Prenatal and early postnatal exposure to air pollution associations with primary care

Myriam Ziou[1], Caroline Gao[2], Amanda Wheeler[1,3], Graeme Zosky[1,4], Nicola Stephens[4], Luke Knibbs[5], Shannon Melody[1], Alison Venn[1] , Marita Dalton[1], Shyamali Dharmage[6], Fay Johnston[1]

1. Menzies Institute for Medical Research, University of Tasmania, Australia; 2. School of Public Health and Preventive Medicine, Monash University, Australia; 3. Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia; 4. School of Medicine, University of Tasmania, Australia; 5. School of Public Health, University of Sydney, Australia; 6. School of Population and Global Health, University of Melbourne, Australia

Background

Effects of air pollution exposure on the respiratory and immune systems can be detected as early as during the first year of life.[1,2]

Landscape fires will contribute to an increasing proportion of outdoor air pollution under climate change.[3,4]

Landscape fires impacts on health services utilisation are mainly understood from studies evaluating hospital data, with a smaller research focus on primary and pharmaceutical care.

On the 9 February 2014, a fire started in the open-cut Hazelwood brown coal mine (Victoria, Australia) and lasted over 5 weeks, which led the Latrobe Valley to experience concentrations of $PM_{2.5}$ well over the Australian 24-hour air quality standard of 25 µg/m^3.

Hypotheses

1) $PM_{2.5}$ from coal smoke in early life will be associated with general practitioner (GP) attendances and dispensation of antibiotics, asthma medications, steroid skin creams, and systemic corticosteroids in the two years following exposure.

2) Vulnerabilities will differ between children exposed prenatally and those exposed postnatally.

Methods

Data

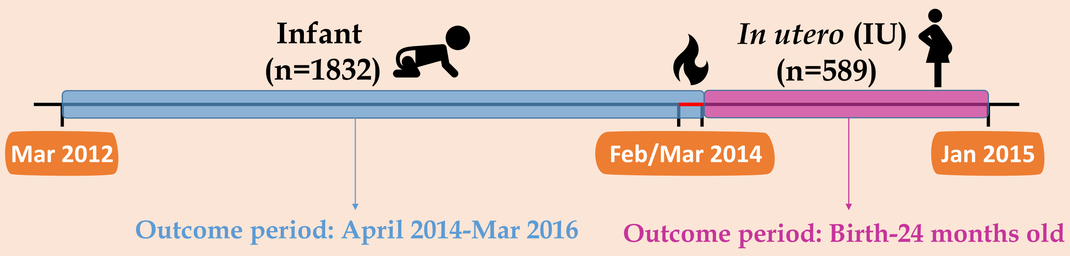
Data linkage of three administrative datasets

Victorian Perinatal Data Collection (maternal/birth characteristics) ⟷ Pharmaceutical Benefits Scheme (prescriptions dispensed) ⟷ Medicare Benefits Schedule (GP contacts)

$PM_{2.5}$ emitted by the fire was estimated through a meteorological and pollutant dispersion model[5]
Background $PM_{2.5}$ emitted by ambient sources (traffic, industrial, heating) was estimated through satellite-informed land-use regression modelling[6]

Cohorts

Figure 1: Sample sizes and dates of birth of children in each of the two cohorts. Periods of outcome measurement indicated at the bottom of the figure.



Analysis

Quasi-Poisson regression for count data to model the number of GP contacts or of prescriptions dispensed in each category
Adjustment through multiple regression for sex, maternal age, maternal smoking, mother's birthplace, mother's parity, Index of Relative Socio-Economic Advantage and Disadvantage, background $PM_{2.5}$, age (infant only), and health vulnerability at birth (infant only)
Listwise deletion to handle missing confounders (<1.5%)

Results

Figure 2: Fire-related $PM_{2.5}$ exposure.

