**University of Leicester**

**College of Life Sciences**

**HPRU Grant studentship**

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**Section 2 – *Project Information***

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| **Project Title** | The causal role of outdoor air pollution and its interactive effects with temperature and aeroallergens on childhood asthma |
| **Project Summary** | |
| **Project description**  **Background and objectives:**  Asthma is a common long-term disease, affecting 10-15% of children worldwide. Air pollution is a known trigger for asthma. In 2019, fine particles in outdoor air were estimated to contribute to about one-third of childhood asthma cases globally.  Research on air pollution and childhood asthma has grown rapidly, creating a valuable opportunity to reassess the evidence and investigate important questions. While air pollution makes symptoms of asthma worse, whether it causes asthma to develop is less clear. Does air pollution combine with aeroallergens and extreme temperatures to worsen symptoms in allergic asthma? Genetic factors and deprivation are likely to affect asthma risks, but no comprehensive review has considered personal factors. Further research into the joint effects of temperature, air pollution levels and allergens is needed, given the likely impacts of climate change.  Objective 1: Systematic reviews and meta-analyses, where appropriate, will be undertaken to examine the causal effects of outdoor air pollution and childhood asthma and also estimate how much air pollution affects childhood asthma in the UK. This will form part of the asthma review work of the Committee on Medical Effects of Air Pollutants (COMEAP) and UKHSA and take place in the first 12-18 months.  Objective 2: Follow-on systematic reviews will identify the at-risk groups and explore how air pollution affects asthma if combined with aeroallergens and extreme temperatures.  Objective 3: An original epidemiological analysis (subject to the student’s background/interests) will be conducted arising from findings in objective 1 and 2, with a suggested focus on the effects of combined exposures.  The PhD will support HPRU Chemical Threats and Hazards work on air quality and the impacts of co-exposures and vulnerability on health (Theme 1). Further, it will link across to Theme 2 in relation to the role of aeroallergens in asthma.  **Outcomes:**  Asthma development and exacerbation in children below 18 years old.  **UK-relevant outdoor exposures:**   * Particulate matter (including PM10, PM10-2.5, PM2.5 and ultrafine particles, UFP) and its components (Elemental carbon/soot /black carbon, BC) * Oxides of nitrogen (NOx) and nitrogen dioxide (NO2) * Ozone (O3) * Sulphur Dioxide (SO2)   **Tasks and study design:**  The main areas of work are outlined below  **The causal role of APs on childhood asthma (addresses Objective 1)**  Asthma development – This component will involve a review of both epidemiological and mechanistic evidence. The student will design a protocol and conduct a review of mechanistic evidence. In parallel, the student will support a systematic review of the epidemiological literature (and meta-analysis, where appropriate), which will be led and pre-designed by COMEAP. The certainty of both evidence streams will then be evaluated to support causal inference.  Asthma exacerbation – Similar to the above, except the student will lead both reviews instead of supporting.  **Burden of disease estimation (addresses Objective 1)**  If the evidence from Task 1 is deemed sufficient to support a causal relationship, COMEAP will advise on appropriate methodologies for quantifying the impact. The student will then estimate the following with the UKHSA:   * The public health burden of asthma attributable to current concentrations of air pollutants in the UK. * The expected impact on asthma of reductions in air pollutant concentrations in the UK.   **At-risk group of the AP-asthma associations & Interactive effects between APs, temperature and aeroallergens (addresses Objective 2)**  The epidemiological and mechanistic evidence of both topics will be reviewed separately for the development of asthma and the exacerbation of asthma. The student will lead these tasks. Where evidence is available, meta-analyses will be undertaken for each identified exposure pair.  **Develop original research & build new evidence (addresses Objective 3)**  The student will build on the findings in Tasks 1-3 and, subject to their background/interests, propose an original epidemiological research project. A suggested direction is to investigate the effects of multiple exposures to APs, temperatures and aeroallergens. Examples include comparing the interactive effects of APs and pollen on asthma emergency admissions between those with and without hay fever, or correlating real-time aeroallergen sampling data, air pollution data, with syndromic surveillance data on asthma hospital admissions. | |