# Full-chain Quantitative Health Impact Assessment of Traffic-Related Air Pollution and Childhood Asthma in Bradford, UK

# Presented by [Haneen Khreis](http://www.its.leeds.ac.uk/people/h.khreis), ITS, University of Leeds

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**Abstract**

Childhood asthma is a burdensome disease that is often cited as the most common chronic disease in children. Traffic-related air pollution (TRAP) may be an important exposure in its development although the impact of TRAP exposures on the burden of childhood asthma is poorly documented.  In the UK, Bradford is a multi-ethnic and economically deprived city suffering from childhood asthma rates higher than national and regional averages. TRAP is of concern to Bradford’s communities and is thought to contribute to this asthma burden. We aimed to estimate the burden of childhood asthma, from birth-18 y.o., attributable to TRAP in Bradford, by estimating new asthma cases attributable to traffic-related air pollutants estimated using novel full-chain air pollution modelling and comparing the estimates with existing commonly used approaches.

We estimated childhood population exposure to traffic-related Nitrogen Oxides (NOx) and Nitrogen Dioxide (NO2) at the smallest census area scale in Bradford using three validated exposure assessment methods: two novel full-chain models linking transport (SATURN), emissions (COPERT and PHEM-based) and air dispersion models (ADMS-Urban) and one land-use regression (LUR) model, which also provided estimates for other pollutants including Particulate Matter 2.5 and 10 micrometres in diameter and black carbon. The two full-chain models were a dispersion model with standard vehicle emission factors and one with novel vehicle emission factors which we developed in previous work. The LUR model was developed as part of the ESCAPE project.  We extracted the UK incidence rate for childhood asthma (birth-18 y.o.) from the peer reviewed literature and conducted pollutant-specific meta-analyses to obtain exposure-response functions for all the pollutants studied. We calculated the relative risk and population attributable fraction of childhood asthma due to each pollutant. We then estimated asthma cases attributable to each pollutant/exposure.

Depending on the model used and the pollutant being studied, the estimated TRAP-attributable childhood asthma cases varied between 300 and 700 annually, representing up to 40% of all cases in the Bradford area. Dispersion modelling work is ongoing.

TRAP is estimated to cause a large, but preventable, childhood asthma burden. This study is the first study undertaking full-chain health impact assessment and considers the full-chain from source (road traffic), through emissions (vehicle emissions), through exposure pathways (air quality) to outcomes (new cases of asthma), in a disadvantaged population with public concern about the effect of TRAP. It adds to the scarce literature exploring the impacts of the different exposure assessment methods on the estimated burden of disease.

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