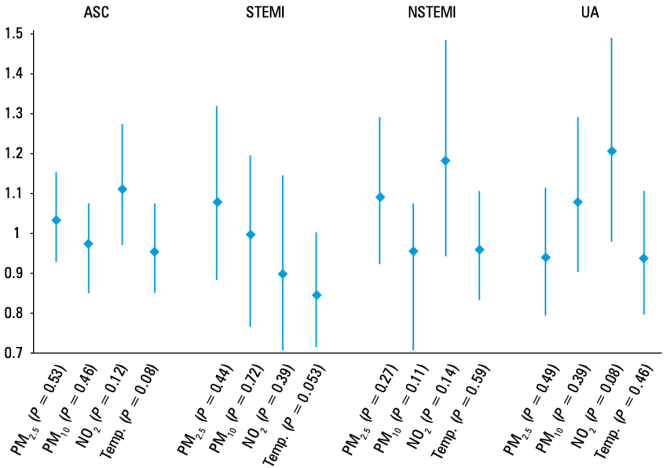

ABSTRACT

INTRODUCTION Air pollution is a documented risk factor for cardiovascular diseases.

OBJECTIVES The aim of the study was to assess the effect of air pollution on the number of hospital admissions for acute coronary syndrome (ACS) in elderly patients.

PATIENTS AND METHODS The medical records of 26 695 patients hospitalized for ACS between 2008 and 2017 were examined. Weather conditions and the following components of air pollution were analyzed: sulfur dioxide, nitrogen dioxide, and particulate matter with a diameter of 2.5 μm or less ($PM_{2.5}$) and a diameter of 10 μm or less (PM_{10}).

RESULTS The study included 1618 inhabitants of Białystok in Poland (mean [SD] age, 75 [6.4] years; men, 52.6%). The norm for $PM_{2.5}$ was exceeded on 23.5% of days, while for PM_{10}, on 5.3% of days. Elevated PM_{10} levels were associated with a higher number of hospitalizations for ACS on the day of exposure (mean [SD], 0.61 [0.78] vs 0.44 [0.69]; $P < 0.001$), and this effect persisted in the subsequent days (mean [SD], 1.07 [1.07] vs 0.88 [1.00]; $P = 0.02$). An increase of PM_{10} concentrations by 10 μg/m^3 was associated with an increase in the number of hospitalizations due to unstable angina, and significant effects were observed even after 6 days (rate ratio, 1.16; 95% CI, 1.03–1.32; $P = 0.02$).

CONCLUSIONS Increased exposure to air pollution, in particular, elevated PM_{10} levels, is associated with a higher incidence of ACS both on the day of exposure and over the following days.

Article

Gender Differences in Association between Air Pollution and Daily Mortality in the Capital of the Green Lungs of Poland–Population-Based Study with 2,953,000 Person-Years of Follow-Up

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Journal of *Clinical Medicine*

Variables	RR	Lower 95% CI for RR	Upper 95% CI for RR	*p*
NO_2 μg/m^3 * + Meteorological parameters	0.99	0.96	1.04	0.96
SO_2 μg/m^3 * + Meteorological parameters	1.10	1.04	1.17	0.002
PM2.5 μg/m^3 ** + Meteorological parameters	1.03	0.99	1.06	0.13
PM10 μg/m^3 ** + Meteorological parameters	0.99	0.96	1.03	0.99
Temp. °C ***	1.01	0.99	1.04	0.29
Variables	**RR**	**Lower 95% CI for RR**	**Upper 95% CI for RR**	***p***
NO_2 μg/m^3 * + Meteorological parameters	1.02	0.97	1.07	0.40
SO_2 μg/m^3 * + Meteorological parameters	1.02	1.00	1.04	0.08
PM2.5 μg/m^3 ** + Meteorological parameters	1.07	1.02	1.12	0.01
PM10 μg/m^3 ** + Meteorological parameters	0.95	0.90	1.01	0.60
Temp. °C ***	1.02	0.98	1.07	0.25

Variables	RR	Lower 95% CI for RR	Upper 95% CI for RR	*p*
NO_2 μg/m^3 * + Meteorological parameters	0.98	0.94	1.03	0.31
SO_2 μg/m^3 * + Meteorological parameters	1.05	1.01	1.10	0.009
PM2.5 μg/m^3 ** + Meteorological parameters	0.99	0.96	1.03	0.73
PM10 μg/m^3 ** + Meteorological parameters	1.03	0.98	1.07	0.17
Temp. °C ***	1.04	1.02	1.07	0.003
Variables	**RR**	**Lower 95% CI for RR**	**Upper 95% CI for RR**	***p***
NO_2 μg/m^3 * + Meteorological parameters	0.99	0.93	1.05	0.69
SO_2 μg/m^3 * + Meteorological parameters	1.02	0.99	1.05	0.19
PM2.5 μg/m^3 ** + Meteorological parameters	1.00	0.95	1.05	0.86
PM10 μg/m^3 ** + Meteorological parameters	1.03	0.97	1.09	0.36
Temp. °C ***	1.08	1.04	1.13	<0.001

