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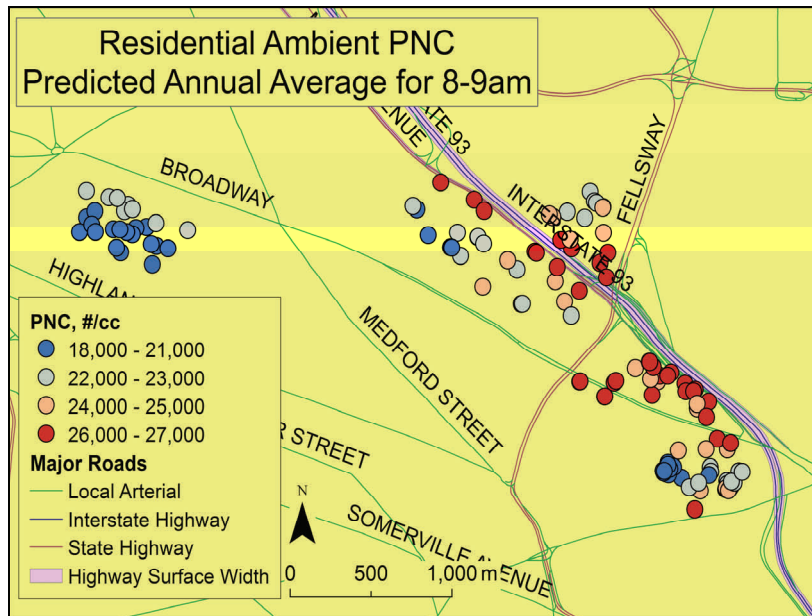
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Modeled Pollution Levels Calculated for Homes in Somerville



The ultrafine particle (UFP) model for Somerville allows us to replace distances from the highway with estimated ambient UFP concentrations at each participant's home. This map shows modeled UFP concentrations at residences of participants in the CAFEH study. Each point is the average of the predictions for the hours of 8-9am for all 365 days of the year. Blue points mark lower concentrations and red points mark higher concentrations. Most, but not all, of the red points cluster near I-93.

Particle Number Concentration (PNC) is synonymous to Ultrafine Particle Concentration (UFP)

Image and caption by: Allison Patton

CAFEH Advisory Board Meeting

This year's Advisory Board meeting and Community Report Back will take place **April 3, 2013 from 9am to 1pm** at the **Boston Chinatown Neighborhood Center (BCNC), 38 Ash Street– 5th Floor, Boston MA, 02111.**

CAFEH participants, community members, and volunteers are all welcome to attend.

Please RSVP to Deena at: deenawang@gmail.com

See Page 2 for Meeting Agenda



More Advisory Board Meeting Information

Advisory Board Meeting Agenda

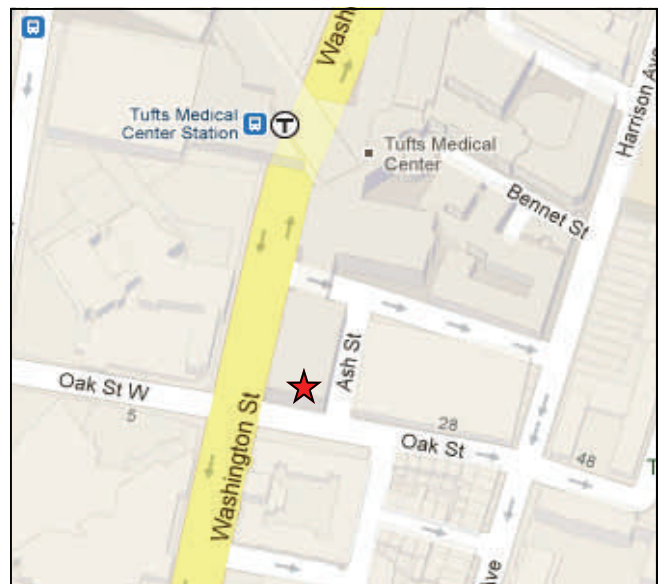
- Introductions and Overview— *Doug Brugge*
- Chinatown 3-D— *John Wu*
- Particle Number Concentration model— *Allison Patton*
- Assigning individual exposures— *Kevin Lane*
- Break
- Early analysis of blood markers— *Kevin Lane*
- Filtration intervention study data analysis— *Luz Padro-Martinez*
- Break and lunch
- Discussion related to Healthy Community Design grant

Directions: 38 Ash Street, Boston MA

From Tufts Medical Center T stop: Take a right on to Washington St. Next, take a left on to Oak St.

