

Air pollution speeds up aging of the lungs and increases chronic lung disease risk

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A study of more than 300,000 people has found that exposure to outdoor air pollution is linked to decreased lung function and an increased risk of developing chronic obstructive pulmonary disease (COPD).

COPD is a long-term condition linked to reduced [lung](#) function that causes inflammation in the lungs and a narrowing of the airways, making breathing difficult. According to the Global Burden of Disease (GBD) project COPD is the third leading cause of death worldwide, and the number of global COPD deaths are expected to increase over the next ten years.

Lung function normally declines as we age, but the new research published today (9 July, 2019) in the *European Respiratory Journal* suggests that air [pollution](#) may contribute to the ageing process and adds to the evidence that breathing in polluted air harms the lungs.

Anna Hansell is Professor of Environmental Epidemiology in the Centre for Environmental Health and Sustainability at the University of

Leicester, UK, and was part of the research team. She said: "There are surprisingly few studies that look at how air pollution affects lung health. To try and address this, we assessed more than 300,000 people using data from the UK Biobank study to examine whether [air pollution exposure](#) was linked to changes in lung function, and whether it affected participants' risk of developing COPD."

The researchers used a validated air pollution model to estimate the levels of pollution that people were exposed to at their homes when they enrolled in the UK Biobank study. The types of pollutants the researchers investigated included [particulate matter](#) (PM₁₀), fine particulate matter (PM_{2.5}) and nitrogen dioxide (NO₂), which are produced by burning fossil fuels from car and other vehicle exhausts, power plants and industrial emissions.

Participants answered detailed health questionnaires as part of the UK Biobank data collection, and lung function was measured using spirometry tests performed by medical professionals at Biobank assessment centers at enrolment between 2006 and 2010. Spirometry is a simple test used to help diagnose and monitor certain lung conditions by measuring how much air can be breathed out in one forced breath.

The research team then conducted multiple tests to see how long-term exposure to higher levels of the different air pollutants was linked to changes to participants' lung function. The participants' age, sex, body mass index (BMI), [household income](#), education level, smoking status, and exposure to secondhand smoke were accounted for in the analyses. Further analyses also looked at whether working in occupations that increase the risk of developing COPD impacted disease prevalence.

The data showed that for each annual average increase of five micrograms per cubic meter of PM_{2.5} in the air that participants were exposed to at home, the associated reduction in lung function

was similar to the effects of two years of ageing.

When the researchers assessed COPD prevalence, they found that among participants living in areas with PM_{2.5} concentrations above World Health Organization (WHO) annual average guidelines of ten micrograms per cubic meter (10 µg/m³), COPD prevalence was four times higher than among people who were exposed to passive smoking at home, and prevalence was half that of people who have ever been a smoker.

The current EU air quality limits for PM_{2.5} is 25 micrograms per cubic meter (25 µg/m³), which is higher than the levels that the researchers noted as being linked to reduced lung function.

Professor Hansell explained: "In one of the largest analyses to date, we found that [outdoor air pollution](#) exposure is directly linked to lower lung function and increased COPD prevalence. We found that people exposed to higher levels of pollutants had lower lung function equivalent to at least a year of ageing.

"Worryingly, we found that air pollution had much larger effects on people from lower income households. Air pollution had approximately twice the impact on lung function decline and three times the increased COPD risk on lower-income participants compared to higher-income participants who had the same air pollution exposure.

"We accounted for participants' smoking status and if their occupation might affect lung health, and think this disparity could be related to poorer housing conditions or diet, worse access to healthcare or long-term effects of poverty affecting lung growth in childhood. However, further research is needed to investigate the differences in effects between people from lower- and higher-income homes."

The researchers were not able to track participants' exposure to pollutants in their daily lives, and say that study participants were generally wealthier and healthier than the wider general public, which could have resulted in underestimations of the strength of the links between declining [lung function](#) and air

pollution exposure.

Professor Tobias Welte from Hannover University, Germany, is President of the European Respiratory Society and was not involved in the study. He said: "The findings of this large study reinforce that exposure to polluted air seriously harms human health by reducing life expectancy and making people more prone to developing chronic lung disease.

"Access to clean air is a fundamental need and right for all citizens in Europe. Governments have a responsibility to protect this right by ensuring that maximum pollutant levels indicated by the World Health Organization are not breached across our cities and towns. Breathing is the most basic human function required to sustain life, which is why we must continue to fight for the right to breathe clean air."

The research team are conducting further studies to look at whether genetic factors interact with [air pollution](#) and its effects on health.

More information: Dany Doiron et al, Air pollution, lung function and COPD: results from the population-based UK Biobank study, *European Respiratory Journal* (2019). [DOI: 10.1183/13993003.02140-2018](#)

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