Conclusions

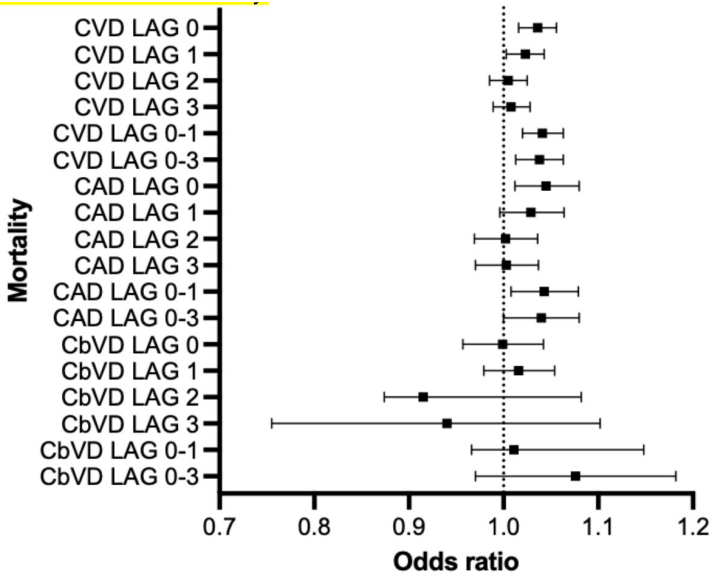
1. Air quality and atmospheric conditions had an impact on the mortality of Bialystok residents.
2. The main air pollutant that influenced the mortality rate was SO_2, and there were no gender differences in the impact of this pollutant. In the male population, an increased exposure to PM2.5 concentration was associated with significantly higher cardiovascular mortality.

Association between air pollution and case-specific mortality in north-eastern part of Poland. Case-crossover study with 4,500,000 person-years of follow-up (PL-PARTICLES study)

Objectives: To assess the short-term impact of air pollution on cardiovascular (CVD)-, coronary artery-related (CAD)-, and cerebrovascular-related (CbVD) mortality.

Patients and methods: The analysis with 4,500,000 person-years of follow-up with a time-stratified case-crossover design was performed.

Results: The interquartile range (IQR) increase in $PM_{2.5}$ (OR 1.036, 95%CI 1.016–1.056,P<0.001) and PM_{10} concentration (OR 1.034, 95%CI 1.015–1.053,P<0.001) was associated with increased CVD mortality on lag 0 and this effect persisted on following days. The effects of PMs were more expressed in association with CAD-related mortality (OR for $PM_{2.5}$=1.045, 95%CI 1.012–1.080,P=0.008), (OR for PM_{10}=1.044, 95%CI 1.010–1.078,P=0.011). Additionally, IQR increase in NO_2 concentration was associated with increased CAD-related mortality at lag 0-1 (OR=1.055, 95%CI .1.004–1.108,P=0.032).



Conclusions: The impact of PMs on CVD mortality is also observed in moderately polluted areas. This adverse health effect was more apparent in CAD mortality. Differences in effect size and seasonality may depend on the source of air pollution.

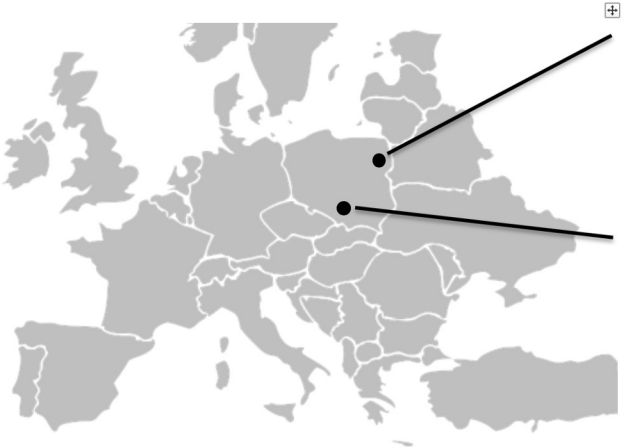
ELSEVIER

Environmental Research

Volume 197, June 2021, 111154

Impact of short-term air pollution exposure on acute coronary syndrome in two cohorts of industrial and non-industrial areas: A time series regression with 6,000,000 person-years of follow-up (ACS - Air Pollution Study)

Łukasz Kuźma [a], Wojciech Wańha [b], Paweł Kralisz [a], Maciej Kazmierski [b], Hanna Bachórzewska-Gajewska [a], Wojciech Wojakowski [b], Sławomir Dobrzycki [a]



