

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

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1. Reviews

EFFECTS OF EXTREMELY LOW-FREQUENCY MAGNETIC FIELD EXPOSURE ON COGNITIVE FUNCTIONS: RESULTS OF A META-ANALYSIS.

Barth A, Ponocny I, Ponocny-Seliger E, Vana N, Winker R.
Bioelectromagnetics. 2010; 31: 173-179.

There is extensive literature on possible effects of extremely low-frequency magnetic fields (ELF-MFs) on human cognitive functions. However, due to methodological deficits (e.g., low statistical power, small sample sizes) findings have been inconsistent. In the current study the authors try to overcome these problems by carrying out a meta-analysis. Literature research revealed 17 studies. Nine of these were included in the meta-analysis because they fulfilled minimum requirements (e.g., at least single-blind experimental study design and documentation of means and standard deviation of the dependent variables). All of the studies used a 50 Hz magnetic field exposure. Small but significant effect sizes could be detected in two cognitive dimensions: in the hard level of visual duration discrimination, task-exposed subjects performed better than controls; at the intermediate level however, exposed subjects performed worse. Additionally, a significant improvement of correct responses was observed in the dimension of "flexibility" under exposure. However, due to the small number of studies per performance dimensions and the resulting instability of estimates, these findings have to be treated with extreme caution.

Conclusion: Taken together, the results of the meta-analysis provide little evidence that ELF-MFs have any effects on cognitive functions.

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.

2. Environmental exposure

ENVIRONMENTAL JUSTICE: A CONTRARY FINDING FOR THE CASE OF HIGH-VOLTAGE ELECTRIC POWER TRANSMISSION LINES.

Wartenberg D, Greenberg MR, Harris G.

J Expo Sci Environ Epidemiol. 2010; 20: 237-244.

Environmental justice is the consideration of whether minority and/or lower-income residents in a geographic area are likely to have disproportionately higher exposures to environmental toxins than those living elsewhere. Such situations have been identified for a variety of factors, such as air pollution, hazardous waste, water quality, noise, residential crowding, and housing quality. This study investigates the application of this concept to high-voltage electric power transmission lines (HVTL), which some perceive as a health risk because of the magnetic fields they generate, and also as esthetically displeasing. The authors mapped all 345 kV and higher voltage HVTL in New York State and extracted and summarized proximate US Census socio-demographic and housing characteristic data into four categories on the basis of distances from HVTL. Contrary to their expectation, people living within 2000 ft from HVTL were more likely to be exposed to magnetic fields, white, of higher income, more educated and home owners, than those living farther away, particularly in urban areas. Possible explanations for these patterns include the desire for the open space created by the rights-of-way, the preference for new homes/subdivisions that are often located near HVTL, and moving closer to HVTL before EMFs were considered a risk.

Conclusion: This study suggests that environmental justice may not apply to all environmental risk factors and that one must be cautious in generalizing. In addition, it shows the utility of geographical information system methodology for summarizing information from extremely large populations, often a challenge in epidemiology.

3. Human experiment

THE CARDIOVASCULAR RESPONSE TO AN ACUTE 1800-MICROT, 60-HZ MAGNETIC FIELD EXPOSURE IN HUMANS.

McNamee DA, Corbacio M, Weller JK, Brown S, Prato FS, Thomas AW, Legros AG.

Int Arch Occup Environ Health. 2010; 83: 441-454.

Previously published literature has suggested an effect of extremely low-frequency (ELF) magnetic fields (MF) on human heart rate (HR) and heart rate variability (HRV). The combined response of the microcirculation and macrocirculation to ELF MF exposure has not previously been studied in humans. This study investigated the effects of 1-h exposure to an 1800 μ T, 60-Hz MF on human microcirculation (represented in this study as skin blood perfusion), HR, low-frequency HRV, and high-frequency HRV. Fifty-eight volunteers were recruited to partake in a double-blinded, counterbalanced study consisting of two testing sessions (real and sham) administered on separate days. Each session included four consecutive blocks of measurements, separated by 15-min rest periods, allowing measurement of cumulative and residual MF effects. Within subjects, ANOVA were conducted on each

of the measured parameters. A decrease of skin blood perfusion and HR, and an increase of HRV were observed over blocks ($p < 0.05$). No session by block interactions were found for any of the cardiovascular parameters which would have suggested a MF effect ($p > 0.05$). A session by block interaction ($p < 0.001$) and a MF order effect (sham or real exposure first, $p < 0.05$) were observed for skin surface temperature.

Conclusions: The MF used in this experiment did not affect cardiovascular parameters. Although an alternative explanation for why skin surface temperatures decreased in the sham and not in the real exposure condition is presented, the possibility of a MF effect cannot be excluded.

4. Exposure assessment

OCCUPATIONAL EXPOSURE TO ELECTRIC AND MAGNETIC FIELDS DURING WORK TASKS AT 110 KV SUBSTATIONS IN THE TAMPERE REGION.

Korpinen LH, Pääkkönen RJ.

Bioelectromagnetics. 2010; 31: 252-254.

The occupational exposure to electric and magnetic fields during various work tasks at seven 110 kV substations in Finland's Tampere region was studied. The aim was to investigate if the action values (10 kV/m for the E-field and 500 microT for the B-field) of the EU Directive 2004/40/EC were exceeded. Electric and magnetic fields were measured during the following work tasks: (1) walking or operating devices on the ground; (2) working from a service platform; (3) working around the power transformer on the ground or using a ladder; and (4) changing a bulb from a man hoist. In work task 2 "working from a service platform" the measured electric field (maximum value 16.6 kV/m) exceeded 10 kV/m in three cases. In the future it is important to study if the limit value (10 mA/m(2)) of Directive 2004/40/EC is exceeded at 110 kV substations. The occupational 500 microT action value of the magnetic flux density field (B-field) was not exceeded in any working situation.

