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# Should Children Use Mobile Phones?

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# Should Children Use Mobile Phones?

## **Abstract**

Should children be allowed to use mobile phones? Parents have been receiving mixed messages from health authorities, some of whom recommend that children limit their use of mobile phones on precautionary health grounds. Other health agencies make no such recommendation. Given the enormous popularity of mobile phones with children—indeed, in the United Kingdom, more than half of all seven to 16 year-olds own a mobile phone—parents may be understandably confused and worried by such conflicting advice.

## **Disciplines**

Electrical and Computer Engineering

## **Comments**

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## Speaker's Corner

### ***Should Children Use Mobile Phones?***

■ **Tung Tommy Chau and Kenneth R. Foster**

Should children be allowed to use mobile phones? Parents have been receiving mixed messages from health authorities, some of whom recommend that children limit their use of mobile phones on precautionary health grounds. Other health agencies make no such recommendation. Given the enormous popularity of mobile phones with children—indeed, in the United Kingdom, more than half of all seven to 16 year-olds own a mobile phone—parents may be understandably confused and worried by such conflicting advice.

We review statements made by expert groups and health agencies related to the use of mobile telephones by children, and their scientific basis for such advice. We limit our discussion to agency recommendations that are based on expert reviews of the health effects literature. Our focus is on the relation between the conclusions of the health agencies (which uniformly fail to find persuasive evidence of a hazard from use of mobile phones) and their recommendations concerning the uses of mobile phones by children. We conclude that, based on current evalua-

tions of the science by health agencies, that no recommendations are warranted with respect to use of mobile telephones by children. The public should be provided with information concerning ways in which individuals could reduce exposure to cell phone emissions if they are concerned about possible health risks, but health agencies should not recommend such measures on health grounds in the absence of any identified health hazard.

We do not consider health concerns related to the siting of mobile base stations near schools or nonhealth concerns such as the safety of children who engage in unsupervised communication with strangers (which is difficult for parents to monitor when their children use mobile phones) and privacy issues that might arise when children take and send photographs using mobile handsets.

The possible hazards of radio-frequency (RF) energy have been debated for many years, and exposure limits for RF energy have been in place in the United States since the 1960s, and most other countries have adopted similar limits. The two most influential limits are those of the IEEE and a broadly similar set of limits of the International Commission on Nonionizing Radiation



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Protection (ICNIRP). These limits, which are revised periodically by panels of experts, are designed to exclude all identified hazards, most of which are related to excessive heating of tissue. Virtually all mobile phone handsets comply with these limits.

The issue, however, is controversial. There has been much public debate about possible health effects of exposures to RF energy from microwave ovens, broadcast transmitters, military radar, and other sources—even as health agencies continue to fail to find persuasive evidence for health hazards from low-level exposures. The scientific literature is also inconsistent. Thousands of

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papers on the subject include a scattering of reports of biological effects of RF fields at exposure levels below the IEEE and ICNIRP limits. However, because of their lack of relevance to human health, technical limitations of the studies, or other problems, these studies have generally been given little weight by standards setting organizations and health agencies—even as they helped to fuel public debate about possible hazards of low-level exposures to RF fields. We do not enter into such arguments here, which would require an extensive review of the health literature that is far beyond the scope of this article (but for a recent review of the issue by one of the present authors, see [1]). We focus on recommendations by health agencies based on their own analyses of the issue.

### Agency Views

Responding to widespread concerns of the public, a number of expert groups and health agencies around the world have reviewed the scientific literature related to possible health effects of RF energy used by wireless communications technologies. Remarkably, these groups have reached similar conclusions about the scientific evidence, even as their recommendations concerning children and mobile phones varied considerably. Several of the most prominent groups that have examined the issue, and their recommendations concerning children follow.

#### IEGMP

The International Expert Group on Mobile Phones (IEGMP) was formed in 1999 by the U.K. government to analyze the possible health impacts of mobile phones. In 2000, the committee (widely known as the Stewart committee after its chair, Sir William Stewart), concluded:

The balance of evidence to date suggests that exposures to RF radiation below NRPB [National Radiological Protection Board of the UK] and ICNIRP guidelines do not cause adverse health effects to the general population.

However, the Stewart report suggested that children might be more susceptible than adults to injury from RF radiation. In

its chapter entitled “A Precautionary Approach,” the report concluded:

There is evidence that at the frequencies used in mobile phone technology, children will absorb more energy per kilogram of body weight from an external electromagnetic field than adults. A one year old could absorb around double, and a five year old around 60%, more than an adult. ...the widespread use of mobile phones by children for non-essential calls should be discouraged. We also recommend that the mobile phone industry should refrain from promoting the use of mobile phones by children.