Non-industrial area (Bialystok)
GPS: 53°08′07″N 23°08′44″E
Total area: 102.12 km^2
Inhabitants: 294,925
>65 years old: 21.2%
Feminization Index: 113
Green Lungs of Poland
Food industry and tourism

Industrial area (Katowice)
GPS: 50°15′51″N 19°01′25″E
Total area: 164.64 km^2
Inhabitants: 296,262
>65 years old.: 25.8%
Feminization Index: 110
Upper Silesian industrial region
Mining industry

6,000,000 person - years

Data on hospitalization for ACS from 2008 to 2017 was obtained and extracted from the National Health Fund reports. We used data from patients registered as residents in the city of Bialystok – non industrial area and Katowice city - industrial area. The limit of the daily mean value for $PM_{2.5}$ according to the WHO guidelines was exceeded on 45.2% days in industrial area and on 24.9% days in non-industrial area. The daily WHO upper limit for PM_{10} was exceeded on 27.6% days in industrial area and on 9.1% days in non-industrial area. The WHO limit for SO_2 was exceeded sporadically in non-industrial area (0.4%) and on 18.4% days in industrial area.

Exposure to Air Pollution and Renal Function - An Underestimated Threat?

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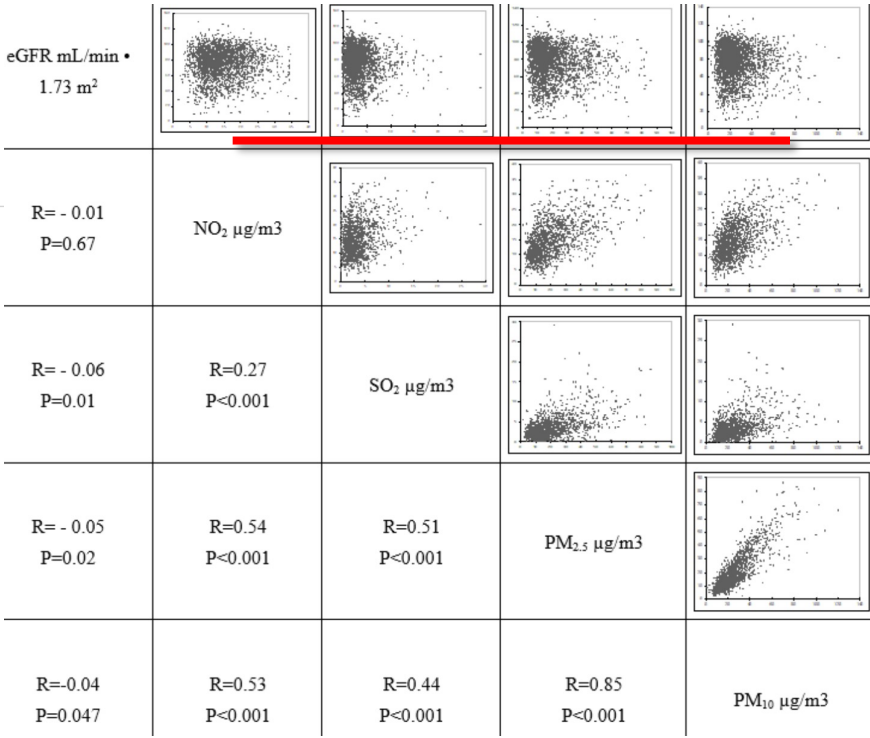
Medical University of Białystok

SPRINGER NATURE
scientific reports

Results: 3,554 patients were included into the final analysis. The median age was 66 (IQR 15) and men were in the majority (53.2%, N=1891). Chronic kidney disease (CKD) was diagnosed in 21.5% (N=764). The long-term increase in annual average concertation of $PM_{2.5}$ (OR for IQR increase=1.07; 95% CI 1.01 – 1.15, P=0.037) and NO_2 (OR for IQR increase=1.05;95% CI 1.01 – 1.10, P=0.047) resulted in an increased number of patients with CKD. In short-term observation the IQR increase in weekly $PM_{2.5}$ concentration was associated with a 2% reduction in eGFR (OR=0.98, 95%CI 0.97 – 0.99, P=0.03)

Conclusions: The effects of air pollution on renal function were observed. Long- and short–term exposure to elevated air pollution levels was associated with a decrease in eGFR. The main pollutant affecting the kidneys was $PM_{2.5}$.



Key message

The effects of **air pollution** on the population's **health** and **quality of life** can also be observed in **low polluted** regions.

Increased incidence of **acute coronary syndromes** and **deaths** from cardiovascular causes is associated with **elevated concentrations of pollutants.**

The most **vulnerable** subgroups are **older people** with multiple **comorbidities.**

The **impact** of pollution on health is **multidirectional.**

Thank you

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