Are electromagnetic fields associated with cancer?

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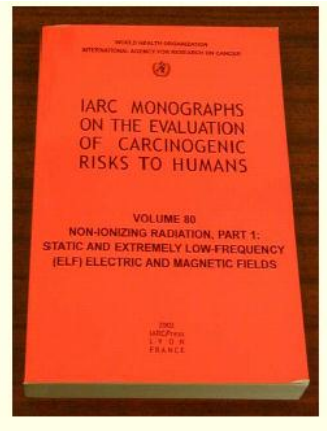
WORKSHOP ON EMF & HEALTH EFFECTS: FROM SCIENCE TO POLICY AND PUBLIC AWARENESS, Athens, March 28, 2014

Controversial issues

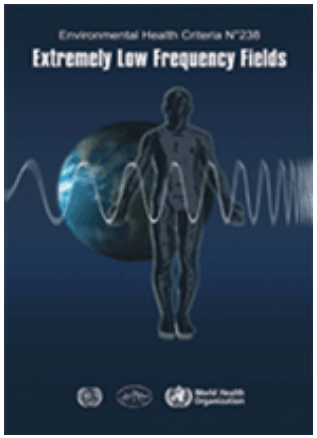
- Balance of evidence from epidemiological, animal and mechanistic studies shows no evidence of an association between EMF at various frequencies and cancer, but:
- Increase of childhood leukaemia risk in relation to elevated ELF magnetic fields?
- Increase of brain tumour risk among heavy long-term users of mobile phones?

ELF MF & Childhood Leukaemia

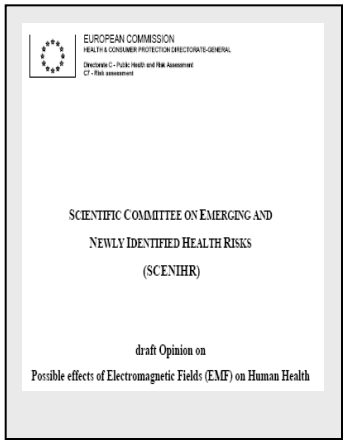
ELF magnetic fields are possibly carcinogenic to humans:



IARC 2001



WHO EHC 2007



EC SCENIHR 2009

EC SCENIHR 2014

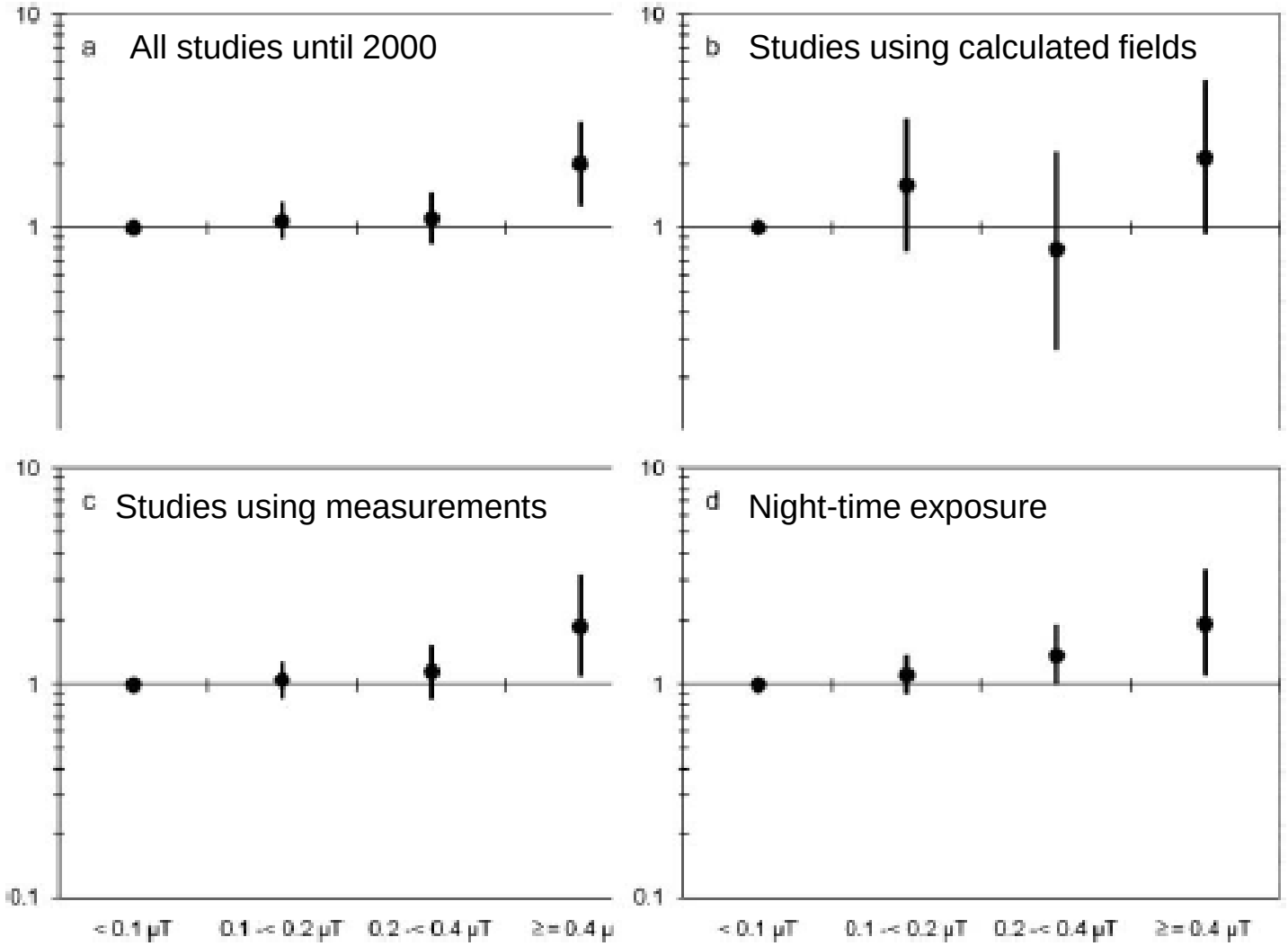
Because:

