

The Impact of Ultrafine Particles on Mental Health

A. S. Torres Yabar¹, R. Cali², S. Lu³, A. Howell-Munson⁴, G. J. Nephew⁵, B. C. Nephew^{4*}

¹Worcester Polytechnic Institute, Department of Chemistry, Worcester, MA, ²University of Massachusetts Medical School, Department of Psychology, Worcester, MA, ³Worcester Polytechnic Institute, Department of Computer Science, Worcester, MA, ⁴Worcester Polytechnic Institute, Department of Biology and Biotechnology, Worcester, MA, ⁵Gibbons Middle School

While there is robust evidence of the critical role of PM_{2.5} in mental health and psychiatric disorders, much less is known about the specific role of ultrafine particle exposure. Lack of assessment of ultrafine particles (UFP) makes it difficult to attribute adverse effects specifically to this size range of particulate matter. This is despite a wealth of predominantly short term epidemiological studies indicating that some of the adverse effects of particulate matter on health are strongly mediated by UFP. The objective of this review is to summarize evidence of the role of UFP in cognitive and mental health from studies of humans and related animal models. Strategies to enhance both human and animal studies through increased collaborative interaction are also discussed. Human studies of UFP clearly indicate the potential for adverse effects on mental health. In areas where PM_{2.5} concentration exceeds government standards, there are increased risks of impaired cognitive development, autism, Alzheimer's/dementia, depression, and ADHD.

Air pollution and UFP specifically may cause cognitive deficits in both early and late life. Compared to other research areas where there are often differences between the findings of clinical and animal studies, work in animal models of the effects of UFP on mental health have been consistent with, and supportive of, the epidemiological and clinical findings. The further optimization of lab related experimental studies through the expansion of naturalistic paradigms and increased direct collaboration between basic researchers and clinicians will enhance the collection of translationally relevant data. Taken together, these human and animal studies indicate that elevated concentrations of UFP air pollution have a considerable adverse impact on the brain and mental health, both in early and late life.