

# research highlights

## Smallest Airborne Pollutants Can Cause Severe Damage to Human Lung Cells, Adversely Affecting Function

ULTRAFINE PARTICULATES – the smallest airborne pollutants produced by automobile and diesel truck exhaust – can inflict severe damage to human lung cells, adversely affecting their function, according to findings reported by UCLA and USC researchers in the April edition of *Environmental Health Perspectives*.

The tiny particles are far more potent than the fine and coarse particulate matter currently targeted by regulators when it comes to inducing oxidative stress, according to a study by researchers at the Southern California Particle Center and Supersite, based in the UCLA School of Public Health and Institute of the Environment.

Previous epidemiological studies have shown an association between ambient air particulates from automobile exhaust and adverse health outcomes, including lung dysfunction, cardiovascular effects, allergic disorders and cancer. But those studies have focused on particulates that measure less than 2.5 microns, the size range currently regulated by the U.S. Environmental Protection Agency. The new results are among the first to

show a direct link between ultrafine particulates – those smaller than 0.1 micrometers – and destruction of a specific entity in a human cell.

Through laboratory analyses, the researchers found that ultrafine particulates not only lodge deep inside the lungs, but also penetrate the mitochondria, the human cell's power source, and remain there indefinitely – ultimately causing severe structural damage that affects cellular function. How the tiny particles gain access to the mitochondria and induce damage is not clear and needs to be investigated in future studies, the researchers note. In addition, more research is needed to establish a link between the cell damage observed by this study and the adverse health effects found previously.

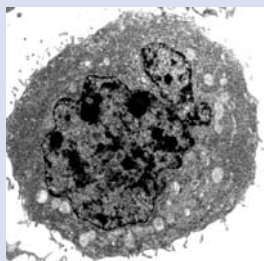
The study also reports that ultrafine particles have the ability to catalyze the production of reactive oxygen species capable of damaging proteins and DNA within cells.

“The results of this study are consistent with data from animal and human clinical studies and human epidemiology developed by our center which demonstrate that exposure to airborne particulate matter, especially fine and ultrafine particulates, is capable of producing adverse respiratory and cardiovascular effects,” says Dr. John Froines, director of the Southern California Particle Center and Supersite, professor at the school, and a co-author of the study. In addition, Froines notes, there is developing evidence for reproductive and neurological toxicity from mobile-source pollution, such as from cars and trucks.

### Ultrafine Particles Lodge Inside Lung Cells and Damage the Mitochondria

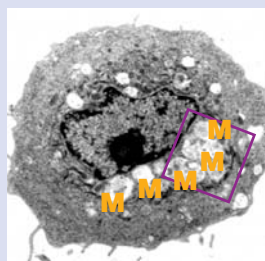
BEAS-2B cells

Untreated



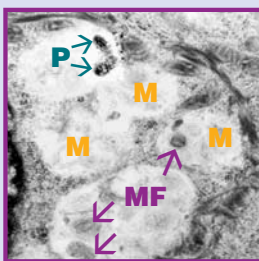
Mag. x8,500

UFP-treated



Mag. x8,500

UFP-treated



Mag. x26,300

Electron micrographs demonstrating mitochondrial destruction in BEAS-2B cells treated with 8.4  $\mu\text{g}/\text{ml}$  of ultrafine particles for 16 hours. Notice the disappearance of cristae, formation of myelin figures (MF), and presence of particles (P) inside the mitochondria (M).

## California's HMO Population More Diverse Than Believed; Plans Face Many Challenges in Meeting Members' Needs

CALIFORNIA'S 17.7 MILLION CHILDREN AND ADULTS who are enrolled in HMO plans are a more diverse group than previously believed, according to a UCLA Center for Health Policy Research report.

The study, funded by the California Office of the Patient Advocate, is the first detailed population-based profile of the state's HMO population. It found that the citizenship status, language fluency, level of education and ethnicity of HMO enrollees across the state vary widely, posing significant challenges for HMOs in providing quality services to all of their members. Because of this diversity, HMOs face major challenges in communicating with members regarding health plan benefits, policies, and procedures, according to the report, which noted that these challenges are greatest in Los Angeles, San Francisco, Santa Clara and Orange counties (see the accompanying graph).

