



## Health Advice on Mobile Phones



Mobile phones operate by using radio waves, a form of non-ionising radiation. There is a large body of scientific evidence on the effects of exposure to radio waves because they have been widely used for decades. For example, radio, TV and radar signals are radio waves.

There are thousands of published scientific papers covering research about the effects of various types of radio waves on cells, tissues, animals and people. The scientific consensus is that, apart from the increased risk of a road accident due to mobile phone use when driving, there is no clear evidence of adverse health effects from the use of mobile phones or from phone masts. However there is now widespread use of this relatively new technology and more research is needed in case there are long term effects.

Some of the published research has produced contradictory results, particularly biology experiments using cell cultures. An important role of radiological protection specialists at the Health Protection Agency is to review the scientific evidence impartially and provide clear advice. The Agency also has an Advisory Group of experts who study the scientific evidence and provide independent advice ([AGNIR, independent Advisory Group on Non-Ionising Radiation](#)).

### Basic Advice

In 2000, an independent expert group in the UK first reviewed the evidence about the health effects of mobile phones. Its report "Mobile Phones and Health" ([Independent Expert Group on Mobile Phones; IEGMP](#)) has become known as the Stewart Report after its chairman Sir William Stewart. This expert group concluded that there was no clear scientific evidence of harm to health from exposure to mobile phone signals.

However, the expert group was concerned about the widespread adoption of a new technology involving exposure from radio waves to people's heads, including those of children, at levels that are significant fractions of international guidelines. This, and some uncertainties in biological evidence, led the expert group to advise some precaution, particularly in the use of mobile phones by children.

This advice was accepted by the Department of Health and leaflets and other information were provided for the public in 2000 and 2004. The basic advice from the Stewart Report continues to be the advice of the Health Protection Agency. The benefits of mobile telecommunications are widely recognised but, given the uncertainties in the science, some precaution is warranted particularly regarding the use of handsets held against the head. This is especially relevant to the use of handsets by children and the Agency recommends that excessive use by children should be discouraged.

Regarding the siting of telephone masts, this is a planning matter and therefore Government decides the law and any permitted development rights. However the Health Protection Agency notes that measurements in the UK and elsewhere, show that exposure levels to the signals from phone masts are much less than those from using mobile phone handsets, typically by factors of 100,

1000 and even 10,000, including when people are quite close to a mast.

Since 2000, expert reviews of the evidence have been carried out in many other countries and they have come to very similar conclusions about the lack of clear scientific evidence for any adverse health effects. For more details, see the sections below on the Stewart Report and other expert reviews of the scientific evidence.

## Advice on Exposure Guidelines

The Health Protection Agency published advice on limiting exposure to electromagnetic fields in 2004 and recommended the adoption in the UK of the established international guidelines from the International Commission on Non-Ionizing Radiation Protection (ICNIRP, see below). This advice was supported by a comprehensive scientific review covering the broad base of the scientific evidence.

The scientific evidence included published studies of human and animal health, the effects on biological cell cultures and the physics of the interaction of radio waves with matter (epidemiological studies, animal studies, experimental biology and dosimetry). The ICNIRP guidelines are based on a critical in-depth evaluation of the established scientific literature. The guidelines represent the international scientific consensus about this evidence and ensure the avoidance of known biological effects.

The Health Protection Agency review also gave recommendations for the research needed to fill the gaps in scientific knowledge and to improve the rigour of the guidelines.

The Health Protection Agency is committed to monitoring the results of further research related to the effects of radio waves on health and to revising its advice when appropriate.

## ICNIRP Guidelines

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) is an independent international scientific organisation formally recognised by the World Health Organization. ICNIRP reviews the science relating to exposure to electromagnetic fields and produces guidelines for limiting people's exposure. ICNIRP has a website from which a copy of its [guidelines and other background information](#) may be downloaded.

ICNIRP published a comprehensive set of guidelines in 1998 restricting exposures to electromagnetic fields, including radio waves. The Commission reconfirmed the basic restrictions in the frequency range 100 kHz-300 GHz (which includes the mobile phone frequency range) in 2009.