- epidemiology risk of 2 at MF > 0.3/0.4 µT
- epidemiology shows evidence of bias
- little support from experimental data

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Epidemiology: Studies up to 2000



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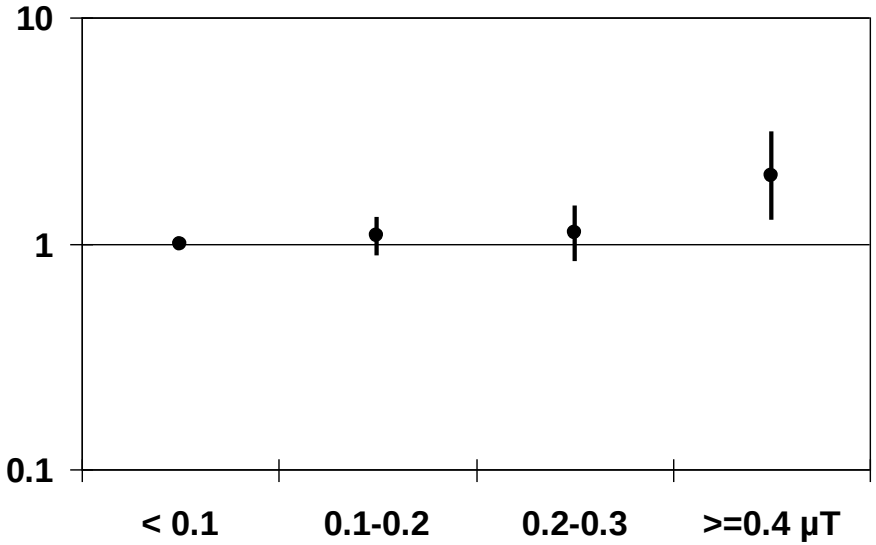
World Health Organization

