

RF-EMF cancer risk assessment: What do we know, what do we need to know?

Conclusions from epidemiological studies

Gabriele Berg-Beckhoff  
Bernd Kowall  
Jürgen Breckenkamp  
Faculty of Public Health  
University of Bielefeld

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## Content

- Public concern
- Methodological considerations
- Cancer related outcome
  - Mobile phone use
  - Occupational exposure
  - Radio and television transmitter
  - Mobile phone base stations
- Conclusion

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## Public concern



- 54.000 mobile phone base stations (own data 2006)
- The exposure is not controllable but the base stations are visible



In Germany

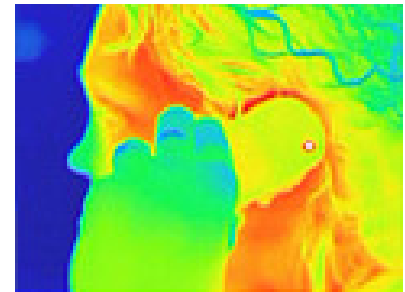
- 75% are using a mobile phone (INFAS 2006)
- 80% of the female children aged 14-17 years are using a mobile phone (Lampert et al. 2007)

→ Concerns given by the EU: 40% are concerned with regard to mobile phone base stations!

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## Public concern

- Cancer
  - Brain tumor
  - Eye melanoma
  - Leukemia
  - Other
- Nervous system
- Well being



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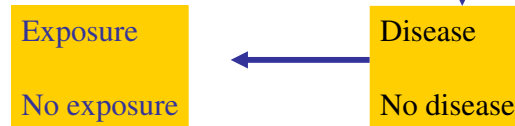
## Epidemiological study design

Cohort study:



Point of study

Case-control study:



Time frame

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## Epidemiological study design

### Ecological study:

Observational study comparing occurrence of diseases and exposures in groups.

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## Epidemiological study design

### Bias

Causes in study design or analyses resulting in a deviation of results or inferences from the truth, or processes leading to such deviations.

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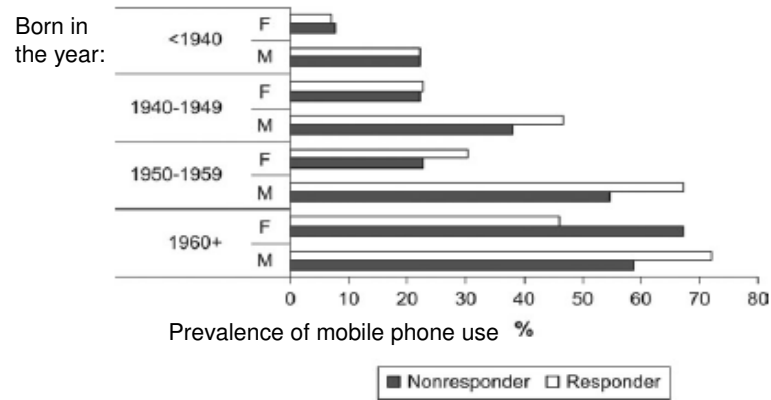
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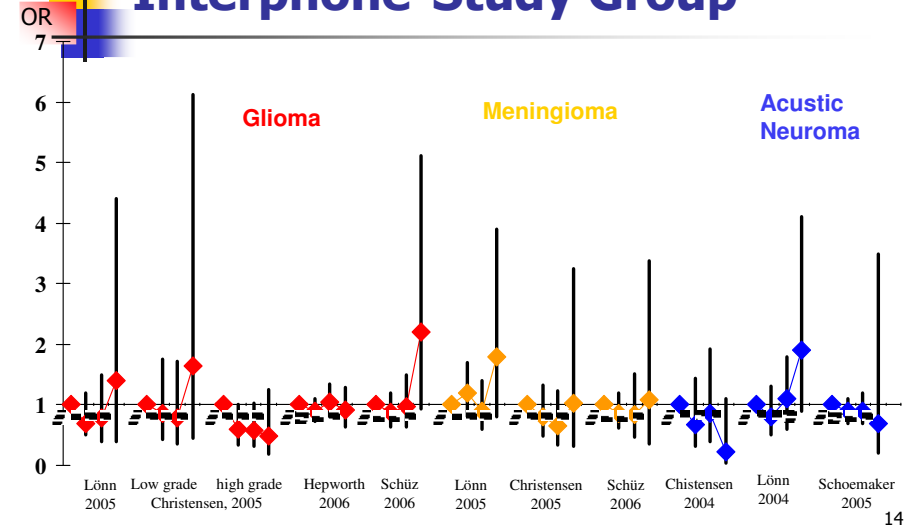


