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Neurotoxicity of inhaled manganese: Public health danger in the shower?

[Robert J.F. Elsner](#), [John G. Spangler](#) 

Wake Forest University School of Medicine, Department of Family and Community Medicine, Medical Center Blvd., Winston-Salem, NC 27157-1084, USA

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Summary

Context

Manganese (Mn) is an essential trace element but is neurotoxic at high doses. Showering with Mn-laden water has never been evaluated as a central nervous system (CNS) delivery vector for Mn, even though intranasally administered Mn in laboratory animals circumvents the blood–brain barrier and passes directly into the brain via olfactory pathways.

Objective

To review the literature on Mn and attempt to quantify potential human CNS exposure to manganese from showering.

Data sources

We systematically searched Medline 11/9/02 and again on 3/9/04. The following search terms were used: manganese, water, drinking water, shower, showering, bath, bathing and inhalation, then combined with “water or drinking water or showering or shower or bathing or inhalation.”

Study selection

Animal experimental investigations, human epidemiological studies, and consensus and governmental reports were utilized.

Data extraction

Data were extracted by both authors and extrapolations to humans were calculated by one of us (JGS) controlling for age, length of exposure and known respiratory differences between rats and humans.

Data synthesis

During a decade of showering in Mn-contaminated water, models for children and adults show higher doses of aerosolized Mn (3-fold and $\frac{1}{2}$ -fold greater, respectively) than doses reported to cause Mn brain deposition in rats.

Conclusions

Long-term shower exposure to Mn-laden water may pose a significant risk for CNS neurotoxicity via olfactory uptake in up to 8.7 million Americans. If our results are confirmed, regulatory agencies must rethink existing Mn drinking water standards.

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