

Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the fourth trimester of 2016

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1. Residential exposure

ASSOCIATIONS OF PARENTAL OCCUPATIONAL EXPOSURE TO EXTREMELY LOW-FREQUENCY MAGNETIC FIELDS WITH CHILDHOOD LEUKEMIA RISK.

Su L, Fei Y, Wei X, Guo J, Jiang X, Lu L, Chen G.

Leuk Lymphoma. 2016;57(12):2855-2862.

Previous studies on the association of parental occupational exposure to extremely low-frequency magnetic fields (ELF-MF) with childhood leukemia risk have produced inconsistent results. To reevaluate this association the authors performed a meta-analysis by pooling 11 case-control and one cohort studies. The overall results showed that neither maternal nor paternal occupational exposure was associated with childhood leukemia risk. For paternal occupational exposure, significant association was found when pooling studies with small number of cases (OR=1.96; 95% CI, 1.03-3.74) or with lower quality score (OR =1.52; 95% CI, 1.07-2.15). However, this association was not confirmed when pooling studies with large number of cases or high quality score.

Conclusions: These data indicate no association between parental occupational ELF-MF exposure and childhood leukemia risk, and the elevated OR under certain subgroup analysis is likely due to chance. Further studies with precise ELF-MF exposure assessment are suggested.

2. Human experimental studies

EFFECTS OF PERSONALISED EXPOSURE ON SELF-RATED ELECTROMAGNETIC HYPERSENSITIVITY AND SENSIBILITY - A DOUBLE-BLIND RANDOMISED CONTROLLED TRIAL.

van Moorselaar I, Slottje P, Heller P, van Strien R, Kromhout H, Murbach M, Kuster N, Vermeulen R, Huss A.

Environ Int. 2016 ; pii: S0160-4120(16)30931-X.

Previous provocation experiments with persons reporting electromagnetic hypersensitivity (EHS) have been criticized because EHS persons were obliged to travel to study locations (seen as stressful), and that they were unable to select the type of signal they reported reacting to. In this study the authors used mobile exposure units that allow double-blind exposure conditions with personalized exposure settings (signal type, strength, duration) at home. Their aim was to evaluate whether subjects were able to identify exposure conditions, and to assess if providing feedback on personal test results altered the level of self-reported EHS.

Double-blind randomised controlled exposure testing with questionnaires at baseline, immediately before and after testing, and at two and four months post testing was used. Participants were eligible if they reported sensing either radiofrequency or extremely low

frequency fields within minutes of exposure. Participants were visited at home or another location where they felt comfortable to undergo testing. Before double-blind testing, the authors verified together with participants in an unblinded exposure session that the exposure settings were selected were ones that the participant responded to. Double-blind testing consisted of a series of 10 exposure and sham exposures in random sequence, feedback on test results was provided directly after testing.

42 persons participated, mean age was 55 years (range 29-78), 76% were women. During double-blind testing, no participant was able to correctly identify when they were being exposed better than chance. There were no statistically significant differences in the self-reported level of EHS at follow-up compared to baseline, but during follow-up participants reported reduced certainty in reacting within minutes to exposure and reported significantly fewer symptoms compared to baseline.

Conclusions: These results suggest that a subgroup of persons exist who profit from participation in a personalized testing procedure.

3. Exposure assessment

ANALYSIS OF PERSONAL AND BEDROOM EXPOSURE TO ELF-MFS IN CHILDREN IN ITALY AND SWITZERLAND.

Struchen B, Liorni I, Parazzini M, Gängler S, Ravazzani P, Röösl M.

J Expo Sci Environ Epidemiol. 2016;26(6):586-596.

Little is known about the real everyday exposure of children in Europe to extremely low-frequency magnetic fields (ELF-MFs). The aims of this study are to (i) assess personal ELF-MF exposure in children; (ii) to identify factors determining personal and bedroom ELF-MF exposure measurements in children; (iii) to evaluate the reproducibility of exposure summary measures; and (iv) to compare personal with bedroom measurements. In Switzerland and Italy, 172 children aged between 5 and 13 years were equipped with ELF-MF measurement devices (EMDEX II, measuring 40-800 Hz) during 24-72 h twice, in the warm and the cold season. In addition, 24-h measurements were taken in the bedroom of children. In this study, sample geometric mean ELF-MF exposure was 0.04 μ T for personal and 0.05 μ T for bedroom measurements. Living within 100 m of a highest voltage power line increased geometric mean personal exposure by a factor of 3.3, and bedroom measurements by a factor 6.8 compared to a control group. Repeated measurements within the same subject showed high reproducibility for the geometric mean (Spearman's correlation 0.78 for personal and 0.86 for bedroom measurements) but less for the 95th and 99th percentile of the personal measurements (≤ 0.42). Spearman's correlation between bedroom and personal exposure was 0.86 for the geometric mean but considerably lower for the 95th and 99th percentiles (≤ 0.60).

Conclusions: Most previous studies on ELF-MF childhood leukaemia used mean bedroom exposure. This study demonstrates that geometric mean bedroom measurements is well correlated with personal geometric mean exposure, and has high temporal reproducibility.

4. Leukemia studies

CHILDHOOD LEUKEMIA AND PRIMARY PREVENTION.

