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Carbon in airway macrophages and lung function in children

Occupation and Epidemiology Best Paper Annual Award, sponsored by GlaxoSmithKline

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MY JOB AND THE UNIT IN WHICH I WORK

I am Professor of Paediatric Respiratory and Environmental Medicine at Queen Mary University London. The Medical School is based at the London Hospital, and serves a population characterised by its ethnic diversity and social deprivation. The Academic Unit of Paediatrics is based in the Institute for Cell and Molecular Science, and has the strategic aim of translating basic scientific observations into clinically relevant outcomes. The current focus of my research team is on air pollution-induced vulnerability to bacterial and viral lower respiratory tract infections (especially in the developing world), and the treatment of wheezing illnesses in children.

MY WINNING PAPER AS PART OF MY RESEARCH

The trigger for the study discussed in the winning paper [1] was an epidemiological study, based in Leicester, UK, where we used a dispersion model to estimate exposure of young children to locally derived particulate pollution (mainly from petrol and diesel engines). We found that modelled exposure to ''primary'' particles, *i.e.* carbonaceous particles directly emitted from exhausts, was associated with an increased prevalence of cough without a cold and wheeze [2]. However, our inability to directly measure exposure to primary particles was frustrating. In previous studies, we had incidentally noted a wide variation in the amount of carbon in alveolar macrophages from normal children [3–5], but had not followed this up at the time. Since alveolar macrophages only reside in the lower airway, any phagocytosed carbon must be: 1) inhaled into the lower respiratory tract, and 2) derived from pollutant particles. We therefore hypothesised that carbon loading of alveolar macrophages is a valid marker of individual exposure to particulate pollution. At the same time, data from the USA suggested that particle exposure is associated with reduced lung function in children [6]. In a study funded by the Health Effects Institute (Boston, MA, USA), we therefore: 1) obtained alveolar macrophages using sputum induction (expectoration after breathing a salty mist) from healthy children; 2) modelled the exposure to ''primary'' particles for each child's home address; and 3) assessed lung function. We found an inverse association between alveolar macrophage carbon and lung function, and a positive association between modelled exposure to primary particles and alveolar macrophage carbon. These data strengthen the epidemiological evidence that particulate air pollution impairs lung function.

MY RESEARCH AS PART OF MY WORKING GROUP/ RESEARCH TEAM

Dr Kulkarni, the clinical research fellow attached to this study, has used alveolar macrophage carbon loading to assess exposure to indoor air pollution in the developing world. Her programme of research was awarded the Paediatric Respiratory Research In Europe Award. Since sputum induction is relatively easy to perform, analysis of carbon loading in alveolar macrophages may be the ''gold standard'' maker of exposure to particulate pollution. It could, for example, be used to test occupational exposures (toll booth operatives), and to assess the effectiveness of interventions such as congestion charging. However, further studies are needed to determine the kinetics of inhaled particles within alveolar macrophages, before this technique can be widely applied.

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