a-c: Ahlbom et al., Br J Cancer, 2000

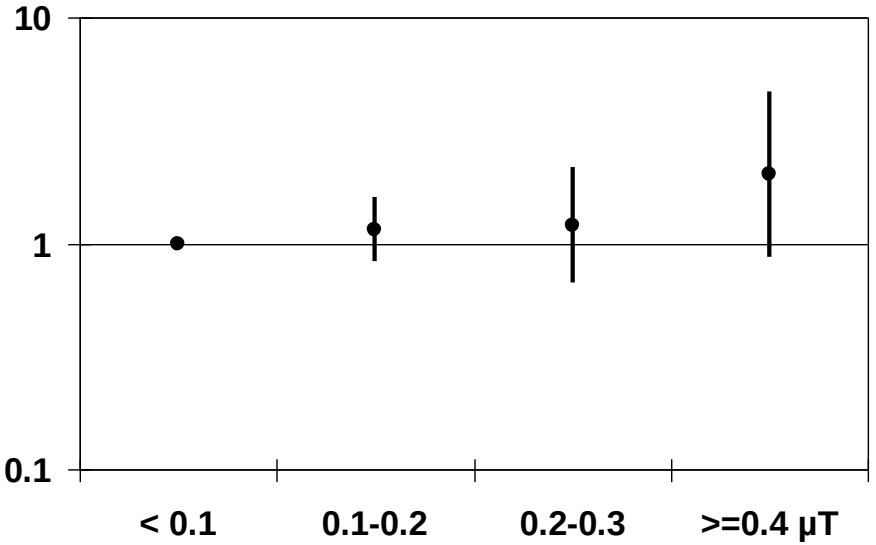
d: Schüz et al, Am J Epidemiol, 2007

Epidemiology: Studies after 2000

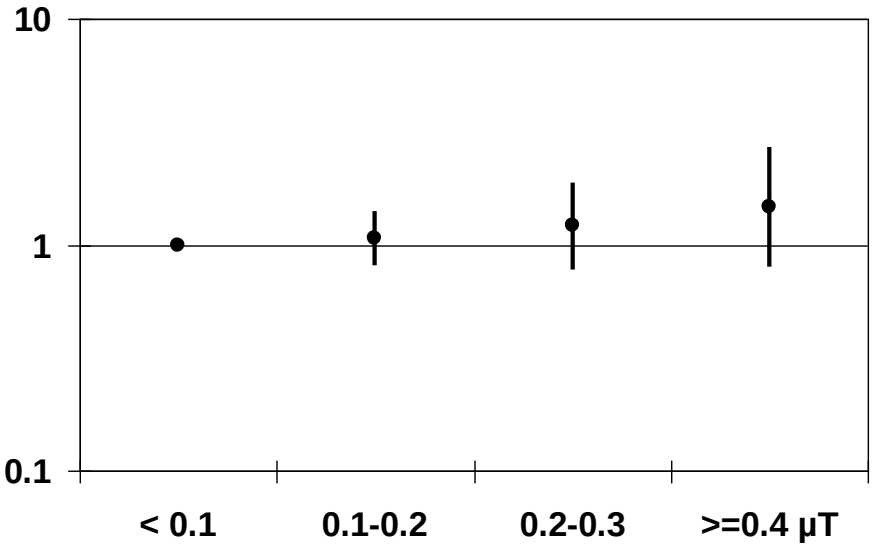
Ahlbom et al., Br J Cancer, 2000



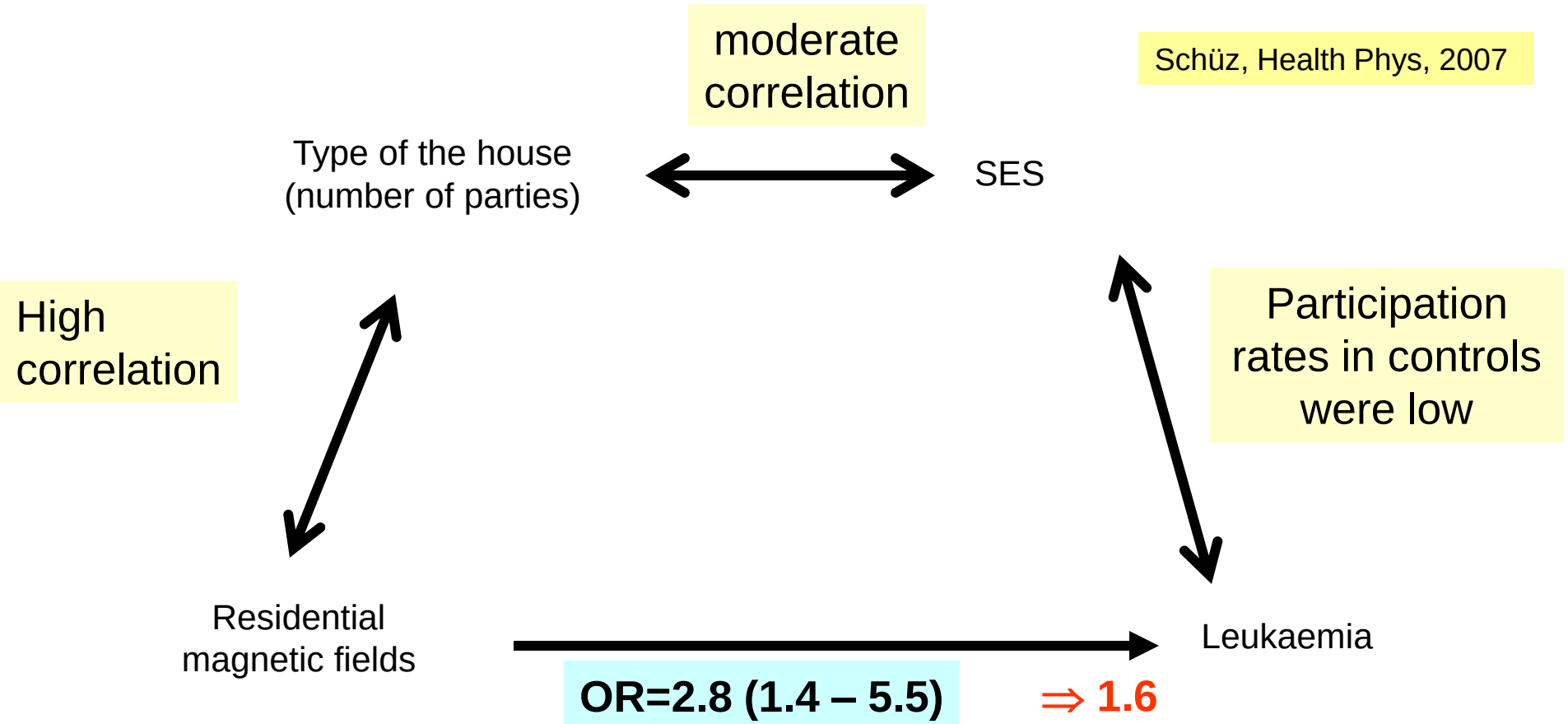
Kheifets et al., Br J Cancer, 2010



Studies conducted after 2000:
- excluding Brazil
- including Brazil



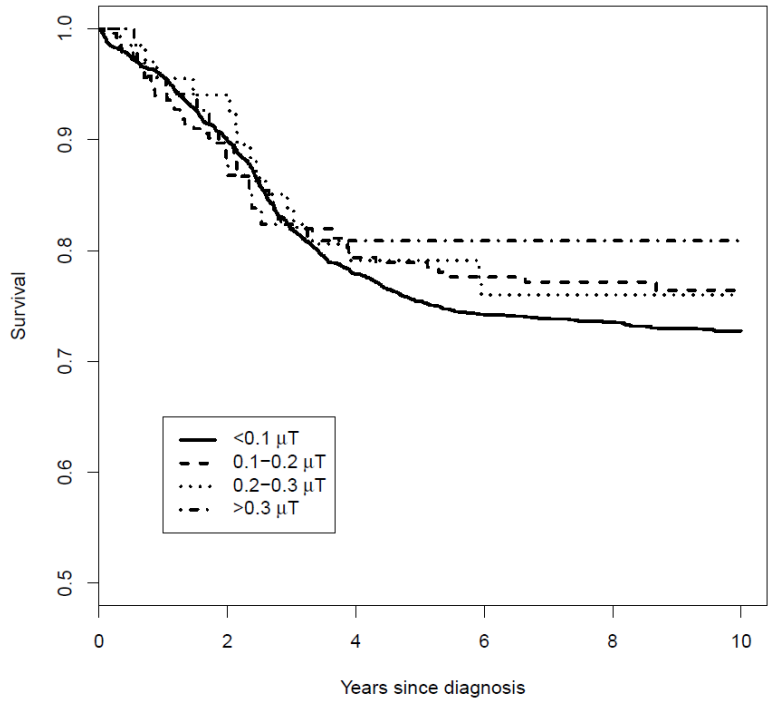
Epidemiology: Concern about bias

