

# Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the third trimester of 2010

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## 1. Reviews

**RISK ANALYSIS OF HUMAN EXPOSURE TO ELECTROMAGNETIC FIELDS**  
European Health Risk Assessment Network on Electromagnetic Fields  
Exposure  
[http://efhran.polimi.it/docs/EFHRAN\\_D2\\_final.pdf](http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf)

For none of the diseases is there sufficient evidence for a causal association between exposure to low frequency fields and the risk of the respective disease.

There is limited evidence for an association between magnetic fields and the risk of leukaemia in children. This evaluation reflects the current state of knowledge that epidemiological studies have shown an association between residential exposures to power frequency magnetic fields at above approximately 0.3/0.4  $\mu\text{T}$  and a two-fold risk of childhood leukaemia with some degree of consistency, but the observed association alone is not sufficient to conclude a causal relationship.

There is inadequate evidence with respect to several diseases, however, the reasons for these evaluations are varying. For Alzheimer's Disease the evidence is suggestive; however compared to the childhood leukaemia case, the studies are fewer and less consistent. As recent, methodologically superior studies suggest an association, there is ample justification to demand further studies into this topic. The situation is similar for childhood brain tumours, where awaited results of an ongoing pooled analysis may make a re-evaluation necessary.

Amyotrophic lateral sclerosis is a third outcome for which there is some indication of an elevated risk, but data are not consistent enough to conclude limited evidence.

For brain tumours in adults, it appears that more recent studies rather suggest a lack of an effect, but due to positive findings in some studies the classification of inadequate evidence remains.

For all other cancers, other neurodegenerative diseases and for subjective symptoms, the classification of inadequate evidence displays rather lack of data. However, due to the weak biological plausibility there appears to be no emerging demand to conduct further studies.

There is lack of evidence for breast cancer and cardiovascular disease. For breast cancer, there were no new studies, but as there were already a large number of studies available at the time of the previous evaluations, this assessment is quite robust. For cardiovascular disease there was one new study confirming the absence of an association.

There is continuing debate about whether non-specific symptoms may be caused by exposure to ELF fields, and whether some individuals show increased sensitivity to exposure, commonly termed electrical hypersensitivity (EHS). As this is a long-lasting discussion with a series of failures to demonstrate EHS, the overall evaluation suggests a lack of effect. Given the uncertainty regarding the role played by EMF in

the etiology of this condition, the World Health Organization (WHO) has proposed that EHS should be better termed Idiopathic Environmental Intolerance with attribution to EMF.

**EXPOSURE TO ELECTROMAGNETIC FIELDS (NON-IONIZING RADIATION) AND ITS RELATIONSHIP WITH CHILDHOOD LEUKEMIA: A SYSTEMATIC REVIEW.**

Calvente I, Fernandez MF, Villalba J, Olea N, Nuñez MI.

*Sci Total Environ.* 2010; 408: 3062-3069.

Childhood exposure to physical contamination, including non-ionizing radiation, has been implicated in numerous diseases, raising concerns about the widespread and increasing sources of exposure to this type of radiation. The primary objective of this review was to analyze the current state of knowledge on the association between environmental exposure to non-ionizing radiation and the risk of childhood leukemia. Scientific publications between 1979 and 2008 that include examination of this association have been reviewed using the MEDLINE/PubMed database. Studies to date have not convincingly confirmed or ruled out an association between non-ionizing radiation and the risk of childhood leukemia. Discrepancies among the conclusions of the studies may also be influenced by confounding factors, selection bias, and misclassification. Childhood defects can result from genetic or epigenetic damage and from effects on the embryo or fetus, which may both be related to environmental exposure of the parent before conception or during the pregnancy. It is therefore critical for researchers to define a priori the type and "window" of exposure to be assessed. Methodological problems to be solved include the proper diagnostic classification of individuals and the estimated exposure to non-ionizing radiation, which may act through various mechanisms of action.

