

An Investigation of Potential Nervous System Effects of Manganese (Mn) at a South African Smelting Works

Myers JE, Thompson Mary Lou, Young T, Ramushu S, Esswein E, Naik I, Iregren A, Rees D, London L

ABSTRACT

Methods: 509 production workers at a Mn smelting works comprising 9 production facilities and 67 external controls were studied crosssectionally. Exposure measures from personal sampling included total inhalable dust, respirable dust, cumulative exposure (ce) indices and intensity (ce/years exposed). Biological exposure measures included blood and urine Mn and serum prolactin. Endpoints included items from the Q16, WHO-NCTB, SPES, Luria Nebraska and CATSYS batteries, and a brief clinical examination. Potential confounders and effect modifiers included age, educational level, alcohol and tobacco consumption, neurotoxic exposures in previous work, past medical history, previous head injury and culture. Associations were evaluated by multiple linear and logistic regression modeling. Modeling assumptions were tested.

Results: Average exposure intensity ranged from zero (external controls) to $5\text{mg}/\text{m}^3$ (only 1 subject) for total inhalable Mn with Mn smelter plant levels 1.5 orders of magnitude higher than the ACGIH TLV of $0.2\text{mg}/\text{m}^3$. There were 2-3 fold increases in blood and urine Mn between subjects in the highest compared with the lowest exposed plants. No association was found with serum prolactin and exposure. Associations with exposure were found for 3 of 44 questionnaire, 3 of 8 Luria Nebraska, 2 of 9 WHO NCTB, 0 of 5 SPES items and 2 of 29 CATSYS items. 8% had poor balance but this was not Mn associated. Only 1 association (WHO digit symbol) showed a clear exposure-response relationship (er). For the rest there was no continuity of exposure-response across the range of exposure. When present e-r was evident in the lower ranges of exposure ($<0.2\text{mg}/\text{m}^3$).

Conclusions: This large study of Mn workers found few convincing exposure effects with a comprehensive range of endpoints despite exposures ranging considerably higher than the ACGIH TLV.