"This study is of critical importance to the large number of Californians enrolled in HMOs when demanding member services and materials responsive to their diverse needs," says Dr. Gerald F. Kominski, professor and associate dean for academic affairs at the school, associate director of the Center for Health Policy Research, and the study's principal author. "HMOs can also benefit from these findings as they strive to provide appropriate services and materials to all of their members, a major challenge as suggested by these data."

The report, titled "Profile of California's HMO Enrollees: Findings from the 2001 California Health Interview Survey," presents HMO enrollee profiles for the entire state and for each of 15 geographic regions. A wide range of socioeconomic characteristics were examined, among them citizenship status, language spoken at home, English proficiency, educational attainment, income and employment, age, and race and ethnicity.

Among the key findings about HMO enrollees statewide:

- Twenty-seven percent are immigrants, including 15% who are naturalized citizens and 12% who are noncitizens.
- Thirty-four percent communicate at home in a language other than English or solely in another language.
- Thirty-five percent of adults ages 18-64 and 45% of adults ages 65 and over have a high school education or less.
- Forty-one percent are nonwhite, including 19% Latino, 12% Asian American and Pacific Islander, and 7% African American.

The full report is available online at [www.healthpolicy.ucla.edu](http://www.healthpolicy.ucla.edu).

### Percentage of HMO Members with Limited English Proficiency, by Region



Notes: Limited language proficiency defined as HMO members who report that they speak English "not well" or "not at all." Ventura County has too few observations to report.

## Nearly Half of State's Adults Know a Friend, Relative or Coworker Who Has Been Domestic Violence Victim

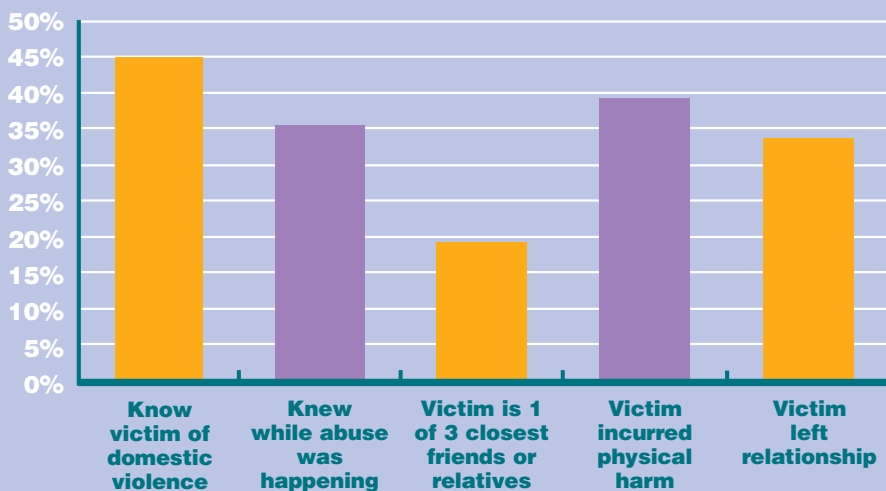
NEARLY 11 MILLION ADULT CALIFORNIANS — 46% of the state's adult population — personally know a victim of domestic violence, according to a UCLA School of Public Health study headed by Dr. Susan B. Sorenson and published in the *Journal of the American Medical Women's Association*. The first peer-reviewed study to examine the extent to which people in this country know victims of domestic violence also found that while women are more likely to know a victim than men and more likely to have specific information about the violence, there are few distinctions across ethnic, educational, and geographic groups.

"An often overlooked resource in domestic-violence intervention and prevention efforts is the victim's social support network of friends, relatives and co-workers," says Sorenson. "Those individuals may be powerful allies in helping — or hindering — victims of domestic violence."