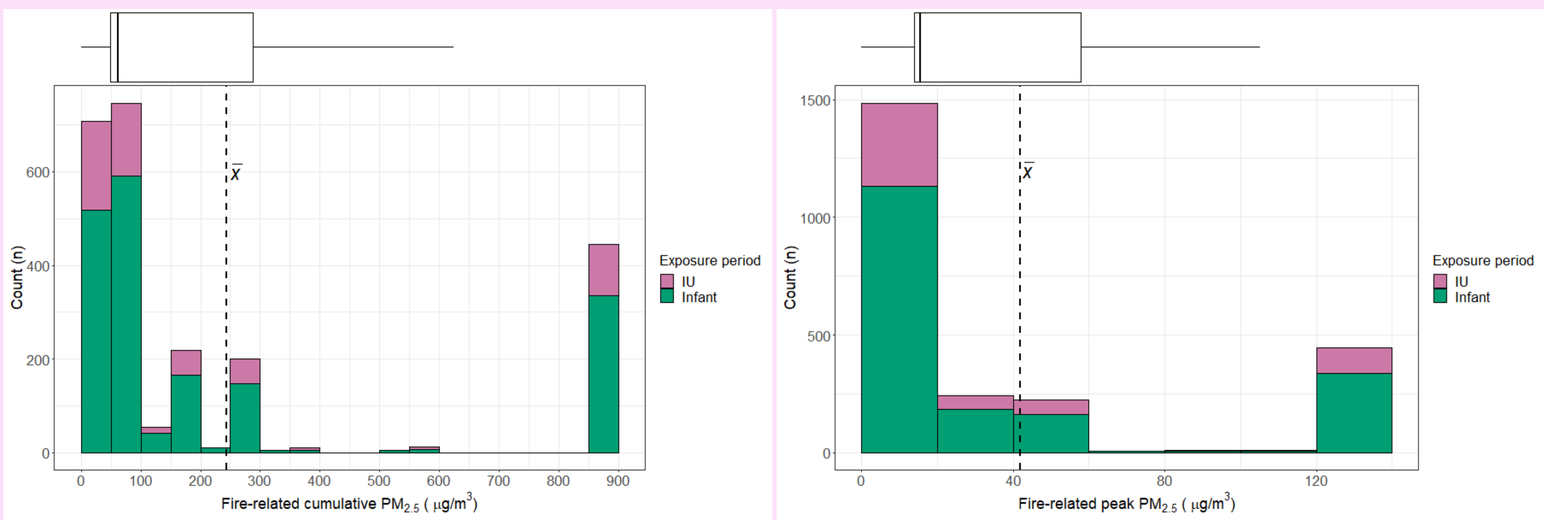
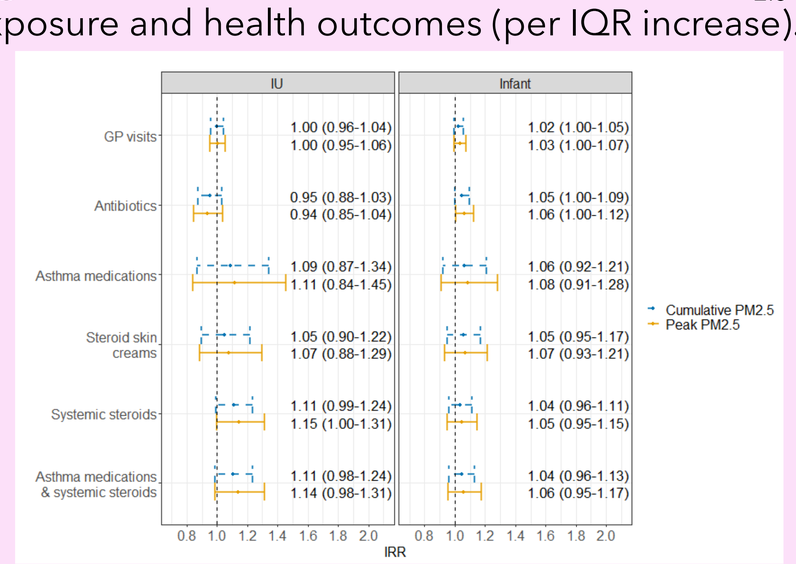


Figure 3: Associations between fire-related $PM_{2.5}$ exposure and health outcomes (per IQR increase).



Discussion

In the prenatal exposure group, we observed a borderline association between coal fire-related $PM_{2.5}$ levels and **systemic steroids**, commonly used to treat croup and asthma symptoms, **dispensations** in the first two years of life.

In the postnatal exposure group, we observed borderline associations with **GP attendances** and **antibiotics dispensations** up to two years after the fire.

Our results indicate that time-limited exposure to elevated $PM_{2.5}$ in early life could lead to increased healthcare services utilisation, particularly for infections, long after return to low levels of ambient air pollution. The findings could also be explained by modifications in parents or prescribers behaviours following a major and distressing fire event. However, the associations found were weak and require validation with studies in other settings.

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