#### NRPB

Later pronouncements by British agencies took a similar position. In April 2005, the National Radiological Protection Board, merged with the Health Protection Agency (HPA), chaired by Sir William Stewart. In its recent reports, the NRPB has reaffirmed the conclusions and recommendations of the Stewart Report. Thus, in late 2003, the NRPB concluded:

The weight of evidence now available does not suggest that there are adverse health effects from exposures to RF fields below guideline levels . . . [but] the published research on RF exposures and health has limitations, and mobile phones have only been in widespread use for a relatively short time. The possibility therefore remains open that there could be health effects from exposure to RF fields below guideline levels [2].

A later report in 2004 concluded that

in the absence of new scientific evidence, the recommendation of the Stewart Report on limiting the use of mobile phones by children remains appropriate as a precautionary measure [3].

#### French Health General Directorate

In 2001, the French Health General Directorate formed a group of experts,

called the Zmirou (after its chair, Prof. Denis of the University of Grenoble) to assess whether changes were necessary in the country’s RF field exposure limits.

There is no scientific data establishing any risks due to long-term exposure in adults or children, but neither is it possible to eliminate that possibility, in the current state of knowledge. ....for this reason, the group of experts suggest that parents who feel it is necessary to equip their children with mobile phones should ensure that they make reasonable use of this equipment. A recommendation to this effect should be included in the instructions for use supplied with all mobile telephones [4].

#### RNCNIRP

The Russian National Committee on Non-Ionizing Radiation Protection (RNCNIRP) is a group of scientists and radiation specialists formed in 1998, and its recommendations form the basis of the current policy of the Russian Ministry of Public Health. The relevant Russian guideline (2003), in unofficial translation, states:

The following measures are recommended to protect members of the public who use mobile land radio communication stations:

- limit the duration of mobile phone use as much as possible
- limit the possibility of use of mobile phones by people younger than 18, pregnant women and people with pacemaker implants.

Agencies and expert groups are making no precautionary recommendations about mobile phones and children [5].

#### FDA

In the United States, the Food and Drug Administration (FDA) is the principal agency that follows the issue of possible health effects of RF energy. In response to the NRPB recommendations, in January 2005 the FDA stated

there is no hard evidence of adverse health effects on the general public.... With regards to the safety and use of cell phones by children, the scientific evidence does not show a danger to users of wireless communication devices including children [6].

## **WHO**

The World Health Organization (WHO), an agency of the United Nations, has an EMF Project that follows the issue of mobile phones and health. A fact sheet published in June 2000 concluded:

Present scientific information does not indicate the need for any special precautions for use of mobile phones. If individuals are concerned, they might choose to limit their own or their children's RF exposure by limiting the length of calls, or using "hands-free" devices. ....[Regulatory authorities] should not undermine the science base of the guidelines by incorporating arbitrary additional safety factors into the exposure limits.

In recent statements, the WHO has been leaning towards precautionary recommendations regarding the use of mobile phones, although its recent statements hardly differ from earlier WHO pronouncements on the subject. In July 2005, several Canadian newspapers quoted Michael Repacholi, the head of the WHO EMF Project, as saying that kids should use hands-free kits. Shortly afterwards, he clarified his comments in a statement issued by the World Health Organization ([http://www.who.int/peh-emf/meetings/ottawa\\_june05/en/index4.html](http://www.who.int/peh-emf/meetings/ottawa_june05/en/index4.html)):

To date, all expert reviews on the health effects of exposure to RF fields have reached the same conclusion: There have been no adverse health consequences established from exposure to RF fields at levels below the international guidelines on exposure limits ...Present scientific evidence does not indicate the need for any special precautions for the use of

mobile phones. If individuals are concerned, they might choose to limit their own or their children's RF exposure by limiting the length of calls, or by using "hands-free" devices to keep mobile phones away from the head and body.

In a just-published paper, Repacholi and colleagues concluded that

the paucity of data, particularly for children, suggests that low-cost precautionary measures are appropriate, especially because some of the exposures are close to guideline limits. Physicians could advise parents that their children's RF exposure can be reduced by restricting the length of calls or by using hands-free devices to keep mobile phones away from the head and body [7].

## **HCN**

The Health Council of the Netherlands (HCN) has published yearly a series of reports on the effects of electromagnetic fields on human health starting in 2001. Its report of 2002 concludes:

It is unlikely from a developmental point of view that major changes in brain sensitivity to electromagnetic fields still occur after the second year of life. The Committee therefore concludes that there is no reason to recommend that mobile telephone use by children should be limited as far as possible [8].

