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Allostatic Load, an Indicator of Chronic Stress, Modifies the Impact of Blood Lead Levels on Hypertension

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Background: Environmental justice advocates argue that agencies should account for the cumulative impacts of multiple hazards, yet few health studies have assessed interactions between environmental and social stressors. We examined whether allostatic load, a biological indicator of chronic stress, amplifies the effects of lead exposure on hypertension among middle-aged adults.

Methods: We assessed the interaction of allostatic load on lead exposure on hypertension among 5,067 National Health and Nutrition Examination Survey (NHANES) participants (aged 40-65). General hypertension was defined as systolic blood pressure ≥ 140 mm Hg or diastolic blood pressure ≥ 90 mm Hg. Models were adjusted for: age, sex, race/ethnicity, education, marital status, smoking, alcohol consumption, and blood pressure medication.

Results: Blood lead levels in this population were generally low (mean = 2.20 $\mu\text{g/dL}$). Hypertension risk increased with increasing blood lead levels only among those with high allostatic load. Compared to the lowest lead exposure group (quintile 1), participants with the highest lead exposure (quintile 5) had elevated risks of general hypertension (odds ratio [OR] = 1.65, 95% CI: 1.05-2.59). A similar risk was observed for systolic hypertension, while the magnitude of risk was higher for diastolic hypertension (OR = 3.43; 95% CI: 1.76-6.67). There was no difference in hypertension risk between the highest and lowest lead exposure groups among participants with low allostatic load (general hypertension OR = 0.82; 95% CI: 0.5-1.3).

Conclusions: Results suggest that the effect of lead on hypertension is more pronounced among those who are chronically stressed. Interactions between environmental and social stressors should be accounted for in regulatory policies.