The INTERPHONE study

**Objectives**

- To assess whether RF radiations emitted by mobile phones are carcinogenic
- To examine the association with known and suspected risk factors, including: ionising radiation, occupational exposures (EMF and other), medical history of subject and family

**Design**

- Population based case-control studies:
  - Glioma and meningioma
  - Acoustic neurinoma
  - Parotid gland tumours
- Common core protocol – 13 countries
- All persons aged 30-59 years who reside in the study regions (metropolitan areas in most countries)
- Study period: 1 September 2000 until mid 2004

International EMF Project - IAC Meeting, Geneva, June 2005
Number of subjects

- Glioma: 2 600
- Meningioma: 2 300
- Acoustic neurinoma: 1 100
- Parotid gland tumours: 400

... and their respective controls
Collection of information

- **Study questionnaire** - face-to-face CAPI interview
  - detailed mobile phone history
  - occupational calendar
  - occupational exposure to EMF and ionising radiation
  - information on potential confounders and risk factors

- **MRIs and CTs**
  - Localisation of probable origin of tumours on grid by neuroradiologists

- **Records of phone companies and software modified phones**
  - Validation of subject’s recall
Collection of information

- Data from specialised laboratories
  - SAR distribution measurements in phantom heads - real phones
  - Simulations of SAR in different tissues with generic phones

- Software Modified Phones
  - To assess relation between power emitted by phone and characteristics of networks and phone use

- Information from mobile phone companies
  - Information on frequencies, power control, ...

International EMF Project - IAC Meeting, Geneva, June 2005
Timing of study

- **Case ascertainment:** 2000-2004
- **Data validation and analysis underway**
- **Results – mobile phone use**
  - national analyses: 2004-2006
  - international analyses: 2005-2006
Publications of results to date

National results

• Acoustic neurinoma
  - Denmark (Christensen et al, AJE, 2004)
  - Sweden (Lönn et al, Epidemiology, 2004)

• Glioma and Meningioma
  - Sweden (Lönn et al, AJE, 2005)
  - Denmark (Christensen et al, Neurology, 2005)
Acoustic neurinoma study *(Christensen et al, 2004)*

- 106 acoustic neurinoma cases in Denmark - 2000-2002
- 212 controls
- Results:
  - No increased risk overall \( \text{OR}=0.9 \) 95% CI (0.5-1.6)
  - No association with duration or amount of use
  - Mean size of tumours larger for regular users
  - Significant disagreement between side of use and side of tumour

*... Hearing loss may be a negative confounder – presence of hearing problems prior to diagnosis may prevent cases from becoming regular users and limit their lifetime calling time*
Acoustic neurinoma study (*Lönn et al, 2004*)

- 148 acoustic neurinoma cases in parts of Sweden - 1999-2002
- 604 controls
- Results:
  - No increased risk overall OR=1.0 95% CI (0.6-1.5)
  - If started use 10 years or more in the past:
    - 14 exposed cases OR=1.9 95% CI (0.9-4.1)
    - If started use 10 years or more in the past:
      - Ipsilateral only OR=3.9 95% CI (1.6-9.5)

... One of few studies with subjects exposed 10 years or more in the past
# Acoustic neurinoma

RR for “long-term” phone use

<table>
<thead>
<tr>
<th>Reference</th>
<th>Study period</th>
<th>Total number of cases</th>
<th>Time since start of use</th>
<th>Number of cases</th>
<th>RR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Muscat, 2000</td>
<td>94-98</td>
<td>90</td>
<td>≥3 years*</td>
<td>11</td>
<td>1.7 (n.s)</td>
</tr>
<tr>
<td>Inskip, 2001</td>
<td>94-98</td>
<td>96</td>
<td>≥5 years*</td>
<td>5</td>
<td>1.9 (0.6-5.9)</td>
</tr>
<tr>
<td>Hardell, 2002</td>
<td>97-00</td>
<td>159</td>
<td>≥5 years</td>
<td>26*</td>
<td>3.7 (1.6-8.6)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>&gt;10 years</td>
<td>7*</td>
<td>3.5 (0.7-17)</td>
</tr>
<tr>
<td>Christensen, 2004</td>
<td>00-02</td>
<td>104</td>
<td>&gt;10 years</td>
<td>2</td>
<td>0.2 (0.04-1.1)</td>
</tr>
<tr>
<td>Lönn, 2005</td>
<td>99-02</td>
<td>148</td>
<td>&gt;10 years</td>
<td>14</td>
<td>1.9 (0.9-4.1)</td>
</tr>
</tbody>
</table>

* Analogue use only
* duration of use
Brain tumour study *(Lönn et al, 2005)*

- 371 glioma cases in parts of Sweden - 1999-2002
- 273 meningioma cases in parts of Sweden - 1999-2002
- 674 population-based controls

Results:

