IARC Research Actions on Radiofrequencies

Isabelle Deltour
International Agency for Research on Cancer
Lyon, France

IARC Monograph program

2 to 3 times per year, ad hoc group of expert convenes for 1 week

• Review published literature
  – Sources and exposure mechanisms
  – Studies of carcinogenicity in humans (epidemiology)
  – Studies of carcinogenicity in animals (in vivo)
  – Other relevant data (in vitro, …)
Evaluating human data (Epidemiology)

- **Cancer in humans**
  - **Sufficient evidence**: Causal relationship has been established. Chance, bias, and confounding could be ruled out with reasonable confidence.
  - **Limited evidence**: Causal interpretation is credible. Chance, bias, or confounding could not be ruled out.
  - **Inadequate evidence**: Studies permit no conclusion about a causal association.
  - **Evidence suggesting lack of carcinogenicity**: Several adequate studies covering the full range of exposure levels are mutually consistent in not showing a positive association at any observed level of exposure. Conclusion is limited to cancer sites and conditions studied.

- **Cancer in experimental animals**

- **Mechanistic and other relevant data**
Combining the human and experimental evaluations

**EVIDENCE IN EXPERIMENTAL ANIMALS**

- **Sufficient**
  - Group 1 (carcinogenic to humans)
- **Limited**
  - Group 2A (probably carcinogenic)
  - Group 2B (possibly carcinogenic) (exceptionally, Group 2A)
- **Inadequate**
  - Group 2B (possibly carcinogenic)
- **ESLC**
  - Group 3 (not classifiable)

**EVIDENCE IN HUMANS**

- **Sufficient**
  - Group 1 (carcinogenic to humans)
- **Limited**
  - Group 2A (probably carcinogenic)
  - Group 2B (possibly carcinogenic) (exceptionally, Group 2A)
- **Inadequate**
  - Group 2B (possibly carcinogenic)
- **ESLC**
  - Group 3 (not classifiable)

http://monographs.iarc.fr/ENG/Classification/ClassificationsAlphaOrder.pdf
“Although both INTERPHONE and Swedish pooled analysis are susceptible to bias—due to recall error and selection for participation— the Working Group concluded that the findings could not be dismissed as reflecting bias alone, and that a causal interpretation between mobile phone RF-EMF exposure and glioma is possible. A similar conclusion was drawn from these two studies for acoustic neuroma,...“  

-> limited evidence from epi studies

Few members: inadequate evidence from epidemiological studies  
(lack of dose response in Interphone, inconsistencies between C-C studies, lack of effect in other epidemiological studies)

Overall classification: Radiofrequency fields: group 2b
Incidence time trends studies

- Yearly description of number of new cancer cases (after age standardisation to a reference population) occurring in a population
- Based on cancer registry data
- Informative for effects occurring at population scale
  - Screening programmes, introduction of new diagnostic tools, impact of tobacco epidemic
- Not informative for effects occurring in small subgroups of populations, or if other factors are also changing at population scale

=> If mobile phone causes gliomas or other cancers, it will ultimately show up in incidence rates of these diseases
Glioma incidence rates (1979-2008)

Denmark, Finland, Norway and Sweden

- 35,250 cases
- 510 million person-years at risk
- Annual % change:
  - men: 0.4% [0.1%;0.6%]
  - women: 0.3% [0.1%;0.5%]

Deltour et al, Epidemiology, 2012
Observed and predicted incidence rates of glioma under scenarios of risk

All users at increased risk after 10 yrs

All users at increased risk after 15 yrs

Among men 40-59 years, Denmark, Finland, Norway, Sweden combined

Risk only for heavy users (>1640 h.)

Graphs based on data from Deltour et al, Epidemiology, 2012
Simulation study of power to detect increased risks

<table>
<thead>
<tr>
<th>Relative Risk and Population at Risk</th>
<th>Induction Period (Years)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>All users</td>
<td></td>
</tr>
<tr>
<td>RR = 2.0</td>
<td>100.0</td>
</tr>
<tr>
<td>RR = 1.5</td>
<td>100.0</td>
</tr>
<tr>
<td>RR = 1.2</td>
<td>100.0</td>
</tr>
<tr>
<td>RR = 1.1</td>
<td>86.7</td>
</tr>
<tr>
<td>RR = 0.8</td>
<td>100.0</td>
</tr>
<tr>
<td>Heavy users</td>
<td></td>
</tr>
<tr>
<td>RR = 2.0</td>
<td>100.0</td>
</tr>
<tr>
<td>RR = 1.5</td>
<td>98.0</td>
</tr>
<tr>
<td>RR = 1.2</td>
<td>35.9</td>
</tr>
<tr>
<td>RR = 1.1</td>
<td>12.2</td>
</tr>
<tr>
<td>RR = 0.8</td>
<td>41.7</td>
</tr>
</tbody>
</table>

