

Background Climate change is increasing population exposure to landscape fire smoke. Although the short-term respiratory effects of such smoke exposure are well described, it remained unclear whether single, time limited but extreme landscape fire smoke exposures during early life increases the risk of childhood asthma. We investigated whether exposure to PM_{2.5} from a coal mine fire during prenatal life or infancy was associated with subsequent childhood asthma.

Methods We analysed data from the 10-year follow-up of the Early Life Follow-up (ELF) Study, a prospective cohort established following the 2014 Hazelwood coal mine fire in regional Australia. Children were exposed prenatally, during infancy (0–2 years), or not exposed to elevated fine particulate matter (PM_{2.5}) from the six-week fire. Associations between mine fire-related PM_{2.5} exposure and parent-reported, doctor-diagnosed asthma by age 8 years were examined using proportional hazards models adjusted for sex and socioeconomic disadvantage. Inverse probability weighting (IPW) was applied to address loss to follow-up.

Results A total of 210 children completed the 10-year follow-up survey, including 76 exposed prenatally, 83 during infancy, and 51 not/minimally exposed. The proportion diagnosed with asthma by age 8 years was higher in the prenatal (33%) and infancy (29%) exposure groups than in the non-exposed group (20%). Prenatal exposure was associated with increased risk of asthma (HR=3.71, 95%CI 1.27–10.8), remaining consistent after IPW adjustment. Associations for infancy exposure were in the same direction but smaller in magnitude and not statistically significant (HR=2.35, 95%CI 0.80–6.93). No effect modification by sex was observed.

Conclusions Early-life exposure to elevated PM_{2.5} from a mine fire was associated with increased risk of parent-reported childhood asthma at 8 years of age, particularly following prenatal exposure. Although estimates were imprecise, these findings suggest that short-term but extreme smoke exposure during critical developmental periods may contribute to childhood asthma developing.