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Commentary on Adverse Health Effects of Air Pollution

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Commentary

As the twentieth century ends, the health effects of outdoor air pollution remain a public health concern in developing and developed countries alike. In the United States, the principal pollutants monitored for regulatory purposes (carbon monoxide, nitrogen dioxide, sulfur dioxide, particles, ozone, and lead show general trends of declining concentrations, although ozone pollution now affects many regions of the country besides southern California. Yet, even at levels of air pollution now measured in many cities of the United States, associations between air pollution levels and health indicators are being demonstrated at concentrations around those set by standards of the U.S. Environmental Protection Agency. In many countries of the developing world, concentrations of air pollutants are rising with industrialization and the increasing numbers of motor vehicles. Extremely large and densely populated urban areas often referred to as "megacities," have the potential to generate unprecedented air quality problems.

There are common principles to air quality management throughout the world. Public health protection unifies all approaches, whether based on voluntary guidelines, mandated standards for concentrations, or source control. The intent is to limit or to avoid any impact of air pollution on the public's health. Air quality management is thus based on a scientific foundation built from the epidemiologic, toxicologic, and clinical evidence on health effects of air pollution. In interpreting this evidence for public health protection, there is a need to identify those effects that are considered "adverse" and to separate them from those effects not considered adverse.

The American Thoracic Society has previously provided guidance on the distinction between adverse and nonadverse health effects of air pollution in its 1985 statement, "Guidelines as to What Constitutes an Adverse Respiratory Health Effect". Definitions of adverse effects have also been offered by the World Health Organization, but the guidance of the American Thoracic Society has received particular emphasis in the United States. Preparation of the original statement was intended to coincide with consideration of the passage of an amended Clean Air Act and to provide a framework for interpreting scientific evidence relevant to the mandate of the act. In particular, the Clean Air Act requires that the Administrator of the Environmental Protection Agency promulgate, for certain pollutants, standards that will be sufficient to protect against adverse effects of the air pollutants on health. The act is silent on the definition of "adverse effect" and, at the time of the 1985 statement, there was considerable controversy around the interpretation of this language as revision of the act was being considered. Recognizing the need of policy makers for expert guidance, the American Thoracic Society released the 1985 statement, which to date constitutes the sole set of recommendations on this issue from an expert panel convened by a health organization.

The American Thoracic Society has revised the 1985 statement because new scientific findings, published since the original statement, have again raised questions as to the boundary between adverse and nonadverse in considering health effects of air pollution. These new findings reflect improved sensitivity of research approaches and the application of biomarkers that can detect even subtle perturbations of biologic systems by air pollutants. Epidemiologic research designs have been refined and large sample sizes and increasingly accurate methods for exposure assessment have increased the sensitivity of epidemiologic data for detecting evidence of effects. New statistical approaches and advances in software and hardware have facilitated analyses of large databases of mortality and morbidity information. The design of clinical studies—including controlled exposures of volunteers has also advanced and biologic specimens may be obtained after exposure, for example, by fiberoptic bronchoscopy, to identify changes in levels of markers of injury. Toxicologic studies have also gained in sophistication through incorporation of more sensitive indicators of effect and the careful tracing of the relationship between exposure and biologically relevant doses to target sites, which may now be considered at a molecular level.

New dimensions have been added to the array of outcome measures. Medical outcomes research now recognizes that patient well-being should be broadly conceptualized and measured rigorously, in addition to considering the biological process of the disease itself. As a result, health-related quality of life, the perception of well-being, is now considered a necessary component of outcomes research. Validated instruments have been developed to assess the impact of health-related symptoms and impairment on functional status and quality of life. The formalization of the concept of environmental justice acknowledges that the effects of specific pollutants cannot be evaluated in isolation without giving consideration to the overlapping exposures of populations, often minority group members of low socioeconomic status, who live in neighborhoods that are heavily exposed to multiple environmental contaminants.

This new statement, like the 1985 statement, is intended to provide guidance to policy makers and others who interpret the scientific evidence on the health effects of air pollution for the purpose of risk management. The statement does not offer strict rules or numerical criteria, but rather proposes principles to be used in weighing the evidence and setting boundaries between adverse and non-adverse health effects. Even if the technical tools were available for scaling the consequences of air pollution on the multiple relevant axes, the placement of dividing lines should be a societal judgment and consequently this committee does not propose specific boundaries for separating adverse from non-adverse effects.

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