**EXTREMELY LOW-FREQUENCY ELECTROMAGNETIC FIELDS EXPOSURE AND FEMALE BREAST CANCER RISK: A META-ANALYSIS BASED ON 24,338 CASES AND 60,628 CONTROLS.**

Chen C, Ma X, Zhong M, Yu Z.

*Breast Cancer Res Treat.* 2010; 123: 569-576.

Exposure to extremely low-frequency electromagnetic fields (ELF-EMF) has been suggested to increase female breast cancer risk; however, the data have been inconclusive. In order to derive a more precise estimation of the relationship, a meta-analysis was performed. Medline, PubMed, Embase, the Cochrane Library and Web of Science were searched. Crude ORs with 95% CIs were used to assess the strength of association between ELF-EMF exposure and female breast cancer risk. A total of 15 studies published over the period 2000 to 2009 including 24,338 cases and 60,628 controls were involved in this meta-analysis. The results showed no significant association between ELF-EMF exposure and female breast cancer risk in total analysis (OR = 0.988, 95% CI = 0.898-1.088) and in all the subgroup analyses by exposure modes, menopausal status, and estrogen receptor status. This result is in accordance with the previous meta-analysis carried out by Erren in 2000.

Conclusion: This meta-analysis suggests that ELF-EMF exposure has no association with the susceptibility of female breast cancer.

**"DIRTY ELECTRICITY": WHAT, WHERE, AND SHOULD WE CARE?**

de Vocht F.

*J Expo Sci Environ Epidemiol.* 2010; 20: 399-405.

Environmental exposure to high-frequency voltage transients (HFVT), also termed dirty electricity, has been advocated among electro(hyper)sensitive interest groups as an

important biological active component of standard electromagnetic pollution. A literature search was conducted in PubMed, in which only seven articles were identified. Exposure to HFVT was associated with increased cancer risks, while preferential removal of 4-100 kHz HFVT from 50-60 Hz ELF circuits was linked to a variety of improvements in health (plasma glucose levels in diabetic patients, symptoms of multiple sclerosis, asthma and other respiratory illnesses, and insomnia), well-being (tiredness, frustration, general health, irritation, sense of satisfaction, mood), and student behavior. However, all these published studies were subject to significant methodological flaws in the design of the studies, the assessment of exposure, and the statistical analysis, which prevented valid assessment of a causal link between this exposure metric and adverse effects.

Conclusion: Environmental exposure to HFVT is an interesting EMF exposure metric, which might explain the spurious results from epidemiological studies using 'standard' ELF and RF exposure metrics. However, at present, methodological problems in published studies prohibit the valid assessment of its biological activity.

## **2. Human experiment**

**POLLUTED PLACES OR POLLUTED MINDS? AN EXPERIMENTAL SHAM-EXPOSURE STUDY ON BACKGROUND PSYCHOLOGICAL FACTORS OF SYMPTOM FORMATION IN 'IDIOPATHIC ENVIRONMENTAL INTOLERANCE ATTRIBUTED TO ELECTROMAGNETIC FIELDS'.**

SZEMERSZKY R, KÖTELES F, LIHI R, BÁRDOS G.  
*Int J Hyg Environ Health.* 2010; 213: 387-394.

'Idiopathic Environmental Intolerance attributed to electromagnetic fields' (IEI-EMF) refers to the perception of subjective symptoms during or following EMF exposure. IEI-EMF has become disproved to be a mostly biologic entity by now, and evidences accumulate to support the role of placebo effect in the phenomenon. The two aims of this study were to demonstrate the significant role of the placebo effect in physical symptoms reported at 50Hz frequency of EMF exposure, as well as to explore some psychological factors which may predispose to IEI-EMF.

