

Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the second trimester of 2013

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1. Residential exposure

CHILDHOOD LEUKAEMIA CLOSE TO HIGH-VOLTAGE POWER LINES--THE GEOCAP STUDY, 2002-2007.

Sermage-Faure C, Demoury C, Rudant J, Goujon-Bellec S, Guyot-Goubin A, Deschamps F, Hemon D, Clavel J.

Br J Cancer. 2013; 108(9): 1899-1906.

This study was carried out to test the hypothesis of an increased acute leukaemia (AL) incidence in children living close to high voltage overhead power lines (HVOL) of 225-400 kV (VHV-HVOL) and 63-150 kV (HV-HVOL).

The nationwide Geocap study included all the 2779 cases of childhood AL diagnosed in France over 2002-2007 and 30 000 contemporaneous population controls. The addresses at the time of inclusion were geocoded and precisely located around the whole HVOL network.

Increased odds ratios (ORs) were observed for AL occurrence and living within 50 m of a VHV-HVOL (OR=1.7 (0.9-3.6)). In contrast, there was no association with living beyond that distance from a VHV-HVOL or within 50 m of a HV-HVOL.

Conclusion: The present study, free from any participation bias, supports the previous international findings of an increase in AL incidence close to VHV-HVOL. In order to investigate for a potential role of ELF-MF in the results, ELF-MF at the residences close to HVOL are to be estimated, using models based on the annual current loads and local characteristics of the lines.

THE EFFECT OF EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELDS ON PREGNANCY AND FETAL GROWTH, AND DEVELOPMENT.

Mahram M, Ghazavi M.

Arch Iran Med. 2013; 16(4): 221-224.

Exposure to electromagnetic fields (EMFs) and its effects at different frequencies on living beings has been investigated for decades. However, there are fewer studies that have been conducted on humans, thus this study aims to determine the effect of extremely low frequency (ELF)-EMFs on pregnancy, fetal growth and development in humans.

In this epidemiologic analytical cohort study, cases included pregnant women and their newborns. There were 222 women exposed to ELF-EMFs from high voltage electricity towers and cables during pregnancy and 158 women who had no exposure during pregnancy. Data that included pregnancy duration, neonatal birth weight, length, head circumference, gender and congenital malformations were collected through direct questions, measurements and referral to the registered data of related hospital or health

center documents. Collected data was analyzed by SPSS-16. $P < 0.05$ was considered significant.

No significant difference was found in pregnancy duration and preterm labor, neonatal birth weight, length, head circumference and congenital malformations in the two studied groups.

Conclusion: The results of this study show no significant effects of ELF-EMFs on human pregnancy, fetal growth and development.

RESIDENTIAL DISTANCE TO HIGH-VOLTAGE POWER LINES AND RISK OF NEURODEGENERATIVE DISEASES: A DANISH POPULATION-BASED CASE-CONTROL STUDY.

Frei P, Poulsen AH, Mezei G, Pedersen C, Cronberg Salem L, Johansen C, Rööslı M, Schüz J.

Am J Epidemiol. 2013; 177(9): 970-978.

The aim of this study was to investigate the possible association between residential distance to high-voltage power lines and neurodegenerative diseases, especially Alzheimer's disease. A Swiss study previously found increased risk of Alzheimer's disease for people living within 50 m of a power line. A register-based case-control study including all patients diagnosed with neurodegenerative diseases during the years 1994-2010 was conducted among the entire adult population of Denmark. Using conditional logistic regression models, hazard ratios for ever living close to a power line in the time period 5-20 years before diagnosis were computed. The risks for developing dementia, Parkinson's disease, multiple sclerosis, and motor neuron disease were not increased in persons living within close vicinity of a power line. The risk of Alzheimer's disease was not increased for ever living within 50 m of a power line (hazard ratio = 1.04, 95% confidence interval: 0.69, 1.56). No dose-response according to number of years of living within 50 m of a power line was observed, but there were weak indications of an increased risk for persons diagnosed by the age of 75 years.

