2.12 Radiofrequency Fields

**Summary**

- Extremely low frequency electromagnetic fields generated by electrical power transmission have been associated with an increased risk of childhood leukemia, but the findings are not conclusive. Even if this association is real, the number of excess cases is likely to be very small.

- Radiofrequency radiation emitted by mobile telephones has been investigated in a number of studies. There is some evidence of increased risk of acoustic neuromas and gliomas at the levels of exposure likely to be encountered from the use of mobile phones. A number of primary natural sources of radiofrequency fields are the sun, natural fields generated by electrical and electronic industry, and wildlife. Environmental exposure to extremely low frequency fields occurs in residential settings due to proximity to electricity transmission lines and use of rental and repair of electrical motors. Exposure to very low frequency fields is easily measured and estimating the exposure to individual components of the spectrum involved is extremely difficult to the point of being impossible.

- The INTERPHONE study is an ambitious project aiming at assessing the risk of cancer from the use of mobile phones. A number of the participating countries have indicated that in most studies, the cell phone-related risk has been more important for acoustic neuromas, gliomas, meningiomas and acoustic neuromas. The studies used a common protocol and were carried out in Australia, Canada, Denmark, Finland, France, Germany, Israel, Japan, New Zealand, Norway, Sweden and the UK. Details of the study, including the methods and results are therefore compatible. Pooling of data from Nordic countries and part of the UK yield a significantly increased risk of glioma related to use of mobile phones for a period of 10 years or more on the side of the head where the tumour developed. This finding could either be causal or artefactual, relative to differential recall between cases and controls.

- For meningiomas and acoustic neuromas, most national studies provide little evidence of an increased risk. The numbers of long-term heavy users in individual studies were even smaller than for glioma, however, and prevent any definitive conclusions. The numbers of long-term heavy users in individual studies were even smaller than for glioma, however, and prevent any definitive conclusions.

**Radiofrequency Fields**

Radiofrequency fields are fields generated as a consequence of commercial radio and television broadcasting and from telecommunications facilities. Radiofrequency fields in the home are generated by microwave ovens and burglar alarms. However, mobile telephones are now the greatest source of radiofrequency exposure for the general public.

A major obstacle in conducting epidemiological studies of EMF is the difficulty in accurately measuring the dose and exposure pattern. This is particularly true in the case of mobile telephones, where the dose emitted by phones has been changing between models and over time, and the use pattern of left or right side also varies within individuals. Measuring exposure to total EMF is also fraught with difficulty, partly because the use pattern of left or right side also varies within individuals.

**Separate studies have been carried out for acoustic neuromas, glioma, meningioma and tumours of the parotid gland. The studies used a common protocol and were carried out in Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, New Zealand, Norway, Sweden and the UK. Details of the study, including the methods and results are therefore compatible. Pooling of data from Nordic countries and part of the UK yield a significantly increased risk of glioma related to use of mobile phones for a period of 10 years or more on the side of the head where the tumour developed. This finding could either be causal or artefactual, relative to differential recall between cases and controls.**

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For parotid gland tumours, no increased risk was observed overall for any measure of exposure investigated. In a combined analysis of data from Sweden and Denmark (7), a non-significantly increased risk of benign tumours was observed for parotid gland tumours of the parotid gland. The studies used a common protocol and were carried out in Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, New Zealand, Norway, Sweden and the UK. Details of the study, including the methods and results are therefore compatible. Pooling of data from Nordic countries and part of the UK found a significantly increased risk of acoustic neuroma related to duration of use of 10 years or more on the side of the tumour (6). Again, this finding could either be causal or artefactual, relative to differential recall between cases and controls.

**Table 2.12.1 Radiofrequency range, class and type of device or service**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Class</th>
<th>Type of device or service</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 300 kHz</td>
<td>LF</td>
<td>AM radio, radio navigation, ship-to-shore</td>
</tr>
<tr>
<td>3 - 30 MHz</td>
<td>FM / VHF</td>
<td>CB radio, anamometers, HF radio communications and broadcast</td>
</tr>
<tr>
<td>300 - 3000 MHz</td>
<td>UHF (low)</td>
<td>FM radio, VHF TV, emergency services</td>
</tr>
<tr>
<td>300 - 3000 MHz</td>
<td>UHF (high)</td>
<td>Mobile phones, amateur radio</td>
</tr>
<tr>
<td>3 - 30 GHz</td>
<td>SHF (low)</td>
<td>Microwave ovens, radar, radio communications and broadcast</td>
</tr>
<tr>
<td>30 - 300 GHz</td>
<td>EHF (low)</td>
<td>Radar, radioastronomy, short-haul microwave communications</td>
</tr>
</tbody>
</table>

**Note:** The spectrum of electromagnetic fields and their use in daily life.
Cancer causation

Several expert groups have recently reviewed the scientific evidence concerning the carcinogenicity of extremely low frequency fields [8-10]. A number of epidemiological studies on childhood leukaemia indicate a possible relationship between risk and exposure to extremely low frequency fields. Studies of adult cancers following occupational or environmental exposures to extremely low frequency fields are much less clear. There is little experimental evidence that these fields can cause mutations in cells. Mechanistic studies and animal experiments do not show any consistent positive results, although sporadic findings concerning biological effects (including increased cancers in animals) have been reported. IARC has classified extremely low frequency fields as possibly causing cancer in humans (Group 2B), based on childhood leukaemia findings [11].

The evidence for the carcinogenicity of radiofrequency fields is even less clear. A few epidemiological studies in occupational settings have indicated a possible increase in the risk of leukaemia or brain tumours, while other studies indicated decreases. These studies suffer from a number of limitations. The experimental evidence is also limited, but suggests that radiofrequency fields cannot cause DNA mutations. The lack of reproducibility of findings limits the conclusions that can be drawn.

REFERENCES