

# Overview of the epidemiologic studies on the health effects of ELF magnetic and electric fields published in the fourth trimester of 2014

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## 1. Review

### **ENVIRONMENTAL EXPOSURE TO ELECTROMAGNETIC FIELDS AND HEALTH. POSITION PAPER OF THE FRENCH HEALTH WATCH INSTITUTE.**

Institut de Veille Sanitaire, 20/11/20104

<http://www.invs.sante.fr/fr/Publications-et-outils/Avis-et-note-de-position/Expositions-environnementales-aux-champs-electromagnetiques-et-sante>

Several epidemiological observations are consistent with an increased risk of childhood leukemia; they involve relatively high environmental exposures to ELF-EMF, above 0.4 microTesla on average over 24 hours, such as those of the immediate neighbors of high or very high voltage power lines (THT).

In France, such exposure would cover 1.8% of the general population and is associated with EHV lines in 10 to 20% of cases. The results of the national Geocap case-control study were published in 2013. This study by Inserm aimed to study the risk of acute childhood leukemia in connection with exposure to ELF-EMF. The risk for leukemia was evaluated based on the distance to power lines in mainland France. It includes 2779 cases of acute childhood leukemia recorded exhaustively at the national level during the period 2002-2007 and 30,000 controls. The study concludes with an increased risk of acute leukemia when the residence is located within 50 m of a line THT (225 and 400 kV), with an odds ratio (OR) of 1.7 (confidence interval 95% [0.9, 3.6]) for all age groups. For children under 5, the OR is significant, equal to 2.6 ([1.0, 7.0]), with a significant trend in the increase in function of the inverse of the distance. In contrast, there is no increase in risk beyond 50 m from EHV line or a power line (from 63 to 150 kV) and no other significant trend in terms of distance. The results of this study carried out for the first time across the entire continental France confirm those already published in the international literature, with risk increases of the same order, found in some specific way in children less than 5 years, at a distance of less than 50 meters from VHT lines or exposed to a magnetic field strength greater than 0.3 / 0.4 microTesla. The Geocap study provides no new information on the danger of ELF-EMF, but confirms previous knowledge and shows that the French situation is comparable to other countries where the risk has been studied.

All the available epidemiological studies, however, did not provide sufficient evidence to establish a link of causality between the occurrence of leukemia and exposure to ELF-EMF and the results have not been confirmed by those of experimental work carried out on the animal. So it is only on the basis of statistical associations observed in epidemiology that the International Agency for Research on Cancer (IARC) in 2002 ranked the ELF-EMF in category 2B: possible carcinogen for humans.

Health effects as diverse as sleep disorders, headaches, reproductive abnormalities, cardiovascular disease and neurodegenerative diseases have been studied at the international level during the last 30 years. At levels of exposure encountered in the general population, in the frequency of the power grid, no health effects are currently

considered causally determined. WHO concluded in 2007 concerning non-cancer pathology, that "the scientific evidence for a link to ELF-EMF was much more tenuous than for childhood leukemia and in some cases (e.g. for cardiovascular disease) the evidence was sufficient to whether one is ensured that ELF-EMF does not cause these diseases." The SCENHIR, in light of the most recent data, confirmed by 2009 most of the findings issued in 2007.

However, epidemiological studies have found a statistical link between exposure to ELF-EMF in the workplace and the onset of Alzheimer's disease. They have been the subject of a meta-analysis in 2008 that could not conclude the existence of a causal relationship. However, the heterogeneity of the studies selected in this meta-analysis make it necessary to consider the results with caution.

#### **EXTREMELY LOW FREQUENCY ELECTRIC AND MAGNETIC FIELDS/ IS IT TIME TO BE REASONABLE?**

Lambrozo J, Plante M.