The ICNIRP guidelines contain basic restrictions on exposure that are set at levels which avoid the known adverse health effects of exposure. At the mobile phone frequencies, compliance with the ICNIRP guidelines will avoid heating by absorption of radio frequency signals. This is because the evidence from scientific studies of animals, cells and people shows clearly that biological effects occur at levels where heating occurs. The ICNIRP guidelines are therefore used as an input to the development of standards in very many countries, including those of the European Union.

The basic restrictions are specified in terms of fundamental dose quantities that occur inside the body; consequently, they are not easy to measure in living people. Reference levels are needed which are expressed in terms of quantities measurable outside the body such as electric field strength and power density.

Mobile phone handsets expose those parts of the body that are closest to the phone when the phone is in use, and most often this is the head. Therefore, for mobile phones, the most important restriction in the guidelines is the one on the localised Specific Energy Absorption Rate (SAR), a measure of the energy absorbed in the head.

Base station antennas tend to be very much further away from the body than a mobile phone and in this situation the reference level in terms of power density is usually meaningful as an indicator of SAR averaged over the whole body.

## The Independent Expert Group on Mobile Phones (Stewart Report)

The Independent Expert Group on Mobile Phones (IEGMP) published its report of May 2000. It has become known subsequently as the Stewart Report.

The Stewart Report supported the conclusion of ICNIRP that heating remains the best basis for setting exposure limits. The report also supported the approach of ICNIRP to have separate exposure guidelines for workers and for members of the public. The public guidelines are more restrictive because within the general public there may be people with illnesses or other characteristics that render them more susceptible to the heating effects of radio waves.



The Stewart Report concluded that the balance of evidence was that exposures to radio frequency waves below ICNIRP guidelines did not cause adverse health effects to the general population. However there were uncertainties in the science and further research needed to be carried out. Given the uncertainties and the widespread use of mobile phone technology, the Stewart Report recommended a precautionary approach. This included a recommendation that excessive use of mobile phones by children should be discouraged.

## Other Expert Reviews of the Scientific Evidence

Since 2000 there have been a number of reviews of the evidence carried out by scientific expert groups in the UK and in other countries, and most have come to conclusions very similar to those in the Stewart Report. A selection is given here

The [Zmirou Report](#) was published in France in 2001 and the [Health Council of the Netherlands](#) published its first report on the topic in 2002. Both reports came to conclusions about the scientific evidence that were similar to those in the Stewart Report. In December 2003, the [Swedish Radiation Protection Authority](#) published its first review and concluded that there was no significant change in the scientific evidence and the conclusions of the Stewart Report were still valid. Following these initial reports, both the Health Council of the Netherlands and the Swedish Radiation Protection Authority have published annual reviews of the evidence. The general conclusions about the evidence have not changed. These annual reports can be found on the website links given above.

In December 2003 the HPA's independent Advisory Group on Non-Ionising Radiation (AGNIR) published a follow up review of the scientific evidence since the Stewart Report. AGNIR concluded that the research published since the [Stewart Report](#) did not change the balance of evidence, but stressed the continued need for research.

In 2004, the ICNIRP Standing Committee on Epidemiology published a detailed review of epidemiological studies of health effects from exposure to radio waves (A Ahlbom, A Green, L Kheifets, D Savitz and A Swerdlow. *Epidemiology of Health Effects of Radiofrequency Exposure*. *Environmental Health Perspectives* 2004; 112(17): 1741-1754). This was a review of many studies carried out over several decades, looking at cancer, fertility, heart problems and cataracts in people who worked with radio waves. It also looked at studies of public exposure from radio and TV transmissions, focusing on leukaemia and studies of mobile phone users, but also looking at brain tumours and other cancers and symptoms. The reviewers concluded that "Results of these studies to date give no consistent or convincing evidence of a causal relation between RF exposure and any adverse health effect." However the authors did not rule out the possibility of an association because of the rapid introduction of mobile phones and their widespread use. Also, "A key concern across all studies is the quality of assessment of RF exposure" and there is "...almost no data is available on the consequences of childhood exposure".

In 2007, the UK Mobile Telecommunications and Health Research (MTHR) programme published a [report summarising the results](#)

of the work it had funded since 2001. It concluded that none of the research had provided evidence of biological effects or health effects below guideline levels. Nevertheless there is still a need for good research and it could not rule out the possibility of long-term effects. The MTHR research programme was set up in response to a recommendation from the Stewart Report and is jointly funded by Government and industry. Its independence is safeguarded by a committee of experts who review the research proposals and monitor each project. Scientists receiving funds from MTHR are encouraged to publish their results in peer reviewed science journals.

