The Adverse Effects of Early Life Exposure to Air Pollution Across the Lifecourse

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Educational background

2025	Fellow, The Academy of Medical Sciences, UK, FMedSci
2018	Fellowship, Faculty of Public Health, FFPH
1999	Fellow, Royal College of Paediatrics and Child Health, FRCPCH
1994	M.D., University of London
1986	Membership of the Royal College of Physicians, MRCP UK

Professional experience

2006-Present	Professor, Queen Mary University of London, Paediatric Respiratory and Environmental Medicine
1997-2006	Senior Clinical Lecturer, University of Leicester
1995-1997	Senior Registrar, St Mary's Hospital London

Epidemiological studies consistently report associations between exposure to fossil fuel–derived air pollution and adverse fetal and postnatal health outcomes. These include impaired fetal growth, preschool wheeze, school-age asthma, poorer asthma control, and reduced lung function development. Although fossil fuel combustion produces a complex mix of particulate matter (PM) and gases, mechanistic evidence points to PM as the key driver. Regulatory limits have therefore been established for PM smaller than 10 microns in aerodynamic diameter (PM10).

Early-life exposure to PM sets children on abnormal developmental paths, increasing the risk of adult-onset disease. However, many questions remain. For example, how does inhaled PM cause disease in organs beyond the lungs? And does PM from non-fossil sources have similar effects? To explore these issues, we examined macrophages from human placentas and found clear evidence that fossil fuel–derived PM reaches these cells. More recently, we observed PM adhering to red blood cells following short-term exposure to traffic-derived emissions. Whether PM hitchhiking on red blood cells is unique to traffic-related nanoparticles or common to all inhalable PM, including natural dusts, remains unclear.

Despite unresolved questions about mechanisms, the evidence we have already justifies strong advocacy for reducing population-wide exposure. Advising individual patients, however, is more complex. At the Royal London Hospital, we have established an environmental exposure assessment clinic to build an evidence base for practical mitigation strategies. We have found many children with asthma attending this clinic are exposed to high levels of PM both outdoors and within their homes. Using our novel blood biomarker of exposure, we have also generated the first evidence that wearing FFP2 masks can reduce the amount of PM entering the bloodstream.