## **ICNIRP**

The International Commission on Non-Ionizing Radiation Protection (ICNIRP) establishes exposure guidelines for RF energy, which have been adopted by many countries throughout the world. In 2004, a review by ICNIRP, written by five epidemiologists (all members of ICNIRP, from Australia, Sweden, the United Kingdom and the United States) concluded:

results of epidemiologic studies to date give no consistent or convincing evidence of a causal relation between RF exposure and any adverse health effect.

On the other hand, these studies have too many deficiencies to rule out an association.

Dr. Paolo Vecchia, president of ICNIRP, stated his position on the issue of children and mobile phones at a WHO meeting in June 2004 "...there is no need, or justification, for a special approach to the protection of children." This is not official ICNIRP policy but may reflect the thinking of the commission.

## **ARPANSA**

The Australian Radiation Safety and Nuclear Safety Agency (ARPANSA) is an advisory body on the topic of possible health and environmental effects of radiation. Its fact sheet on health effects of RF fields states:

At present, there is insufficient evidence in the science to substantiate the hypothesis that children may be more vulnerable to RF [electromagnetic] emissions from mobile phones than adults.

## **Scientific Basis of Precautionary Recommendations**

The Stewart Report made its precautionary recommendations for children on the grounds that

children may be more vulnerable because of their developing nervous system, the greater absorption of energy in the tissues of the head, and a longer lifetime of exposure.

We examine each of these points in turn.

### ***Is There a Greater Absorption of RF Energy from Mobile Phones in Children than in Adults?***

This presumption, which is based on engineering studies, underlies the recommendations of the Stewart committee. This is, however, far from certain.

The amount of energy that a person is exposed to from a mobile phone is quantified in terms of the specific absorption rate (SAR), in watts of absorbed power per kilogram of body mass. In 1996, Gandhi and colleagues [9] reported a numerical study of the SAR in models of the human body.



The study examined models of adult size and scaled-down models with dimensions appropriate for five- and ten-year-old children. The study reported higher SAR values in the child than adult models due to the relatively deeper penetration of RF fields from the handset into the smaller models. This study was the apparent basis for the Stewart committee's opinion that mobile phones produce higher exposure in children than adults. However, two later studies [10], [11] failed to confirm this result.

To help resolve this issue, the FDA recently conducted a "benchmark validation study" in which 14 groups participating in the project, including those of Gandhi, Kuster, and Chou, conducted numerical studies of the SAR produced by mobile phone handsets in two models of the head (of a child and an adult). At a meeting in 2004, the FDA concluded

The larger (adult) head resulted in a slightly higher group aver-

aged peak SAR over both 1 and 10 grams, than did the smaller (child) head for all conditions of frequency and position.

A more recent study compared the calculated SAR in 14 anatomical head models of different size and found no trend for higher RF absorption in smaller head models, although pronounced differences were present associated with anatomical differences in the models [12]. Thus, present data do not show that children absorb more RF energy from handsets than adults; indeed, they may absorb less.

**Are Children More Vulnerable Because of Their Developing Nervous Systems?**

In the absence of any identified hazard of RF exposures at levels below present exposure limits, this is a difficult question to answer reliably. "The facts clearly indicate that developing organisms are different than adults," Robert L. Brent, a distinguished toxicologist,

pointed out at a meeting of the WHO EMF Project [13] to consider possible sensitivity of children to RF fields,

However, few generalizations about children's vulnerability to environmental exposures apply, given that vulnerability and sensitivity are specific to the embryo and child's developmental stage, and is also agent specific.

Thus, there is little basis to speculate about an increased sensitivity of children to RF fields or what age groups might be of greatest concern. This is clearly separate from the issue whether the exposure to children from a mobile handset is different than that to an adult, given the lack of identified hazard from exposure at levels below present limits.

**Discussion**

The recommendations reviewed have two elements in common. First, all of these expert reports conclude that, based

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HP100-015	100	2 weeks	100	2 weeks	100	2 weeks
HP100-016	100	2 weeks	100	2 weeks	100	2 weeks
HP100-017	100	2 weeks	100	2 weeks	100	2 weeks
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HP100-019	100	2 weeks	100	2 weeks	100	2 weeks
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on current scientific data, mobile phones and base stations cause no adverse health effects in adults and children. Second, they stress that additional research is needed to supplement the current state of knowledge. They differ in their recommendations for precaution.

We offer several comments.