In 2008 the US National Cancer Institute published a [detailed factsheet on mobile phone use](#) and cancer. The NCI concluded that although research has not demonstrated a consistent link between mobile phone use and cancer, scientists still caution that further surveillance is needed before conclusions can be drawn.

The European Commission set up a Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in 2004 and this committee has published reports on the Possible Effects of Electromagnetic Fields on Human Health in 2007 and 2009. In the 2009 report ([http://ec.europa.eu/health/ph\\_risk/committees/04\\_scenihhr/docs/scenihhr\\_o\\_022.pdf](http://ec.europa.eu/health/ph_risk/committees/04_scenihhr/docs/scenihhr_o_022.pdf)) the Committee concluded "...from three independent lines of evidence (epidemiological, animal and in vitro studies) that exposure to RF fields is unlikely to lead to an increase in cancer in humans. However, as the widespread duration of exposure of humans to RF fields from mobile phones is shorter than the induction time of some cancers, further studies are required to identify whether considerably longer-term (well beyond ten years) human exposure to such phones might pose some cancer risk."

In 2009 the French Agency for Environmental and Occupational Health Safety (Afsset) published [an opinion from an expert group](#) on biological and health effects from radiofrequency waves.

After reviewing the biological, epidemiological and health evidence, this expert group concluded "that the majority of the studies carried out do not show effects for exposures at non-thermal powers" and "that available work does not currently allow the mechanism of a non-thermal effect nor a cumulative mechanism of action of radiofrequencies to be identified". Nevertheless, the expert group recognised the continuing uncertainties in the scientific evidence and Afsset issued precautionary advice aimed at minimising radiofrequency exposures to people, and to children in particular.

In 2009, members of the ICNIRP Standing Committee on Biology published a review of the effects of radiofrequency fields on the human nervous system (E van Rongen, R Croft, J Juutilainen, I Lagroye, R Saunders, R de Seze, T Tenforde, L Vershaeve, B Veyret and Z Xu. Effects of radiofrequency electromagnetic fields on the human nervous system. *J Toxicol and Env. Health* 2009 Part B; 12: 572-597). They concluded that "There is some evidence of an effect of exposure to a Global System for Mobile Telecommunication (GSM)-type signal on the spontaneous electroencephalogram (EEG). They noted however, that the effect may be of little functional significance since, "No consistent significant effects on cognitive performance in adults have been observed. If anything, any effect is small and exposure seems to improve performance." With regard to subjective symptoms such as headaches and migraine, the authors noted that these had been "attributed to various radiofrequency sources both at home and at work. However, in provocation studies a causal relation between EMF exposure and symptoms has never been demonstrated. There are clear indications, however, that psychological factors such as the conscious expectation of effect may play an important role in this condition.

In 2009, members of the ICNIRP Standing Committee on Epidemiology published an update of their 2004 review mentioned above (A Ahlbom, M Feychting, A Green, L Kheifets, D Savitz and A Swerdlow. Epidemiologic evidence on mobile phones and Tumor Risk: A Review. *Epidemiology* 2009; 20(5): 639-652) They noted that the number of papers on this topic had grown since 2004, but methodological problems remain. These are primarily the selective non-response of participants, and the inaccuracy and bias in their recall of phone use. Most studies had shown small increased or decreased risk amongst users, but a subset of studies showed an elevated risk. The subset of elevated results comes from a particular research group and there is no obvious explanation of why they obtain such different results from other studies. Overall, the ICNIRP Standing Committee conclude that the available data do not suggest a causal association between mobile phone use and fast growing tumours in the brain such as malignant glioma. The similar absence of an association for slow growing tumours (such as meningioma and acoustic neuroma) is far less conclusive, because the period of observation is simply too short.

## The INTERPHONE Study

This multi-national study was set up in 2000, following a successful feasibility study during 1998/99. It involves research in 13 countries to see whether mobile phone use is associated with an increased risk of head and neck tumours (including brain and salivary gland tumours).

