EPIDEMIOLOGIC STUDIES ON HEALTH EFFECTS FROM HIGH VOLTAGE POWER LINES AND MOBILE PHONE USE

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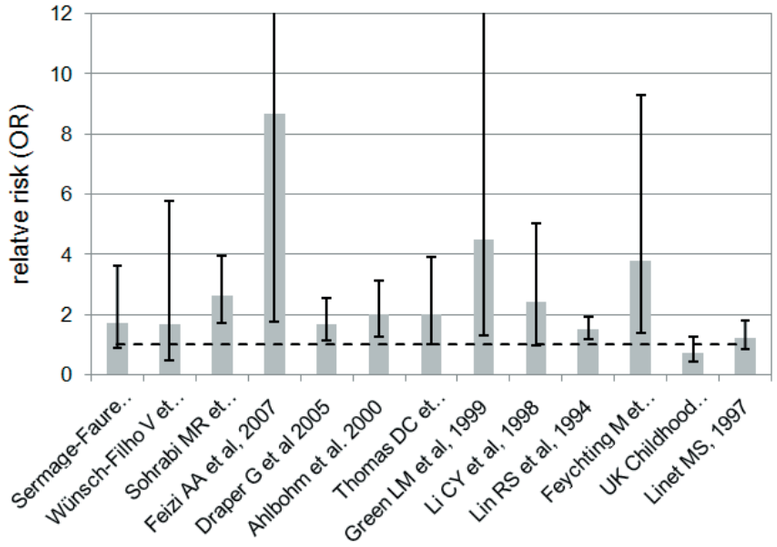
HIGH POWER VOLTAGE LINES

Numerous epidemiological studies have been conducted on possible adverse health effects to populations living in the proximity of high voltage power lines. The majority of available studies found an increase in leukemia incidence in children, with about a doubling of risk in the highest exposure group. Since childhood leukemia is a rare disease - with only about 4 cases per 100,000 per year - the results of single studies often do not reach statistical significance. But overall, the evidence of an association of childhood leukemia risk with proximity to high voltage power lines is beyond reasonable doubt.

In a case-control study, odds is the ratio of the number of cases (children with cancer) to the number of controls (children without cancer). The odds ratio (OR) is the ratio of two odds, i.e. the ratio of the odds near the power line to the odds far from the power line (categorial analysis). In most studies, the cut point is chosen at 50 meters or at a magnetic field strength of 0.3 or 0.4 μT. Other studies use trend analyses (logistic regression) to determine the distance dependency of the odds.

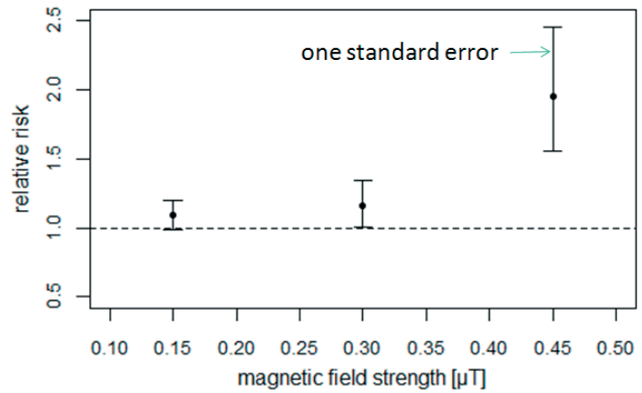
Figure 1 summarizes the results for relative risks (OR) and 95% confidence intervals found in 13 case control studies that published these data. The broken line indicates OR=1. The mean OR is about 2. Only one study, the UK Childhood Cancer Study (2000), reported OR<1. For seven studies, the lower limit of the 95% confidence interval is greater than 1.

Fig.1: **Results of case-control studies of childhood leukemia near HV power lines**



The case-control study by Ahlbom et al. (2000) [1] is a meta-analysis of studies from 9 countries (Canada, Denmark, Finland, Germany, New Zealand, Norway, Sweden, USA, and UK). He grouped the data into four dose categories (<0.1, 0.1-0.2, 0.2-0.4, >0.4 μT) and determined the OR for the individual categories >0.1 μT vs. the lowest category <0.1 μT. For the highest category (>0.4 μT), the OR was 1.95 (*P*<0.01). The OR for 0.1-0.2 μT and 0.2-0.4 μT were not significantly greater than one.

Fig.2: **Distance dependency of relative risk (odds ratio) determined by Ahlbom et al.**



A large French study by Sermage et al. (2013) [2] included all 2779 cases of childhood acute leukemia (AL) in 2002-2007 and 30 000 controls. At distances r<50 m they found OR=2.08 (95% CI: 0.9-4.7) for all children, but OR=4.67 (1.3-13.3) for young children below age 5. No increase was observed for children age 5-14; the odds ratio was 1.02. The numbers of cases and controls, and the results, are presented in Table 1.

Table 1: **Results of the study by Sermage et al. [2]**

	>200 m	100-200 m	50-100 m	<50 m
0-14 yrs				
cases	610	13	6	7
controls	7061	200	68	39
odds	0.09	0.07	0.09	0.18
odds ratio	1.00	0.75	1.02	2.08 (0.9-4.7)
0-4 yrs				
cases	311	4	4	5
controls	2326	63	19	8
odds	0.13	0.06	0.21	0.63
odds ratio	1.00	0.47	1.57	4.67 (1.3-13.3)
5-14 yrs				
cases	299	9	2	2
controls	4735	137	49	31
odds	0.06	0.07	0.04	0.06
odds ratio	1.00	1.04	0.65	1.02

MOBILE PHONE USE AND BRAIN TUMOR

Mobile phones and smart phones emit high frequency (HF) electromagnetic radiation in the GHz range. Due to their wide use, possible adverse health effects would have a great impact on public health. Most epidemiological studies have focused on brain cancer (glioma). The evaluation of these studies caused the International Agency for Research on Cancer (IARC) and the World Health Organization (WHO) in 2011 to consider HF fields from mobile phones as potentially cancerogenic.