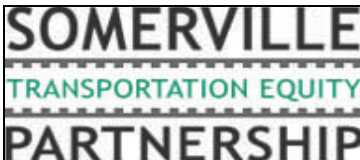
The next left is Ash St. and the BCNC will be immediately on the right.

Parking: Free/ meter parking is available on Marginal Road. Garage parking is available on Nassau Street (adjacent to Ash St) in the Metropolitan.

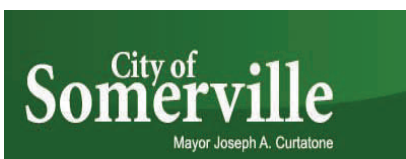


CAFEH Community Partners

Working together to examine the effect of air pollution of traffic on the health of people living near major highways.



CRA
Chinatown Residents Association



Tufts
UNIVERSITY

NEWSLETTER CREDITS:

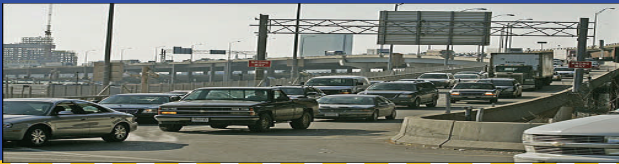
Doug Brugge—Issue Co-Editor
Maria Campbell—Issue Co-Editor, Designer, & Producer

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NEW Website!

<http://sites.tufts.edu/cafeh/>



Pilot Study Suggests a Role for an Inflammatory Molecule Rarely Studied in Air Pollution Research

By: Maria Campbell

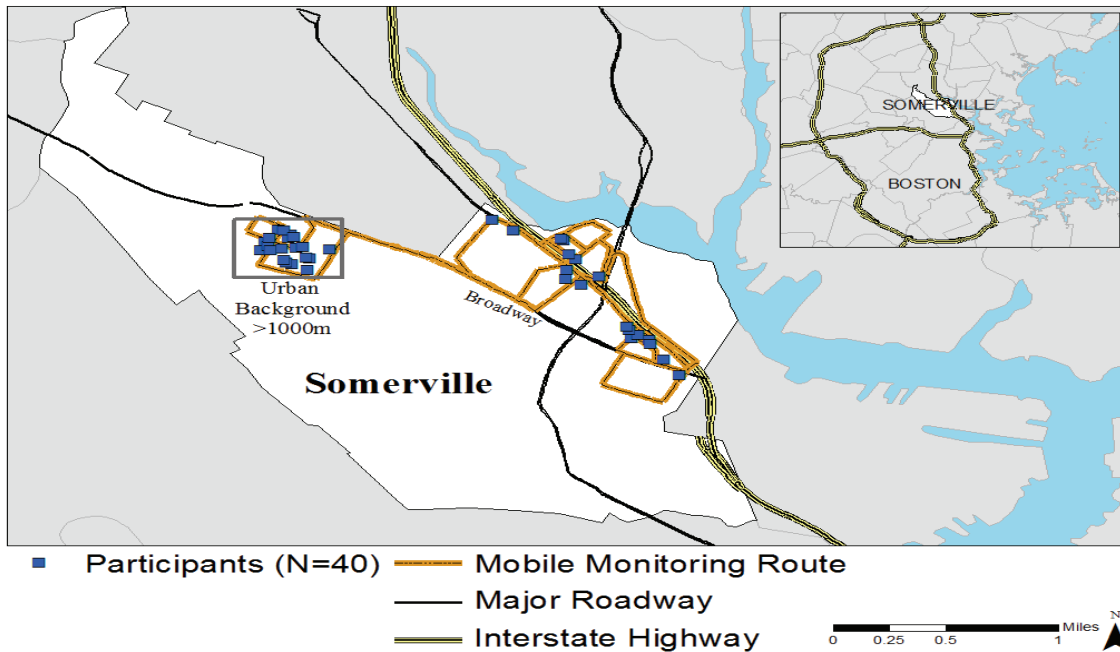


Figure 1: Map of Somerville which shows the locations of the 40 participants and their proximity to a major road or highway

Image by: Kevin Lane

Living close to a major road or highway is linked to having an increased risk of heart attacks and strokes. This may be due to the ultrafine particles (UFP) in the air, which are produced by vehicle emissions. In order to investigate further, this study chose to focus on the presence of cytokines and other biomarkers in the bloodstream of participants. Cytokines are protein molecules that relay messages between immune systems cells. There are many different kinds of cytokines. This study was particularly interested in the IL-1 β variety. The IL-1 β cytokines are relevant to the overall highway pollution study because of their relation to inflammation. Inflammation may be brought on by exposure to UFPs.

