Early childhood leukaemia near nuclear power stations. A pooled analysis of data from recent ecological studies in Germany, England, and France.

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Background

Following the publication of the German KiKK study of leukaemia rates in young children in the vicinity of nuclear power stations (NPS), ecological studies were conducted in Germany (2), England (3), and France (4). None of them yielded significantly increased leukaemia rates near NPS. But the studies in GB and more so in France suffer from low numbers of leukaemia cases in the 5-km zone (18 and 5, respectively); a significant increase could therefore not be expected. In this study the result of a pooled analysis of the 3 data sets is presented.

Data and Methods

Observed (O) and expected (E) cases of leukaemia in children below age 5 in Germany (16 sites, 1980-2003), Great Britain (13 sites, 1969-2004), and France (19 sites, 1990-1998). The data are analysed on a community level (GB: electoral wards). Standardised incidence ratios (SIR) are calculated for two distance zones: 0-5 km and greater than 5 km. Relative risks (RR) are determined, ie the ratios of the SIRs in the 0-5 km zone to the SIRs in the 5+ km zone. A one-sided binomial test is used to investigate whether the relative risks are significantly increased.

Results

The results for the relative risks in the three data sets are listed in Table 1.
The relative risks are RR=1.45 (p=0.029) in the German data (2), RR=1.30 (p=0.169) in GB (3), and RR=0.91 (p=0.645) in the French data (4). The pooled data from Germany and GB yield RR=1.40 (p=0.0153). For all three data sets combined the relative risk is RR=1.33 which is still significantly greater than 1 (p=0.0246).

Since the French study only contains 5 observed leukaemia cases in the 5-km zone, an additional analysis was conducted for the 0-10 km zone compared to the 10-20 km zone. Then the relative risk is RR=1.19 based on 25 observed cases in the 10-km zone (p=0.248) (see Table 1, last entry).

Discussion

The negative results of the British (3) and French (4) study were used to argue against the findings of the KiKK study (1). The analysis of the pooled data from Germany, GB, and France, however, yields an even more significant result than the analysis of the German data (2) alone. Therefore the studies from GB (3) and France (4) do not contradict the highly significant relative risk of 2.19 ($p<0.001$) found in the German data with a more sophisticated case control study design (1). Based on the same data, the ecological design applied in (2) yields an SIR of 1.41 which is not significant when a two-sided test is used (p=0.066). This illustrates that only large and well designed studies are able to detect leukaemia increases in the vicinity of NPS.

References

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Table 1: Relative risks (0-5 km vs. 5+ km zone)

Kaatsch (2)	O	E	SIR	p(Poisson)	RR	p(Binomial)
0-5 km	34	24.09	1.41	0.0328		
5-30 km	417	427.09	0.98	0.6873	1.45	0.0289
Bithell (3)	O	E	SIR	p(Poisson)	RR	p(Binomial)
0-5 km	18	14.58	1.23	0.2166		
5-25 km	342	360.32	0.95	0.8328	1.30	0.1686
Laurier (4)	O	E	SIR	p(Poisson)	RR	p(Binomial)
0-5 km	5	5.2	0.96	0.5939		
5-20 km	109	103	1.06	0.2900	0.91	0.6449
pooled data	O	E	SIR	p(Poisson)	RR	p(Binomial)
0-5 km	57	43.87	1.30	0.0322		
> 5 km	868	890.41	0.97	0.7737	1.33	0.0246
Laurier (4)	O	E	SIR	p(Poisson)	RR	p(Binomial)
0-10 km	25	20.6	1.21	0.1922		
10-20 km	89	87.6	1.02	0.4547	1.19	0.2481