



Conference of Radiation Control Program Directors, Inc.

Fact Sheet

Epidemiology

Background

Recent epidemiologic studies suggest a link between exposure to 60 hertz electric and magnetic fields (EMF) and certain childhood cancers, especially leukemia. Although each epidemiologic study has advanced the knowledge from previous ones and accounted for early sources of error, the reported associations have not changed. The consistent findings are the major reason for the ongoing research effort.

Epidemiology is the study of diseases and injuries in human populations and the factors that might cause the health effects. Epidemiology is concerned about what kind and how much illness occurs in communities or groups of people and what factors determine that pattern.

Research Results

1979

A study in Denver found a correlation between leukemia in children and living near power lines. A wire code, based on size, number and nearness of power lines, was used to estimate the strength of the magnetic fields in nearby homes. The study associated living near high current carrying lines with an increased risk of childhood leukemia. The result suggested that the risk would be 2 in 10,000 per year in high exposure homes, versus 1 in 10,000 in low exposure homes. (Wertheimer and Leeper)

1986

The follow-up study in Denver also found a link to childhood cancer. This study corrected some weaknesses of the Wertheimer study. The investigators determined the wire code for the home and also directly measured magnetic field strengths. Using the wire codes, this study suggested a risk of 2 per 10,000 per year for those children living near high current carrying lines. However the direct measurements did not confirm the association. (Savitz)

1991

A Los Angeles study found similar results as the Savitz study; the association was greater for wire code than for direct measurements. Additionally, this study included sources within the home, and showed an association with in-home appliances. This study suggests a risk for childhood leukemia of 2.5 per 10,000 per year for the wire code indicating the highest exposure to magnetic fields. (London)

1992

A study conducted in Sweden employed a different method for determining exposures. The study focused on major transmission lines of 220 and 400 kilovolts. Historical records of transmission line currents and voltages were used to reconstruct long-term average magnetic field levels in nearby residences. This study associated a risk of 4 in 10,000 per year for childhood leukemias for children exposed to an average annual magnetic field level above 3 milligauss. (Feychting and Ahlbom)

1993

A study similar to the Swedish study was conducted in Finland. As in the Swedish study, the index of exposure was the calculated annual average magnetic field exposures for individuals living near transmission lines. Unlike the Swedish study, there was no statistically significant increase observed for leukemias, lymphomas, or overall cancer at any field level. The authors concluded that the results suggest that magnetic fields at levels close to 2 milligauss do not form a major public health risk regarding childhood cancers. (Verkasalo)

One way to think about the results of these studies is as follows: the selected populations were based on an assumed exposure to electric and magnetic fields and were examined for the incidence of childhood leukemia, a relatively rare disease. Three of the studies (Wertheimer, Savitz and London) found that populations selected on the basis of wire code showed an increase in childhood leukemia which is statistically significant. The Feychting study showed a statistically significant increase in groups selected on the basis of higher calculated fields. "Statistically significant" means there is at least a 95% certainty that the difference between the exposed and unexposed groups was not due to chance alone.

Complicating the interpretation of these results with respect to determining the risks faced by the population are several important facts. First, of these studies, when fields strengths were determined on a short-term basis the risk estimates were less than for wire codes or long-term calculated exposures. Second, there have been epidemiologic studies (Myers, Fulton, Verkasalo) which have shown no increase in childhood leukemias.

These studies are difficult for two additional and related reasons: the natural incidence of childhood leukemia is low, and apparently the risk factor due to electric and magnetic fields is small. Taking both factors into account, we can estimate that extremely large numbers of individuals would have to be studied in order to determine the magnitude of the risk factor.

Related Research

Other researchers have studied the patterns of disease among workers who were thought to have been exposed to higher EMF fields during their careers. For example, workers in certain jobs in the telephone and electrical power industries were studied to determine what diseases they developed and to try to estimate the fields to which they might have been exposed. Although an increased occurrence of leukemia and brain cancer has been observed, studies in the United States and other countries have not identified a positive link between cancer and EMF exposure in the workplace. Also, there is no clear indication of a link between EMF exposure in the home and adult cancer.

Issues

The increased risk seen with wire codes rather than actual measurements of magnetic fields indicate that the significant factors of EMF exposure are still unknown. Wire codes may be a better indicator of historical exposure than short-term measurements. Where exposure to other substances has been definitely linked to cancer, scientists have been able to measure some aspect of the exposure and show that increased incidence of cancer is related to increased exposure. No such aspect of EMF has been identified that is definitely related to increased incidence of cancer. There is also contradictory findings in determining what the "dose" may be. In fact, some laboratory studies of biological cells show that increased exposure actually leads to decreased occurrence of the effects. In some studies of exposed groups of workers, the individuals with the higher exposures had a lower incidence of cancer. Study continues to determine what measurements are significant.

Summary/Conclusions

Epidemiology has led to a suspicion that 60 hertz electric and magnetic fields may be a contributor to the development of childhood cancers, especially leukemia. However, epidemiology studies are never considered as sufficient evidence of a cause and effect relationship because of the large number of complicating variables. A cause and effect relationship requires supporting evidence from cellular, animal and human studies.

Cellular and long-term animal studies are in progress. Additional research will be funded under section 2118 of the Energy Policy Act of 1992.

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Published April 1994

This Fact Sheet was prepared by the CRCPD Committee on Electromagnetic Environmental Effects, and was supported in part by grant number FD-U-00005-12 from the Food and Drug Administration. The opinions and statements expressed in this publication are those of the authors and are not necessarily the opinions or positions of CRCPD, the Food and Drug Administration, the Nuclear Regulatory Commission, or the Environmental Protection Agency.

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