Conclusion: Overall, there was little support for an association between neurodegenerative disease and living close to power lines.

RESIDENTIAL MOBILITY OF POPULATIONS NEAR UK POWER LINES AND IMPLICATIONS FOR CHILDHOOD LEUKAEMIA.

Swanson J.

J Radiol Prot. 2013; 33(3):N9-N14

Epidemiological studies suggest associations between childhood leukaemia and living near high-voltage power lines, but the most obvious potential causative agent, the magnetic fields produced by the power lines, is not supported by laboratory studies or a known mechanism. An alternative hypothesised explanation is if there is greater population mobility near power lines, linking to the findings of Kinlen that population mixing increases leukaemia rates. The authors used the names recorded in electoral registers to see whether people near power lines move house more often than the population as a whole. They did find variations, but only small ones, and not such as to support the hypothesis.

2. Occupational exposure

OCCUPATIONAL EXPOSURE TO EXTREMELY LOW-FREQUENCY MAGNETIC FIELDS AND CARDIOVASCULAR DISEASE MORTALITY IN A PROSPECTIVE COHORT STUDY.

Koeman T, Slottje P, Kromhout H, Schouten LJ, Goldbohm RA, van den Brandt PA, Vermeulen R.

Occup Environ Med. 2013; 70(6):402-407.

Although a study among utility workers found an increased risk for acute myocardial infarction and arrhythmia-related deaths associated with occupational extremely low-frequency magnetic fields (ELF-MF) exposure, later studies largely failed to replicate these findings. This study investigated the association between occupational ELF-MF exposure and cardiovascular disease (CVD) mortality within a community-based prospective cohort study.

The Netherlands Cohort Study is a prospective cohort study among 120 852 men and women aged 55-69 years at baseline. Participants were followed-up for CVD mortality over a period of 10 years, resulting in 8200 CVD deaths. Information on occupational history and potential confounders, such as educational level, smoking and alcohol use were collected at baseline through a self-administered questionnaire. Occupational ELF-MF exposure was assigned using a job-exposure matrix. Associations with CVD mortality were analysed using Cox regression.

Ever low or high exposure to ELF-MF showed no association with total CVD mortality (HR of 1.02, 95% CI 0.99 to 1.06), nor with any cause-specific subtypes of CVD mortality. Other ELF-MF exposure metrics showed no increased risks either.

Conclusions: In this study, we found no indication of an association between occupational ELF-MF exposure and risk of CVD mortality.

3. Human experiment studies

EFFECTS OF 60 HZ MAGNETIC FIELDS ON TEENAGERS AND ADULTS.

Kim SK, Choi JL, Kwon MK, Choi JY, Kim DW.

Environ Health. 2013; 12:42.

As use of electrical devices has increased, social concerns about the possible effects of 60 Hz electromagnetic fields on human health have increased. Accordingly, the number of people who complain of various symptoms such as headache and insomnia has risen. Many previous studies of the effects of extremely low frequency (ELF) magnetic field exposure on children have focused on the occurrence of childhood leukaemia and central nervous system cancers. However, very few provocation studies have examined the health effects of ELF magnetic fields on teenagers. In this double-blind study, the authors simultaneously investigated physiological changes (heart rate, respiration rate, and heart rate variability), subjective symptoms, and magnetic field perception to determine the reliable effects of 60 Hz 12.5 μ T magnetic fields on teenagers. Two volunteer groups of 30 adults and 30 teenagers were tested with exposure to sham and real magnetic fields for 32 min. ELF magnetic field exposure did not have any effects on the physiological parameters or eight subjective symptoms in either group. Neither group correctly perceived the magnetic fields.

Conclusions: Physiological data were analysed, subjective symptoms surveyed, and the percentages of those who believed they were being exposed were measured. No effects were observed in adults or teenagers resulting from 32 min of 60 Hz 12.5 μ T magnetic field exposure.

