

# Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the fourth trimester of 2018

---

Dr. Maurits De Ridder  
Occupational and Environmental Health Section  
Ghent University

---

## 1. Reviews

### **Amyotrophic Lateral Sclerosis and Occupational Exposures: A Systematic Literature Review and Meta-Analyses.**

Gunnarsson LG, Bodin L.

*Int J Environ Res Public Health.* 2018 Oct 26;15(11).

The authors conducted a systematic literature review to identify studies fulfilling good scientific epidemiological standards for use in meta-analyses of occupational risk factors for amyotrophic lateral sclerosis (ALS). They identified 79 original publications on associations between work and ALS. The MOOSE (Meta-analysis Of Observational Studies in Epidemiology) and GRADE (Grading of Recommendations, Assessment, Development and Evaluations) guidelines were used to ensure high scientific quality, and reliable protocols were applied to classify the articles. Thirty-seven articles fulfilled good scientific standards, while 42 were methodologically deficient and thus were excluded from our meta-analyses. The weighted relative risks for the various occupational exposures were respectively; 1.29 (95% confidence interval (CI): 0.97-1.72; six articles) for heavy physical work, 3.98 (95% CI: 2.04-7.77; three articles) for professional sports, 1.45 (95% CI: 1.07-1.96; six articles) for metals, 1.19 (95% CI: 1.07-1.33; 10 articles) for chemicals, 1.18 (95% CI: 1.07-1.31; 16 articles) for electromagnetic fields or working with electricity, and 1.18 (95% CI: 1.05-1.34; four articles) for working as a nurse or physician.

Conclusions: Meta-analyses based only on epidemiologic publications of good scientific quality show that the risk of ALS is statistically significantly elevated for occupational exposures to excessive physical work, chemicals (especially pesticides), metals (especially lead), and possibly also to electromagnetic fields and health care work. These results are not explained by publication bias.

### **Occupational exposure to extremely low frequency magnetic fields and risk of Alzheimer disease: A systematic review and meta-analysis.**

Jalilian H, Teshnizi SH, Rösli M, Neghab M.

*Neurotoxicology.* 2018 Dec;69:242-252.

There is some evidence suggesting ELF-MF exposure to be a risk factor for Alzheimer's disease (AD). The current study aims at systematically reviewing the literature and conducting a meta-analysis to evaluate the risk of AD amongst workers exposed to ELF-MF. Bibliographic databases were searched including PubMed, EMBASE, Cochrane Library, and Web of Science in November 2017. Risk of bias was assessed in the all included studies. Pooled estimates were obtained using

random-effects meta-analysis. In addition, sources of heterogeneity between studies and publication bias were explored. In total, 20 articles met the inclusion criteria. The pooled results suggest an increased risk of AD (RR: 1.63; 95% CI: 1.35, 1.96). Higher risk estimates were obtained from case-control studies (OR: 1.80; 95% CI: 1.40, 2.32) than from cohort studies (RR: 1.42; 95% CI: 1.08, 1.87). A moderate to high heterogeneity ( $I^2 = 61.0\%$ ) and indication for publication bias (Egger test:  $p < 0.001$ ) were found.

Conclusions: The results suggested that occupational exposure to ELF-MF might increase the risk of AD. However, this suggestion should be interpreted with caution given the moderate to high heterogeneity and indication for publication bias.

## **2. Residential exposure**

### **Exposure and health risks perception of extremely low frequency and radiofrequency electromagnetic fields and the effect of providing information.**

Gallastegi M, Jiménez-Zabala A, Molinuevo A, Aurrekoetxea JJ, Santa-Marina L, Vozmediano L, Ibarluzea J.

*Environ Res.* 2018 Nov 28;169:501-509.