*Environ Risque Santé 2014; 13,6:440-444.*

In briefly summarizing the origins of the EMF issue, the authors note that unlike so many other risk factors such as smoking and asbestos, which arose from clinical observations, EMF was highlighted by the exploratory study by Wertheimer and Leeper, who were seeking commonalities among the families of children with leukemia. Some subsequent studies of childhood leukemia and power lines showed a consistent risk above exposure levels of 0.3-0.4  $\mu\text{T}$ , but, the authors ask, "had we really answered the question?"

They first point out the difficulties in ascertaining the exposure. Wire codes, distance to power lines, and field measurements have all been used. In addition, exposure assessment must take into account the time exposure first began, duration, intensity, and temporal variations. Studies have used geometric means, medians, and arithmetic means. Lastly, in the absence of a demonstrated biological effect, the relevant metric is still unknown.

Bias is also an issue. The classification errors between exposed and unexposed populations, selection bias, especially of controls, publication bias, and failure to take confounding factors (which are not always known) into account all contribute to weakening the reach of the results.

The authors raise several other issues related to research on low-level EMF. First, it has been mentioned in conjunction with different types of cancer with different types of mechanisms, as well as with neurodegenerative diseases, cardiovascular diseases, depression, suicide, fertility disorders, and hypersensitivity. Second, exposure to most chemical or physical agents known to be human carcinogens produces a toxic effect, that is, preliminary chronic irritation (cell damage) before any tumor appears, e.g. chronic smoker's bronchitis before bronchial cancer, skin aging before skin cancer from UV rays, respiratory irritation before cancer from formalin, pleural plaques and fibrosis before pleural mesothelioma from asbestos, and radiation burns before skin cancer from ionizing radiation. No such effect has been associated with exposure to EMF. Third, in laboratory studies, animals exposed for a lifetime have not shown tumor initiation or promotion or any effect on food intake, weight, or behavior. And last, no mechanism of action in living creatures has been demonstrated, to explain how the low energy delivered by EMF could do biological damage.

In the last paragraphs of the paper, the authors address whether Hill's criteria for causation have been met:

The strength of the association (relative risk) was around 2 in the first combined analyses. It has fallen in the most recent studies, even as their methodological quality has improved. The improvement of the classification between exposed and unexposed populations, for example, should have resulted in reducing the confidence interval, but that has not been the case. The most recent studies show instead associations that are not statistically significant or no associations at all.

There is no consistent association over all studies, for most show no significant association. The studies taking the variability of exposure into account with an exposimeter have been negative.

Dose-effect relation: one of the most reliable criteria of causality is a gradient relation between the level of exposure and the amplitude of the effect. This relation has not been observed for childhood leukemia. Moreover, the epidemiologic studies in workers exposed to magnetic field levels 10 to 15 times higher throughout their working life have not shown any excess risk.

The exposure must precede the effect: this criterion is met, because the magnetic fields associated with electricity use have been present everywhere for more than a century. Nonetheless, the usual latency between an exposure to a carcinogenic substance and its effect is not present.

The animal experiments studying carcinogenesis have proved negative.

Finally, in terms of biological plausibility, no mechanism 'squares' with the effect of a magnetic field at these levels of exposure.

Conclusions: The authors conclude that after 30 years of work, the epidemiological results stand alone and are becoming less and less certain. They agree that the issue has merited this work because it is the responsibility of the electric power industry and public authorities to ensure public safety.

## **2. Residential exposure**

### **EVERYDAY EXPOSURE TO POWER FREQUENCY MAGNETIC FIELDS AND ASSOCIATIONS WITH NON-SPECIFIC PHYSICAL SYMPTOMS.**

Bolte JF, Baliatsas C, Eikelboom T, van Kamp I.

*Environ Pollut.* 2014; 196C:224-229.

The aim of this study was to investigate the association between exposure to extremely low frequency magnetic fields (ELF MF), or power frequency fields, and non-specific physical symptoms (NSPS). In a cross-sectional study, personal exposure to ELF MF was measured for 99 adults selected in and around Amsterdam, the Netherlands in 2009-2010. They were scored on 16 NSPS. As a cut-off point for the individual 24-h time weighted average exposure the 80-percentile (0.09  $\mu$ T) was chosen. As only one man scored "moderately high" on the somatisation scale against nine women, it was decided to proceed the analyses only with the 48 women.