First, the question whether or not children receive higher exposure to RF energy than adults from mobile handsets has no clear relation to the question of possible health risks. The established hazards of RF energy (as reflected in views of health agencies and standards setting groups such as the IEEE and ICNIRP) are related to excessive heating of tissue, which is hardly a problem with mobile phone handsets. (If health agencies concluded that “nonthermal” hazards existed from low levels of exposure, the situation would clearly change.) And it is by no means clear that there is any difference in exposure at all. The controversy between Gandhi and Kuster and other investigators turns on numerical models of the head and handsets fixed in precisely specified positions. But an individual’s actual exposure will vary greatly depending on usage characteristics (e.g., the position of the handset with respect to the head), variations in geometry, and electrical characteristics of the body, and (because of adaptive power control) the strength of the signal from the base station. These uncontrolled factors are likely to result in far greater variability in exposure than any differences between children and adults as calculated from numerical models.

Second, users of mobile phones, for whatever reason, can take steps to reduce their exposure to RF fields. Thus the recommendation of ARPANSA, that

if individuals are concerned, they should choose to limit their own or their children’s RF EME (electromagnetic energy) exposure by limiting the number and length of calls, or using “hands-free” devices to keep mobile phones away from the head and body.

Alternative responses by parents concerned about possible health effects of using mobiles can be taken as well, and

might be more appropriate for some parents. These include reading the authoritative (and generally reassuring) reports by health agencies on the subject.

Third, it is inconsistent for a health agency such as the NRPB to conclude, on the one hand, that

the weight of evidence now available does not suggest that there are adverse health effects from exposures to RF fields below guideline levels

and, at the same time, to recommend precautionary measures. Moreover, issuing precautionary recommendations is, in itself, a cause of worry to the public, as shown in a recent study [14] that reported that precautionary measures may trigger concerns, amplify risk perceptions in the public, and lower trust in public health protection.

The precautionary measures recommended by NRPB and the Zmirou report can be considered as examples of the precautionary principle, which can loosely be described in terms of the adage “better safe than sorry.” The precautionary principle is a complex issue, being subject to varying definitions and governed in its use by a complex and inconsistent set of legal precedents in different jurisdictions. We note, however, that an influential commentary by the European Commission in 2000 stressed that the principle should be invoked only if a problem has been identified, however imperfectly it might be understood [15], which is not the case at present with mobile phones. Other critics, notably the eminent American legal scholar Cass Sunstein, have complained that applications of the precautionary principle often focus on avoiding one set of possible risks, but ignore risk-risk tradeoffs [16]. For mobile phones, this might include the possibility that giving a child access to a mobile telephone might reduce his or her risks.

Additional guidance can be found from central concepts in ethics: autonomy, beneficence (or nonmaleficence), and paternalism [17]. Nonmaleficence is the duty not to harm other individuals. Governments act on this duty, for example, by imposing RF exposure limits, and other safety-related regulations on wire-

less communication technologies. Nonmaleficence would require action only to the extent that a harm is foreseeable.

Autonomy is the freedom of an individual to carry out his or her wishes. It is a truism that all technologies have possible unforeseen consequences and possibility of failure. Everybody who lives in modern society must choose on a daily basis whether or not to use a host of technologies, trading off the benefits that they receive against the possibility of harm from known or unknown hazards. The principle of autonomy requires that consumers be provided with sufficient information to be able to make informed decisions. With mobile telephones, governments have shown respect for the autonomy of citizens by providing detailed reviews of the scientific data related to possible health effects of mobile telephones, comparisons of SAR levels produced by different models of handsets, and information about the relative effectiveness (or lack of effectiveness) of hands-free kits and other shielding devices. While these efforts need to be improved (much of this information is too technical for the average consumer to be able to understand, and SAR data are not directly useful in comparing possible health risks of mobile phones) they reflect an appropriate response to the need to respect the autonomy of the public.

Recommendations by health agencies regarding the use of mobile telephones by children seem to be based on another ethical concept, paternalism. One form of paternalism consists of preventing individuals from taking actions that would harm themselves, for example, efforts by governments to convince people to stop smoking or use helmets while riding a motorcycle—both clearly hazardous activities. (A European colleague who read this, however, pointed out that many Europeans would have a different perspective on such restrictions: since their governments pay for medical care, they would be justified as cost-saving measures.)


But paternalism is in tension with autonomy, and governments are often inconsistent in their efforts to prevent individuals from using even clearly hazardous technologies, driving motor vehicles for example. (Pennsylvania,

for example, recently repealed its motorcycle helmet law, as an infringement on the autonomy of the rider.) Restrictions on driving while using a mobile telephone (another clearly risky behavior) are very inconsistently applied throughout the United States. Such restrictions might be justified on paternalistic grounds (to prevent the

driver from injuring him or herself), but a stronger moral justification would be on grounds of nonmaleficence (to prevent harm to other individuals). In the absence of any identified or suspected hazard, neither paternalism, autonomy, nor nonmaleficence would require a government to recommend that children not use mobile telephones.

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