IARC 2B & RF epidemiological studies

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IARC evaluation of carcinogenicity May 2011

- IARC convened a working group of 30 experts from various scientific backgrounds
- The working group concluded:
  “There is "limited evidence in humans" for the carcinogenicity of RF-EMF, based on positive associations between glioma and acoustic neuroma and exposure to RF-EMF from wireless phones.”
- The working group was not unanimous, some members considered the evidence "inadequate" because of:
  - inconsistencies between case-control studies,
  - lack of exposure-response in the Interphone study,
  - no increased risk in cohort study,
  - no increase in the brain tumor incidence since mobile phones were introduced – but incidence trends only available until early 2000s
Overall conclusion of IARC evaluation

- Radiofrequency electromagnetic fields was classified as “possibly carcinogenic to humans” (Group 2B), a category used when a causal association is considered credible, but when chance, bias or confounding cannot be ruled out with reasonable confidence.

- Major biases discussed:
  - Selection bias in case-control studies from non-participation leads to underestimation of risk.
  - Recall bias in case-control studies – cases tend to over-report mobile phone use in distant past, leads to over-estimation of risk.
New evidence after IARC evaluation

- Several brain tumor incidence trend studies with longer follow-up – until 2009
- Simulation studies – estimated what the incidence would have been if results from case-control studies were true
- A few new case-control studies with retrospective recall of phone use – potential recall bias
- New analyses of Danish cohort study of subscribers
- One new cohort study from the UK with prospectively collected information on mobile phone use – no recall bias
Interphone results brain tumors
Cumulative call duration

Hardell 2006, >64 h: OR=2.4 (1.6-3.7)
Inskip 2001, >100 h: OR=0.9 (0.5-1.6)
Muscat 2000, >60-480 h: OR=0.9 (0.5-1.8)
>480 h: OR=0.7 (0.3-1.4)

Coureau 2014, >339-895 h: OR=1.78 (0.98-3.24)
>895 h: OR=2.89 (1.41-5.39)

- Glioma
- Meningioma
Glioma and mobile phone use, long induction period, ~ > 10 years

Pooled estimate, excl. Hardell 2006 p-homog 0.074

New study

Cohort studies

Hardell 1999
Hardell 2002 analogue
Hardell 2006 analogue
Interphone 2010
Courgeau 2014
Schuz 2006 cohort
Benson 2013 cohort

Pooled estimate p-homog 0.000
Pooled estimate, excl. Hardell 2006 p-homog 0.074
New case-control study from Hardell group, 2013
- glioma

<table>
<thead>
<tr>
<th>Time since first use</th>
<th>OR (95% CI) Analogue phone</th>
<th>OR (95% CI) Digital phone</th>
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<tbody>
<tr>
<td>&gt;1-5 years</td>
<td>-</td>
<td>1.8 (1.01-3.4)</td>
</tr>
<tr>
<td>&gt;5-10 years</td>
<td>0.6 (0.1-3.1)</td>
<td>1.6 (0.97-2.7)</td>
</tr>
<tr>
<td>&gt;10-15 years</td>
<td>1.4 (0.7-3.0)</td>
<td>1.3 (0.8-2.2)</td>
</tr>
<tr>
<td>&gt;15-20 years</td>
<td>1.4 (0.7-2.7)</td>
<td>2.1 (1.2-3.6)</td>
</tr>
<tr>
<td>&gt;20-25 years</td>
<td>2.1 (1.1-4.0)</td>
<td>-</td>
</tr>
<tr>
<td>&gt;25 years</td>
<td>3.3 (1.6-6.9)</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: 23 years is the maximum time possible that handheld mobile phones had been available in Sweden.
Observed and predicted glioma incidence rates under scenarios of risk, Nordic countries, men 40-59 years, 1979-2008

Under the assumption that all users at increased risk after 10 years:

Deltour et al. 2012
Observed and predicted glioma incidence rates under scenarios of risk, Nordic countries, men 40-59 years, 1979-2008

Under the assumption of risk for heavy users (>1640 hours)

Deltour et al. 2012
Observed and projected incidence of glioma in the US based on results from case-control studies

Little M P et al. BMJ 2012;344:bmj.e1147
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Glioma incidence, Sweden 1970-2012, Men

Source: Cancer Register, The National Board of Health and Welfare
Glioma incidence – Australia 2000-2008

Dobes et al. 2011
Results acoustic neuroma, Interphone study:
Cumulative hours of use

Hardell 2005, >64 h: OR=2.5 (1.2–5.2)

Pettersson 2014, >680 h: OR=1.46 (0.98–2.17)
restricted to confirmed cases: OR=1.14 (0.63–2.07)

New study: OR=1.32 (0.88–1.97)
Acoustic neuroma incidence England

Benson et al. 2013
Acoustic neuroma and mobile phone use, long induction period

Pooled estimate p-homog 0.233
Children

- No increase in childhood leukemia incidence near radio- and television transmitters observed in two well-designed studies from Germany and South Korea
Large-scale systematic case-control studies (South Korea, Germany)

- Individually predicted RF field strength
- No evidence for an association between RF fields and childhood leukaemia risk

From Schuz J, Ahlbom A. Rad Prot Dosim, 2008
Children

- No increase in childhood leukemia incidence near radio- and television transmitters observed in two well-designed studies from Germany and South Korea.
- No increased incidence in any types of childhood cancer (0-4 years) was observed in a UK study of children whose mothers were living near mobile phone base-stations during pregnancy.
- No increased brain tumor risk related to mobile phone use was observed in a case-control study of childhood brain tumors (the CEFALO study).
- No increase in the incidence of childhood brain tumors have been observed since the introduction of handheld mobile phones.
Conclusions

- Difficult to remember and correctly estimate amount of mobile phone use – especially long time in the past
  - Give room for recall bias
- Cohort studies with prospectively collected information about mobile phone use have not found an increased risk of brain tumors or acoustic neuroma – but crude exposure information
- New (and old) incidence trend studies do not support a causal interpretation of results from some epidemiological case-control studies
- Few data on children available
  - No increased cancer risk observed and no increased incidence of brain tumors in children