Conclusions: The crude odds ratio (OR) for women was 8.50 (CI 95%: 1.73-46.75), suggesting that for women environmental exposure to ELF MF is associated with an increased score on NSPS. As this is an exploratory cross-sectional study in a relatively small sample, no conclusions regarding causality can be drawn.

### **RESIDENTIAL EXPOSURE TO EXTREMELY LOW FREQUENCY ELECTROMAGNETIC FIELDS AND THE RISK OF ALS.**

Seelen M, Vermeulen RC, van Dillen LS, van der Kooi AJ, Huss A, de Visser M, van den Berg LH, Veldink JH  
*Neurology. 2014; 83(19):1767-1769.*

The authors performed a meta-analysis on the risk of exposure to extremely low frequency electromagnetic fields (ELF-EMF) and the risk of amyotrophic lateral sclerosis (ALS) combining new results with 2 previously published case-control studies. A fixed effect model showed an overall odds ratio of 0.90 (95% CI 0.73–1.10) for subjects living <200 meters compared with ≥200 meters from any high-voltage power line. One of these studies only assessed the current address at time of death, so important historical residential data regarding ELF-EMF exposure before onset of disease might be missing. A third cohort study substantiated the negative results, reporting a HR of 0.88 (95% CI 0.47–1.64).

There was no association of ALS with residential exposure to ELF-EMF. This is consistent with the lack of such an association in a previously published meta-analysis of electrical occupations. Strengths of this study are the population-based study design, inclusion of large numbers of patients and age- and sex-matched controls, and prevention of recall bias by the use of the Municipal Personal Records Database for collection of residential data. A limitation of this study may be the low number of participants living in close vicinity to power lines (<200 meters). However, taking all studies together, one can conclude that exposure to ELF-EMF from power lines does not increase the risk of developing ALS.

### **3. Occupational exposure**

#### **OCCUPATIONAL EXPOSURE TO EXTREMELY LOW FREQUENCY MAGNETIC FIELDS OR ELECTRIC SHOCKS AND CANCER INCIDENCE IN FOUR NORDIC COUNTRIES.**

Guxens M, Slottje P, Kromhout H, Huss A, Ivar Martinsen J, Kauppinen T, Uuksulainen S, Weiderspass E, Sparén P, Tryggvadóttir L, Kjærheim K, Vermeulen R, Pukkala E.

*Occup Environ Med. 2014; 71 Suppl 1:A50.*

The objective of this study was to evaluate the association between occupational exposure to extremely low frequency magnetic fields (ELF-MF) or electric shocks and brain cancer, haemopoietic and lymphatic malignancies, and breast cancer incidence in the Nordic Occupational Cancer cohort.

The cohort was set up by linking occupational information from national censuses held in 1960, 1970, 1980-1, and/or 1990 to national cancer registry data in Finland, Iceland, Norway, and Sweden. All subjects aged 30-64 years who participated in a census were followed-up for cancer incidence until 2003-2005. Occupational exposure to ELF-MF or electric shocks (low, medium, high) was assigned to each subject based on census reported jobs using job-exposure matrices. For each case, five controls were randomly selected by matching for country, age, and sex. Conditional logistic regression models were performed adjusting for social class and occupational exposure to solvents.

A total of 68 770 brain cancer cases, 65 609 non-hodgkin lymphoma cases, 83 088 leukaemia cases, 33 791 multiple myeloma cases, 1827 male breast cancer cases, and 297 283 female breast cancer cases were included. Thirty-five percent of the total population was ever exposed to medium levels of ELF-MF and 7% to high levels,

whereas 19% was ever exposed to a medium risk of electric shocks and 13% to a high risk. No associations were found between occupational exposure to ELF-MF or electric shocks and any of the cancer outcomes.