The study asked 3,713 California adults whether a friend, relative or co-worker had been threatened or harmed by an intimate partner. Unlike previous surveys on domestic violence, which have mostly focused on personal experience, Sorenson's study provides a window into whether victims talk with others about the abuse. "Given that nearly half of Californians know someone close to them who has been a victim of domestic violence, the answer is yes," Sorenson says. "This also tells us that Californians, particularly women, already know about the problem. Our legislators are mostly men, and their efforts to increase awareness of domestic violence might reflect their own experience, or that of other men they talk to. But this suggests that rather than educational campaigns, we need action. If half of the people in California knew somebody who had a certain disease, we would not say, 'Let's increase the awareness about the disease.' We need to prevent domestic violence from occurring."

Sorenson believes the findings also suggest the importance of health care providers encouraging victims to identify and use their social networks for safety and emotional support. "Such efforts can increase the level of support and options available to domestic-violence victims, as well as increasing community awareness, involvement and investment in reducing domestic violence," she says. "This may eventually lead to changes in social norms within a community — namely, less tolerance for domestic violence and less consideration of the practice as a private family matter."

### Personal Knowledge of Domestic Violence, California



## Addressing Cause-and-Effect Issues in Treatment Results

ONE OF THE MAJOR CHALLENGES facing biostatisticians in analyzing data from medical treatment studies is how to determine the true causal relationship between treatment and some health outcome of interest, particularly when there are so-called confounders — variables related to the treatment and outcome that, if not accounted for, can lead to a misrepresentation of the causal nature of the relationship. A study finding an association between carrying matches and developing lung cancer, for example, would clearly be misguided to conclude that there is a causal relationship without considering the obvious confounder, smoking — the reason that most people would carry matches.

Not all cases are so clear. And, while randomized controlled clinical trials are designed to ensure that comparison groups don't differ in any way that would

influence the outcome beyond the treatment, the growing use of data stored by hospitals and other health care organizations means that analyses are often taking place outside the clinical trials environment, presenting more opportunities for confounders to cloud the waters.

“We have this wealth of data that isn’t necessarily being collected within the classical clinical trials parameters,” says Dr. Tanya Henneman, a postdoctoral researcher at the UCLA School of Public Health. “This provides a great opportunity to observe how treatment is being given in a naturalistic setting and how people are responding, but because treatment assignment isn’t randomized, if you want to use data from these sources you have to deal with the issue of confounders. When it is thought that the treated group differs systematically from the non-treated group in ways that confound the comparison, the challenge to statisticians becomes identifying the actual causal relationship between treatment and outcome.”

Henneman is among those who have been addressing this problem in explicit terms in the emerging sub-field known as causal inference. She has explored how methods evaluating treatment effect using data from observational studies can be improved. To account for unmeasured confounders, Henneman has applied concepts originally used by economists. “Sometimes you have situations where you know there are confounders and you have access to them in your data set, but other times you know they’re there and *don’t* have the data on them,” she explains. “We’re trying to find ways we can implement these ideas from econometrics in our own statistical analyses so that we can make use of existing data in ways we haven’t been able to before.”

## Study Fuels U.S. Navy Effort to Restore Coastal Wetland Using Sewage Sludge

SEWAGE SLUDGE IS AN UNLIKELY ALLY to the cause of cleaning up California’s coastal wetlands. But recently completed research by a UCLA School of Public Health environmental biologist and colleagues on the use of the sludge in restoring a coastal wetland is fueling an ambitious U.S. Navy-led effort to return the Mugu Lagoon to its original salt marsh condition.

In collaboration with experts from UCLA, including Dr. Richard Ambrose, professor at the School of Public Health and director of the Environmental Science and Engineering Program, the Navy has begun work on what it hopes will be one of the most successful salt marsh restoration projects in the country – an effort that would produce revenue savings in the process.

