Overview of the epidemiologic studies on the health effects of ELF electric and magnetic fields (ELF-EMF) published in the first quarter of 2025.

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1. Reviews and meta-analyses

1.1. Environmental risk factors for all-cause dementia, Alzheimer's disease dementia, vascular dementia, and mild cognitive impairment: An umbrella review and meta-analysis

Jones, A., Ali, M. U., Mayhew, A., Aryal, K., Correia, R. H., Dash, D., Manis, D. R., Rehman, A., O'Connell, M. E., Taler, V., Costa, A. P., Hogan, D. B., Wolfson, C., Raina, P., & Griffith, L. (2025). Environmental risk factors for all-cause dementia, Alzheimer's disease dementia, vascular dementia, and mild cognitive impairment: An umbrella review and meta-analysis. *Environmental research*, *270*, 121007.

Background: Mitigation of environmental risk factors for neurocognitive disorders could reduce the number of incident cases. The authors sought to synthesize the literature on environmental risk factors for dementia and mild cognitive impairment.

Methods: An umbrella review and meta-analysis was conducted. Multiple databases were systematically searched to identify systematic reviews and meta-analyses of longitudinal studies examining environmental risk factors for dementia or mild cognitive impairment. The authors used random effects multi-level, meta-analytic models to synthesize risk ratios for each risk factor while accounting for overlap in the studies within reviews. As a secondary objective, risk factors for two common phenotypes of dementia were examined: Alzheimer's disease dementia and vascular dementia.

Results: A total of 19 reviews containing 37 meta-analyses were included umbrella review. 9 factors were found where exposure was associated with higher risks of all-cause dementia: fine particulate matter, particulate matter, nitrogen dioxide, nitrogen oxides, carbon monoxide, shift work, night shift work, chronic noise, and extremely-low frequency magnetic fields. Neighbourhood greenness was associated with a lower risk of all-cause dementia. In a narrative review, the authors found that exposure to sulfur dioxide, proximity to roadways, ionizing radiation, aluminum, solvents, pesticides, and environmental tobacco smoke were also associated with dementia. They also found that fine particulate matter, extremely-low frequency magnetic fields, sulfur dioxide, chronic noise, and pesticides were related to Alzheimer's disease dementia. Fine particulate matter, particulate matter, and chronic noise were related to vascular dementia. No systematic review reported on mild cognitive impairment.

Conclusions: Achieving stronger air quality targets has the potential to reduce population-level dementia risk. Neighbourhood (i.e., greenness and chronic noise) and occupational (i.e., shift work) characteristics are associated with dementia and are viable public health intervention points. Additional research should examine the relationship between other environmental risk factors and mild cognitive impairment and specific types of dementia.

Comment: As explained by the authors, high exposures to ELF-EMF was estimated from occupation. The observed impact on dementia may be confounded by other occupational factors; since these are more 'blue collar' type workers, they may have a higher risk of dementia through social variables.

2. Residential exposure

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3. Occupational exposure

3.1. Electrical injuries in occupational and non-occupational settings over a decade in Colombia: Cross-sectional study

Teherán, A. A., Ayala, K. P., Camero-Ramos, G., Pombo, L. M., Mejía, M. C., & Piñeros, L. G. (2025). Electrical injuries in occupational and non-occupational settings over a decade in Colombia: Cross-sectional study. *Clinical Epidemiology and Global Health*, *33*.

Background: Annually, electrical injuries affect 1.2 million people worldwide, and up to 40 % injured people have long time complications. This study aims to identify factors related to electrical injuries in occupational and nonoccupational settings.

Methods: A cross-sectional study was conducted using an anonymized public database about electrical injuries in Colombia (2010–2019). Sociodemographic characteristics were described (counts [%], incidence/100,000 people), and a binary logistic regression model was applied to identify factors related (adjusted for age and sex; aOR, IC95 %) to electrical injuries in occupational and non-occupational settings.

Results: 3009 electrical injuries were analyzed, 2452 in non-occupational settings, and 557 in occupational settings, mostly men (87.0 %), and the median age was 30 years. Burns (49.7 %) and deaths (29.2 %) were the most frequent outcomes, respectively, in occupational and non-occupational settings. Factors related to electrical injuries in occupational settings were male sex (13.4; 6.31–28.5), adulthood (5.80; 4.54–7.42), high school/ technical education (24.6; 18.4–32.9), rural areas (3.47; 2.85–4.23), daytime occurrence (2.32; 1.65–3.26), and the median time to the event was 20 months (Kaplan Meier: CI95 %); In non-occupational settings, they were early childhood (25.2; 9.25–68.8) and adolescence (41.9; 5.88–299.7), primary education level (3.12; 2.24–4.35), urban areas (3.47; 2.85–4.23), and nighttime occurrence (2.32; 1.65–3.26).

Conclusions: In Colombia, electrical injuries mainly occurred in non-occupational settings. Implementing public health measures targeting high-risk groups identified in factors associated with these injuries, particularly in homes and outdoor environments, could potentially prevent at least 67.8 % of these incidents.

4. Exposure Assessment

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5. Leukaemia Studies

5.1. The association between iron supplementation during pregnancy and the risk of childhood leukemia: a meta-analysis of case-control studies.

Dabir, M., Pam, P., Jamali, M., Saba, F., & Ghoreishi, Z. (2025). The association between iron supplementation during pregnancy and the risk of childhood leukemia: a meta-analysis of case-control studies. *The Journal of Maternal-Fetal & Neonatal Medicine*, *38*(1). https://doi.org/10.1080/14767058.2025.2474268

Background: Acute leukemia (AL) presents significant health challenges, particularly in children, and iron plays a critical role in cellular processes that could influence cancer development. The study was motivated by the need to clarify the potential role of iron supplementation during pregnancy in influencing the risk of developing childhood leukemia.