Conclusions: In this very large census cohort no evidence of increased risk of several cancers in relation with occupational exposure to ELF-MF or electric shocks was found.

**OCCUPATIONAL ELECTROMAGNETIC FIELD EXPOSURES ASSOCIATED WITH SLEEP QUALITY: A CROSS-SECTIONAL STUDY.**

Liu H, Chen G, Pan Y, Chen Z, Jin W, Sun C, Chen C, Dong X, Chen K, Xu Z, Zhang S, Yu Y.

*PLoS One.* 2014; 9(10):e110825.

Exposure to electromagnetic field (EMF) emitted by mobile phone and other machineries concerns half the world's population and raises the problem of their impact on human health. The present study aims to explore the effects of electromagnetic field exposures on sleep quality and sleep duration among workers from electric power plant.

A cross-sectional study was conducted in an electric power plant of Zhejiang Province, China. A total of 854 participants were included in the final analysis. The detailed information of participants was obtained by trained investigators using a structured questionnaire, which included socio-demographic characteristics, lifestyle variables, sleep variables and electromagnetic exposures. Physical examination and venous blood collection were also carried out for every study subject.

After grouping daily occupational electromagnetic exposure into three categories, subjects with long daily exposure time had a significantly higher risk of poor sleep quality in comparison to those with short daily exposure time. The adjusted odds ratios were 1.68 (95%CI: 1.18, 2.39) and 1.57 (95%CI: 1.10, 2.24) across tertiles. Additionally, among the subjects with long-term occupational exposure, the longer daily occupational exposure time apparently increased the risk of poor sleep quality (OR (95%CI): 2.12 (1.23~3.66) in the second tertile; 1.83 (1.07~3.15) in the third tertile). There was no significant association of long-term occupational exposure duration, monthly electric fee or years of mobile-phone use with sleep quality or sleep duration.

Conclusions: The findings showed that daily occupational EMF exposure was positively associated with poor sleep quality. It implies EMF exposure may damage human sleep quality rather than sleep duration.

#### **4. Human experiment**

**INVESTIGATION OF EEG CHANGES DURING EXPOSURE TO EXTREMELY LOW-FREQUENCY MAGNETIC FIELD TO CONDUCT BRAIN SIGNALS.**

Shafiei SA, Firoozabadi SM, Tabatabaie KR, Ghabaee M.

*Neurol Sci.* 2014; 35(11):1715-1721.

There are evidences that confirm the effect of magnetic fields (MFs) on brain signals and some psychological disorders such as headache, migraine and depression. The aim of the present study was to investigate changes in EEG power spectrum due to localized exposure in different parts of the brain by extremely low-frequency magnetic fields (ELF-MFs) to extract some protocols for treatment of some psychological disorders. In addition, regular effects were investigated by increasing intensity of ELF-MF. Therefore, EEG relative power spectrum was evaluated at T4, T3, F3, F4, and Cz points, when all

the points were exposed to MFs with 45, 17, 10, 5, and 3 Hz frequencies, separately. Intensity of MF was 0, 100, 240, or 360  $\mu$ T in four sessions. Significant changes were observed in different EEG bands caused by locally exposing to ELF-MF in different points of brain ( $P < 0.05$ ). Some exposure to MFs decreased alpha band of frontal and central areas in closed-eyes state. Based on the findings in this study, some protocols can be designed using a combination of various MFs exposures to conduct the brain signals that is necessary to evaluate clinically.

## 5. Exposure assessment

### **RELATIVE ACCURACY OF GRID REFERENCES DERIVED FROM POSTCODE AND ADDRESS IN UK EPIDEMIOLOGICAL STUDIES OF OVERHEAD POWER LINES.**

Swanson J, Vincent TJ, Bunch KJ.

*J Radiol Prot.* 2014; 34(4):N81-86.