IDIOPATHIC ENVIRONMENTAL INTOLERANCE ATTRIBUTED TO ELECTROMAGNETIC FIELDS (IEI-EMF) AND ELECTROSENSIBILITY (ES) - ARE THEY CONNECTED?

Köteles F, Szemerszky R, Gubányi M, Körmendi J, Szekrényesi C, Lloyd R, Molnár L, Drozdovszky O, Bárdos G.

Int J Hyg Environ Health. 2013; 216(3): 362-370.

The tendency of experiencing unpleasant symptoms in the proximity of working electric devices is called idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF). Evidence about psychophysiological backgrounds of the phenomenon (i.e., detection ability and mechanisms of symptom generation) is not yet conclusive.

Participants of the provocation experiment were 29 individuals with self-reported IEI-EMF and 42 control persons. Participants completed questionnaires (symptom expectations, somatosensory amplification - SSAS, modern health worries radiation subscale - MHW-R), and attempted to detect the presence of 50 Hz 0.5 mT magnetic field (MF) directed to their right arm in 20 subsequent 1-min sessions. Heart rate was also recorded and various indices of heart rate variability (HF, LF/HF, SDNN) were calculated.

Using the methodology of the signal detection theory, individuals with IEI-EMF as opposed to the control group showed a higher than random detection performance (d' differed slightly but statistically significantly from zero), and they used a significantly lower criterion (β value) when deciding about the presence of the MF. Detection sessions followed by correct decisions (hits or correct rejections) were characterized by higher HRV (SDNN and HF indices) than periods followed by errors (misses or false alarms). Previous expectations and affiliation to the IEI-EMF group were significant predictors of symptoms reported following exposure. IEI-EMF was closely related to MHW-R and SSAS scores.

Conclusion: Detection of MF might be possible for people with IEI-EMF to some extent. Although heightened sensibility to MFs may play a role in the development and/or in the perpetuation of the IEI-EMF phenomenon, symptoms attributed to the MF seem to be mainly of psychogenic origin.

4. Leukemia studies

CHILDHOOD ACUTE LEUKEMIA, MATERNAL BEVERAGE INTAKE DURING PREGNANCY, AND METABOLIC POLYMORPHISMS.

Bonaventure A, Rudant J, Goujon-Bellec S, Orsi L, Leverger G, Baruchel A, Bertrand Y, Nelken B, Pasquet M, Michel G, Sirvent N, Bordigoni P, Ducassou S, Rialland X, Zelenika D, Hémon D, Clavel J.

Cancer Causes Control. 2013; 24(4): 783-793.

This study aimed to analyze the associations between childhood acute leukaemia (AL) and maternal caffeinated beverage consumption during pregnancy, and to explore interactions between caffeinated and alcoholic beverage consumption and polymorphisms of enzymes involved in caffeine and ethanol metabolisms.

The data were generated by the French ESCALE study, which included 764 AL cases and 1,681 controls in 2003-2004. The case and control mothers were interviewed on their consumption habits during pregnancy using a standardized questionnaire. Genotypes of the candidate alleles (NAT2*5 rs1801280, ADH1C*2 rs698 and rs1693482, CYP2E1*5 rs2031920 and rs3813867) were obtained using high-throughput genotyping and imputation data for 493 AL cases and 549 controls with at least two grandparents born in Europe.

Maternal regular coffee consumption during pregnancy was associated with childhood AL (OR = 1.2 [1.0-1.5], $p = 0.02$); the odds ratios increased linearly with daily intake (p for trend <0.001 ; >2 cups per day vs. no or less than 1 cup per week: AL: OR = 1.6 [1.2-2.1], lymphoblastic AL: OR = 1.5 [1.1-2.0], myeloblastic AL: OR = 2.4 [1.3-4.3]). The association was slightly more marked for children born to non-smoking mothers. Lymphoblastic AL was also associated with cola soda drinking (OR = 1.3 [1.0-1.5], $p = 0.02$). No significant gene-environment interactions with coffee, tea, cola soda, or alcohol drinking were observed.

