

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

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1. Reviews

OCCUPATIONAL EXPOSURE TO EXTREMELY LOW-FREQUENCY MAGNETIC FIELDS AND NEURODEGENERATIVE DISEASE: A META-ANALYSIS.

Vergara X, Kheifets L, Greenland S, Oksuzyan S, Cho YS, Mezei G.
J Occup Environ Med. 2013; 55(2): 135-146.

Previous studies reported associations of occupational electric and magnetic fields (MF) with neurodegenerative diseases (NDDs). Results differ between studies using proxy exposure based on occupational titles and estimated MF levels. The authors conducted a meta-analysis of occupational MF NDD, primarily Alzheimer disease (AD), and motor neuron diseases (MNDs) studies.

The authors identified 42 peer-reviewed publications and focused our analysis on study characteristics, exposure metrics, and publication bias.

They found weak associations for occupational MF exposure proxies with AD and MND. Motor neuron disease risk was associated with occupational titles, whereas AD risk was associated with estimated MF levels. Results varied in study design, with dissimilar variation across diseases.

Conclusions: These results do not support MF as the explanation for observed associations between occupational titles and MND. Disease misclassification, particularly for AD, and imprecise exposure assessment affected most studies.

ELECTROMAGNETIC FIELD EXPOSURE AND MALE BREAST CANCER RISK: A META-ANALYSIS OF 18 STUDIES.

Sun JW, Li XR, Gao HY, Yin JY, Qin Q, Nie SF, Wei S.
Asian Pac J Cancer Prev. 2013; 14(1): 523-528.

The possibility that electromagnetic fields (EMF) exposure may increase male breast cancer risk has been discussed for a long time. However, arguments have been presented that studies limited by poor quality could have led to statistically significant results by chance or bias. Moreover, data for the last 10 years have not been systematically summarized. To confirm any possible association, a meta-analysis was performed by a systematic search strategy. Total of 7 case-control and 11 cohort studies was identified and pooled ORs with 95% CIs were used as the principal outcome measures. Data from these studies were extracted with a standard meta-analysis procedure and grouped in relation to study design, cut-off point, exposure assessment method, adjustment and exposure model. A statistical significant increased risk of male breast cancer with EMF exposure was defined (pooled ORs = 1.32, 95% CI = 1.14 -1.52, P < 0.001), and subgroup analyses also showed similar results. Conclusions: This meta-analysis suggests that EMF exposure may be associated with the increase risk of male breast cancer despite the arguments raised.

2. Residential exposure

ADULT CANCERS NEAR HIGH-VOLTAGE OVERHEAD POWER LINES.

Elliott P, Shaddick G, Douglass M, de Hoogh K, Briggs DJ, Toledano MB.

Epidemiology. 2013; 24(2): 184-190.

The authors conducted a case-control study to investigate risks of adult cancers in relation to distance and extremely low-frequency magnetic fields from high-voltage overhead power lines using National Cancer Registry Data in England and Wales, 1974-2008. The study included 7823 leukemia, 6781 brain/central nervous system cancers, 9153 malignant melanoma, 29,202 female breast cancer cases, and 79,507 controls frequency-matched on year and region (three controls per case except for female breast cancer, one control per case) 15-74 years of age living within 1000 m of a high-voltage overhead power line.

There were no clear patterns of excess risk with distance from power lines. After adjustment for confounders (age, sex [except breast cancer], deprivation, rurality), for distances closest to the power lines (0-49 m) compared with distances 600-1000 m, odds ratios (ORs) ranged from 0.82 (95% confidence interval = 0.61-1.11; 66 cases) for malignant melanoma to 1.22 (0.88-1.69) for brain/central nervous system cancer. No meaningful excess risks and no trends of risk with magnetic field strength for the four cancers were observed. In adjusted analyses at the highest estimated field strength, ≥ 1000 nanotesla (nT), compared with < 100 nT, ORs ranged from 0.68 (0.39-1.17) for malignant melanoma to 1.08 (0.77-1.51) for female breast cancer.

Conclusion: These results do not support an epidemiologic association of adult cancers with residential magnetic fields in proximity to high-voltage overhead power lines.

3. Human experimental studies

LONG-TERM (UP TO 20 YEARS) EFFECTS OF 50-HZ MAGNETIC FIELD EXPOSURE ON IMMUNE SYSTEM AND HEMATOLOGICAL PARAMETERS IN HEALTHY MEN.

Touitou Y, Djeridane Y, Lambrozo J, Camus F, Selmaoui B.

Clin Biochem. 2013; 46(1-2) :59-63.

