

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

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1. Reviews

RECENT RESEARCH ON EMF AND HEALTH RISK

Eleventh report from SSM's Scientific Council on Electromagnetic Fields, 2016

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Conclusions on ELF epidemiological studies

New studies on ELF-MF exposure and childhood leukaemia were small and thus do not alter the current interpretation on this subject. In adult cancer studies, no indication for a risk increase was seen in a large cohort study investigating use of electric blankets in relation to thyroid cancer and also not in a large study on occupational ELF-MF exposure and acute myeloid leukaemia. For ALS, a large population-based Swedish study suggested that electric shocks, but not ELF-MF exposure, may be a risk factor for the working population less than 65 years. This is in contrast to studies that appeared last year that suggested it may be the other way around. This question therefore remains as yet unresolved. For non-vascular dementia, a Dutch study provided some indications for an association with ELF-MF exposure. Only few observational studies addressing ELF-MF exposure and symptoms have been published during the last decade and correspondingly, study results are scarce. A large cross-sectional survey found some associations with self-reported exposure to electrical devices. The limitation for the interpretation of this finding is that both outcome and exposure are reported by the same person.

2. Residential exposure

CHILDHOOD LEUKAEMIA AND DISTANCE FROM POWER LINES IN CALIFORNIA: A POPULATION-BASED CASE-CONTROL STUDY.

Crespi CM, Vergara XP, Hooper C, Oksuzyan S, Wu S, Cockburn M, Kheifets L.
Br J Cancer. 2016; 115(1):122-128.

Studies have reported an increased risk of childhood leukaemia associated with living near high-voltage electric power transmission lines that extend to distances at which magnetic fields from lines are negligible. The authors conducted a large records-based case-control study of childhood leukaemia risk in the population living near power lines in California. The study included 5788 childhood leukaemia and 3308 central nervous system (CNS) cancer cases (for comparison) born in and diagnosed in California (1986-2008), and matched to population-based controls by age and sex. Birth address was

geocoded and the distance from residence to transmission lines was estimated using geographic information systems, aerial imagery, and, for some residences, site visits.

For leukaemia, there was a slight excess of cases within 50 m of a transmission line over 200 kV (odds ratio 1.4, 95% confidence interval 0.7-2.7). There was no evidence of increased risk for distances beyond 50 m, for lower-voltage lines, or for CNS cancers.

Conclusions: These findings did not clearly support an increased childhood leukaemia risk associated with close proximity (<50 m) to higher voltage lines, but could be consistent with a small increased risk. Reports of increased risk for distances beyond 50 m were not replicated.

EPIDEMIOLOGICAL STUDY OF POWER LINES AND CHILDHOOD CANCER IN THE UK: FURTHER ANALYSES.

Bunch KJ, Swanson J, Vincent TJ, Murphy MF.
J Radiol Prot. 2016; 36(3):437-455.

The authors report further analyses from an epidemiological study of childhood cancer and residence at birth near high-voltage power lines in the UK. These results suggest that the elevated risks for childhood leukaemia that they previously found for overhead power lines may be higher for older age at diagnosis and for myeloid rather than lymphoid leukaemia. There are differences across regions of birth but not forming any obvious pattern. These results suggest the decline in risk previously reported from the 1960s to the 2000s is linked to calendar year of birth or of cancer occurrence rather than the age of the power lines concerned.

PSYCHOLOGICAL SYMPTOMS AND HEALTH-RELATED QUALITY OF LIFE IN IDIOPATHIC ENVIRONMENTAL INTOLERANCE ATTRIBUTED TO ELECTROMAGNETIC FIELDS.

Kjellqvist A, Palmquist E, Nordin S.
J Psychosom Res. 2016; 84:8-12.

Need for better understanding of the etiology of idiopathic environmental intolerance attributed to electromagnetic fields (IEI-EMF) motivated the present study of psychological symptoms and health-related quality of life (HRQOL) in person who attribute health problems to electromagnetic fields. Participants with IEI-EMF (n=114) and a population-based sample of referents (n=104) were investigated with six subscales of the symptom checklist 90 (scl-90) to assess psychological symptoms, and with eight subscales of the short form (36) health survey (sf-36) to assess HRQOL.