## Non-Responder-Analyses INTERPHONE-Study



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## Latent time and brain tumor Interphone-Study Group



## Cohort studies on mobile phone use

Source	n	Method	Results	Problems
Rothman 1996	256,000	Telephone subscribers; one year follow up; comparison between users of mobile phones and portable phones	No increased risk	Exposure time too short
Johannsen 2001 Schüz 2006	420,095	Telephone subscribers; three (later seven) years follow up SIR, with Danish cancer registry	No increased risk	Exposure time too short

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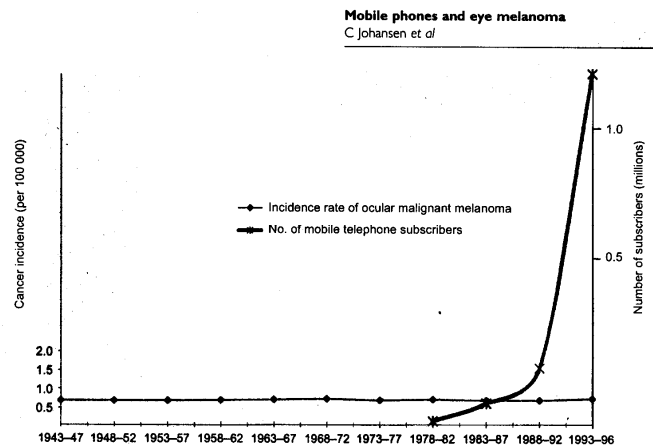
## Case-control study on eye melanoma



Exposure near by the eye

A German case control study was able to show an association between the use of mobile phone during work and eye melanoma.

## Ecological study on mobile phone use and eye melanoma



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## Summary: Mobile phone use and cancer

- Most studies are seen with regard to the risk of mobile phone use and brain tumors
- Main problem: Duration of use

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## Cohort studies of occupational exposure

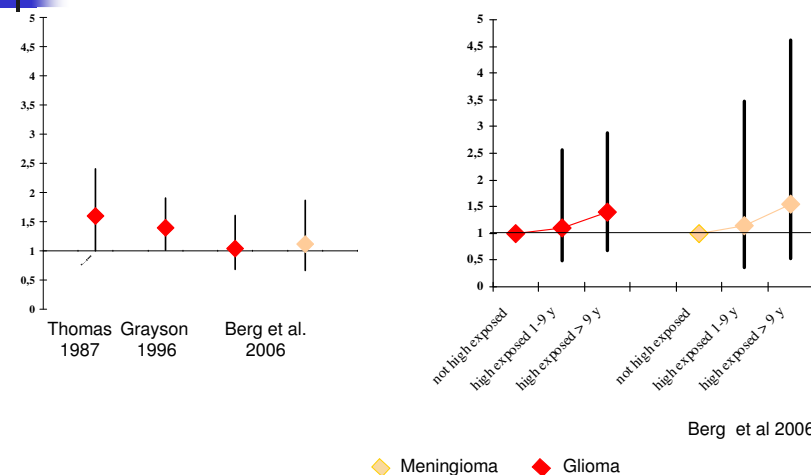
Exposure	Cohort	Measure	Mortality (95% CI)	Cancer (95% CI)	Source
RF	US-navel personnel, n=40,890 men, follow up: 1950-1974	SMR	0.96	1.04	Robinette et al 1980
RF	Amateur radio operators, n=67,829 persons, follow up: 1979-1984	SMR	0.71 (0.69-0.74)	0.89 (0.82-0.95)	Milham 1988
RF/ ELF	Norwegian electrical workers n=37,945 men follow up 1961-1985	SIR	-	1.06 (1.03-1.09)	Tynes et al. 1992
RF	Female radio and telegraph operators n=2,619 follow up 1961-1991	SIR	-	1.2 (1.0-1.4)	Tynes et al. 1996
Radar/ RF	Military career personnel n= 128,000 follow up 1971-1985	OER	-	2.7 (1.12-3.58)	Szmigielski 1996
RF	Plasticware workers n=481 women Follow up: 1961-1992	SIR	1.4 (0.7-2.7)	2.0 (0.7-4.3)	Lagorio et al 1997
Radar	Ontario police officers, n=22,197	SIR	-	0.90 (0.83-0.93)	Finkelstein 1998
RF	Employees of Motorola n=195,775 follow up 1950-1997	SMR	0.71 (0.64-0.78)	-	Morgan et al. 2000
Radar	US Naval Personnel, n=40,890 men; follow up 1950-1997	SMR	0.69 (0.67-0.71)	0.73 (0.69-0.77)	Groves et la. 2002