Given that regardless of actual exposure levels, high-risk perceptions of electromagnetic fields of non-ionizing radiation (EMF-NIR) may cause health effects, it is important to understand the mechanisms behind perceptions in the general population. The aims of this study were to assess perceptions of both exposure and health-risk among mothers of the INMA (Environment and childhood)-Gipuzkoa child cohort; to explore possible determinants that explain such perceptions; and to evaluate whether providing information on exposure levels has any effect on perceptions. Overall, 387 mothers completed a questionnaire composed of four questions on perceived exposure and perceived health-risk of exposure to extremely low frequency (ELF) and radiofrequency (RF) fields answered on a Likert-type scale from 0 to 10. Later, measurements of ELF and RF fields were conducted in the houses of a subsample of 104 participants. All measured levels were far below the levels established by the European Council recommendation. This was explained in the individual reports sent to the families. After reading the results, mothers completed the aforementioned questionnaire a second time, plus two additional questions regarding the role of public health bodies in risk communication. The association between perceived and measured levels as categorical variables was assessed with a chi-square test. Multiple linear regressions were conducted for each of the questions related to perceived exposure and health-risk perceptions. Wilcoxon signed-rank test was conducted to assess the effect of receiving information. Both exposure and health risk were perceived to be very high for both ELF and RF fields, with mean and medians of 7 on a 10-point scale. Reporting higher perception levels was not associated with higher levels of exposure measured at home. Variables that were repeatedly associated with higher perceptions included: manual social class, not having the feeling of living in a good neighborhood, difficulty getting by financially, not having a television antenna within 600 m, being younger and having fewer devices at home.

Conclusions: Providing information on EMF-NIR exposure levels at home did not alter health-risk perceptions, but mean perceived RF exposure decreased significantly (by 0.7 points). Most of the participants claimed to have received no or insufficient information regarding exposure and health-risks of EMF-NIR from public bodies and considered it very important that they should.

### **3. Exposure assessment**

No publications

### **4. Leukemia studies**

#### **Household exposure to pesticides and risk of leukemia in children and adolescents: Updated systematic review and meta-analysis.**

Van Maele-Fabry G, Gamet-Payrastre L, Lison D.

*Int J Hyg Environ Health.* 2019 Jan;222(1):49-67.

The objective of this study is to update an earlier systematic review on the association between residential/household/domestic exposure to pesticides and childhood leukemia, and to explore potential sources of heterogeneity not previously assessed. A systematic search of studies published in English between January 2009 and June 2018 was conducted in MEDLINE, and a "snowball searching" was performed from the reference list of identified publications and from Web of Science citations. Risk estimates were extracted from 15 case-control studies published between 1987 and 2018. The quality of the publications was assessed by using a modified version of the Downs and Black (1998) checklist. A random-effect meta-analysis model was used to calculate summary odds ratios (SOR) and separate analyses were conducted for acute lymphoblastic leukemia (ALL), acute myeloid leukemia (AML), unspecified AL/leukemia and any leukemia types. Stratification by critical exposure period, exposure location, pesticide biocide category, child age at diagnosis, study quality, specific exposures, type of pest treated, and geographic location were performed.

A statistically significant association between residential pesticide exposure and childhood leukemia was observed by combining all studies (SOR: 1.57; 95% CI: 1.27-1.95) without evidence of publication bias. Statistically significant increased risks were observed for all types of leukemia, and specifically for exposure during pregnancy, indoor exposure, prenatal exposure to insecticides and whatever the age at diagnosis. Statistical significance was also reached for high quality studies, pet treatments, professional pest control treatment and use of insect repellants, mosquito treatment and for studies from USA/Canada or International. The highest increased risks were observed

for AML among children aged 2 years or less, as well as for unspecified leukemia type observed after prenatal indoor exposure.

Conclusions: A positive association between domestic pesticide exposure and childhood leukemia is confirmed. Although the literature provides moderate to low-quality of evidence, these new results further justify the need of limiting the use of household pesticides during pregnancy and childhood.

**Childhood leukaemia risk and residential proximity to busy roads.**

Tamayo-Uria I, Boldo E, García-Pérez J, Gómez-Barroso D, Romaguera EP, Cirach M, Ramis R.

*Environ Int.* 2018 Dec;121(Pt 1):332-339.

The objectives of this study is to ascertain the possible effects of residential proximity to road traffic on childhood leukaemia, taking into account traffic density, road proximity and the type of leukaemia (acute lymphoid leukaemia or acute myeloid leukaemia). The authors conducted a population-based case-control study of childhood leukaemia in Spain, covering the period 1990-2011. It included 1061 incidence cases gathered from the Spanish National Childhood Cancer Registry and those Autonomous Regions with 100% coverage, and 6447 controls, individually matched by year of birth, sex and autonomous region of residence. Distances were computed from the respective participant's residential locations to the different types of roads and four different buffers. Using logistic regression, odds ratios (ORs) and 95% confidence intervals (95% CIs), were calculated for four different categories of distance to roads.

