Neuropsychological Motor Outcomes in Adults from Airborne Manganese Exposure

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Background: The literature on manganese (Mn) is dominated by occupational exposures of adults exposed often to high levels without protection. Neuropsychological adverse health effects are similar to Parkinson's Disease with psychomotor slowing, tremor, cognitive and mood disturbances. Environmental exposures have rarely been studied in adults. Our study in two air-Mn exposed towns in Ohio is the first adult study in the U.S. with measures of motor, cognitive and mood function. This presentation presents the motor findings of 186 adults from two exposed towns, Marietta (N=100) and East Liverpool (N=86), Ohio.
The objective of this study was to evaluate motor function and Mn exposures as estimated by U.S.EPA's AERMOD dispersion model, which was calibrated with measured data from air monitors in both towns. Estimated annual air-Mn exposures were as high as 1.93 9µg/m^3 in total suspended particles (TSP). Exposure estimates were consistent with the range of measured air-Mn in the communities where air modeling was conducted. A cumulative exposure index (cDEI) was calculated and compared to motor test function with effect sizes reported.

Method and Results: Participants were carefully selected within 2 air miles downwind from the source in East Liverpool and at random within Marietta (residents with serious non-related illnesses were excluded). Questionnaires, psychomotor, cognitive and mood tests were administered and blood samples were collected. Comparing Marietta with East Liverpool, years education (14.6 vs. 13.7) were higher in Marietta and years of residence greater in East Liverpool (36.1vs. 41.1). Blood levels for Mn and other metals were within normal limits. Tests of psychomotor speed and grip strength were associated ($p < .05$) with the cDEI with large effect sizes for: WAIS-III Digit Symbol, Fingertapping, Dynamometer and approached significance for tactile function (Grooved Pegboard).

Conclusion: Findings in this epidemiologic study showed lower exposures to Mn than for occupational studies yet similar results suggest that long-term chronic exposures impact the residents, albeit to a lower degree. The exposure methodology employed here shows that a combination of modeling and ambient air sampling and sensitive neuropsychological testing can be used when source emission data may not be available.

Note: This abstract does not necessarily reflect EPA policy