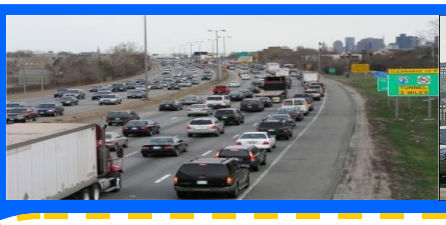

COMMUNITY ASSESSMENT OF FREEWAY EXPOSURE & HEALTH

Research Summary: Various Measures of Ultrafine Particles and Markers of Cardiovascular Health

By: Oliver-John Bright

Background

Several studies have found evidence that exposure to air pollution has negative effects on heart and blood health. One specific type of pollutant, ultrafine particles (UFP; particles smaller than 100 nm in diameter), is found at higher levels close to traffic. This is a major concern in cities, where both highways and major roadways contribute to high UFP levels. Because UFP are so small, they penetrate deep into the lungs and can enter our blood. Some research has found that UFP are associated with elevated levels of substances in the blood that predict risk of heart and blood health. Our study looked at the association between blood markers of inflammation and three different measurements of UFP: levels measured at a central location, levels measured at a near-highway location, and predicted values based on a statistical model.

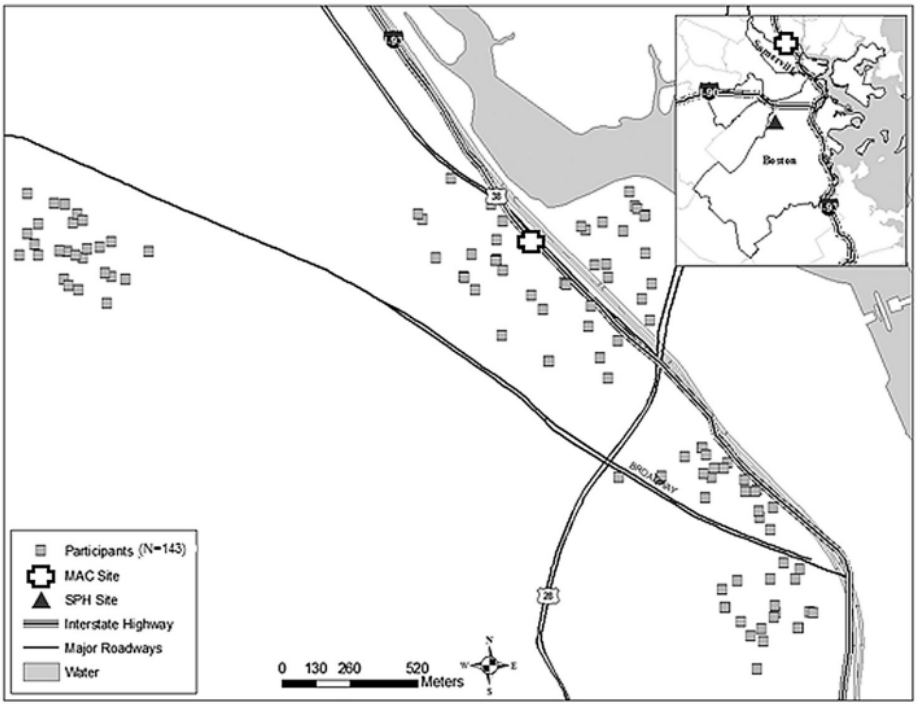

Figure 1: A map of the study area, showing air monitoring sites and locations of participants' homes.

Blood Markers of Inflammation:

- *IL-6* : Interleukin-6
- *hsCRP* : High-sensitivity C-reactive protein
- *TNF-RII* : Tumor necrosis factor-alpha receptor II
- *Fibrinogen*

How was it done?

This study looked at a group of Somerville residents participating in the Community Assessment of Freeway Exposure and Health (CAFEH) Study. Participants were asked to give blood samples at two different times a few months apart. The samples were analyzed for levels of IL-6, hs-CRP, TNF-RII, and fibrinogen (see box above). Participants also provided information about their age, sex, race, health status, and current medications. UFP levels were collected from: 1) a central site at Harvard's Countway Library of Medicine and, 2) a near highway site at the Mystic Activity Center. Mobile monitoring conducted in Somerville (for more information, see our mobile monitoring fact-sheet) was the third method, which was used to predict the level of UFP at participants' homes. Averages of UFP exposure for participants for different amounts of time leading up to their blood draw were calculated.

