

Fine particulate matter exposure during pregnancy and infancy and incident asthma

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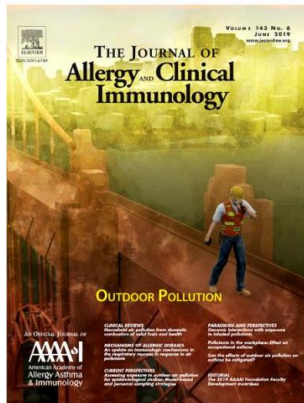
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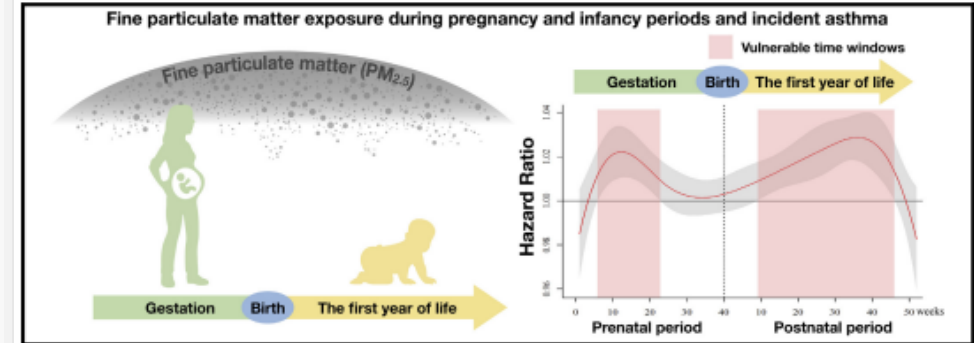
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GRAPHICAL ABSTRACT



Background: Lung development is a multistage process from conception to the postnatal period, disruption of which by air pollutants can trigger later respiratory morbidity.
Objective: We sought to evaluate the effects of weekly average fine particulate matter (particulate matter with an aerodynamic diameter less than 2.5 μm [$\text{PM}_{2.5}$]) exposure during pregnancy and infancy on asthma and identify vulnerable times to help elucidate possible mechanisms of the effects of $\text{PM}_{2.5}$ on asthma symptoms.
Methods: A birth cohort study including 184,604 children born during 2004-2011 in Taichung City was retrieved from the Taiwan Maternal and Child Health Database and followed until 2014. A daily satellite-based hybrid model was applied to estimate $\text{PM}_{2.5}$ exposure for each subject. A Cox proportional hazard model combined with a distributed lag nonlinear model was used to evaluate the associations of asthma with $\text{PM}_{2.5}$ exposure during pregnancy and infancy.
Results: The birth cohort contained 34,336 asthmatic patients, and the mean age of children given a diagnosis of asthma was

3.39 ± 1.78 years. Increased exposure to $\text{PM}_{2.5}$ during gestational weeks 6 to 22 and 9 to 46 weeks after birth were significantly associated with an increased incidence of asthma. The exposure-response relationship indicated that the hazard ratio (HR) of asthma increased steeply at $\text{PM}_{2.5}$ exposure of greater than $93 \mu\text{g}/\text{m}^3$ during pregnancy. Additionally, the HRs remained significant with postnatal exposure to $\text{PM}_{2.5}$ between 26 and $72 \mu\text{g}/\text{m}^3$ (range, 1.01-1.07 $\mu\text{g}/\text{m}^3$), followed by a sharp increase in HRs at $\text{PM}_{2.5}$ exposure of greater than $73 \mu\text{g}/\text{m}^3$.
Conclusion: Both prenatal and postnatal exposures to $\text{PM}_{2.5}$ were associated with later development of asthma. The vulnerable time windows might be within early gestation and midgestation and infancy. (J Allergy Clin Immunol 2019;143:2254-62.)

Key words: Asthma, air pollution, birth cohort, particulate matter with an aerodynamic diameter less than 2.5 μm , prenatal, postnatal, vulnerable time windows