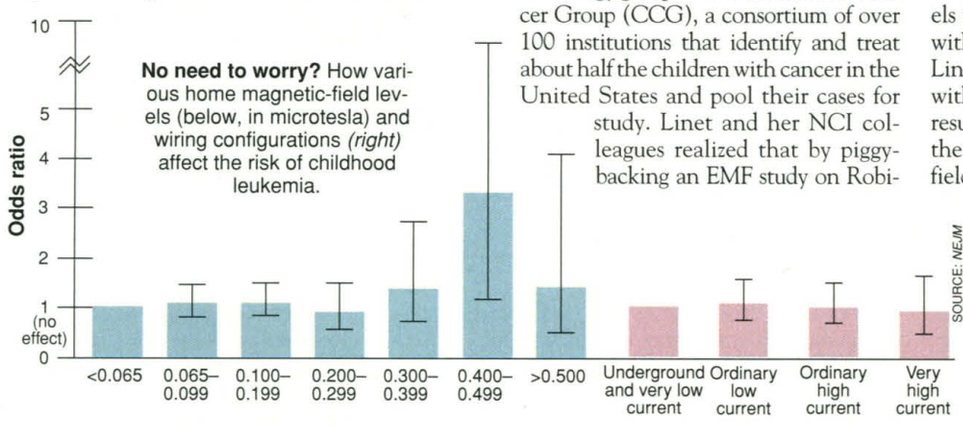
PUBLIC HEALTH

Magnetic Field–Cancer Link: Will It Rest in Peace?

It could be the obituary. For 18 years, researchers have explored the question of whether low-frequency electromagnetic fields (EMFs) can cause cancer. But they have neither come up with solid support for the hypothesis, nor managed to put it to rest. This week, a team led by epidemiologists Martha Linet of the National Cancer Institute (NCI) and Leslie Robison of the University of Minnesota, Minneapolis, reported the results of the most carefully controlled study yet: a $5 million, 5-year investigation into the possible link between magnetic-field exposure and childhood leukemia. "The results are very clear," says Robison. "They're negative."

The study, which appeared in the 3 July issue of *The New England Journal of Medicine* (*NEJM*), could mark the end of a trail that researchers began following in 1979, with the first suggestions of a link between residential exposure to high EMFs and childhood leukemia. Since then, a series of studies has turned up vague epidemiologic associations between EMFs from various sources and everything from leukemia to breast cancer to brain cancer. A series of expert reviews—the latest being a National Research Council (NRC) study of residential EMFs released last year—has concluded that there is little evidence to support most of these claims (*Science*, 8 November 1996, p. 910). But a weak positive association between childhood leukemia and certain home wiring configurations has refused to go away.



No need to worry? How various home magnetic-field levels (below, in microtesla) and wiring configurations *(right)* affect the risk of childhood leukemia.

With the new study, it might—at least for most scientists. "The study will be less easily criticized than previous studies, simply because it was conducted so carefully," says Lawrence Fischer, a toxicologist at Michigan State University in East Lansing and chair of the study's advisory group. David Savitz of the University of North Carolina, a member of the NRC panel and the author of a study that had linked wiring configurations to childhood leukemia, describes the study as "quite impressive ... a massive undertaking." He says, "This will certainly be interpreted as a negative bottom line." The researchers measured residential EMFs directly as well as inferring them from wiring codes, the strategy that had led to positive results in the past. They also enrolled childhood leukemia cases immediately after diagnosis rather than years later, when EMF exposure at the time of the disease's onset may be hard to assess.

The study was launched at the behest of Congress in the late 1980s. While still in the planning stage, says Linet, the NCI received a proposal from Robison and his colleagues to take a comprehensive look at risk factors for acute lymphoblastic leukemia (ALL), which accounts for 80% of all childhood leukemias. Robison chairs the epidemiology and cancer-control strategy group for the Childhood Cancer Group (CCG), a consortium of over 100 institutions that identify and treat about half the children with cancer in the United States and pool their cases for study. Linet and her NCI colleagues realized that by piggybacking an EMF study on Robison's project, they could take advantage of the CCG's infrastructure and cases.

The other advantage of working with the CCG was that the researchers would be notified of eligible cases within several days of diagnosis. "So interviews and contacting families could be done in a relatively expedient way," says Robison. The EMF subgroup of the ALL study eventually collected 638 children with childhood leukemia and 620 matched controls in nine midwestern and mid-Atlantic states and assessed their EMF exposures.

In doing so, they hoped to avoid some of the weaknesses of previous studies. Three U.S. studies that had reported an association between childhood leukemia and EMFs had relied on local wiring configurations—in particular, the thickness of the wires going into the houses and the distance from the houses to nearby power lines—as a surrogate for actual field strengths. Those studies, as well as others, had found no cancer-EMF link when they actually measured the field strengths inside the children's houses. But these direct measurements were open to criticism because they were made years after diagnosis.

To learn the best way of assessing residential EMF exposure, the NCI team did a preliminary study in which they had 30 children wear 24-hour dosimeters "about the size of a beeper," says Linet. "[They were] put on children in pouches tied with thick plastic ties that the kids couldn't undo." The dosimeters monitored the children's exposure to EMFs in their homes, schools, and day-care centers—data that guided the team in designing its measurements. "We wanted to make sure that area measurements would reflect children's actual personal exposures," says Linet. During the study itself, the NCI team measured field strengths in each child's bedroom over 24 hours and made spot measurements in the kitchen, the family room, and the room where the mother had slept during her pregnancy.

Comparing the EMF exposure of the cases and controls, the researchers found no association between an increased risk of childhood leukemia and magnetic fields of 0.2 microtesla (mT) or more, which were the levels that previous investigators had associated with the cancer. The researchers did find what Linet calls a "hint" of an association in homes with field strengths of 0.4 to 0.499 mT—a result Savitz calls "not flatly negative." But the numbers of cases and controls at those field strengths were small—just 14 and 5 respectively. "The study was not designed to address the question of leukemia risk ... at the very highest EMF levels," says Robison. Above 0.5 mT, in any case, the hint vanished.

Perhaps most important, points out Harvard School of Public Health epidemiologist Dimitrios Trichopoulos, the study also looked for a link between wiring configuration—the EMF proxy that previous positive studies had relied on—and the risk of ALL. While the wiring codes turned out to be reasonably good estimators of actual EMF exposure, they showed no association whatsoever to ALL—"Nada," says Trichopoulos. "Flatly negative," agrees Savitz.

The results, *NEJM* Deputy Editor Edward Campion says in an accompanying editorial, suggest it is time to "stop wasting our research resources" on the EMF-cancer question. Those familiar with the emotional tenor of the issue, however, are not sanguine that the study will convince the public at large. As Fischer puts it, "Many people, when they hear the result, will think, 'This can't be right.' " But, he adds, "they will think that not on any scientific basis, but because of their emotional involvement with the disease."

–Gary Taubes