OVERVIEW
In the course of daily activities, we come in contact with a variety of chemical and biological air contaminants, both outdoors and indoors. Exposures at relatively low concentrations during pregnancy, infancy, and childhood can have immediate and long-term effects on health. Recent studies suggest that air pollution exposure during pregnancy can result in adverse birth outcomes. In particular, as children’s lungs undergo rapid growth, early exposure may result in respiratory ailments and, later on, exacerbate asthma and allergy.

Investigators at the Yale Center for Perinatal, Pediatric and Environmental Epidemiology (CPPEE) at the Yale School of Public Health are engaged in a number of population-based studies in the U.S. and China intended to give us a better understanding of the health risks associated with exposure to relatively low and high levels of air pollution in childhood and during pregnancy. An emerging component of our research is the exploration of the role of genetics in asthma and allergy.

THE CHALLENGE
Environmental factors are estimated to account for 24% of global diseases (WHO – Preventing Disease through Healthy Environments). In terms of the environmental contribution to disease, respiratory infections are ranked second, perinatal conditions seventh, and asthma fifteenth. Air pollution is a major environmental risk factor in all three diseases. Asthma is a major chronic disease in the US, accounting for more than two million emergency room visits and $14 billion in health care costs and lost productivity per year. Asthma is the most common chronic illness of childhood, accounting for more absenteeism (14 million missed school days per year) than any other chronic disease. Absenteeism impacts academic performance, participation in extracurricular activities, and peer acceptance. Underserved populations are especially affected by asthma. In Connecticut, for example, asthma prevalence of 9.9% is among the highest in the US. The rate among children enrolled in Connecticut’s HUSKY program (health insurance program for uninsured children) is 19.5%. Increases in asthma and allergy are likely due to a combination of factors—genetic, environmental, socioeconomic, lack of access to care, and differential treatment.

The challenge is to define the role of air pollution in asthma and allergy in children, particularly in underserved minority populations, while controlling for other potential risk factors. Identification and quantification of these environmental risk factors in population-based studies will aid in developing cost-effective interventions.

OUR RESPONSE
With funding from the National Institutes of Health and the enthusiastic cooperation of hospitals and school districts, we have undertaken several large prospective epidemiologic studies to investigate the roles of outdoor (air pollution, closeness to traffic, weather, etc.) and indoor (home allergens, unvented space heaters, environmental tobacco smoke, etc.) environmental, genetic, and lifestyle risk factors in the development and exacerbation of asthma and allergy in children. Our ongoing studies include: a birth cohort of 1,002 children and two panel studies (one with 466 and the second with 1553 asthmatic children). In addition, we are investigating the role of air pollution on birth outcomes in Connecticut from 2000 to 2006.
WHAT WE HOPE TO ACHIEVE

The central goal of our studies is the identification and quantification of the role of environmental and genetic risk factors in the development and exacerbation of asthma and allergy in children, with a focus on high-risk populations. Specifically, we want to identify air-pollutant exposure levels that provide an adequate level of protection and design cost-effective intervention strategies to reduce pollutants to safe levels. We will achieve these goals through:

Research
- Determine the impact of early life exposures to chemical and biological air pollutants and traffic on risk of developing asthma and allergy.
- Determine how asthma severity in children is affected by exposure to chemical and biological air pollutants and traffic.
- Explore the role of gene-environment interactions in the development of asthma and allergy and asthma exacerbation.
- Develop innovative modeling tools that use traffic data, satellite remote sensing data, geographic information systems, and source apportionment in order to increase the accuracy of temporal and spatial exposure assessment.
- Expand our population-based studies to examine the role of obesity, exercise, and diet on asthma and asthma severity.

Advocacy
- Have a direct impact on the regular re-evaluations of the US EPA ambient air quality standards.
- Influence federal and state efforts to reduce sources of indoor air pollution including allergens, mold, particles, and gases in different microenvironments.

Training
- Expand efforts to train masters-level, doctoral, and post-doctoral students in environmental epidemiology and offer a seminar series that focuses on collaborative research on asthma, the environment, and genetics.

Collaborations
- Work with scientists in immunology, genetics, and pulmonary medicine to apply laboratory-based findings related to allergy and asthma to our study populations, for which we already have extensive exposure and biologic data.
- Collaborate with the schools and health departments in order to continue and expand our school-based asthma studies.

PARTNERSHIP FOR CHANGE

The CPTEE at the Yale School of Public Health is committed to deepening our knowledge of the relationship between air pollution and the respiratory health of children. Financial support is sought to:
- Conduct pilot studies to explore the relationship between asthma and diet, exercise and obesity
- Use the bank of biological samples collected in our population studies to explore the role of genetics and gene-environment interactions in asthma and allergy
- Develop a platform for collaborations between CPTEE researchers and scientists in immunology, genetics, and pulmonary medicine
- Develop a university-wide seminar series on air pollution and human health
- Fund fellowships at the masters’, doctoral, and post-doctoral levels for interdisciplinary research on the environmental and social factors in asthma in underserved populations

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