Methods: This meta-analysis adhered to PRISMA guidelines and systematically searched PubMed, Scopus, and Web of Science databases up to April 2024 for relevant observational studies. Inclusion criteria focused on case-control studies assessing the relationship between iron supplementation during pregnancy and leukemia risk, reporting odds ratios (ORs) with 95% confidence intervals (CIs). Data extraction and quality assessment were performed independently by two researchers using the Newcastle-Ottawa Scale (NOS). Statistical analysis involved calculating overall relative risk (RR) using a random-effects model and assessing heterogeneity through Cochran's Q test and the I^2 statistic. Publication bias was evaluated using Egger's and Begg's tests.

Results: The study analyzed data from 9 studies with 12 data sets involving a total of 4281 participants (2327 cases and 1954 controls). The findings indicated no significant association between iron supplementation during pregnancy and the overall risk of childhood leukemia (OR:1.01; 95% CI: 0.84–1.21, I2=63.2%). Also, no relationship was found between receiving iron supplements during pregnancy and the risk of AML (OR:1.01; 95% CI: 0.84–1.21, I2=56.6%) and ALL (OR:1.00; 95% CI: 0.81–1.24, I2=67.3%).

Conclusions: This study found no significant association between iron supplementation during pregnancy and AL risk among case-control studies. Further research is needed to explore the potential influence of genetic and environmental factors on this relationship.

5.2. Maternal and infant diet play a role in acute leukemia development: An expanded systematic review and meta-analysis.

Flores-García, M. K., Flores-Collado, G., Mérida-Ortega, Á., Ugalde-Resano, R., González-Rocha, A., Denova-Gutiérrez, E., Muñoz-Aguirre, P., Zapata-Tarrés, M., & López-Carrillo, L. (2025). Maternal and infant diet play a role in acute leukemia development: An expanded systematic review and meta-analysis. *Clinical nutrition ESPEN*, *66*, 515–522.

Background: The most common subtypes of acute leukemia (AL) are acute lymphoid leukemia (ALL), and acute myeloid leukemia (AML). Among those less than 15 years old, ALL is the most common subtype. It has recently been proposed that diet may play an important role in the development of AL. This review expands on the existing systematic reviews and meta-analyses published on infant and maternal diet in relation to AL.

Methods: An electronic search was carried out in four databases (Pubmed/Medline Lilacs, Scopus and Web of Science), through April 2022. Observational epidemiological studies that reported the association between AL (ALL and/or AML) and the food consumed by children (<18 years), their mother or both were included. Fixed effects models were used for meta-analysis and heterogeneity between studies was assessed using the Q statistic test and I2 estimation. The risk of bias was assessed using the Newcastle-Ottawa scale.

Results: A total of 15 studies were included (1 cohort and 14 case-control), of which 9 exclusively evaluated the maternal diet, 4 child diet, and 2 that evaluated both. The results showed that children's consumption of processed meat was positively associated with AL (OR = 1.72; 95 % CI 1.08, 2.72), whereas the consumption of vegetables was found to be inversely associated with AL (OR = 0.61; 95 % CI % 0.39, 0.92). Furthermore, maternal fruit consumption was inversely associated with ALL (OR = 0.71; 95 % CI 0.59-0.83), while coffee consumption was positively associated with AL (OR = 1.20; 95 % CI 1.00, 1.44) and ALL (OR = 1.31; 95 % CI: 1.10, 1.56).

Conclusions: These results support that maternal and early infant diet play a role in the development of AL. They also highlight the dearth of information regarding the relationship between dietary patterns and AL, presenting an opportunity for future studies to explore this aspect further.

5.3. Maternal illnesses during pregnancy and the risk of childhood cancer: A medical-record based analysis (UKCCS).

Bonaventure, A., Simpson, J., Kane, E., & Roman, E. (2025). Maternal illnesses during pregnancy and the risk of childhood cancer: A medical-record based analysis (UKCCS). *International journal of cancer*, *156*(5), 920–929.

Background: Often relying on mother's recollections of past events, the possible relationship between maternal illness in pregnancy and risk of malignancy in their offspring has long been a focus of research. Free from recall bias, this study of childhood cancer (0-14 years) examined these associations using data abstracted from mothers' primary-care (1623 cases, 2521 controls) and obstetric (2721 cases, 5169 controls) records.

Methods: Maternal infections and other illnesses in pregnancy were examined for any possible associations with childhood leukaemia, lymphoma, CNS or embryonal tumours using pooled information from the two medical record sources (2885 cases and 5499 controls), accounting for potential confounders.

Results: Maternal anaemia was associated with childhood acute myeloid leukaemia (AML) (odds ratio, OR = 2.07, 95%CI [1.40-3.08]). Anaemia during pregnancy was also recorded more frequently in the notes of mothers of children with medulloblastoma, retinoblastoma and embryonal rhabdomyosarcoma: ORs 2.36 [1.36-4.11], 1.83 [1.01-3.33] and 2.91 [1.64-5.16], respectively. Other

associations included urinary tract infections (UTIs) and non-Hodgkin lymphoma (NHL); preeclampsia and NHL; and polyhydramnios with both AML and NHL. No evidence was found to suggest that influenza during pregnancy impacted on childhood leukaemia risk.

Conclusions: These findings are supportive of an association between maternal anaemia in pregnancy and childhood AML, and maternal anaemia and embryonal tumours; underscoring the need for further research exploring the potential causes and roles of iron and vitamin deficiencies. Due to small numbers and lack of corroborative evidence, the associations observed for UTIs, preeclampsia, and polyhydramnios must be treated cautiously.

6. References

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