How was it done?

Blood samples were taken in order to analyze the biomarkers and cytokines. A subsample of 40 participants from Somerville, MA was chosen for this analysis. Participants were chosen based on their residential proximity to Interstate 93. Half of them lived near the highway (<100m away) while the other half lived in an urban background area (>1000m away from the highway and >50m from major roads). The near-highway participants and the urban background participants were matched as much as possible on age, gender, and education.

What did they find?

The most interesting finding was that there were differences in IL-1 β between the near highway and urban background populations even though this was not statistically significant. The difference in C-reactive protein (CRP) values was also close to being statistically significant. CRP is a marker of inflammation. The near-highway population also had higher levels of low-density lipoprotein (LDL). There were no differences in other markers found in the blood samples. Controlling for income, employment, and health history did not greatly alter these findings.

Why is it important?

To our knowledge this is the first report to find an association of IL-1 β with proximity to highways or heavy traffic. If IL-1 β is increased by pollution from the highway, it could affect the risk of developing heart attacks and strokes.

Future research

The researchers who did this analysis are interested in the possibility that IL-1 β may be a valuable addition to blood markers that are more commonly assessed in near highway studies and, more generally, in air pollution research.

Maria Campbell is a Undergraduate Intern with the Tufts Community Health Program.

For more information, contact:

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This study was funded by:

- National Institute of Environmental Health Sciences
- EPA STAR Fellowship
- National Center for Research Resources
- National Center for Advancing Translational Sciences
- National Institutes of Health

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

Brugge D, Lane KJ, Stewart A, Tai AK, Woodin M. 2013. *Highway Proximity Associations with Blood Markers of Inflammation: Evidence for a Role for IL-1 β* . Journal of Toxicology and Environmental Health. <http://www.tandfonline.com/doi/abs/10.1080/15287394.2013.752325>



Indoor and Outdoor Measurements of Particle Number Concentration in Near-Highway Homes

By: Lindsay Kephart

Studies have shown that being exposed to particles in highway pollution can harm health in a significant way, including higher heart and lung disease mortality and a higher incidence of lung cancer, asthma and cardiovascular disease. Ultrafine particles (UFP) are defined as particles in the air that are less than 100 nanometers in size. For comparison, a normal human hair is about 75,000 nanometers in diameter. Because of their small size, these particles can easily infiltrate the bloodstream and contribute to negative health effects. Few studies have looked at the exposure to ultrafine particles indoors and their effects on health. It is important to study these particles, as people tend to spend most of their time indoors. In this study, researchers sought to identify the differences between the concentration of particles outdoors and indoors based on a home's distance from the highway Interstate-93 in Somerville. Additionally, they wanted to better understand the environmental and behavioral factors that may affect infiltration of UFP into these Somerville homes.

How was it done?

A subset of participants from the CAFEH study were selected by Dr. Christina H. Fuller for indoor/outdoor monitoring from three categories: residences with a distance

of less than 100 meters from I-93, 100-400 meters and more than 1000 meters from the highway. Water-based condensation particle counters (WCPC) served to measure indoor and outdoor particle number concentration, which is comprised mostly of UFP. These counters, housed in a box, contained two sampling lines which alternately collected a one minute average UFP levels from indoor and outdoor air. The researchers also made use of weather information: a stationary site on a roof near I-93 collected information on wind speed, wind direction, temperature and humidity. In order to gain a more thorough understanding on the effects of behavioral and environmental factors, a questionnaire was answered by participants including information about demographics, smoking, air-conditioner and window use, heating type and home age.

What did they find?

Researchers found that near-highway homes had higher indoor UFP, while homes in the background area (>1000m from the highway) had lower indoor UFP. The relationships between indoor and outdoor particle number concentration seemed to be influenced by the use of air conditioning. Homes with a window AC unit or central air conditioning had a lower concentration of UFP than those without either.