- Glioma \( \text{OR}=0.8, 95\% \text{ CI } 0.6-1.0 \)
- Meningioma \( \text{OR}=0.7, 95\% \text{ CI } 0.5-0.9 \)
- No increased risk in long term users
  (12 meningioma and 25 glioma cases had started using mobile phones 10 years or more in the past)
- No increased risk in ipsilateral users
1st INTERPHONE national results

Brain tumour study *(Collatz-Christensen et al, 2005)*

- 252 glioma cases in Denmark - 2000-2002
- 175 meningioma cases in parts of Sweden - 1999-2002
- 822 population-based controls

**Results:**
- High-grade glioma  \(OR= 0.58, 95\%CI 0.4-0.9\)
- Low-grade glioma \(OR= 1.08, 95\% CI 0.6-2.0\)
- Meningioma \(OR=1.00, 95\% CI 0.5-1.3\)
- No increased risk in long term users

*(only 6 meningioma and 6 low-grade glioma cases had started using mobile phones 10 years or more in the past)*

... *Reduced risk for high-grade glioma may reflect selection and/or recall bias - 18% of the glioma cases not interviewed and patients with high-grade glioma had low scores on mental state test*

International EMF Project - IAC Meeting, Geneva, June 2005
Timetable for international analyses

• **Analyses of mobile phone use**
  – On-going – first paper submitted November?

• **Analyses with RF exposure gradients**

• **Analyses of other sections of questionnaire**
  – Occupational EMF exposures
  – Use of other portable transmitters
  – Ionising radiation
  – Medical history of subject and family

... 2006
### Main collaborators

<table>
<thead>
<tr>
<th>Australia</th>
<th>France</th>
<th>New Zealand</th>
<th>Exposure Ass.</th>
</tr>
</thead>
<tbody>
<tr>
<td>B Armstrong</td>
<td>M. Hours</td>
<td>A Woodward</td>
<td>J. Bowman</td>
</tr>
<tr>
<td>M. Carroll</td>
<td></td>
<td>A. Cook</td>
<td>S. Mann</td>
</tr>
<tr>
<td><strong>Canada</strong></td>
<td></td>
<td></td>
<td>L. Nadon</td>
</tr>
<tr>
<td>J. Siemiatycki</td>
<td>J. Schuez</td>
<td>T. Tynes</td>
<td>M. Taki</td>
</tr>
<tr>
<td>M. McBride</td>
<td>M. Blettner</td>
<td>L. Klaeboe</td>
<td>M. Van Tongeren</td>
</tr>
<tr>
<td>D. Krewski</td>
<td>G. Berg</td>
<td></td>
<td>P. Vecchia</td>
</tr>
<tr>
<td>P. Nelson</td>
<td>K. Schlaefer</td>
<td></td>
<td>J. Wiart</td>
</tr>
<tr>
<td>P. Carty</td>
<td>B. Schlehofer</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Denmark</strong></td>
<td><strong>Germany</strong></td>
<td><strong>Norway</strong></td>
<td></td>
</tr>
<tr>
<td>C. Johansen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H. Collatz-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Christensen</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Finland</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. Auvinen</td>
<td>S. Sadetzki</td>
<td>M. Feychting</td>
<td>IARC/RCA</td>
</tr>
<tr>
<td>T. Salminen</td>
<td></td>
<td>S. Lönn</td>
<td>E. Cardis</td>
</tr>
<tr>
<td><strong>Italy</strong></td>
<td><strong>Israel</strong></td>
<td></td>
<td>I. Deltour</td>
</tr>
<tr>
<td>S. Lagorio</td>
<td></td>
<td></td>
<td>L. Richardson</td>
</tr>
<tr>
<td>I. Iavorone</td>
<td></td>
<td></td>
<td>M. Vrijheid</td>
</tr>
<tr>
<td><strong>Japan</strong></td>
<td><strong>UK</strong></td>
<td></td>
<td>D. McLean</td>
</tr>
<tr>
<td>N. Yamaguchi</td>
<td></td>
<td></td>
<td>E. Combalot</td>
</tr>
<tr>
<td>T. Takebayashi</td>
<td></td>
<td></td>
<td>M. Moissonnier</td>
</tr>
</tbody>
</table>
The future?

- **INTERPHONE-Kids**
  - Rationale – children may be more sensitive to effects of RF
    - Istanbul meeting recommendations
    - Various expert committees
    - Concern among the general public and health professionals
  - Proposal 1 year ago ... assess the feasibility
    - Document patterns and amount of mobile phone use in children of different age groups 5-10 years in the past
    - Test questionnaire – procedures for documenting past phone use
    - Identify tumour types and age ranges of interest for a study
    - Evaluate statistical power and informativity of a possible study
      - *If feasible and informative and if main INTERPHONE study suggests an effect, prepare protocol for a case-control study*
  - Studies already starting in several Nordic countries
    - (Denmark, Sweden, ...)

*International EMF Project - IAC Meeting, Geneva, June 2005*