5. Leukaemia studies

A META-ANALYSIS OF THE ASSOCIATION BETWEEN DAY-CARE ATTENDANCE AND CHILDHOOD ACUTE LYMPHOBLASTIC LEUKAEMIA.

Urayama KY, Buffler PA, Gallagher ER, Ayoob JM, Ma X.

Int J Epidemiol. 2010; 39: 718-732.

Childhood acute lymphoblastic leukaemia (ALL) may be the result of a rare response to common infection(s) acquired by personal contact with infected individuals. A meta-analysis was conducted to examine the relationship between day-care attendance and risk of childhood ALL, specifically to address whether early-life exposure to infection is protective against ALL. Searches of the PubMed database and bibliographies of publications on childhood leukaemia and infections were conducted. Observational studies of any size or location and published in English resulted in the inclusion of 14 case-control studies. The combined odds ratio (OR) based on the random effects model indicated that day-care attendance is associated with a reduced risk of ALL [OR = 0.76, 95% confidence interval (CI): 0.67, 0.87]. In subgroup analyses evaluating the influence of timing of exposure, a similarly reduced effect was observed for both day-care attendance occurring early in life (< or =2 years of age) (OR = 0.79, 95% CI: 0.65, 0.95) and day-care attendance with unspecified timing (anytime prior to diagnosis) (OR = 0.81, 95% CI: 0.70, 0.94). Similar findings were observed with seven

studies in which common ALL were analysed separately. The reduced risk estimates persisted in sensitivity analyses that examined the sources of study heterogeneity.

Conclusions: This analysis provides strong support for an association between exposure to common infections in early childhood and a reduced risk of ALL. Implications of a 'hygiene'-related aetiology suggest that some form of prophylactic intervention in infancy may be possible.

THE ASSOCIATION BETWEEN ATOPY AND CHILDHOOD/ADOLESCENT LEUKEMIA: A META-ANALYSIS.

Linabery AM, Jurek AM, Duval S, Ross JA.

Am J Epidemiol. 2010; 171: 749-764.

Atopic disease is hypothesized to be protective against several malignancies, including childhood/adolescent leukemia. To summarize the available epidemiologic evidence, the authors performed a meta-analysis of associations between atopy/allergies, asthma, eczema, hay fever, and hives and childhood/adolescent leukemia, acute lymphoblastic leukemia (ALL), and acute myeloid leukemia (AML). They searched MEDLINE literature (1952-March 2009) and queried international experts to identify eligible studies. Ten case-control studies were included. Summary odds ratios and 95% confidence intervals were computed via random-effects models. Odds ratios for atopy/allergies were 1.42 (95% confidence interval (CI): 0.60, 3.35) for 3 studies of leukemia overall, 0.69 (95% CI: 0.54, 0.89) for 6 studies of ALL, and 0.87 (95% CI: 0.62, 1.22) for 2 studies of AML, with high levels of heterogeneity detected for leukemia overall and ALL. Inverse associations were observed for ALL and asthma (odds ratio (OR) = 0.79, 95% CI: 0.61, 1.02), eczema (OR = 0.74, 95% CI: 0.58, 0.96), and hay fever (OR = 0.55, 95% CI: 0.46, 0.66) examined separately. Odds ratios for ALL differed by study design, exposure data source, and latency period, indicating that these factors affect study results. These results should be interpreted cautiously given the modest number of studies, substantial heterogeneity, and potential exposure misclassification but are useful in designing future research.

MATERNAL FOLATE AND OTHER VITAMIN SUPPLEMENTATION DURING PREGNANCY AND RISK OF ACUTE LYMPHOBLASTIC LEUKEMIA IN THE OFFSPRING.

Milne E, Royle JA, Miller M, Bower C, de Klerk NH, Bailey HD, van Bockxmeer F, Attia J, Scott RJ, Norris MD, Haber M, Thompson JR, Fritschi L, Marshall GM, Armstrong BK.

Int J Cancer. 2010; 1; 126 : 2690-2699.

The Australian Study of Causes of Acute Lymphoblastic Leukemia in Children (Aus-ALL) was designed to test the hypothesis, raised by a previous Western Australian study, that maternal folic acid supplementation during pregnancy might reduce the risk of childhood acute lymphoblastic leukemia (ALL). Aus-ALL was a national, population-based, multicenter case-control study that prospectively recruited 416 cases and 1,361 controls between 2003 and 2007. Detailed information was collected about maternal use of folic acid and other vitamin supplements before and during the index pregnancy. Data were analyzed using logistic regression, adjusting for matching factors and potential confounders. A meta-analysis with the results of previous studies of folic acid supplementation was also conducted. The authors found weak evidence of a protective effect of maternal folate supplementation before pregnancy against risk of childhood ALL, but no evidence for a protective effect of its use during pregnancy. A meta-analysis including this and 2 other studies, but not the study that raised the hypothesis, also found little evidence that folate supplementation during pregnancy protects against ALL: the summary odds ratios (ORs) for folate supplementation were 1.06 [95% confidence

interval (CI): 0.77-1.48] with reference to no folate supplementation and 1.02 (95% CI: 0.86-1.20) with reference to no vitamin supplementation. For vitamin supplementation in general, the summary OR from a meta-analysis of 5 studies-including Aus-ALL-was 0.83 (95% CI: 0.73-0.94).

Conclusion: Vitamin supplementation in pregnancy may protect against childhood ALL, but this effect is unlikely to be large or, if real, specifically due to folate.