Conclusion: This study provides additional evidence that maternal coffee consumption during pregnancy may be associated with childhood AL. Coffee consumption is a prevalent habit and its potential involvement in childhood AL needs to be considered further.

POTENTIAL IMPACTS OF RADON, TERRESTRIAL GAMMA AND COSMIC RAYS ON CHILDHOOD LEUKEMIA IN FRANCE: A QUANTITATIVE RISK ASSESSMENT.

Laurent O, Ancelet S, Richardson DB, Hémon D, Ielsch G, Demoury C, Clavel J, Laurier D.

Radiat Environ Biophys. 2013; 52(2): 195-209.

Previous epidemiological studies and quantitative risk assessments (QRA) have suggested that natural background radiation may be a cause of childhood leukemia. The present work uses a QRA approach to predict the excess risk of childhood leukemia in France related to three components of natural radiation: radon, cosmic rays and terrestrial gamma rays, using excess relative and absolute risk models proposed by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Both models were developed from the Life Span Study (LSS) of Japanese A-bomb survivors. Previous risk assessments were extended by considering uncertainties in radiation-related leukaemia risk model parameters as part of this process, within a Bayesian framework. Estimated red bone marrow doses cumulated during childhood by the average French child due to radon, terrestrial gamma and cosmic rays are 4.4, 7.5 and 4.3 mSv, respectively. The excess fractions of cases (expressed as percentages) associated with these sources of natural radiation are 20 % [95 % credible interval (CI) 0-68 %] and 4 % (95 % CI 0-11 %) under the excess relative and excess absolute risk models, respectively. The large CIs, as well as the different point estimates obtained under these two models, highlight the uncertainties in predictions of radiation-related childhood leukaemia risks. These results are only valid provided that models developed from the LSS can be transferred to the population of French children and to chronic natural radiation exposures, and must be considered in view of the currently limited knowledge concerning other potential risk factors for childhood leukemia. Last, they emphasize the need for further epidemiological investigations of the effects of natural radiation on childhood leukaemia to reduce uncertainties and help refine radiation protection standards.

ALLERGY AND RISK OF ACUTE LYMPHOBLASTIC LEUKEMIA AMONG CHILDREN: A NATIONWIDE CASE CONTROL STUDY IN GREECE.

Lariou MS, Dikaloti SK, Dessypris N, Baka M, Polychronopoulou S, Athanasiadou-Piperopoulou F, Kalmanti M, Fragandrea I, Moschovi M, Germenis AE, Petridou ET.

Cancer Epidemiol. 2013; 37(2): 146-151.

Several reports point to inverse associations between allergies and ALL; yet, no study has explored this link using both self-reported-data on allergic history and biomarkers of atopic sensitization.

Clinical information for the variables of interest was available for 252 out of 292 cases of childhood (0-14 years) ALL, newly diagnosed across Greece over a 4.5 year period as well as for 294 hospital controls. Allergen-specific-IgEs, as markers of allergic predisposition against 24 most prevalent respiratory and food allergens, were determined, using an enzyme immunoassay procedure for 199 children with ALL and 113 controls. Cases were compared with controls through frequency distributions and unconditional multiple logistic regression models to estimate odds ratios (ORs) and 95% confidence-intervals (CIs) regarding associations of allergy with childhood ALL.

Self-reported-allergic history overall (OR: 0.49, 95% CI: 0.34-0.72) and practically each one of its main components (respiratory, food, any other clinical allergy) were strongly and inversely associated with ALL. Likewise, the serum IgE inverse association was of the same magnitude (OR: 0.43, 95% CI: 0.22-0.84) mainly contributed by food IgE (OR: 0.39, 95% CI: 0.18-0.83).

Conclusion: Beyond the already established inverse association of allergic history with childhood ALL, a same magnitude association is evident when serologic markers of allergic predisposition are used as an alternative measure of allergy. Further research with more appropriate study designs is needed to better understand possible associations between prior allergy and childhood ALL risk.