Studies by ACE Centers Show Populations Impacted by Air Pollution

by Michaela Burns

In 2016, the U.S. Environmental Protection Agency (EPA) announced funding, through the Science to Achieve Results (STAR) grant program, for three Air, Climate and Energy (ACE) Centers. The research at these multi-project centers is designed to improve understanding of the health impacts from exposure to air pollutants from multiple sources; determine what regional differences in air pollution may exist; and explore the effects of a changing climate and human activity on local air quality and human health. The ACE Centers include research scientists at universities across the country and are already producing important studies. Three major findings from 2017 are highlighted here.
Racial Disparities Found in Air Pollution Exposure

CACES researchers from the University of Washington and the University of Minnesota examined pollution levels over time and found that race makes a difference when it comes to exposure to nitrogen dioxide (NO₂), a transportation-related air pollutant. This study estimated the exposure of outdoor NO₂ by race-ethnicity, socioeconomic status, and location across the United States in 2000 and 2010. Consistent with several previous studies, researchers found that the disparities in exposure were larger by race-ethnicity than other socioeconomic categories.

“We saw disparities by race at every level of income. You look at lower income, middle income, and higher income, and there is still a difference by race. This relative disparity in pollution exposure is largely unchanged over a decade,” says Julian Marshall, one of the authors of the study and a professor of Civil and Environmental Engineering at the University of Washington.

Marshall and his colleagues examined changes over time, and found that average exposure to NO₂ for all races and income levels decreased from 2000 to 2010. However, relative disparities persisted: non-whites were exposed to 40-percent higher concentrations of NO₂ than whites in 2000, and 37-percent higher concentrations in 2010. Further, though none of the populations were exposed to levels that exceeded the National Ambient Air Quality Standard (NAAQS) for NO₂ in 2010, non-whites were 2.5 times more likely to live in areas where the average NO₂ concentrations exceeded the World Health Organization’s guideline.

“One really important aspect of our study is that we observed disparities in exposure to air pollution throughout the country and how it varies by city and by state. Our findings point to a national pattern of race being a more important determinant of exposure to air pollution than other factors such as income, age or education,” says Marshall.

Additional work is needed to further investigate potential underlying causes.

Women, the Elderly, and Low-Income People Are Vulnerable

An article by ACE Center researchers from Harvard University reported health impacts of fine particulate matter (PM₂.₅) and ozone (O₃) at levels below the current NAAQS. Researchers examined the association between long-term exposure to PM₂.₅ and time to death for the entire Medicare population in the continental United States from 2000 to 2012 and determined that short-term exposure to PM₂.₅ and warm-season ozone, even at levels lower than the...
current NAAQS standards, were significantly associated with an increased risk of death. Unique to this study was the inclusion of individuals living in smaller cities, towns, and rural areas that were not included in previous research studies.

The study also assessed the association of mortality with PM$_{2.5}$ for low-income individuals, people of color, women, and the elderly (age 70 or older). Researchers found that these groups had higher risks of mortality associated with exposure to levels of PM$_{2.5}$ below the NAAQS compared to the rest of the Medicare population. Researchers saw the largest effect for individuals that were part of multiple vulnerable subgroups such as women who were non-white, elderly, and had a lower income.

“One advantage of studying a large population is that we were able to more fully explore the effects of short-term PM$_{2.5}$ on vulnerable groups,” says Francesca Dominici, one of the authors of the study, and a professor of biostatistics at Harvard T.H. Chan School of Public Health.

**Coarse Particle Pollution Impacts Children’s Health**

A study by SEARCH ACE Center researchers from Johns Hopkins University found that children exposed to airborne coarse particulate matter (PM$_{10-2.5}$) are more likely to develop asthma and need emergency room or hospital treatment than other children. This research finding is significant because while previous human health studies have established an association between exposure to PM$_{2.5}$ and the development of asthma and other respiratory diseases, coarse PM, which can come from grinding and roadway-derived particles such as brake wear, was thought to be less dangerous to health. While PM$_{2.5}$ can penetrate the lungs and go into the bloodstream, the larger particles of coarse PM can deposit in the upper airways and can lead to obstructive lung diseases such as asthma.

SEARCH researchers examined asthma prevalence and disease in a dataset of nearly 8 million children between 5 to 20 years of age enrolled in Medicaid in 34 states between 2009 and 2010. They found that coarse PM was associated with increased asthma diagnosis, hospitalizations, and emergency room visits in children. Children aged 11 and younger were found to be more susceptible to health effects from coarse PM. Researchers hypothesized that this is because younger children traditionally spend more time outdoors and are in a critical window of lung development.

“I think this study along with other studies suggest that we should be paying more attention to this fraction of particulate matter.” says Dr. Corinne Keet, Associate Professor of Pediatrics at the Johns Hopkins University School of Medicine and lead author of the study.

The research conducted by the ACE Centers could help answer important questions about which air pollutants pose the greatest threat to human health and the environment, how they can harm health and how we might reduce that risk.