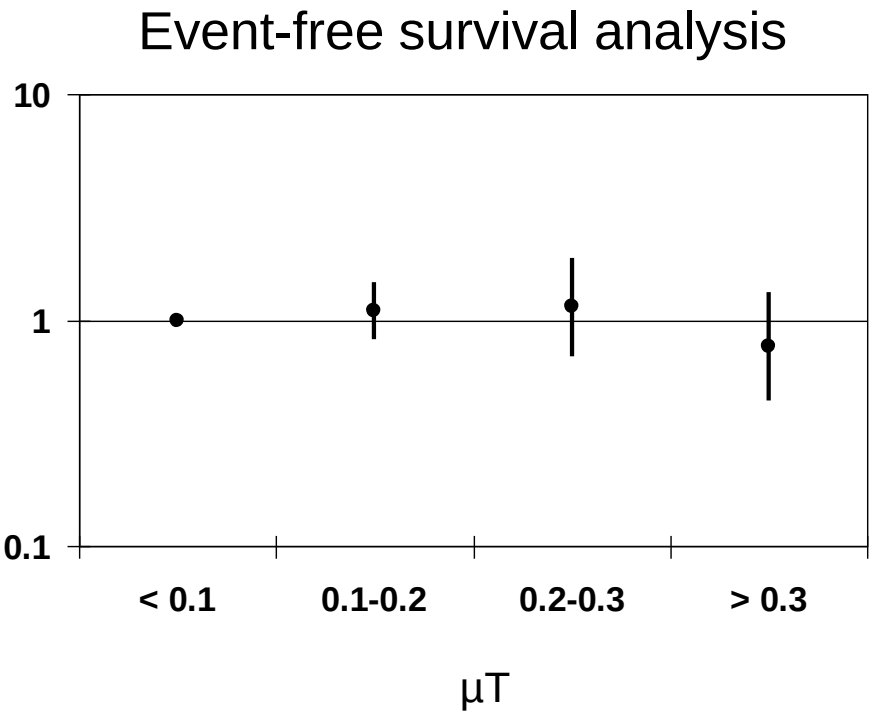


Certainly explains some of the observed association, but unclear whether in its entirity

ELF MF & Survival after Childhood Leukaemia

Schüz et al, Blood Cancer J, 2012





No effect of ELF MF on survival

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ELF MF & Childhood Leukaemia: Summary

- Not recognized as causal (weak evidence of positive association; IARC class 2B)
- Knowledge gap: mechanistic understanding