In the UK, the location of an address, necessary for calculating the distance to overhead power lines in epidemiological studies, is available from different sources. The authors assess the accuracy of each. The grid reference specific to each address, provided by the Ordnance Survey product Address-Point, is generally accurate to a few meters, which will usually be sufficient for calculating magnetic fields from the power lines. The grid reference derived from the postcode rather than the individual address is generally accurate to tens of meters, and may be acceptable for assessing effects that vary in the general proximity of the power line, but is probably not acceptable for assessing magnetic-field effects.

### **OCCUPATIONAL EXPOSURE TO ELECTROMAGNETIC FIELDS OF UNINTERRUPTIBLE POWER SUPPLY INDUSTRY WORKERS.**

Teşneli NB, Teşneli AY.

*Radiat Prot Dosimetry.* 201; 162(3):289-298.

To assess exposure to ELF EMFs, electric and magnetic field spot measurements were performed extensively at the workplace of a worldwide uninterruptible power supply (UPS) factory. The measurements were carried out in order to get the electric and magnetic field exposure results in real working situations in test areas, production lines and power substations. The electric and magnetic fields reached up to 992.0 V m<sup>(-1)</sup> and 215.6  $\mu$ T in the test areas, respectively. The fields existed up to 26.7 V m<sup>(-1)</sup> and 7.6  $\mu$ T in the production lines. The field levels in the vicinity of the power substations did not exceed 165.5 V m<sup>(-1)</sup> and 65  $\mu$ T. The data presented are useful in determining the occupational exposure levels of UPS industry workers. The measurements are below the reference levels recommended by the guideline published in 2010 by the International Commission on Non-Ionizing Radiation Protection and action levels of the directive adopted in 2013 by European Parliament and Council.

## 6. Childhood leukaemia studies

### **RESIDENTIAL LEVELS OF POLYBROMINATED DIPHENYL ETHERS AND RISK OF CHILDHOOD ACUTE LYMPHOBLASTIC LEUKEMIA IN CALIFORNIA.**

Ward MH, Colt JS, Deziel NC, Whitehead TP, Reynolds P, Gunier RB, Nishioka M, Dahl GV, Rappaport SM, Buffler PA, Metayer C.

*Environ Health Perspect.* 2014; 122(10):1110-1116.

House dust is a major source of exposure to polybrominated diphenyl ethers (PBDEs), which are found at high levels in U.S. homes.

The authors studied 167 acute lymphoblastic leukemia (ALL) cases 0-7 years of age and 214 birth certificate controls matched on date of birth, sex, and race/ethnicity from the Northern California Childhood Leukemia Study. In 2001-2007, they sampled carpets in the room where the child spent the most time while awake using a high-volume small-surface sampler or taking dust from the home vacuum. Concentrations of 14 PBDE congeners including penta (28, 47, 99, 100, 153, 154), octa (183, 196, 197, 203), and decaBDEs (206-209) were measured. Odds ratios (ORs) were calculated using logistic regression, adjusting for demographics, income, year of dust collection, and sampling method.

BDE-47, BDE-99, and BDE-209 were found at the highest concentrations (medians, 1,173, 1,579, and 938 ng/g, respectively). Comparing the highest to lowest quartile, the authors found no association with ALL for summed pentaBDEs (OR = 0.7; 95% CI: 0.4, 1.3), octaBDEs (OR = 1.3; 95% CI: 0.7, 2.3), or decaBDEs (OR = 1.0; 95% CI: 0.6, 1.8). Comparing homes in the highest concentration (nanograms per gram) tertile to those with no detections, significantly increased ALL risk for BDE-196 (OR = 2.1; 95% CI: 1.1, 3.8), BDE-203 (OR = 2.0; 95% CI: 1.1, 3.6), BDE-206 (OR = 2.1; 95% CI: 1.1, 3.9), and BDE-207 (OR = 2.0; 95% CI: 1.03, 3.8) was observed.

Conclusions: The authors found no association with ALL for common PBDEs, but observed positive associations for specific octa and nonaBDEs. Additional studies with repeated sampling and biological measures would be informative.