The project, located at Point Mugu in Ventura County, Calif., dates to 1995, when the Los Angeles Regional Water Quality Control Board required the Navy to remove 56,000 tons of sludge that had accumulated in sewage oxidation ponds. The board was concerned about groundwater contamination from the metals contained in the sludge. In the year that followed, the Navy worked with the board, the U.S. Environmental Protection Agency, and others to determine the best clean-up method.

The long-term strategy of using the sludge to restore the salt marsh was developed as an alternative to digging and hauling the sewage sludge off site for disposal, which would have cost up to \$15 million. “The current strategy has the dual benefit of significant cost savings as well as restoring the ponds to their original salt marsh wetland condition,” Ambrose explains. Researchers had to be careful, however, that the metals in the sludge did not harm the environment.

To ensure the environment was protected, the researchers employed a phased experimental approach, called adaptive management. The recently completed phase involved a 2.5-acre test of several different mixtures of sludge, soils and plant types to determine the optimum combination. Several years of sam-



The beginning of construction that incorporates sewage sludge into the restoration of Mugu Lagoon in Ventura County, Calif., and the restored wetland at the beginning of its “life.”

pling and analyses have confirmed the proper site restoration requirements, Ambrose says. In the second phase, constructed last year, a 9-acre plot was restored, using heavy equipment to mix sludge and the underlying clay soil, and creating contours to maximize tidal flow and plant growth. That work has been monitored to ensure the restoration is effective, both in terms of wetland creation and in making sure no metals are leaching off site. If the second phase shows that the restoration is safe for the environment, the final phase of the project will restore the remaining 19.5 acres.

“California has lost 91% of its original wetlands,” Ambrose notes. “When the Mugu restoration is completed, it will provide essential habitat for a variety of plants, fish and birds, including several endangered species. This also demonstrates how innovative approaches to environmental problems can lead to win-win solutions, improving the natural environment while saving taxpayers millions of dollars.”

### “Food-Insecure” Adults in State: More than 2.2 Million

MORE THAN 2.24 MILLION LOW-INCOME ADULTS in California can’t always afford to put food on the table, and as a result, one in three of these adults experiences episodes of hunger, according to a UCLA School of Public Health team, whose findings were based on data from the California Health Interview Survey (CHIS 2001).

The ranks of “food-insecure” Californians include not just the most impoverished individuals, but also working adults, retired older persons with fixed incomes, and many parents with children, reports Dr. Gail G. Harrison, professor at the school, associate director of the UCLA Center for Human Nutrition and lead author of the study. “This is a sad reality in a state that has the largest agricultural economy in the United States and produces abundant high-quality fruits and vegetables for much of the nation,” Harrison says.

The study found that more than 8% of low-income California adults – defined as those in households with incomes below 200% of the federal poverty level, or below \$36,200 for a family of four – experience food insecurity with hunger, while another 20% experience food insecurity that falls short of hunger. With or without hunger, food insecurity – lack of assured access to enough food through socially acceptable means – causes families to forego such basic needs as rent, utilities, and medical care in order to put food on the table, and is a threat to health, the study authors note.

To better address the problem, Harrison recommends that hunger and food insecurity be routinely included as basic health indicators in all health surveillance surveys in California; that enrollment procedures be streamlined and application processes simplified to increase participation in federal food programs; and that legislators invest in outreach for the Food Stamp and

Women, Infants, and Children (WIC) Special Supplemental Nutrition programs, whose target populations are the groups with the highest prevalence of food insecurity and hunger. A longer-term solution would include improved wages and adequate cash assistance programs for seniors, the disabled, and the unemployed and underemployed.

CHIS 2001, the largest health survey ever conducted in any state and among the largest in the nation covering a broad range of public health concerns, is a collaborative project of the UCLA Center for Health Policy Research, the California Department of Health Services and the Public Health Institute. More information on CHIS 2001 and the food insecurity study can be found at [www.healthpolicy.ucla.edu](http://www.healthpolicy.ucla.edu).

**Prevalence of Food Insecurity (with and Without Hunger) Among Vulnerable Adult Groups, Below 200% Poverty, California, 2001**