Most individual studies in the various countries were published between 2004 and 2008. The pooled INTERPHONE study has combined the results from individual countries into one study involving nearly 6,500 cases and over 7,500 controls. This pooled study is due to be published in 2010

The participating countries are Australia, Canada, Denmark, Finland, France, Germany, Israel, Italy, Japan, New Zealand, Norway, Sweden and the UK.

The first step was to identify people with head and neck tumours (cases) and a similar number of people without such tumours (controls). The researchers then assessed the individuals' usage of mobile phones (ie, in both cases and controls) so they could be classified into groups such as heavy or light users. All the participants were also asked to recall the side of the head that the mobile phone was normally, or most frequently, used. This information was obtained via an in-person, computer-assisted interview.

The results so far from the individual INTERPHONE studies in different countries appear to show a protective effect, correlating the use of mobile phones with a reduced risk of head and neck tumours. These unexpected findings could be due to selection bias. The participation rate was fairly high for cases in general, but lower among potential controls. If mobile phone use differed between those controls who took part in the studies and those potential controls who did not take part, then this would lead to biased findings. Such a situation could arise if people with a relatively high level of education and socio-economic status were more willing than others to participate in this research and tended to use mobile phones more often than other members of the population. As a consequence, over-estimation of exposure among controls due to selective participation might result in an apparent protective effect of mobile phone use.

In contrast, results from individual countries also show that people with cancers in the head and neck tend to associate the use of mobile phones with the side of the head or neck where the tumour has been appeared. This appears to be a relatively strong association for some tumours (glioma and acoustic neuromas) after more than 10 years' usage. These findings might be due, at least in part, to bias in recalling the side of the head on which the mobile phone was generally used. The cases might have tended to over-report use on same side of head as that where the tumour arose, because some of them may have thought that mobile phone use caused their tumour. Conversely, they may have tended to under-report use on the other side of the head from where the tumour arose. In contrast, the controls are unlikely to have systematically over-reported use on one side of the head. Therefore, the overall interpretation of these results should bear in mind both selection and recall biases.

In order to estimate how strong an influence this recall bias and other biases in the INTERPHONE study could be, various validation studies have been carried out. These studies showed that mobile phone use was indeed being under-estimated by light users and over-estimated by heavy users, and the over-estimation of use was greater for the more remote time periods. The possibility of a selection bias caused by light users refusing to participate as controls in the study was also identified as a possible contributor to the apparent protective effect of mobile phone use.

There is also some uncertainty in the classification of tumours as right sided or left sided, and precisely where they are in the head. Measurements and modelling show that the exposure to radio waves from mobile phones is very localised and decreases rapidly with depth. More data on the precise location of tumours and their proximity to the mobile phone usage area is needed, rather than a simple classification on the left or right side of the head. This more detailed data was gathered in the INTERPHONE study and may be used in the interpretation of the pooled results due to be published in 2010.

## Links

[INTERPHONE study status](#)

[Update on IARC website \(pdf file\)](#)

## Other reports and information

In 2007 a report was produced by the [BioInitiative Working Group](#) which has received attention and has been used to suggest that the use of mobile phone technology should be restricted. The report contains chapters written by individual contributors reviewing studies in particular areas, and fronted by a chapter written by the editors which concludes that the existing public safety limits are inadequate to protect public health. The report advocates the use of precautionary measures and recommendations are made on establishing limits for exposure that are much lower than the guidelines currently recommended by ICNIRP.

The BioInitiative report has been criticised for a number of reasons, including for its campaigning style and the lack of scientific support for its various recommendations. For example, the [Health Council of the Netherlands has criticised its selective use of scientific data and lack of balance](#). The Council concluded that "...the BioInitiative report is not an objective and balanced reflection of the current state of scientific knowledge. Therefore, the report does not provide any grounds for revising the current views as to the risks of exposure to electromagnetic fields. The BioInitiative report argues that any effect of electromagnetic fields on biological systems should be avoided, thereby ignoring the distinction between effect and damage."

Along with the use of mobile telecommunications since the 1990s, the internet has also become an integral part of modern life for many people throughout the world. It provides a large source of information on a vast number of topics and can be very useful. However on many issues, including matters of health advice, people need to be discriminating and check that advice on the internet is from a reliable source.

Last reviewed: 11 February 2010

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