

Link between electromagnetic fields and childhood cancer unresolved

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The long-awaited UK Childhood Cancer Study (UKCCS) on exposure to power-frequency magnetic fields and risk of childhood cancer published in today's *Lancet* does not support the hypothesis that exposure to magnetic fields, associated with the use or transmission of electricity in the UK, increases the risk of childhood leukaemia, central nervous system tumours, or any other childhood cancer.

Reviews of epidemiological studies conducted by the US National Research Council,¹ WHO,² and the National Institute of Environmental Health Sciences (NIEHS)³ have suggested that there is a weak link between exposure to power-frequency magnetic fields and childhood leukaemia, with an odds ratio of about 1.5. Using the International Agency for Research on Cancer criteria for classifying potential carcinogens, an international working group convened by the NIEHS³ rated exposure to power-frequency fields as a category 2B, a possible human carcinogen.

WHO, through its International EMF Project, has been promoting research that attempts to address this 2B classification. From WHO's viewpoint, although the UKCCS is very large and well conducted, it is not the "definitive" study many scientists have been hoping for.

The first reason is that this study was designed many years ago, so the exposure assessment relies on time-weighted average (TWA) fields. TWA has been used in many studies but does not relate to any known mechanism of action of low-frequency fields in tissues. A recent WHO report⁴ recommends that, although TWA should continue to be used in future epidemiological studies for comparison purposes, other measures that relate to known mechanisms should also be included in the exposure-assessment protocol. Key among these measures is an assessment of any rapid changes in the magnetic field (transients) that occur when appliances are used, and in transients from distribution lines. Currents induced by power transients can produce signals in cells above the cell's normal electrical-noise levels.⁵

The second reason why the study is not definitive is the low numbers of children in the higher exposure categories. As the UKCCS investigators state, only 2.3% of their controls had been exposed to magnetic fields over 0.2 μ T. Although this percentage is similar to that in Germany (2%),⁶ in the US study⁷ it was 11.4% and in the Canadian study⁸ 15.4%. This difference reflects, in part, the line voltage in North America of about 110 V, and in Europe of 220 V. Thus for the same power consumption North Americans use twice as much current as Europeans

do, and so are exposed to about double the magnetic-field strength. Another factor influencing the level of magnetic-field exposure between the two continents relates to how the power is distributed—for example, how electrical wiring is configured in homes and how the currents are earthed. Whatever the explanation, the small numbers in the higher exposure categories mean that the UKCCS provide evidence only for exposures of up to 0.2 μ T.

The third reason is that the small numbers of cases and controls in the higher exposure categories are unlikely to significantly affect the results of previous meta-analyses and reviews suggesting a weak link between power-frequency magnetic-field exposure and childhood leukaemia.¹⁻³ An analysis, funded by the European Union, which includes the UKCCS, is near completion.

Today's *Lancet* also carries a research letter reporting some new data from a previously published New Zealand study.⁹ However, the study has the same inadequacies as the UKCCS.

A major childhood leukaemia study is being done by Japan's National Institute of Environmental Studies. This study will take account of transients in the assessment of exposure to magnetic fields. 1500 cases (1000 leukaemia and 500 brain tumours) and a similar number of matching controls will be recruited. Because Japan is highly industrialised, the study is expected to have large numbers in the high-exposure groups. This study, in conjunction with those being done in Germany and Italy, may be one of the last hopes of finally resolving the vexing issue of whether there is truly an increased risk of childhood cancer from exposure to magnetic fields or whether the weak association is occurring by chance.

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- 1 National Research Council. Possible health effects of exposure to residential electric and magnetic fields. National Research Council, Washington: National Academy Press, 1996.
- 2 Repacholi MH, Greenebaum B. Interaction of static and extremely low frequency electric and magnetic fields with living systems: health effects and research needs. *Bioelectromagnetics* 1999; **20**: 133-60.
- 3 Portier CJ, Wolfe MS (eds). National Institute of Environmental Health Sciences Working Group Report. Assessment of health effects from exposure to power-line frequency electric and magnetic fields (NIH publication no. 98-3981). Research Triangle Park: NIEHS, 1998.
- 4 McKinlay AF, Repacholi MH, eds. Exposure metrics and dosimetry for EMF epidemiology: Proceedings of an International Workshop held at the National Radiological Protection Board, Chilton, UK, Sept 7-9, 1998. *Radiation Protection Dosimetry* 1999; **83** (1-2): 1-194.
- 5 Electric Power Research Institute. Residential transient magnetic field research: interim report, project RP2966-07 (report TR-103470). Palo