Cases of childhood leukaemia had more than three-fold increased odds of living at <50 m of the busiest motorways compared to controls (OR = 2.90; 95%CI = 1.30-6.49). The estimates for acute lymphoid leukaemia (ALL) were slightly higher (OR = 2.95; 95%CI = 1.22-7.14), while estimates for cases with the same address at birth and at diagnosis were lower (OR = 2.40; 95%CI = 0.70-8.30).

Conclusions: This study agrees with the literature and furnishes some evidence that living near a busy motorway could be a risk factor for childhood leukaemia.

**Maternal exposure to gasoline and exhaust increases the risk of childhood leukaemia in offspring - a prospective study in the Norwegian Mother and Child Cohort Study.**

Kirkeleit J, Riise T, Bjørge T, Christiani DC, Bråtveit M, Baccarelli A, Mattioli S, Hollund BE, Gjertsen BT.

*Br J Cancer.* 2018 Oct;119(8):1028-1035.

In the prospective population-based Norwegian Mother and Child Cohort Study (MoBa), comprising 113 754 offspring, the authors investigated the association between parental exposure to "gasoline or exhaust", as a proxy for benzene exposure, and childhood leukaemia. Around gestational week 17, mothers and fathers responded to a questionnaire on exposure to various agents during the last 6 months and 6 months pre-conception, respectively. Benzene exposure was assessed through self-reported exposure to "gasoline or exhaust". Cases of

childhood leukaemia (n = 70) were identified through linkage with the Cancer Registry of Norway. Risk was estimated by hazard ratios (HRs) with 95% confidence intervals (95%CI), comparing offspring from exposed and unexposed parents using a Cox regression model. Maternal exposure to "gasoline or exhaust" was associated with an increased risk of childhood leukaemia (HR = 2.59; 95%CI: 1.03, 6.48) and acute lymphatic leukaemia (HR = 2.71; 95%CI: 0.97, 7.58). There was an increasing risk for higher exposure (p value for trend = 0.032 and 0.027). The association did not change after adjustment for maternal smoking.

Conclusions: In spite of rather few cases, the findings in this prospective study, with the exposure metric defined a priori, support previous observations relating maternal exposure to benzene from gasoline and other petroleum-derived sources and the subsequent development of childhood leukaemia in the offspring.

**Maternal prenatal exposure to environmental factors and risk of childhood acute lymphocytic leukemia: A hospital-based case-control study in China.**

Wang Y, Gao P, Liang G, Zhang N, Wang C, Wang Y, Nie L, Lv X, Li W, Guo Q, Jiang X, Lu J.

*Cancer Epidemiol.* 2018 Dec 19;58:146-152.

The objective of this study is to investigate an association between maternal prenatal exposure to several environmental factors and risk of childhood acute lymphocytic leukemia (ALL), and the possible interactions in the Chinese population. 345 cases with ALL and their 1:1 age, gender, residence region matched controls aged 0-15 years were recruited from four hospitals in Henan Province from 2014 to 2016. Information was collected by interviews using a questionnaire. Unconditional logistic regression adjusted for age, gender, residence region and relevant confounders was carried out to generate the odds ratios (ORs) and 95% confidence intervals (CIs). The data indicate that maternal prenatal exposure to interior housing renovation (adjusted OR: 2.98, 95% CI: 1.51-5.86) or pesticides (adjusted OR: 1.48, 95% CI: 1.67-2.28) increased the risk of childhood ALL. Various subgroup analyses stratified by child's gender, age at diagnosis and other factors also supported these results. However, no interaction was detected between exposure to interior housing renovation and pesticides using an additive model. No significant links between maternal exposures to, environmental tobacco smoking (ETS), antipyretic analgesia intake, or viral infectious diseases with risk of ALL were detected.

Conclusions: These findings are in line with the existing literature, which support the hypothesis that maternal prenatal exposure to interior housing renovation and pesticides are risk factors for childhood ALL. There was no interaction between these two risk factors.