



Risk in Perspective

EMF and Human Health — an Open Question

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In 1979, Wertheimer and Leeper published an epidemiologic study suggesting a possible association between power lines and childhood leukemia in Denver, Colorado. This study, buttressed by later epidemiologic reports, stimulated public concern and scientific interest in the potential health effects of electric and magnetic fields (EMF). Although these fields are generally much weaker than the earth's natural magnetic fields, citizens worry about their exposure to EMF from high voltage transmission lines, electrical wiring in buildings, and household appliances, while scientists debate the biological plausibility of conflicting evidence on the potential dangers of EMF. With such widespread exposure of humans to electric and magnetic fields, the potential impact of any adverse health effects associated with EMF could be profound.

In response to both the significance of this issue and the uncertainty surrounding it, the Harvard Center for Risk Analysis (HCRA) has assembled a panel of distinguished scientists to provide an ongoing review of the emerging science on EMF. The goals of this new group, the Harvard Advisory Committee on EMF and Human Health, are to examine the new studies and issues arising in the EMF area, to interpret the state of the science for nontechnical audiences, and to recommend new research activities that are needed to clarify these issues.

This issue of RISK IN PERSPECTIVE examines several of the key issues involved in the public health debate over EMF. It also introduces the new Harvard Advisory Committee on EMF and Human Health.

Perplexing Science

Over the past decade and a half, researchers from a broad array of scientific disciplines have published hundreds of studies on the potential health effects of human exposure to electromagnetic fields. The scientific results from these studies have been diverse and perplexing.

In epidemiologic research, for example, there have been many studies whose findings suggest a possible association between EMF and childhood leukemia. There have also been several studies that find no statistically consistent association. Similar conflicting results have emerged from epidemiologic studies exploring the relationship of EMF exposures in various residential and occupational settings to other adverse health outcomes, such as male breast cancer, cancers of the skin and central nervous system, and various forms of leukemia. Some of these studies suggest positive associations between EMF and one or more of these cancers; others indicate no association. One explanation for the inconsistent results may lie in the difficulties inherent in trying to measure residential and occupational exposures to EMF, particularly the difficulties in trying to reconstruct and estimate past EMF exposures in occupational settings. The studies may also be influenced by various confounding risk factors, such as the general health and socioeconomic status of residents living near power lines or electrical workers' exposure to chemicals or other potential toxicants.

There have also been numerous studies exploring a host of different factors in the effort to search for biological clues. Studies at the cellular level have investigated and found possible effects associated with EMF in 1) the flow of calcium ions across cell membranes, 2) DNA synthesis and RNA transcription and synthesis, and 3) the hormonal and immunological systems, such as inhibition of the secretion of melatonin from the pineal gland, which may play a role in suppressing the growth or preventing the initiation of breast, prostate, and possibly other cancer cells. Other potential effects of exposure to EMF currently being investigated include changes in cell signaling and cell proliferation. To date, there is a broad array of evidence suggesting that exposure to EMF affects cellular level activity. The mechanism of action and the dose-response relationship associated with EMF have not been defined,