Outdoor ultrafine particles were found to be the most important predictor for indoor UFP. Researchers also found that other important predicting factors in the amount of indoor UFP were the temperature, day of the week, time of day, wind speed and direction. These results show that a variety of factors are important in determining the presence of UFP, which in turn may affect health, even when people are indoors.

Why is it important?

While we often consider the effects of outdoor pollution on our health, we rarely think about how we are exposed to inside our home. For residents living in the study area, ultrafine particles appeared to easily enter homes near highways. The results of this study show higher indoor/outdoor ratios than previous studies, which did not do sampling under typical living conditions. This study is notable because it examines conditions that have not been researched before and provides evidence for a link between the quality of outdoor and indoor air.

What can you do?

There are many factors that people cannot control, including the weather and traffic, but there are ways to reduce indoor air particles. When traffic is heavy, you could keep windows closed. In this study, the use of central air conditioning (and less so, window AC units) seemed effective at lowering the amount of UFP inside. Use of air conditioning during the summer may be an alternative to opening a window. You can also reduce exposure to particles generated indoors from sources like smoking whose harmful effects are well documented. Chose not to smoke and avoid secondhand smoke. Additionally, you can participate in a research study to help researchers gain a better understanding of the presence of UFP in homes and how it affects health. You may learn more about air pollution and work with your community to reduce exposures.

For more information, contact:

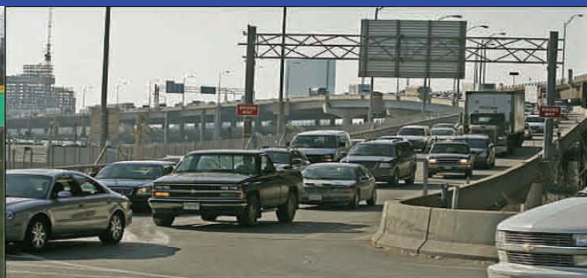
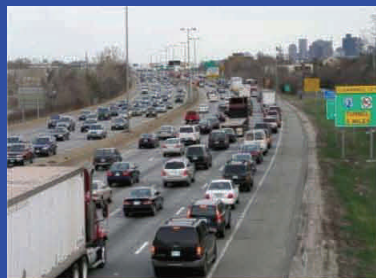
Dr. Christina H. Fuller, Institute of Public Health, Georgia State University, P.O. Box 3995, Atlanta, GA 30302-3995, USA. E-mail: cfuller@gsu.edu

This study was funded by:

- National Institute of Environmental Health Sciences
- Molecular and Integrative Physiological Sciences Training Grant

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

Fuller Christina H, Brugge Doug, Williams Paige L, Mittleman Murray A, Lane Kevin, Durant John L, Spengler John D 2013. *Indoor and outdoor measurements of particle number concentration in near-highway homes*. Journal of Exposure Science and Environmental Epidemiology. <http://www.nature.com/jes/journal/vaop/ncurrent/suppinfo/jes2012116s1.html>



COMMUNITY ASSESSMENT



OF FREEWAY EXPOSURE & HEALTH

Research summary: Mobile monitoring of particle number concentration and other traffic-related air pollutants in a near-highway neighborhood over the course of a year.

By: Christine Papastamelos

Car emissions from highways contain many types of pollutants that can be harmful to a person's health. People who live close to highways are exposed to a higher level of these pollutants. Some of these pollutants are particles that, when breathed in, can do harm to the lungs and heart. Ultrafine particles are the smallest and possibly the most dangerous of these particles. Because they are so small, they can get inside the body more easily where they may cause disease. Particle number concentration (PNC) is a measure of the amount of particles in the air. Most of the particle number concentration is made up of the extremely small ultrafine particles. PNC varies with distance from the highway, time of the day, weather and traffic conditions.

Researchers from Tufts University, involved in the Community Assessment of Freeway Exposure and Health Study, explored how distance from the highway, along with other factors, affected the concentration of pollutants in a part of Somerville near a highway. This study aimed to better understand how much near-highway residents are exposed to pollutants from highway emissions.

How was it done?

A mobile monitoring van containing sensitive air monitoring equipment was used to measure the concentration of particles. This mobile lab was driven along a fixed route, monitoring PNC in the Winter Hill neighborhood (close to I-93) in northeast Somerville. Particle concentrations were also measured using the mobile lab in a neighborhood distant (greater than 1000m) from I-93. Monitoring of PNC happened in shifts between September 2009 and August 2010. Monitoring was done at different times of the day, on different days of the week, and during different seasons of this year-long period. Distance from the highway, traffic conditions, wind speed and wind direction were all measured.