Significantly higher scores were found on obsessive/compulsive behavior, interpersonal hypersensitivity, hostility, phobic anxiety, paranoid thoughts in the IEI-EMF group compared to referents, whereas only a tendency of such a difference was found for psychotism. Furthermore, poorer HRQOL in the IEI-EMF group, compared to referents, were found regarding physical and social functioning, physical and emotional role limitations, general health, vitality, bodily pain, and mental health. Significant correlation with moderate to strong effect sizes were found between several of the scl-90 and sf-36 subscales.

Conclusions: The results suggest that IEI-EMF is associated with various types of psychological symptoms and with poor HRQOL. Clinical implications include theoretical support for cognitive behavioral therapy, and, although further research is needed, that attention should be directed towards feelings of inferiority and uneasiness in relationships as well as anger, hostility and resentment towards other people.

3. Human experimental studies

ATTRIBUTION-BASED NOCEBO EFFECTS. PERCEIVED EFFECTS OF A PLACEBO PILL AND A SHAM MAGNETIC FIELD ON COGNITIVE PERFORMANCE AND SOMATIC SYMPTOMS.

Szemerszky R, Dömötör Z, Berkes T, Köteles F.

Int J Behav Med. 2016; 23(2):204-213.

Negative non-specific (nocebo-like) effects of medications and electromagnetic fields are often described as results of mistaken attribution. This study aimed to find empirical evidence supporting this theory.

Participants completed questionnaires assessing modern health worries, health anxiety, and somatosensory amplification, were assigned to one of three conditions (placebo pill with sedative information, sham magnetic field, or control), and completed a 14-min vigilance task. Changes in physiological arousal (heart rate, heart rate variability, and skin conductance) and reported symptoms were also measured. Finally, causal attributions concerning cognitive performance and reported symptoms were assessed.

No increase in symptom reports and physiological arousal was measured in the two intervention groups. A perceived negative effect on cognitive performance was attributed to both sham conditions, and attributions were connected to modern health worries. A proportion of reported symptoms was ascribed to the placebo pill but not to the sham magnetic field. Symptom attributions were not related to any assessed psychological variables.

Conclusions: An aroused physiological state is not necessary for the automatic causal attribution process. Negative effects attributed to medication and environmental factors can be regarded as unavoidable side effects of human cognitive-emotional functioning; they might be alleviated, but cannot be completely eradicated.

DISPOSITIONAL ASPECTS OF BODY FOCUS AND IDIOPATHIC ENVIRONMENTAL INTOLERANCE ATTRIBUTED TO ELECTROMAGNETIC FIELDS (IEI-EMF).

Dömötör Z, Doering BK, Köteles F.

Scand J Psychol. 2016; 57(2):136-43.

Body focus is often considered an undesirable characteristic from medical point of view as it amplifies symptoms and leads to higher levels of health anxiety. However, it is connected to mindfulness, well-being and the sense of self in psychotherapy. The current study aimed to investigate the contribution of various body focus related constructs to acute and chronic generation and maintenance of medically unexplained symptoms (MUS).

Thirty-six individuals with idiopathic environmental intolerance to electromagnetic fields (IEI-EMF) and 36 controls were asked to complete questionnaires assessing negative affect, worries about harmful effects of EMFs, health anxiety (HA), body awareness, and somatosensory amplification (SSA), and to report experienced symptoms evoked by a sham magnetic field. Body awareness, HA, SSA, and EMF-related worries showed good discriminative power between individuals with IEI-EMF and controls. Considering all variables together, SSA was the best predictor of IEI-EMF. In the believed presence of a MF, people with IEI-EMF showed higher levels of anxiety and reported more symptoms than controls. In the IEI-EMF group, actual symptom reports were predicted by HA and state anxiety, while a reverse relationship between symptom reports and HA was found in the control group. These findings show that SSA is a particularly important contributor to IEI-EMF, probably because it is the most comprehensive factor in its aetiology.