- Assuming causality, the effect for most European countries suggests ~1% of leukaemias in children may be due to ELF MF exposure

Mobile phones and brain tumours: Case-control studies

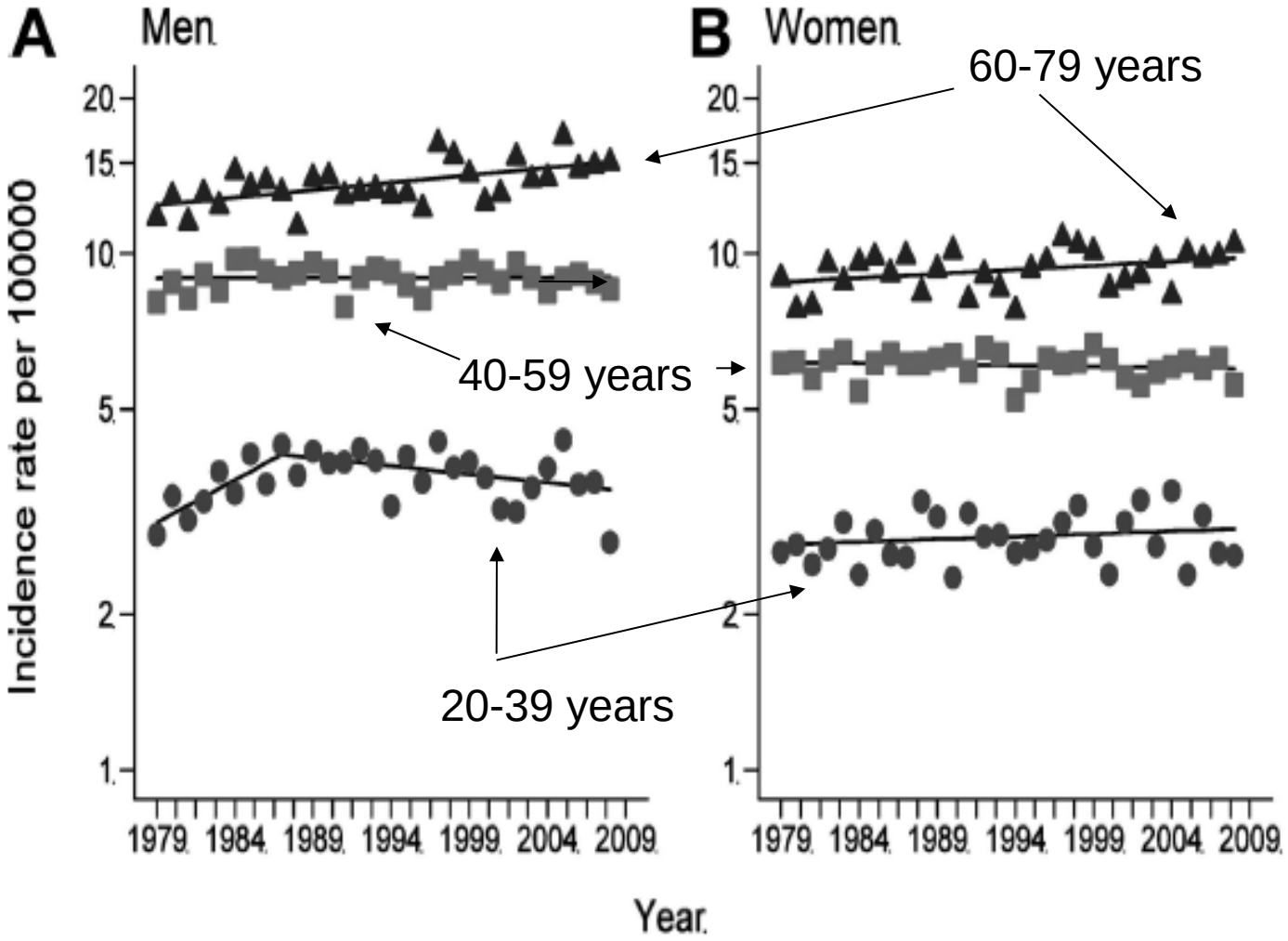
- Interphone Study:
  Glioma - no overall association
  - RR 1.4 in ~5% heaviest users of phones
  Acoustic neuroma - no overall association
  - RR increased in heaviest users, but variable dose-response effect