The authors examined the nocturnal profiles of red blood cells, hemoglobin, hematocrit, platelets, mean platelet volume, total white blood cells, lymphocytes, monocytes, eosinophils, basophils, neutrophils, Ig (Immunoglobulin) A, IgM, IgG, CD (cluster of differentiation) 3, CD4, CD8, natural killer cells, B cells, total CD28, CD8+ CD28+, activated T cells, interleukin (IL)-2, IL-6, and IL-2 receptor, in 15 men exposed chronically and daily for a period of 1-20 years, in the workplace and at home, to a 50-Hz magnetic field. The weekly geometric mean of individual exposures ranged from 0.1 to 2.6 μT . The results are compared to those of 15 unexposed men age-matched, with the same synchronization and physical activity that served as controls (individual exposures ranged from 0.004 to 0.092 μT). Blood samples were taken hourly from 20:00 h to 08:00 h.

Exposure over a long period and on a daily basis to magnetic fields resulted in no changes in the levels or patterns of hematological and immune system variables.

Conclusions: These data show that a long-term exposure to 50-Hz magnetic fields does not affect the hematological and immune system functions or their profile in healthy men, at least for the variables studied, and suggest that magnetic fields have no cumulative effects on these functions.

ELECTROMAGNETIC INTERFERENCE WITH CARDIAC PACEMAKERS AND IMPLANTABLE CARDIOVERTER-DEFIBRILLATORS FROM LOW-FREQUENCY ELECTROMAGNETIC FIELDS IN VIVO.

Tiikkaja M, Aro AL, Alanko T, Lindholm H, Sistonen H, Hartikainen JE, Toivonen L, Juutilainen J, Hietanen M.

Europace. 2013; 15(3): 388-394.

Electromagnetic interference (EMI) can pose a danger to workers with pacemakers and implantable cardioverter-defibrillators (ICDs). At some workplaces electromagnetic fields are high enough to potentially inflict EMI. The purpose of this in vivo study was to evaluate the susceptibility of pacemakers and ICDs to external electromagnetic fields.

Eleven volunteers with a pacemaker and 13 with an ICD were exposed to sine, pulse, ramp, and square waveform magnetic fields with frequencies of 2-200 Hz using Helmholtz coil. The magnetic field flux densities varied to 300 μ T. The authors also tested the occurrence of EMI from an electronic article surveillance (EAS) gate, an induction cooktop, and a metal inert gas (MIG) welding machine. All pacemakers were tested with bipolar settings and three of them also with unipolar sensing configurations. None of the bipolar pacemakers or ICDs tested experienced interference in any of the exposure situations. The three pacemakers with unipolar settings were affected by the highest fields of the Helmholtz coil, and one of them also by the EAS gate and the welding cable. The induction cooktop did not interfere with any of the unipolarly programmed pacemakers.

Conclusion: Magnetic fields with intensities as high as those used in this study are rare even in industrial working environments. In most cases, employees can return to work after implantation of a bipolar pacemaker or an ICD, after an appropriate risk assessment. Pacemakers programmed to unipolar configurations can cause danger to their users in environments with high electromagnetic fields, and should be avoided, if possible.

4. Leukaemia studies

A RECORD-BASED CASE-CONTROL STUDY OF NATURAL BACKGROUND RADIATION AND THE INCIDENCE OF CHILDHOOD LEUKAEMIA AND OTHER CANCERS IN GREAT BRITAIN DURING 1980-2006.

Kendall GM, Little MP, Wakeford R, Bunch KJ, Miles JC, Vincent TJ, Meara JR, Murphy MF.

Leukemia. 2013; 27(1) :3-9.

The authors conducted a large record-based case-control study testing associations between childhood cancer and natural background radiation. Cases (27,447) born and diagnosed in Great Britain during 1980-2006 and matched cancer-free controls (36,793) were from the National Registry of Childhood Tumours. Radiation exposures were estimated for mother's residence at the child's birth from national databases, using the County District mean for gamma rays, and a predictive map based on domestic measurements grouped by geological boundaries for radon. There was 12% excess relative risk (ERR) (95% CI 3, 22; two-sided P=0.01) of childhood leukaemia per millisievert of cumulative red bone marrow dose from

gamma radiation; the analogous association for radon was not significant, ERR 3% (95% CI -4, 11; P=0.35). Associations for other childhood cancers were not significant for either exposure. Excess risk was insensitive to adjustment for measures of socio-economic status. The statistically significant leukaemia risk reported in this reasonably powered study (power ~50%) is consistent with high-dose rate predictions. Substantial bias is unlikely, and mechanisms by which confounding might plausibly account for the association, which are regarded as likely to be causal cannot be identified.

Conclusion: The study supports the extrapolation of high-dose rate risk models to protracted exposures at natural background exposure levels.