A total of 40 volunteer university students have completed a battery of psychological questionnaires (expectations; IEI-EMF; state anxiety - STAI-S; dispositional optimism - LOT-R; somatisation - PHQ-15; somatosensory amplification - SSAS) before, and checklists of physical symptoms during sham exposure to "weak" and "strong" EMFs, respectively. Participants were also asked about the extent to which they had perceived the presence of the presumed EMF.

Participants with higher IEI-EMF scores expected and experienced more symptoms. Suggestion of stronger EMF exposure resulted in larger symptom scores and enhanced EMF-perception as compared to the presumed weaker exposure. Experienced symptom scores were predicted primarily by somatisation scores, whereas self-rating of IEI-EMF was predicted by somatosensory amplification scores.

Conclusion: The results confirm that there is considerable placebo effect in symptom reports related to 50Hz frequency EMFs. IEI-EMF seems to be formed through a vicious circle of psychosocial factors, such as enhanced perception of risk and expectations, self-monitoring, somatisation and somatosensory amplification, causalization and misattribution.

### **3. Exposure assessment**

#### **MEASUREMENT AND ANALYSIS OF ELECTROMAGNETIC FIELDS FROM TRAMS, TRAINS AND HYBRID CARS.**

Halgamuge MN, Abeyrathne CD, Mendis P.

*Radiat Prot Dosimetry. 2010; 141: 255-268.*

Electricity is used substantially and sources of electric and magnetic fields are, unavoidably, everywhere. The transportation system is a source of these fields, to which a large proportion of the population is exposed. Hence, investigation of the effects of long-term exposure of the general public to low-frequency electromagnetic fields caused by the transportation system is critically important. In this study, measurements of electric and magnetic fields emitted from Australian trams, trains and hybrid cars were investigated. These measurements were carried out under different conditions, locations, and are summarised in this article. A few of the measured electric and magnetic field strengths were significantly lower than those found in prior studies. These results seem to be compatible with the evidence of the laboratory studies on the biological effects that are found in the literature, although they are far lower than international levels, such as those set up in the International Commission on Non-Ionising Radiation Protection guidelines.

### **4. Leukaemia studies**

#### **CHILDHOOD LEUKAEMIA AND PARENTAL OCCUPATIONAL EXPOSURE TO PESTICIDES: A SYSTEMATIC REVIEW AND META-ANALYSIS.**

Van Maele-Fabry G, Lantin AC, Hoet P, Lison D.

*Cancer Causes Control. 2010; 21: 787-809.*

The objective of this study was to conduct a systematic review and meta-analysis of published studies on the association between parental occupational exposure to pesticides and childhood leukaemia.

Studies were identified from a MEDLINE search through 31 July 2009 and from the reference lists of identified publications. Relative risk (RR) estimates were extracted from 25 studies published between 1985 and 2008. Meta-rate ratio estimates (mRR) were calculated according to fixed and random-effect meta-analysis models. Separate analyses were conducted after stratification for study design, definition of exposure (employment in a farm/agriculture assuming exposure to pesticides versus exposure to pesticides stipulated), exposed parent, window of exposure, type of leukaemia and biocide category.

No statistically significant association between childhood leukaemia and parental occupation as farmers/agricultural workers was observed. When exposure to pesticides was stipulated, positive associations were reported for maternal exposure for all studies combined (mRR: 1.62; 95% CI: 1.22-2.16), in all exposure windows considered and for acute non-lymphocytic leukaemia (ANLL). There was no association with paternal exposure when combining all studies (mRR: 1.14; 95% CI: 0.76-1.69). However, significant increased risks were seen for paternal exposure, in some exposure windows as well as for the biocide category.

Conclusion: The strongest evidence of an increased risk of childhood leukaemia comes from studies with maternal occupational exposure to pesticides. The associations with paternal exposure were weaker and less consistent. These results add to the evidence leading to recommend minimizing parental occupational exposure to pesticides. These findings also support the need to rely more on studies that clearly stipulate exposure to pesticides rather than those that assume pesticide exposure because of farm/agriculture employment.