## Cohort studies: occupational exposure and brain tumour

Exposure	Cohort	Measure	brain tumours		
			Classification	n	Result (95% CI)
RF	Amateur radio operators	SMR	ICD 8 (191)	29	1.39 (0.93-2.00)
RF/ ELF	Norwegian electrical workers	SIR	ICD 7 (193) *	119	1.09 (0.90-1.41)
RF	Female radio and telegraph operators	SIR	ICD 7 (193) *	5	1.0 (0.3-2.3)
Radar/ RF	Military career personnel in Poland	OER	NS*	85	1.91 (1.08-3.47)
Radar	Ontario police officers	SIR	ICD 9 (191)	16	0.84 (0.48-1.36)
RF	Employees of Motorola	SMR	NS*	51	0.53 (0.21-1.09)
Radar	US Naval Personnel	SMR	ICD 9 (191.0-9)	88	0.71 (0.51-0.98)

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## Case-control studies: Occupation and brain tumor



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## Summary: Occupation and cancer

- Cohort studies
  - Determination of exposure was not possible in an individual manner
  - The size of the cohorts (example: 300 persons) was too small to achieve a statistically significant estimate
  - Mixture of exposure / combined exposure
- Case-control studies
  - The exposure assessment might be confounded by recall bias

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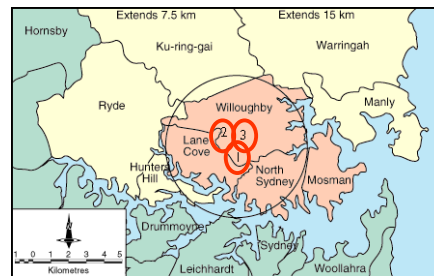
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## Ecological Australian study on radio and television transmitters

- Increased risk of childhood leukaemia incidence in the three considered regions
- RR = 1.5 (during a period of 20 years)

Hocking et al. 1996



- A recalculation of the ecological data revealed that the main result based on area specific excess risk. This findings might not be causal due to RF-EMF
- Ecological fallacy

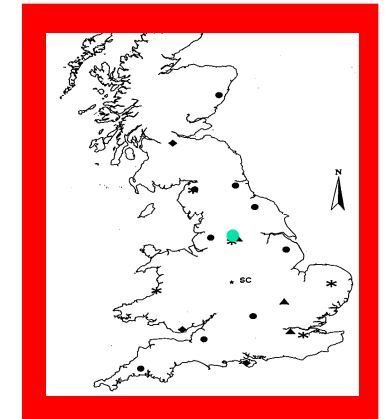
McKenzie et al. 2004

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## Ecological study in GB on radio and television transmitters

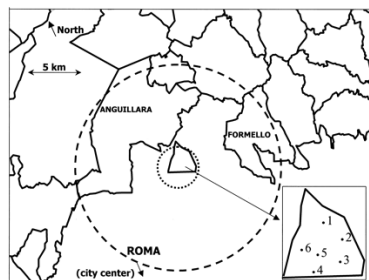
- A cluster of leukemia was found in the surrounding of Sutton Coldfield OR: 1.8 95% CI: 1.2-2.7)
- A repetition of the analysis extended to 20 other radio and television transmitters did not reveal any significant result

Dolk et al. 1997 a, b



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## Ecological study in Radio Vatikan



Michelozzi et al. 2002

- Cancer incidence was measured in the surrounding of the Radio Vatican transmitter (10 km)
- Mortality of adult leukaemia was not increased in the surrounding
- Childhood leukaemia mortality was increased. However, estimates based on small numbers (four cases)

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## Summary: Radio/television transmitters

- Problem: ecological fallacy
- Exposure estimates based only on distance
- The observed number of cases is small
- Further information is needed

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## Summary: Mobile phone base stations

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- Studies are based on small numbers
  - Selected regions
  - Possible confounders where not considered
  - Missing exposure assessment
  - Latent time is not considered
- Results are difficult to interpret

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## Conclusion

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- So far there is no clear evidence for adverse health effects of RF-EMF as long as limit values are kept.
- Problems due to methodological restrictions of environmental epidemiological studies like difficulties in estimating the exposure or a too short latency period
- Problem of assessing unclear risk:
  - Positive results of risk assessment are mostly known independently of the quality of the given study

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- Thank you very much for your attention!

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## Literature (only reviews)

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- Steward W. (2000). Mobile phones and health. IEGMP. Ed. Clinton, Oxon: National radiological Protection Board,.

### WEB:

- EURO-barometer
- Scientific Committee on Emerging and newly identified Health risks (SCENHIR): Possible effects of Electromagnetic fields on human health. EU 2007
- BioInitiative Report. A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Fields.
- WHO: International EMF-Project Project-database.
- FEMU: EMF-Portal. Information on the effect of electromagnetic fields