IARC referred mainly to the results of the INTERPHONE study (2010) [3], a large international case-control study which included 2708 cases of glioma and matched controls from 13 countries. The main result was a statistically significant increase of risk in the highest exposed group (>1640 cumulated hours of mobile phone use); the odds ratio was 1.40 (1.03-1.89), but no increased risk was found in the less exposed groups.

A study by Little et al. (2012) [4] investigated the time trend of brain cancer in the U.S. in 1992-2008. The study included 24 813 cases of glioma in people age 18 years or older. Glioma incidence did not increase with time (-0.02% change per year) while mobile phone use experienced an exponential growth. The authors concluded that their results did not support any brain cancer risk from mobile phone use.

The rapid increase in mobile phone use in young people has generated concern about possible health effects of exposure to radiofrequency (RF). MOBI-Kids [5], a multinational case-control study, is designed to investigate the potential effects of childhood and adolescent exposure to radiation from mobile communications technologies on brain tumor risk in 14 countries. The study, which aims to include approximately 1,000 brain tumor cases aged 10-24 years and two individually matched controls for each case, follows a common protocol and builds upon the methodological experience of the INTERPHONE study. The researchers concluded that MOBI-Kids is feasible and will generate results that will contribute to the understanding of potential brain tumor risks associated with use of mobile phones and other wireless communications technologies among young people.

SUMMARY

Most epidemiological studies of childhood leukemia near overhead power lines find increased risks at distances less than 50 meters. A large meta-analysis determines a doubling of risk for exposures at a magnetic field strength greater than 0.4 μT. The effect is driven by children below age 5 years. The biological mechanism, however, is not yet understood. Therefore a causal relation is disputed by official institutions, e.g. WHO and ICNIRP. The possible effects of mobile phone use on brain cancer were investigated by INTERPHONE, a large international case-control study. The study found a small but statistically significant rise of glioma risk after frequent mobile phone use. This caused IARC and WHO to consider heavy mobile phone use as potentially cancerogenic.

References

1. Ahlbom A, Day N, Feychting M, Roman E, Skinner J, Dockerty J, Linet M, McBride M, Michaelis J, Olsen JH, Tynes T, Verkasalo PK. A pooled analysis of magnetic fields and childhood leukaemia. Br J Cancer. 2000 Sep;83(5):692-8. PubMed PMID: 10944614; PubMed Central PMCID: PMC2363518.
2. Sermage-Faure C, Demoury C, Rudant J, Goujon-Bellec S, Guyot-Goubin A, Deschamps F, Hemon D, Clavel J. Childhood leukaemia close to high-voltage power lines--the Geocap study, 2002-2007. Br J Cancer. 2013 May 14;108(9):1899-906. doi: 10.1038/bjc.2013.128. PubMed PMID: 23558899; PubMed Central PMCID: PMC3658518.
3. INTERPHONE Study Group. Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. Int J Epidemiol. 2010 Jun;39(3):675-94. doi: 10.1093/ije/dyq079. Erratum in: Int J Epidemiol. 2012 Feb;41(1):328. Montestruq, L [corrected to Montestrucq, L]. PubMed PMID: 20483835.
4. Little MP, Rajaraman P, Curtis RE, Devesa SS, Inskip PD, Check DP, Linet MS. Mobile phone use and glioma risk: comparison of epidemiological study results with incidence trends in the United States. BMJ. 2012 Mar 8;344:e1147. doi: 10.1136/bmj.e1147. PubMed PMID: 22403263; PubMed Central PMCID: PMC3297541.
5. Sadetzki S, Langer CE, Bruchim R, Kundi M, Merletti F, Vermeulen R, Kromhout H, Lee AK, Maslanyj M, Sim MR, Taki M, Wiart J, Armstrong B, Milne E, Benke G, Schattner R, Hutter HP, Woehrer A, Krewski D, Mohipp C, Momoli F, Ritvo P, Spinelli J, Lacour B, Delmas D, Remen T, Radon K, Weinmann T, Klostermann S, Heinrich S, Petridou E, Bouka E, Panagopoulou P, Dikshit R, Nagrani R, Even-Nir H, Chetrit A, Maule M, Migliore E, Filippini G, Miligi L, Mattioli S, Yamaguchi N, Kojimahara N, Ha M, Choi KH, Mannetje A', Eng A, Woodward A, Carretero G, Alguacil J, Aragones N, Suare-Varela MM, Goedhart G, Schouten-van Meeteren AA, Reedijk AA, Cardis E. The MOBI-Kids Study Protocol: Challenges in Assessing Childhood and Adolescent Exposure to Electromagnetic Fields from Wireless Telecommunication Technologies and Possible Association with Brain Tumor Risk. Front Public Health. 2014 Sep 23;2:124. doi: 10.3389/fpubh.2014.00124. PubMed PMID: 25295243; PubMed Central PMCID: PMC4172002.