

Are children with sickle cell disease at particular risk from the harmful effects of air pollution? Evidence from a large, urban/peri-urban cohort.

Paul E. George¹, Alexander Maillis N², Yijing Zhu³, Yang Liu³, Peter Lane¹, Wilbur Lam¹, Joseph Lipscomb⁴, and Stefanie Ebel³

¹Emory University Department of Pediatrics

²Children's Healthcare of Atlanta Inc Aflac Cancer and Blood Disorders Center

³Emory University School of Public Health

⁴Emory University Department of Health Policy and Management

January 24, 2023

Abstract

Introduction Pathophysiologic pathways of sickle cell disease (SCD) and air pollution involve inflammation, oxidative stress, and endothelial damage. It is therefore plausible that children with SCD are especially prone to air pollution's harmful effects. **Methods** Patient data were collected from a single center, urban/peri-urban cohort of children with confirmed SCD. Daily ambient concentrations of particulate matter (PM_{2.5}) were collected via satellite-derived remote-sensing technology, and carbon monoxide (CO), nitrogen dioxide (NO₂), and ozone from local monitoring stations. We used multivariable regression to quantify associations of pollutant levels and daily counts of emergency department (ED) visits, accounting for weather and time trends. For comparison, we quantified the associations of pollutant levels with daily all-patient (non-SCD) ED visits to our center. **Results** From 2010-2018, there were 17 731 ED visits by 1740 children with SCD (64.8% HbSS/HbSβ₀). Vaso-occlusive events (57.8%), respiratory illness (17.1%), and fever (16.1%) were the most common visit diagnoses. Three-day (lags 0-2) rolling mean PM_{2.5} and CO levels were associated with daily ED visits among those with SCD (PM_{2.5} incident rate ratio (IRR) 1.051 (95% CI 1.010-1.094) per 9.4 μg/m³ increase; CO 1.088 (1.045-1.132) per 0.5 ppm). NO₂ showed positive associations in secondary analyses; ozone levels were not associated with ED visits. The comparison, all-patient ED visit analyses showed lower IRR for all pollutants. **Conclusions** Our results suggest short-term air pollution levels as triggers for SCD events and that children with SCD may be more vulnerable to air pollution than those without SCD. Targeted pollution-avoidance strategies could have significant clinical benefits in this population.

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