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Exposure to magnetic fields and childhood leukemia: a systematic review and meta-analysis of case-control and cohort studies

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Abstract

The association between childhood leukemia and extremely low frequency magnetic fields (ELF-MF) generated by power lines and various electric appliances has been studied extensively during the past 40 years. However, the conditions under which ELF-MF represent a risk factor for leukemia are still unclear. Therefore, we have performed a systematic review and meta-analysis to clarify the relation between ELF-MF from several sources and childhood leukemia. We have systematically searched Medline

Article

takes into account the different measures used to assess magnetic field exposure: magnetic flux density measurements (<0.2 μT vs. >0.2 μT), distances between the child's home and power lines (>200 m vs. <200 m) and wire codings (low current configuration vs. high current configuration). Moreover, meta-analyses either based on magnetic flux densities, on proximity to power lines or on wire codings have been performed. The association between electric appliances and childhood leukemia has also been examined. Of the 863 references identified, 38 studies have been included in our systematic review. Our global meta-analysis indicated an association between childhood leukemia and ELF-MF (21 studies, pooled OR=1.26; 95% CI 1.06–1.49), an association mainly explained by the studies conducted before 2000 (earlier studies: pooled OR=1.51; 95% CI 1.26–1.80 vs. later studies: pooled OR=1.04; 95% CI 0.84–1.29). Our meta-analyses based only on magnetic field measurements indicated that the magnetic flux density threshold associated with childhood leukemia is higher than 0.4 μT (12 studies, >0.4 μT: pooled OR=1.37; 95% CI 1.05–1.80; acute lymphoblastic leukemia alone: seven studies, >0.4 μT: pooled OR=1.88; 95% CI 1.31–2.70). Lower magnetic fields were not associated with leukemia (12 studies, 0.1–0.2 μT: pooled OR=1.04; 95% CI 0.88–1.24; 0.2–0.4 μT: pooled OR=1.07; 95% CI 0.87–1.30). Our meta-analyses based only on distances (five studies) showed that the pooled ORs for living within 50 m and 200 m of power lines were 1.11 (95% CI 0.81–1.52) and 0.98 (95% CI 0.85–1.12), respectively. The pooled OR for living within 50 m of power lines and acute lymphoblastic leukemia analyzed separately was 1.44 (95% CI 0.72–2.88). Our meta-analyses based only on wire codings (five studies) indicated that the pooled OR for the very high current configuration (VHCC) was 1.23 (95% CI 0.72–2.10). Finally, the risk of childhood leukemia was increased after exposure to electric blankets (four studies, pooled OR=2.75; 95% CI 1.71–4.42) and, to a lesser extent, electric clocks (four studies, pooled OR=1.27; 95% CI 1.01–1.60). Our results suggest that ELF-

MF higher than 0.4 μT can increase the risk of developing leukemia in children, probably acute lymphoblastic leukemia. Prolonged exposure to electric appliances that generate magnetic fields higher than 0.4 μT like electric blankets is associated with a greater risk of childhood leukemia.
Keywords: cancer; childhood leukemia; electromagnetic fields; magnetic fields; power lines

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Supplementary Material

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