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"Estimation of Impact of Playground Exposures to Soil Lead on Childhood Blood Lead Levels and IQ"

Background: Lead (Pb) is a neurotoxic heavy metal that persists in soil due to long-term environmental dispersal. Primary sources of soil Pb include historic use of leaded gasoline and paint, and industry and waste incineration. In children, Pb exposure is associated with impaired cognitive function, attention deficit disorders, and antisocial behavior. The 2024 U.S. Environmental Protection Agency (EPA) established a regional screening level (RSL) of 100 ppm to protect children in areas with multiple sources of lead. Exposure to playground soil of 80 ppm for four days per week is associated with an increase in childhood blood lead level (BLL) of 1 µg/dL (90^{th} percentile). Increases in 1 µg/dL of BLL is roughly associated with up to a one-point decrease in IQ. The US Centers for Disease Control and Prevention (CDC) reference level for blood lead level (BLL) is 3.5 µg/dL, however, this is only a population screening value— the CDC acknowledges that there is no safe level of Pb exposure. The aim of this study is to evaluate potential Pb exposures at playgrounds on childhood BLLs and their associated neurocognitive impacts (estimated IQ).

Methods: Soil samples (n=858) were collected at 35 parks in the greater New Orleans area using a grid-based system. Samples were analyzed for Pb with a SciApps X-550 XRF analyzer (LOD-5 ppm). Results were compared to the 2024 RSL guideline of 100 ppm. In addition, the Integrated Exposure Uptake Biokinetic model (IEUBK) was used to estimate the impact of soil Pb exposure. The 95^{th} percentile soil lead level (SLL) was derived for each park to estimate BLLs for children aged six months to seven years (95^{th} percentile BLL). A low dose response relationship from CA OEHHA (2007) was used to derive an estimate of IQ loss for this age group.

Results: The 95th percentile of SLLs across sampled parks ranged from 40 to 1,498 ppm, with modeled increases in park soil-specific BLLs for all age groups ranging from 1 to 9 µg/dL. Using the associations between BLLs and cognitive deficiencies in the literature, these predicted exposure levels corresponded to an estimated 1- to 9-point reduction in IQ. Twenty-five of 35 parks (71%) were associated with an estimated decrease of ≥2 IQ points.

Conclusion: These results suggest that children playing in parks with SLLs exceeding 100 ppm are at risk of developing neurocognitive deficiencies. Remediation of elevated SLLs should reduce Pb exposure, which in turn will reduce the risk of IQ deficits. Future studies should assess the efficacy of different remediation approaches in maintaining long-term SLL reductions.