### **TOBACCO SMOKE AND RISK OF CHILDHOOD ACUTE NON-LYMPHOCYTIC LEUKEMIA: FINDINGS FROM THE SETIL STUDY.**

Mattioli S, Farioli A, Legittimo P, Miligi L, Benvenuti A, Ranucci A, Salvan A, Rondelli R, Magnani C; SETIL Study Group.

*PLoS One.* 2014 Nov 17;9(11):e111028.

Parental smoking and exposure of the mother or the child to environmental tobacco smoke (ETS) as risk factors for Acute non-Lymphocytic Leukemia (AnLL) were investigated. Incident cases of childhood AnLL were enrolled in 14 Italian Regions during 1998-2001. Odds ratios (OR) and 95% confidence intervals (95%CI) were estimated conducting logistic regression models including 82 cases of AnLL and 1,044 controls. Inverse probability weighting was applied adjusting for: age; sex; provenience; birth order; birth weight; breastfeeding; parental educational level age, birth year, and occupational exposure to benzene.

Paternal smoke in the conception period was associated with AnLL (OR for  $\geq 11$  cigarettes/day = 1.79, 95% CI 1.01-3.15; P trend 0.05). An apparent effect modification by maternal age was identified: only children of mothers aged below 30 presented increased risks. Weak statistical evidence of an association of AnLL with maternal exposure to ETS (OR for exposure >3 hours/day = 1.85, 95%CI 0.97-3.52; P trend 0.07)

was found. No association was observed between AnLL and either maternal smoking during pregnancy or child exposure to ETS.

Conclusions: This study is consistent with the hypothesis that paternal smoke is associated with AnLL. The authors observed statistical evidence of an association between maternal exposure to ETS and AnLL, but believe bias might have inflated their estimates.

**MATERNAL BENZENE EXPOSURE DURING PREGNANCY AND RISK OF CHILDHOOD ACUTE LYMPHOBLASTIC LEUKEMIA: A META-ANALYSIS OF EPIDEMIOLOGIC STUDIES.**

Zhou Y, Zhang S, Li Z, Zhu J, Bi Y, Bai Y, Wang H.

*PLoS One.* 2014; 9(10):e110466.

The prevalence of childhood leukemia is increasing rapidly all over the world. However, studies on maternal benzene exposure during pregnancy and childhood acute lymphoblastic leukemia (ALL) have not been systematically assessed. Therefore, the authors performed a meta-analysis to investigate the association between maternal solvent, paint, petroleum exposure, and smoking during pregnancy and risk of childhood ALL.

Relevant studies up to September 1st, 2013 were identified by searching the PubMed, EMBASE, Cochrane library and the Web of Science databases. The effects were pooled using either fixed or random effect models based on the heterogeneity of the studies.

Twenty-eight case-control studies and one cohort study were included for analysis, with a total of 16,695 cases and 1,472,786 controls involved. Pooled odds ratio (OR) with 95% confidence interval (CI) for ALL was 1.25 (1.09, 1.45) for solvent, 1.23 (1.02, 1.47) for paint, 1.42 (1.10, 1.84) for petroleum exposure, and 0.99 (0.93, 1.06) for maternal smoking during pregnancy. No publication bias was found in this meta-analysis and consistent results were observed for subgroup and sensitivity analyses.

Conclusions: Childhood ALL was associated with maternal solvent, paint, and petroleum exposure during pregnancy. No association was found between ALL and maternal smoking during pregnancy.

**PARENTAL OCCUPATIONAL PAINT EXPOSURE AND RISK OF CHILDHOOD LEUKEMIA IN THE OFFSPRING: FINDINGS FROM THE CHILDHOOD LEUKEMIA INTERNATIONAL CONSORTIUM.**

Bailey HD, Fritschi L, Metayer C, Infante-Rivard C, Magnani C, Petridou E, Roman E, Spector LG, Kaatsch P, Clavel J, Milne E, Dockerty JD, Glass DC, Lightfoot T, Miligi L, Rudant J, Baka M, Rondelli R, Amigou A, Simpson J, Kang AY, Moschovi M, Schüz J.

