

Childhood leukaemia and electromagnetic radiation – a review of epidemiological studies

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Risk factors for childhood leukaemia are largely unknown. The only established external risk factor is ionizing radiation. For quite a number of other environmental factors it has been hypothesized that they might play a role in the origin or development of the disease and a substantial number of such hypotheses have been tested epidemiologically. While increased disease risks have been seen for several of these exposures, the results have not been consistent enough for firm conclusions about causality to be drawn. The exposures that have been looked at have concerned exposure to the child itself, exposure in utero, and also maternal and even paternal prenatal exposure, but findings have been inconclusive regardless of exposure circumstances.

One exposure that has attracted considerable interest during the last couple of decades is electromagnetic radiation. This interest was originally focused on so called power frequency magnetic fields, or extremely low frequency fields (ELF). Later also other frequencies have been implicated, and with the advent of mobile telephony the focus has shifted towards radio frequency fields (RF).

ELF fields are generated during production, transmission, distribution, and usage of electric power and are thus ubiquitous in modern society. ELF fields interact with the human body through the induction of electric currents. It is well established that strong currents can be harmful via effects on the nervous system. However, the fields that one encounters in the general environment are typically several orders of magnitude below the fields that are known to produce harmful internal currents. For a review, refer to Ahlbom et al. (2001)

Despite this epidemiologic studies have rather consistently found associations between elevated exposure to ELF and risk of childhood leukaemia. This research began in 1979 with the publication of an American study that investigated childhood cancer mortality and that used power lines near the homes as markers for ELF exposure (Wertheimer & Leeper 1979). The power lines were classified in wire code categories based on distance to the home and presumed amount of current flowing through the line. This original study has been followed by more than a dozen studies, largely of increasing quality. These studies have to a great extent confirmed the findings of the first study, perhaps to the surprise of many. Two major meta-analyses have been published that used somewhat different designs, but nevertheless came to rather similar results in that they both confirm that the studies taken together do suggest that exposure to elevated ELF fields increase the risk of childhood leukaemia (Ahlbom et al 2000; Greenland et al. 2000). However, in both articles the authors draw careful conclusions.

While various hypotheses about mechanisms of interaction with the human body are currently being tested, the only established mechanism to date is the induction of currents; this, however, seems unlikely to explain the epidemiological results. This makes a firm causal conclusion difficult to draw. However, epidemiologists have carefully looked at other

explanations as well, such as confounding and selection bias, but without success. To take the issue further it would be useful to know more about the characteristics of the exposure-disease association. Questions that come to mind include effect modifications by age and gender, importance of exposure during pregnancy versus during after birth, and of course what aspects of the exposure that appears to have an effect. Unfortunately, available data are too sparse for meaningful analysis of most of these questions.

This situation is intriguing with rather strong and consistent epidemiological data suggesting an effect of ELF on childhood leukaemia risk but few suggestions as for how such an association can be explained. It is possible that in order to improve the understanding of this, one will have to wait for a better general knowledge about childhood leukaemia aetiology.

RF fields are used in telecommunications and exposure has increased in parallel with the surge of mobile phone use. The established mechanism for interaction between RF exposure and humans is heating. While exposure standards are designed to protect from harmful effects of heating, the phones may be operating on power levels yielding exposure near the exposure standards.

To date there are no studies on leukaemia, or other disease, risks in children in relation to mobile phone use. The only available data on RF exposure in relation to disease risk in children are from studies on people living near radio and TV antennas. These studies have mainly focused on adults but in some instances reported also on children. However, the numbers referring to children in these studies are too low for meaningful interpretations. Even though there is to date no strong background on which to build a hypothesis about RF exposure and childhood cancer, this is an area of great concern. This is for example expressed in the so called Stewart report commissioned by the UK Department of Health, which cautions against mobile phone use in children (IEGMP 2000).

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