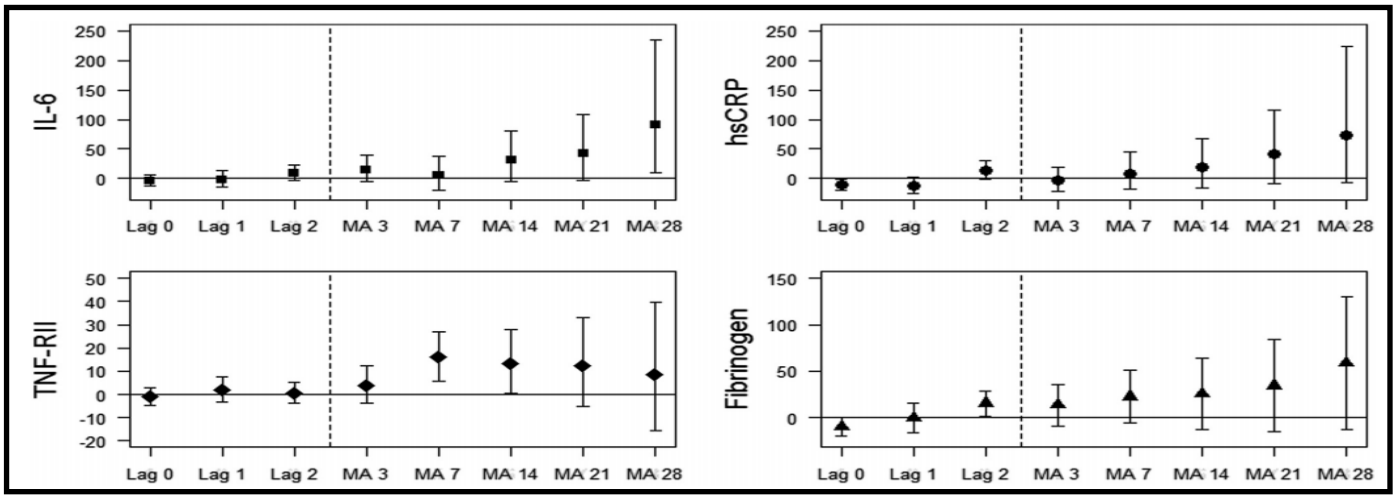

Figure 2: The relationship between four markers of heart and blood health with the measurements of UFP at Countway Library of Medicine. Points above the horizontal lines indicates that as exposure to UFP increases, so do blood levels of that marker.

What did we find?

Participants average age was 58.6. They had high levels of the blood markers. The average hs-CRP level suggested an elevated risk for future stroke or heart attack. We found that increasing levels of UFP at the central site the Countway Library of Medicine were associated with increasing levels of IL-6, hs-CRP, TNF-RII and fibrinogen. Associations were stronger for longer periods of averaged exposure (out to 28 days). We did not, however, find any associations between UFP measurements at the near-highway Mystic Activity Center or the UFP predicted by the statistical model with blood markers. It is possible that we observed this result due to a difference in the effect of "primary" (freshly emitted from cars) and "secondary" UFP on markers of heart and blood health.

Why is it important?

Our study findings are similar to other research and add evidence that there is a negative relationship between UFP exposure and heart and blood health. We were surprised that we did not see an association between near highway UFP and the blood markers and cannot fully explain why. By contributing to the understanding of UFP's effects on human health, research can raise awareness and guide policies on how to reduce exposure.

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To learn more about this research, please refer to the following source:

Fuller CF, Williams PL, Mittleman MA, Patton AP, Spengler JD, Brugge D. **Response of biomarkers of inflammation and coagulation to short-term changes in central site, local and predicted particle number concentrations**. *Annals of Epidemiology*. 2015.