What did they find?

Researchers found that the highest concentrations of particles were in the near-highway neighborhood. The concentration of these particles decreased with distance from the highway.

The lowest concentrations were found in the neighborhood distant from I-93. PNC was also higher in the winter and spring and lower in the summer and fall. In addition, concentrations were higher on weekdays compared to weekends. Morning hours with busy traffic



Figure 1: The colored dots highlight the monitoring route. Concentration of particles increases during the busy morning hours. The most concentrated areas are down wind (in the direction the larger black arrow is pointing).

(6am-8am) had higher levels of particle concentration than later hours of the day.

Wind direction and speed also affected the PNC of the neighborhoods studied. Near-highway homes were exposed to higher concentrations of particles when they were downwind from the highway. For example, if winds were blowing from the west, then PNC would increase around homes in the east. Particle concentration also increased when winds were calm.

PNC mainly reflects the concentration of the smaller ultrafine particles. However, separate measurements recorded the mass of fine particles ($PM_{2.5}$) per cubic meter, which are larger than ultrafine particles. Unlike the concentration of ultrafine particles, the amount of these larger particles did not vary with distance from the highway. Measurements of fine particles differed very little between the near-highway neighborhood and the distant neighborhood.

Why is it important?

These findings show trends in particle concentrations in a near-highway neighborhood. This study shows that particle concentration can vary based on distance from the highway, time of the day, weather, and season. These trends can help near-highway residents understand when and where they are more exposed to highway pollutants. Furthermore, these findings reveal that the concentration of ultrafine particles is higher closer to the highway, while larger fine particles do not share this trend. This information is useful to researchers studying the effects that higher concentrations of ultrafine particles have on the health of near-highway residents.

The findings can also guide decisions on siting and designing of sensitive land uses like residential homes, schools, hospitals, and open space to protect the health of the occupants.

What can you do?

There are ways to reduce your exposure to pollutants if you live close to a major highway. Try to keep your windows closed during the morning when traffic is heaviest. Also, try to do outdoor activities during later hours of the day in a location that is not next to busy roads and highways.

Christine Papastamelos is an Undergraduate Intern with the Tufts Community Health Program

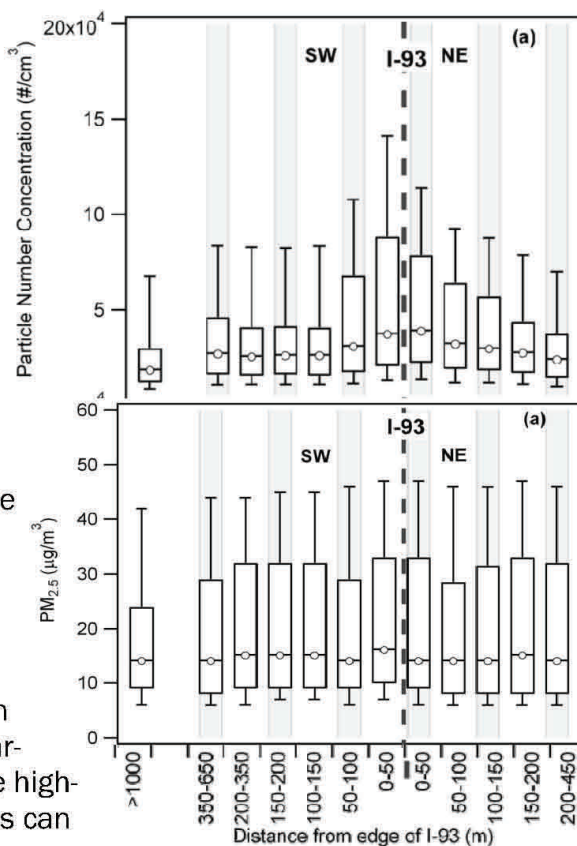


Figure 2:

PNC varies with distance from I-93, while $PM_{2.5}$ stays approximately the same.

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

Padro-Martinez L, Patton A, Trull J, Zamore W, Brugge D, Durant J 2012. Mobile monitoring of particle number concentration and other traffic-related air pollutants in a near-highway neighborhood over the course of a year. *Atmospheric Environment* 61:253-264.

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- National Institute of Environmental Health Sciences
- Tisch College through the Tufts Community Research Center

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