Analysis of short- and medium-term influence of Polish smog on atherothrombotic cardiovascular diseases in 709 counties in Eastern Europe - preliminary results (EP-Particles study)

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Background: Polish smog is a specific type of air pollution characterized by high concentrations of particulate matters (PMs) and benzo(a)pyrene (BaP), which causes exceptionally adverse cardiovascular effects. In Eastern Europe, this is a problem in large cities and also small towns, where residents’ suboptimal heating choices lead to poor air quality. Moreover, myocardial infarction and ischemic stroke (IS) are one of the most common causes of emergency hospitalizations in this area.

Purpose: We aimed to assess the short- and medium-term impact of multiple air pollutants on the incidence of ST Elevation Myocardial Infarction (STEMI) and IS.

Methods: We collected data on hospitalizations due to IS and STEMI in the years 2011-2020 from National Health Fund. Effects of PM2.5, PM10, NO2, SO2, O3, CO and BaP were calculated using time-stratified panel data Poisson regression. Results are reported as odds ratio (OR) and 95% Confidence Intervals (95%CI) associated with an increase of the interquartile range (IQR) in a daily concentration of air pollutants on the day of exposure (LAG 0), during the week (LAG 0-6) and month (LAG 0-30) after exposure. The study covered 709 counties located in Eastern Europe with 90 million person-years of follow-up.

Results: We recorded 159,952 and 68,251 cases of IS and STEMI, respectively. The mean age of patients in IS groups was 73.78 years old and 48.46% of them were men. In the STEMI group mean age was 67.52 years old and males accounted for 64.38%. In the figures, we presented the influence of all analyzed air pollutants on IS (Figure 1) and STEMI (Figure 2) incidence. Exposure to PMs was associated with the highest STEMI (PM2.5: OR=1.086, 95%CI 1.074-1.099, p<0.001; PM10: OR=1.091, 95%CI 1.078-1.104, p<0.001) and IS (PM2.5: OR=1.027, 95%CI 1.019-1.035, p<0.001; PM10: OR=1.028, 95%CI 1.02-1.036, p<0.001) occurrence on LAG 0, and this effect increased during the following month. The IQR increase in BaP concentration was associated with increased IS incidence on LAG 0 (OR=1.009, 95%CI 1.002-1.016, p=0.01), LAG 0-6 (OR=1.012, 95%CI 1.004-1.021, p=0.004) and LAG 0-30 (OR=1.016, 95%CI 1.007-1.026, p=0.001). A similar effect was noted on STEMI occurrence. Exposure to CO was associated with increased IS incidence on all analyzed LAGs, whereas in STEMI it only affected LAG 0-30. The IQR increase in O3 had a protective effect on IS occurrence on LAG 0-6 (OR=0.974, 95%CI 0.962-0.987, p<0.001) and LAG 0-30 (OR=0.967, 95%CI 0.952-0.983, p<0.001), while it had a negative effect on STEMI incidence on LAG 0 (OR=1.023; 95%CI 1.006-1.04, p=0.008).

Conclusions: Polish smog has a detrimental influence on the incidence of atherothrombotic diseases as a result of the toxic effects of mainly PMs and also other air pollutants. Exposure to air pollution can act as a trigger for STEMI and IS. Furthermore, medium-term exposure also increases the risk of STEMI and IS occurrence, most likely due to cumulative doses of air pollutants.