Lead exposure and stunting in young children in Delhi and Mumbai, India

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Overview

Lead is a toxic, naturally occurring metal that has become widespread in the environment due to its many industrial uses. The adverse effects of exposure to lead have long been known, particularly the effects of lead on neurologic, hematologic, and renal function. However, studies documenting the association between asymptomatic lead poisoning and short stature have been significantly outnumbered by analyses of the effects of lead on neurological development and function.

The 1998-99 National Family Health Survey (NFHS-2) in India incorporated the collection of blood lead, hemoglobin, and anthropometric measures into a survey instrument that also collects an extensive array of social, behavioral and demographic data. Using this unique cross-sectional dataset, which provides information on blood lead levels for a representative sample of young children living in Mumbai and Delhi, this study finds a negative association between blood lead levels and child growth. Preliminary analyses indicate that this association remains even after controlling for such confounding factors as age, hemoglobin levels, and household wealth.

Results from this analysis reflect not only that levels of lead exposure in India's cities are quite high, but that blood lead levels exceed 10ug/dL – the level at which neurotoxicity has been demonstrated to occur – even among children from the wealthiest households.

These findings reinforce the need for education of health care providers and parents about the prevalence of lead poisoning and its associated deleterious effects on multiple dimensions of child health. They also emphasize the importance of blood lead screening of children and the abatement or removal of lead from identified environmental sources, particularly leaded gasoline, paint, and other consumer goods.

Data and Methods

Data from the 1998-99 NFHS-2 were used for this analysis. This is the first survey in which both lead and hemoglobin biological data were collected for representative subsamples of the populations of Delhi and Mumbai, in conjunction with a comprehensive set of demographic and health data.

Four hundred and fifty-five children in Mumbai and 626 children in Delhi were tested for blood lead levels, for a total sample size of 1,081 children under the age of three years. Approximately 100 children were found to have missing or incomplete anthropometric data, leaving an unweighted sample size of 979 children.

Forty-seven percent of children in this sample had a blood lead level at or exceeding 10ug/dL; 9 percent of children had blood lead levels in excess of 20ug/dL. Seventy-one percent of children were anemic, with 3 percent being severely anemic.

The bivariate analysis uses Student's t-test and chi-square tests of independence for continuous and categorical variables, respectively, while linear regression models are used to estimate the coefficients of the variables associated with the dependent variable, height-for-age (stunting).