Conclusions: IEI-EMF is associated with both a fear-related monitoring of bodily symptoms and a non-evaluative body focus. The identification of dispositional body focus may be relevant for the management of MUS.

4. Exposure assessment

CHILDREN'S PERSONAL EXPOSURE MEASUREMENTS TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS IN ITALY.

Liorni I, Parazzini M, Struchen B, Fiocchi S, Rössli M, Ravazzani P.

Int J Environ Res Public Health. 2016;13(6).

Extremely low frequency magnetic fields (ELF-MFs) exposure is still a topic of concern due to their possible impact on children's health. Although epidemiological studies claimed an evidence of a possible association between ELF-MF above 0.4 μ T and childhood leukemia, biological mechanisms able to support a causal relationship between ELF-MF and this disease were not found yet. To provide further knowledge about children's ELF-MF exposure correlated to children's daily activities, a measurement study was conducted in Milan (Italy). Eighty-six children were recruited, 52 of whom were specifically chosen with respect to the distance to power lines and built-in transformers to oversample potentially highly exposed children. Personal and bedroom measurements were performed for each child in two different seasons. The major outcomes of this study are: (1) median values over 24-h personal and bedroom measurements were $<3 \mu$ T established by the Italian law as the quality target; (2) geometric mean values over 24-h bedroom measurements were mostly $<0.4 \mu$ T; (3) seasonal variations did not significantly influence personal and bedroom measurements; (4) the highest average MF levels were mostly found at home during the day and outdoors; (5) no significant differences were found in the median and geometric mean values between personal and bedroom measurements, but were found in the arithmetic mean.

5. Leukaemia studies

AIR TOXICS AND EARLY CHILDHOOD ACUTE LYMPHOCYTIC LEUKEMIA IN TEXAS, A POPULATION BASED CASE CONTROL STUDY.

Symanski E, Tee Lewis PG, Chen TY, Chan W, Lai D, Ma X.

Environ Health. 2016; 15(1):70.

Traffic exhaust, refineries and industrial facilities are major sources of air toxics identified by the U.S. Environmental Protection Agency (U.S. EPA) for their potential risk to human health. In utero and early life exposures to air toxics such as benzene and 1,3-butadiene, which are known leukemogens in adults, may play an etiologic role in childhood leukemia that comprises the majority of pediatric cancers. The authors conducted a population based case-control study to examine individual effects of benzene, 1,3-butadiene and polycyclic organic matter (POM) in ambient residential air on acute lymphocytic leukemia (ALL) diagnosed in children under age 5 years in Texas from 1995-2011.

Texas Cancer Registry cases were linked to birth records and then were frequency matched by birth month and year to 10 population-based controls. Maternal and infant characteristics from birth certificates were abstracted to obtain information about potential confounders. Modelled estimates of benzene, 1,3-butadiene and POM exposures at the census tract level were assigned by linking geocoded maternal addresses from birth certificates to U.S. EPA National-Scale Air Toxics Assessment data for single and co-

pollutant statistical analyses. Mixed-effects logistic regression models were applied to evaluate associations between air toxics and childhood leukemia.

In adjusted single pollutant models, odds of childhood leukemia among mothers with the highest ambient air exposures compared to those in the lowest quartile were 1.11 (95 % CI: 0.94-1.32) for POM, 1.17 (95 % CI: 0.98-1.39) for benzene and 1.29 (95 % CI: 1.08-1.52) for 1,3-butadiene. In co-pollutant models, odds ratios for childhood leukemia remained elevated for 1,3-butadiene but were close to the null value for benzene and POM.

Conclusions: Positive associations between 1,3-butadiene and childhood leukemia in single and co-pollutant models were observed whereas effect estimates from single pollutant models were diminished for benzene and POM in co-pollutant models. Early life exposure to 1,3-butadiene rather than benzene or POM appears to increase early childhood risk of acute lymphocytic leukemia.