Proportion of simulated datasets out of 10,000 showing a statistically significant increase/decrease in glioma incidence in men aged 40–59 years

Conclusions

- No upward turn in glioma incidence rates observed
- High quality, registry based, time trends
  - 100% incompatible with increased OR MBT in Hardell et al (2005)
  - likely incompatible with Interphone increased OR for glioma
Cohort studies

- Follow a group of people over time
- Compare the occurrence of disease among exposed individuals to non-exposed individuals
Danish cohort of early mobile phone subscribers: design

From the 2 Danish mobile telephone companies, Sonofon and TeleDanmarkMobil, all numbers issued between 1982 and 1995 were obtained, name and address of subscription holder (person or company), date of subscription.

<table>
<thead>
<tr>
<th>Unexposed (no subscription bef. 1996)</th>
<th>Exposed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximately 4,130,000 persons</td>
<td>Early subscribers maximum 720,000 persons</td>
</tr>
</tbody>
</table>
Danish cohort study of early mobile phone subscribers

Exclusions: 200,000 corporate subscriptions (no individual user identified) & 100,000 subscriptions (mismatch names, addresses, 2 subscriptions for 1 name,...)

Identification of 420,095 persons who were early subscribers of mobile phones and their date of subscription (1982-1995); exclusion of subscriptions contracted prior to 1987 (mainly car phones); Link with individual data on income, education available for all Danes born after 1925, older than 30, after 1990.

- No subscription before 1996
  - Approximately 2,800,000 persons

- Early identified subscribers
  - 358,000 persons

- No data on income, education
  - Approximately 1,600,000 persons

Not identified subscribers
Danish cohort study of early mobile phone subscribers

Analysis: number of observed vs expected cases stratified by sex, age, calendar period, education, income

356 glioma cases among early subscribers,

Results for glioma risk among men

IRR (10-12 years) = 1.06 (0.85-1.34)
IRR (>13 years) = 0.98 (0.70-1.36)
Research questions

• Unclear if there are effects of RF on risk of glioma and acoustic neuroma after prolonged exposures

• Weakness of existing studies: exposure assessment

• Other diseases and symptoms?

-> Large prospective cohort of mobile phone users with validated exposure assessment: WHO research priorities, SCENHIR (EU-DG SANCO) recommendations, « Grenelle des Ondes »
On-going activities: the Cosmos study

- Prospective European cohort study with validated data on exposure
  Operators: duration of incoming and outgoing calls

Sweden, United Kingdom, Denmark, Finland, Netherlands
COSMOS:
Etude de cohorte internationale téléphonie mobile et santé

Cohorte: 250.000+

Questionnaire Cosmos

Tous les 4 ans

Données

Registres (Selon le pays)

À la demande

Usage de téléphone mobile

Annuel

2007 2008 2009 2010 201? 2030
Health events studied in Cosmos

- Cancer (brain tumours, leukaemia, skin cancer)
- Cerebro-vascular diseases
- Neurological diseases: Parkinson, Alzheimer, other dementia, multiple sclerosis, amyotrophic lateral sclerosis
- Symptoms: hearing loss, tinnitus, migraine, sleep problems, well-being
- Road traffic accidents (Cosmos – France?)
Feasibility study for Cosmos-France (1)

- Validated use of mobile phone is needed for the Cosmos study
  - Round table with the 4 operators (Orange, Bouygues Telecom, SFR, Free)
    - Volume and type of mobile phone traffic are available in databases
    - For the participants who agree, could be communicated to research team
Feasibility study for Cosmos-France (2)

- Cosmos-France based on 2 existing cohorts: (cheaper, quicker)

Recruitment, follow-up, recording of health events

Cosmos-France partners

International Agency Research on Cancer
   Environment and Radiation Section
   Dr Joachim Schüz, Dr Isabelle Deltour

IFSTTAR (Transports, Aménagement, Réseaux)
   UMRESTTE - Dr Martine Hours

INSERM
   U 1018 – Constances - Dr Marie Zins
   U 557 – Nutrinet-Sante – Dr Serge Hercberg

Centre Leon Berard
   Unité Cancer et Environnement - Dr Beatrice Fervers

WHIST Lab: Exposure assessment
   RESA/WASA/WAVE - Dr Joe Wiart
• Thank you for your attention

deltouri@iarc.fr