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Short-term population-based and spatiotemporal nonlinear concentration-response associations between fine particulate matter and children's respiratory clinic visits

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Advert health impacts associated with the PM2.5 exposure have been confirmed in mortality and cardiovascular diseases; however, findings of the influence of PM2.5 on respiratory diseases investigated among previous studies are still inconsistent. We investigated the short-term population-based associations between the respiratory clinic visits of children population and the PM2.5 exposure levels with considering both the spatiotemporal distributions of the ambient pollution and clinic visit data. We applied a spatiotemporal structured additive regression model to examine the concentration-response (C-R) association between daily children's respiratory clinic visits and PM2.5 concentrations. The analysis was performed separately on the four selected respiratory disease categories of the population-based dataset, obtained from Taiwan National Health Insurance database, covering the 41 districts in Taipei area during the period of 2005 to 2007. This study reveals a strong nonlinear C-R pattern that the PM2.5 increment can significantly affect respiratory health at PM2.5 concentration $\leq$ 18.17μg/m3 for both preschool children and schoolchildren. The elevated risks are especially present in the category of acute respiratory infections. PM2.5 increase is mostly non-significant to the more severe respiratory diseases, e.g., COPD and pneumonia, over the ranges of 8.85-92.45μg/m3. The significantly higher relative rate of respiratory clinic visit most likely concentrated at populated areas. We highlight the nonlinearity of the respiratory health impacts of PM2.5 on children's populations from the first study, to our knowledge, to investigate this population-based association. The strong nonlinearity can possibly cause the inconsistency of PM2.5 health impact assessments with linear assumptions.