Children's Hospital of Philadelphia PolicyLab

Associations of short-term changes in air pollution with spontaneous preterm birth: A time-stratified case-crossover analysis

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Spontaneous preterm birth (sPTB) is a leading cause of neonatal morbidity in the United States. Genetics incompletely explains sPTB risk and environmental contributions remain poorly understood. We analyzed associations of short-term fine particulate matter ($PM_{2.5}$) exposure with sPTB in two datasets: 109,735 sPTBs in Michigan (2003-2020) and 5321 sPTBs in metropolitan Philadelphia (2008-2020). We used a time-stratified case-crossover design and daily high-resolution $PM_{2.5}$ estimates to evaluate exposures in the week prior to sPTB using three complementary approaches: (1) nested daily lag terms; (2) averaged lag exposures; and (3) distributed lag non-linear models (DLNMs). To assess whether allowing flexible lag structures improved model fit, we performed likelihood ratio tests comparing models with linear lag terms to DLNMs. All models were adjusted for temperature. Across both cohorts and modeling approaches, we did not detect statistically significant associations of short-term $PM_{2.5}$ exposure with sPTB, with point estimates close to the null with narrow confidence intervals. These findings suggest that, at the studied concentrations, short-term elevations in $PM_{2.5}$ are unlikely to be associated with sPTB. As environmental regulatory protections evolve, pollution levels may change, underscoring the importance of continued surveillance of $PM_{2.5}$-related health effects.

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