Interphone, Int J Epidemiol, 2010
Interphone, Cancer Epidemiol, 2011

- Series of studies from Sweden:
  Glioma - RR increased with modest amount of use
  - Effect becomes stronger with intensity of use
  Acoustic neuroma - similar as for glioma

Several publications by Hardell et al.

Increase in brain tumour rates?



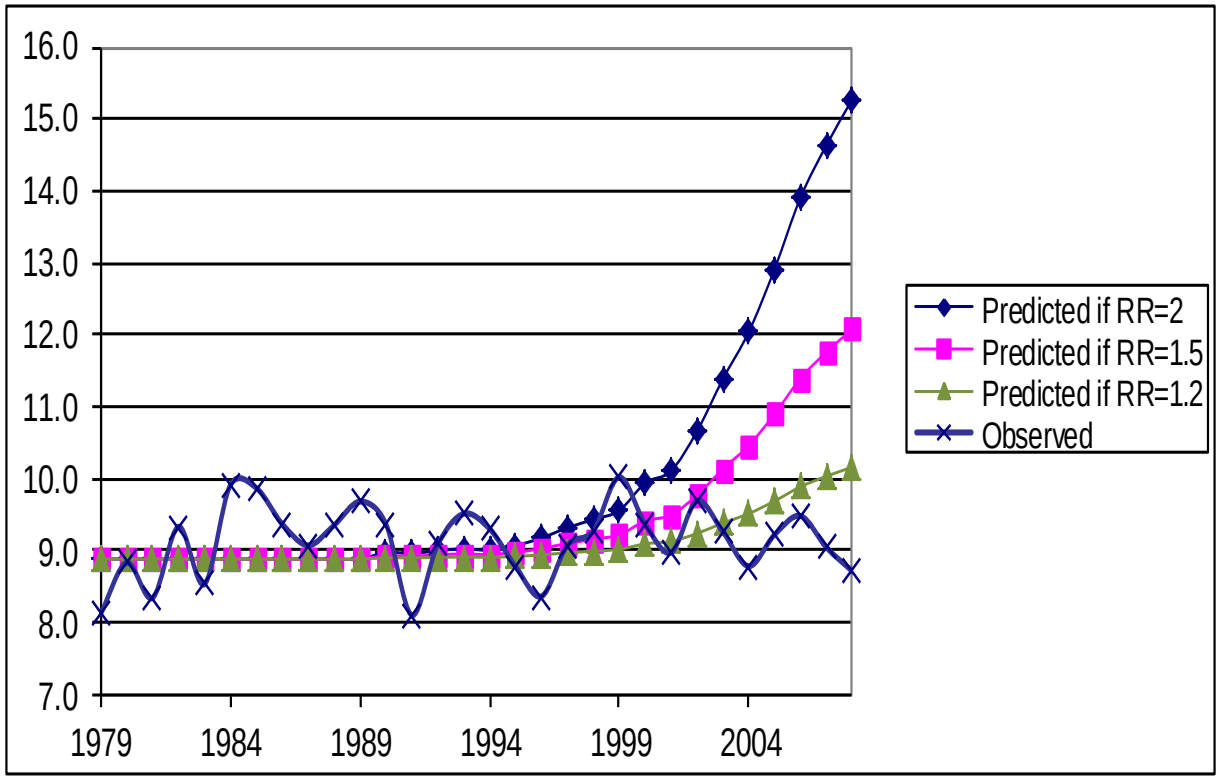
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Deltour et al., Epidemiology, 2012

Increase in brain tumour rates?