Whitehead TP, Metayer C, Wiemels JL, Singer AW, Miller MD.
Curr Probl Pediatr Adolesc Health Care. 2016;46(10):317-352.

Leukemia is the most common pediatric cancer, affecting 3800 children per year in the United States. Its annual incidence has increased over the last decades, especially among Latinos. Although most children diagnosed with leukemia are now cured, many suffer long-term complications, and primary prevention efforts are urgently needed. The early onset of leukemia-usually before 5 years of age-and the presence at birth of "pre-leukemic" genetic signatures indicate that pre- and postnatal events are critical to the development of the disease. In contrast to most pediatric cancers, there is a growing body of literature, in the United States and internationally, that has implicated several environmental, infectious, and dietary risk factors in the etiology of childhood leukemia, mainly for acute lymphoblastic leukemia, the most common subtype. For example, exposures to pesticides, tobacco smoke, solvents, and traffic emissions have consistently demonstrated positive associations with the risk of developing childhood leukemia. In contrast, intake of vitamins and folate supplementation during the preconception period or pregnancy, breastfeeding, and exposure to routine childhood infections have been shown to reduce the risk of childhood leukemia. Some children may be especially vulnerable to these risk factors, as demonstrated by a disproportionate burden of childhood leukemia in the Latino population of California. The evidence supporting the associations between childhood leukemia and its risk factors, including pooled analyses from around the world and systematic reviews, is strong; however, the dissemination of this knowledge to clinicians has been limited.

Conclusions: To protect children's health, it is prudent to initiate programs designed to alter exposure to well-established leukemia risk factors rather than to suspend judgment until no uncertainty remains. Primary prevention programs for childhood leukemia would also result in the significant co-benefits of reductions in other adverse health outcomes that are common in children, such as detriments to neurocognitive development.

RISK OF CHILDHOOD CANCER AND SOCIO-ECONOMIC DISPARITIES: RESULTS OF THE FRENCH NATIONWIDE STUDY GEOCAP 2002-2010.

Marquant F, Goujon S, Faure L, Guissou S, Orsi L, Hémon D, Lacour B, Clavel J.
Paediatr Perinat Epidemiol. 2016;30(6):612-622.

Socio-economic status is related to many life style and environmental factors, some of which have been suggested to influence the risk of childhood cancer. Studies requiring subject participation are usually hampered by selection of more educated parents. To prevent such bias, the authors used unselected nationwide Geographical Information System (GIS) based registry data, to investigate the influence of socio-economic disparities on the risk of childhood cancer.

The Geocap study included all French residents diagnosed with cancer aged up to 15 years over the period 2002-2010 (15 111 cases) and 45 000 contemporaneous controls representative of the childhood population. Area socio-economic characteristics used to calculate the European Deprivation Index (EDI) were based on census data collected on the fine scale of the Merged Islet for Statistical Information (IRIS).

Overall, the risk of acute lymphoblastic leukaemia (ALL) was lower in the most deprived quintile than in the other quintiles of EDI (OR_{Q5vs<Q5} 0.80 (95% confidence interval (CI)

0.73, 0.88)). The odds ratio for all the other cancers taken together was close to the null (OR_{Q5vs<Q5} 0.99 (95% CI 0.94, 1.04)).

Conclusions: Living in the most deprived areas was inversely associated with the risk of ALL in childhood. There was no indication that the risk of childhood cancer of any site could be increased by deprivation. Life style or environmental factors potentially underlying the association need further investigation.

BACKGROUND RADIATION AND CHILDHOOD LEUKEMIA: A NATIONWIDE REGISTER-BASED CASE-CONTROL STUDY.

Nikkilä A, Erme S, Arvela H, Holmgren O, Raitanen J, Lohi O, Auvinen A.
Int J Cancer. 2016;139(9):1975-1982.

High doses of ionizing radiation are an established cause of childhood leukemia. However, substantial uncertainty remains about the effect of low doses of radiation, including background radiation and potential differences between genetic subgroups of leukemia have rarely been explored. The authors investigated the effect of the background gamma radiation on childhood leukemia using a nationwide register-based case-control study. For each of the 1,093 cases, three age- and gender matched controls were selected (N = 3,279). Conditional logistic regression analyses were adjusted for confounding by Down syndrome, birth weight (large for gestational age), and maternal smoking. Complete residential histories and previously collected survey data of the background gamma radiation in Finland were used to assess the exposure of the study subjects to indoor and outdoor gamma radiation. Overall, background gamma radiation showed a non-significant association with the OR of childhood leukemia (OR 1.01, 95% CI 0.97, 1.05 for 10 nSv/h increase in average equivalent dose rate to red bone marrow). In subgroup analyses, age group 2-<7 years displayed a larger effect (OR 1.27, 95% CI 1.01, 1.60 for 1 mSv increase in equivalent cumulative dose to red bone marrow). Suggestive difference in OR by genetic subtype was found.

Conclusions: These results provide further support to the notion that low doses of ionizing radiation increase the risk for childhood leukemia, particularly at age 2-<7 years. These findings suggest a larger effect of radiation on leukemia with high hyperploididy than other subgroups, but this result requires further confirmation.