Environmental Cardiology: Pollution and Heart Disease
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In an underdeveloped country, don’t drink the water; in a developed country, don’t breathe the air. —Changing Times Magazine

Economic development clearly comes at a cost, and has huge implications for human health in ways that are both direct and indirect (for example, through climate change). Environment risk factors are taking center stage as we realize that our internal well-being is determined to a surprising degree by the external environment. The monograph titled Environmental Cardiology is a superb and timely compilation of 13 chapters that provide a comprehensive overview of the topic. The broad motivations are simple. The juxtaposition of traditional risk factors with all pervasive environmental toxicants occurring at an unprecedented scale may create a toxic mélange that may help to explain the emerging epidemic of chronic cardiovascular disease.

The cardiovascular system tends to be exquisitely sensitive to the environment, including the physical (eg, air, water, land pollution), social (eg, stress, socioeconomic status), and our own personal environments. For all too long, we have ignored these omnipresent and omniscient influences that, in many cases, may have outsized effects that rival traditional risk factors and very rightfully should be considered a separate discipline, as eloquently argued by Dr Bhatnagar. The first chapter is an elegantly written treatise on the environmental basis for cardiovascular disease and is the keystone to the monograph, because it provides the context for subsequent, more focused chapters. The relationship among socioeconomic factors, social interactions, time, seasons, latitudinal variations, physical activity, and the choices we make (eg, food, activity) is succinctly discussed. The clearest direction and argument for this new focus on environmental risk factors are that they provide a forum for prevention. This is particularly obvious in personal lifestyle choices such as poor diet, lack of exercise, and smoking. However, such lifestyle choices cannot be examined in isolation, and are indeed markedly tempered by the social environment or context in which individuals live. An example is the pernicious effects of air pollution on an individual driving a fuel-efficient natural gas car in an environment in which the vast majority of vehicles are inefficient and lacking catalytic converters. Although personal choices are important in our personal health, for many environmental factors, massive changes are often required at the societal level, with approaches that cover the gamut of behavior, engineering, and economics. Such approaches are some of the hardest to implement at the societal level, but may well represent some of the most cost-effective for mankind. Thus, the business of environmental engineering is truly a risky business, which Dr. Bhatnagar articulately argues in the first chapter.

This opening chapter sets the stage for subsequent reviews of the health effects of air pollution and other inhaled toxicants. The epidemiology of air pollution-mediated cardiovascular disease and the cardiovascular health effects are discussed in chapters 2 and 3. The epidemiology of air pollution-mediated health effects has been the wellspring of knowledge that has been the basis of environmental standards for particulate matter exposure worldwide and sustained scientific research in this area. This is covered elegantly by the authors, who acknowledge limitations of current methods and potential approaches in which such investigations may be vastly improved. These include improvements in individual exposure methodologies in conjunction with better end-point adjudications that may enhance our understanding of health effects. In chapter 3, the cardiovascular effects of short- and long-term exposure are succinctly dealt with, and a current framework of understanding is provided. Multiple caveats and lacunae in our current framework of understanding are provided, including some of the most important and intractable questions in the field, such as: How are systemic effects transduced from the pulmonary circulation? How does individual susceptibility play into air pollution-mediated effects? What are some of the air pollution components responsible for cardiovascular effects? How does an arguably weak stimulus for cardiovascular events exert such potent effects even in the light of decreasing air pollution levels over the last 3 decades, at least in the western hemisphere? Chapter 4 provides a summary on prohypertensive effects of particulate matter exposure, whereas chapter 5 provides an overview of the association with type II diabetes mellitus. A growing number of studies have suggested that low-grade systemic inflammation, which is sine qua non of type II diabetes mellitus, may be facilitated by chronic exposure to air pollution, which may alter susceptibility and simultaneously make people with diabetes mellitus more vulnerable to air pollution-mediated health effects. Faced with a pandemic of type II diabetes mellitus and its links with urbanization, the need to examine hitherto unsuspected and particularly insidious environmental factors (both dietary and inhaled) is more important than ever. Chapters 6 to 9 are devoted to the risk of stroke, heart failure, atherosclerosis, and ischemic heart disease with particular matter exposure. Separate chapters (10–12) are devoted to ultrafine particle-mediated cardiovascular effects, vehicular emissions, and the cardiovascular effects of engineered nanoparticles, an emerging class of pollutants that may be permeating our environments. There is considerable interest in the cardiovascular safety of nanoparticles, many of which are ubiquitous in devices and materials commonly consumed and inhaled by humans. The role of environmental aldehydes in food, water, and air is very thoroughly discussed in the final chapter (chapter 13). The monograph thus is a fabulous and deliberately focused compilation of some of the most important environmental concerns, with an emphasis on air pollution. Issues such as water pollution, chemical pollution, and indoor sources of pollution are not covered in the monograph; rightfully so, considering that the scope and complexity of these problems may warrant a separate monograph.

At an individual level, the effect of air pollution may be a small blip, but the population-attributable risk is enormous, considering the truly global nature of the problem and that no individual is spared. However, the redeeming feature of this threat is the simple fact that it is also readily modifiable, almost instantaneously, if society so wishes. On March 2, 2011, 2 reports published on either side of the Atlantic provided an economic analysis of the health and economic impact of air pollution regulation. The Aphekrom project, sponsored by the European Council, noted that curbing pollution to WHO stan-
Standards throughout Europe could save 19,000 lives per year, add 2 years to life expectancy, and save €31.5 billion in health costs. In the United States, the Environmental Protection Agency (EPA) released its own report, titled “The Benefits and Costs of the Clear Air Act from 1990 to 2020.” The 1990 amendment of the Clear Air Act prevented 160,000 early deaths, 130,000 heart attacks, and 1.7 million asthma attacks in the year 2010 alone. The numbers estimated for the year 2020 will amount to a savings of $2 trillion in health costs. These numbers may pale in significance against a cost analysis (in life and dollars) with even modest improvements in air quality standards in developing countries such as China and India, where levels routinely exceed that in the EU and North America by at least by an order of magnitude. Although these reports are compelling arguments for the implementation of tighter standards for air quality, there remains the debate as to what extent of control (lowering of acceptable standards) constitutes an acceptable balance between cost of newer alternate technologies and benefit. Although regulation is certainly a necessary step in prevention of cardiovascular disease, the lessons learned from the health effects of particulate matter and its components would hopefully serve an invaluable role in furthering our understanding of human disease. In summary, this monograph should serve as an essential addition to anyone with any interest in environmental risk factors and their impact on cardiovascular health.

Disclosures

None.

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