All users at increased risk after 10 years

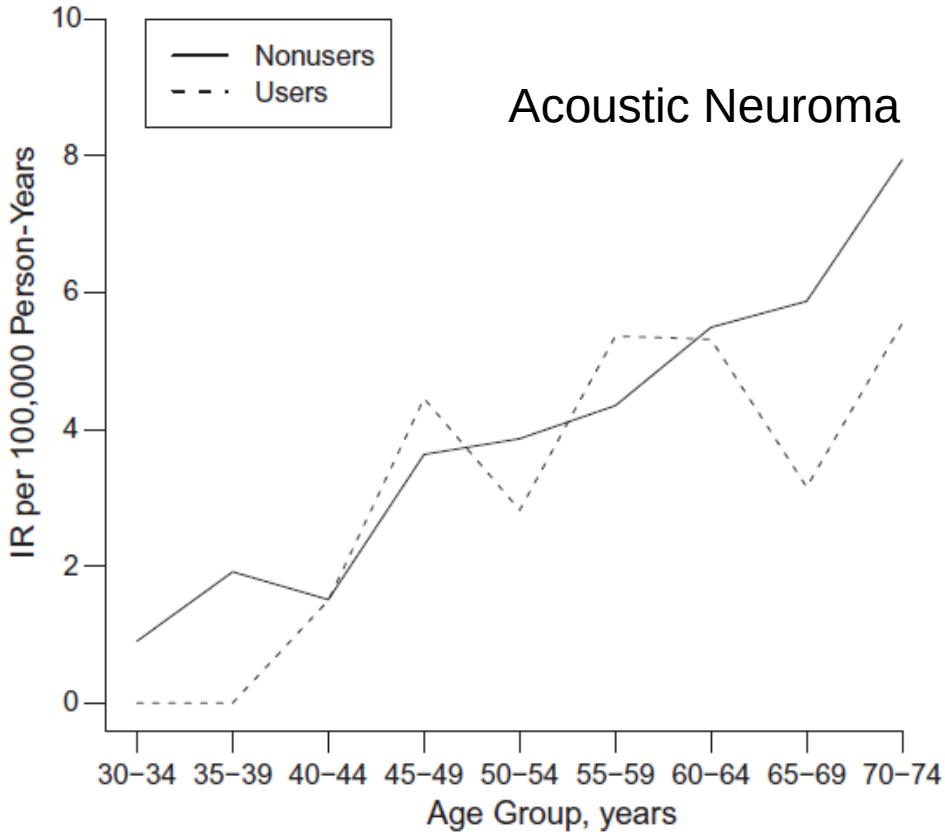


Glioma

Deltour et al., Epidemiology, 2012

Little et al., BMJ, 2012

Danish nationwide study



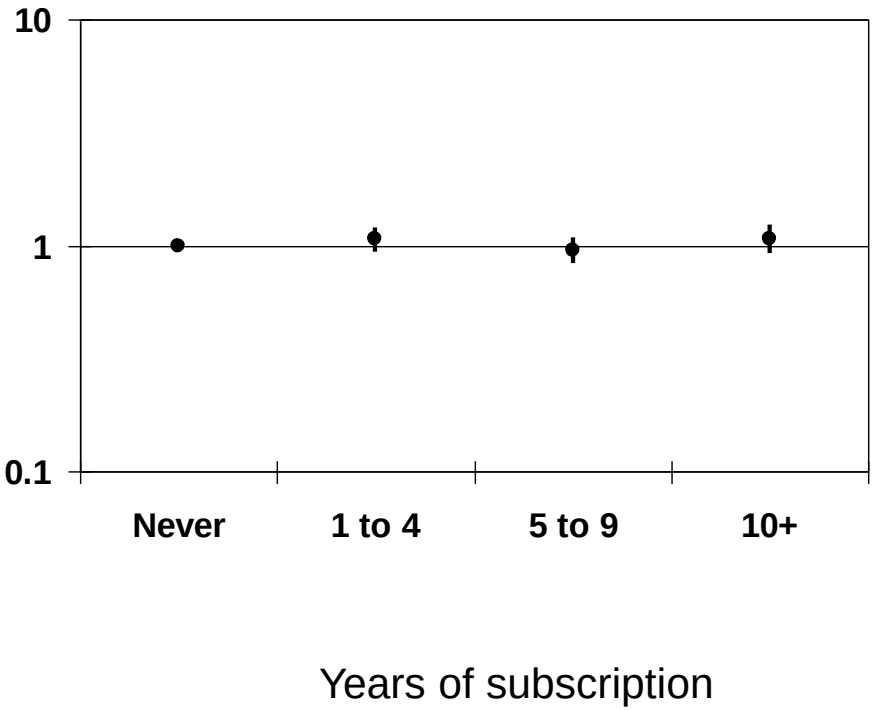


Figure 1. Age-specific incidence rates (IRs) per 100,000 persons of vestibular schwannoma in the period 1998–2006 among Danish men with ("users" curve) or without ("nonusers" curve) a long-term mobile phone subscription (first subscription 11 years ago or longer).

