

Title: Comparison of Traffic-Related Ultrafine Particle Number Concentrations on Roads and at Nearby Residential Locations in Boston, Massachusetts (USA)

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Abstract:

Background: Exposure to traffic-related ultrafine particles (UFP; < 100 nm diameter) may be associated with cardiovascular disease. Epidemiologic studies often use mobile monitors and stationary fixed sites to characterize UFP. Relatively little work has been done to compare UFP concentrations on roadways to nearby residential sites and to determine how the difference could impact individual exposure estimates.

Aims: The aim of this work was to monitor particle number concentration (PNC; a proxy for UFP) on roads and at nearby residential locations in an effort to generate individual estimates of exposure for the Puerto Rican Health Study in Boston.

Methods: A study area covering ~ 45 km² was selected based on residences of the cohort. Between May 2012 and November 2013 PNC was measured by mobile monitoring along the same route on 59 days (2-4 hours per day), as well as immediately outside of 14 participant homes continuously for six weeks per residence.

Results: Median on-road PNC was up to two-fold higher than PNC measured immediately outside participant homes < 100 m from roads. Ambient PNC in residential areas within 100 m of major roads (> 20,000 vehicles/day) were higher than residential areas > 100 m from major roads (25,000particles/cm³ versus 20,000 particles/cm³). A slight exponential decrease in mean annual PNC occurred with increasing distance from major roads. PNC within 50 m of major roads were ~45% higher than areas 400-800 m from major roads. Median annual PNC varied significantly between seasons with the highest median concentration in winter (37,000 particles/cm³) and the lowest in summer (18,000 particles/cm³).

Conclusions: Residential areas closest to major roadways have the highest ambient PNC levels as compared to those further away, but are still at levels up to two-fold lower than those measured on the road. These results could have implications for reducing exposure misclassification in epidemiological studies.