*Cancer Causes Control.* 2014; 25(10):1351-1367.

It has been suggested that parental occupational paint exposure around the time of conception or pregnancy increases the risk of childhood leukemia in the offspring.

The authors obtained individual level data from 13 case-control studies participating in the Childhood Leukemia International Consortium. Occupational data were harmonized to a compatible format. Meta-analyses of study-specific odds ratios (ORs) were undertaken, as well as pooled analyses of individual data using unconditional logistic regression.

Using individual data from fathers of 8,185 cases and 14,210 controls, the pooled OR for paternal exposure around conception and risk of acute lymphoblastic leukemia (ALL)



was 0.93 [95% confidence interval (CI) 0.76, 1.14]. Analysis of data from 8,156 ALL case mothers and 14,568 control mothers produced a pooled OR of 0.81 (95% CI 0.39, 1.68) for exposure during pregnancy. For acute myeloid leukemia (AML), the pooled ORs for paternal and maternal exposure were 0.96 (95% CI 0.65, 1.41) and 1.31 (95% CI 0.38, 4.47), respectively, based on data from 1,231 case and 11,392 control fathers and 1,329 case and 12,141 control mothers. Heterogeneity among the individual studies ranged from low to modest.

Conclusions: Null findings for paternal exposure for both ALL and AML are consistent with previous reports. Despite the large sample size, results for maternal exposure to paints in pregnancy were based on small numbers of exposed. Overall, no evidence was found that parental occupational exposure to paints increases the risk of leukemia in the offspring, but further data on home exposure are needed.

**PARENTAL OCCUPATIONAL PESTICIDE EXPOSURE AND THE RISK OF CHILDHOOD LEUKEMIA IN THE OFFSPRING: FINDINGS FROM THE CHILDHOOD LEUKEMIA INTERNATIONAL CONSORTIUM.**

Bailey HD<sup>1</sup>, Fritschi L, Infante-Rivard C, Glass DC, Miligi L, Dockerty JD, Lightfoot T, Clavel J, Roman E, Spector LG, Kaatsch P, Metayer C, Magnani C, Milne E, Polychronopoulou S, Simpson J, Rudant J, Sidi V, Rondelli R, Orsi L, Kang AY, Petridou E, Schüz J.

*Int J Cancer. 20141 ;135(9):2157-2172.*

Maternal occupational pesticide exposure during pregnancy and/or paternal occupational pesticide exposure around conception have been suggested to increase risk of leukemia in the offspring. With a view to providing insight in this area the authors pooled individual level data from 13 case-control studies participating in the Childhood Leukemia International Consortium (CLIC). Occupational data were harmonized to a compatible format. Pooled individual analyses were undertaken using unconditional logistic regression. Using exposure data from mothers of 8,236 cases, and 14,850 controls, and from fathers of 8,169 cases and 14,201 controls the odds ratio (OR) for maternal exposure during pregnancy and the risk of acute lymphoblastic leukemia (ALL) was 1.01 [95% confidence interval (CI) 0.78, 1.30] and for paternal exposure around conception 1.20 (95% 1.06, 1.38). For acute myeloid leukemia (AML), the OR for maternal exposure during pregnancy was 1.94 (CI 1.19, 3.18) and for paternal exposure around conception 0.91 (CI 0.66, 1.24.) based on data from 1,329 case and 12,141 control mothers, and 1,231 case and 11,383 control fathers. This finding of a significantly increased risk of AML in the offspring with maternal exposure to pesticides during pregnancy is consistent with previous reports. The authors also found a slight increase in risk of ALL with paternal exposure around conception which appeared to be more evident in children diagnosed at the age of 5 years or more and those with T cell ALL which raises interesting questions on possible mechanisms.