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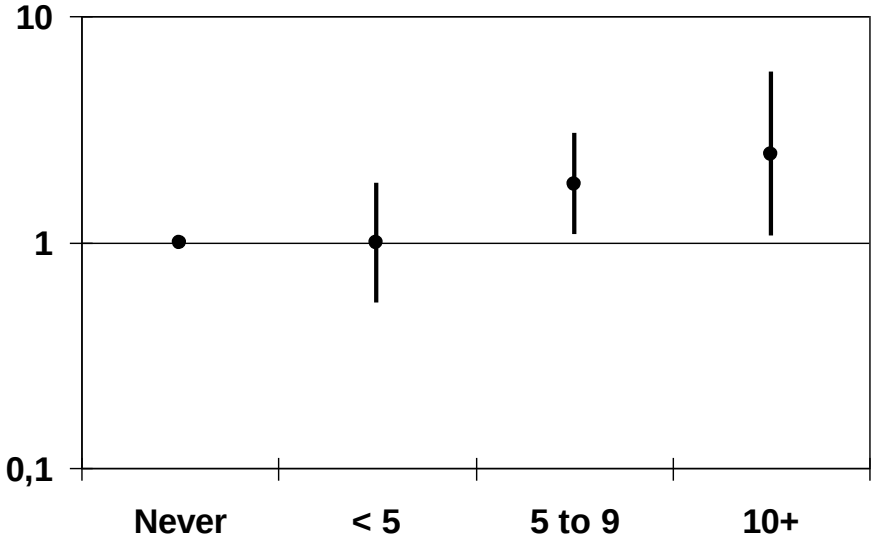
Schüz et al., Am J Epidemiol, 2011

Frei et al., BMJ, 2011

UK Million Women Study

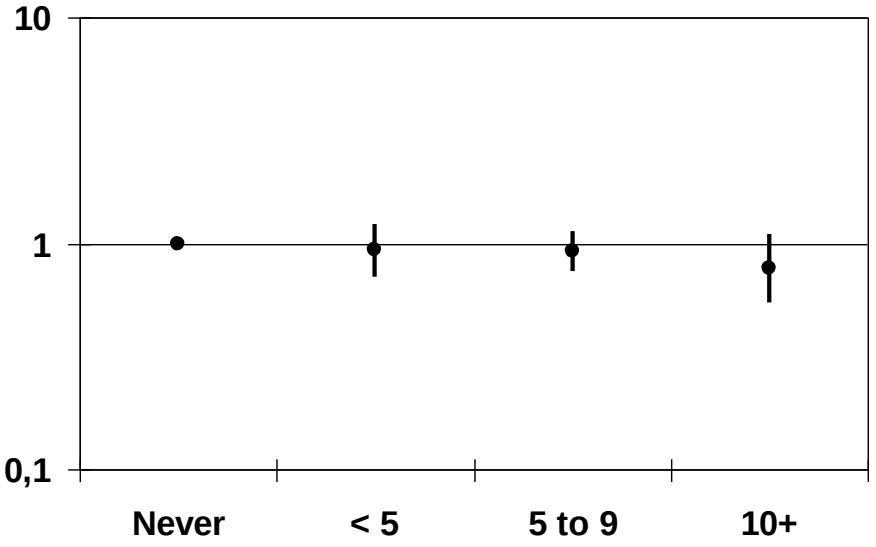
Acoustic Neuroma

Years of mobile phone use



Glioma

Years of mobile phone use



Years

Results observed in prospective follow up of 300,000 never users and 500,000 ever users of middle aged women in the UK

International Agency for Research on Cancer

World Health Organization

Benson et al., Int J Epidemiol, 2013

Mobile phones & Brain tumour risk: Summary

- Not recognized as causal (weak evidence of positive association; IARC class 2B)
- More recent studies attenuate evidence, in particular for glioma (SCENIHR, 2014)
- Knowledge gaps: latency > 15-20 years, use in the very heaviest users
  Prospective studies of mobile phone users

This paper was produced for a meeting organized by Health & Consumers DG and represents the views of its author on the subject. These views have not been adopted or in any way approved by the Commission and should not be relied upon as a statement of the Commission's or Health & Consumers DG's views. The European Commission does not guarantee the accuracy of the data included in this paper, nor does it accept responsibility for any use made thereof.