RF and Health: A WHO Perspective

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World Health Organization
OUTLINE

- Introduction
- Assessing the health risk
- Managing the potential risk
- Conclusions
The Present EMF Context

- Increasing EMF human exposure due to electricity demand, medical technologies and wireless devices
- Increasing concern from the public
Radio Frequency Fields (100 kHz – 300 GHz)

- Wi-Fi
- Telecommunications
- Broadcasting
- Residential sources
- Security scanners
- Commercial
- Navigation/Radar
- Emerging technologies

ITU Workshop on EMF | Turin | 9 May 2013
Mobiles ‘boost cancer’

Radiation use are still unclear. The biggest British study, led by Sir William Stewart two years ago, could find no evidence of a risk to health. But Sir William still remains. Cancer develops when control signals in a normal cell go wrong and an abnormal cell results. Instead of destroying itself the mutant cell keeps on dividing and forms a lump.

Stop Smart Meters!

Fighting for health, privacy, and safety
The Present Scientific Knowledge

- Large and increasingly sophisticated database
- Known mechanisms
- Health effects not established below international guidelines
- Scientific uncertainty
WHO International EMF Project

- Established in 1996
- Coordinated by WHO HQ
- A multinational, multidisciplinary effort to create and disseminate information on human health risk from EMF
WHO Partners in Radiation

International Organizations

International Advisory Committee

National Authorities

NGOs

Collaborating Centres

[Flags and logos of various international organizations and countries]
mHealth
an ITU/WHO initiative

ITU and WHO launch mHealth initiative to combat noncommunicable diseases

Plan to save lives and reduce costs agreed at ITU Telecom World 2012

Joint ITU/WHO news release

17 OCTOBER 2012 | DUBAI, UNITED ARAB EMIRATES - The International Telecommunication Union (ITU) and WHO today launched a new partnership called the 'mHealth' Initiative to use mobile technology, in particular text messaging and apps, to help combat noncommunicable diseases (NCDs) such as diabetes, cancer, cardiovascular diseases and chronic respiratory diseases.
Do EMFs pose a health risk?

Risk Assessment
The Evidence

Risk Perception
The Public Concern

Risk Management
The Policies
OUTLINE

- Introduction

- Assessing the health risk
What do we know?

- 100 kHz
- 300 MHz
- 10 GHz

Frequency
What do we know?
Mechanisms of interaction

- 100 kHz
- 300 MHz
- 10 GHz

Induced currents
Induced currents and heating
Surface heating

Non-thermal effects??
What type of research is needed?
RF Research Agenda

- To promote research areas that have relevance to public health, and can
  - reduce scientific uncertainties: health effects research
  - respond to public concern through better risk communication: social science research
- Useful to researchers and funding agencies
- Uptake of the latest agenda in several countries
Research
Balance of studies needed

Laboratory Studies

- Cellular studies
  - Genotoxicity
  - Gene expression

- Animal studies
  - Cancer
  - Behaviour
  - BBB
  - Skin

- Human studies
  - Sleep
  - EEG
  - Hormones
  - EHS
Short-term effects
( WHO fact sheet 193, June 2011 )

- To date, research does not suggest any consistent evidence of adverse health effects from exposure to RF fields at levels below those that cause tissue heating.

- Research has not been able to provide support for a causal relationship between exposure to EMF and self-reported symptoms, or “electromagnetic hypersensitivity”.

Epidemiological studies

Studies on mobile phones

- Tumours in head and neck
  - Glioma, meningioma, acoustic neuroma, parotid gland

- Over 15 studies on the use of mobile phones
  - Published: USA, Nordic countries, INTERPHONE, CEFALO
  - Ongoing: MOBI-Kids, COSMOS
Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case–control study

The INTERPHONE Study Group*

Corresponding author. Elisabeth Cardis; CREAL, Doctor Aiguader 88
*List of members of this study group is available in the Appendix.

Accepted 8 March 2010

Cases:
- 2,765 gliomas
- 2,425 meningiomas
- 1,121 acoustic neuroma
- 109 malignant parotid gland

Controls:
- 7,658
Long-term effects
(WHO fact sheet 193, June 2011)

- No increased risk of glioma, meningioma or acoustic neuroma with mobile phone use of more than 10 years

- Indications of increased risk of glioma for heavy users
  - Biases and errors prevent a causal interpretation
  - Basis for classification of RF fields as "possible carcinogenic"

- No available data for long-term use (15-20 years)

- Studies on children ongoing
  - No causal relationship seen in CEFALO study (July 2011)
Electromagnetic fields and public health: mobile phones

Fact sheet N°193
June 2011

Key facts

- Mobile phone use is ubiquitous with an estimated 4.6 billion subscriptions globally.
- The electromagnetic fields produced by mobile phones are classified by the International Agency for Research on Cancer as possibly carcinogenic to humans.
- Studies are ongoing to more fully assess potential long-term effects of mobile phone use.
- WHO will conduct a formal risk assessment of all studied health outcomes from radiofrequency fields exposure by 2012.

Epidemiological studies
Base stations and wireless networks

- Some studies have been performed
  - Well-being and performance
  - Cancer

- Difficulty of personal exposure assessment

Conclusions:
“Considering the very low exposure levels and research results collected to date, there is no convincing scientific evidence that the weak RF signals from base stations and wireless networks cause adverse health effects”
How do we evaluate the health risk from EMF?
EMF Health Risk Assessment

Problem Formulation

Cancer

Hazard Identification
Review key research to identify any potential health problems that an agent can cause

Exposure Assessment
Determine the amount, duration and pattern of exposure to the agent

Risk Characterization
Assess the risk for the agent to cause cancer or other illnesses in the general population

Exposure-Response Assessment
Estimate how much of the agent it would take to cause varying degrees of health effects that could lead to illnesses
Overview of the evaluation process

- **Cancer in humans**
  - Sufficient evidence
  - Limited evidence
  - Inadequate evidence
  - Evidence suggesting lack of carcinogenicity

- **Cancer in experimental animals**
  - Sufficient evidence
  - Limited evidence
  - Inadequate evidence
  - Evidence suggesting lack of carcinogenicity

- **Mechanistic and other relevant data**
  - Mechanistic data “weak,” “moderate,” or “strong”? 
  - Mechanism likely to be operative in humans?

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**Overall evaluation**

- **Group 1** Carcinogenic to humans
- **Group 2A** Probably carcinogenic to humans
- **Group 2B** Possibly carcinogenic to humans
- **Group 3** Not classifiable as to its carcinogenicity to humans
- **Group 4** Probably not carcinogenic to humans
IARC Monograph on RF


- Expert meeting, May 2011
- *The Lancet Oncology*, 22 June 2011
- Monograph publication, 24 April 2013

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Carcinogenicity of radiofrequency electromagnetic fields

In May, 2011, 30 scientists from 14 countries met at the International Agency for Research on Cancer (IARC) in Lyon, France, to assess the carcinogenicity of radiofrequency electromagnetic fields (RF-EMF). These assessments will be published as Volume 102 of the IARC Monographs.·

Human exposure to RF-EMF (frequency range 30 kHz to 200 GHz) can occur from use of personal devices (eg, mobile telephones) and from other sources such as power lines and electric motors. The induced electric and magnetic fields and associated currents inside tissues. The most important factors that determine the induced fields are the distance of the source from the body and the output power level. Additionally, the efficiency of coupling and resulting field distribution inside the body strongly depend on the frequency, polarization, and direction of wave incidence on the body, and geometric factors, such as the smoking, and regarding associations between use of wireless phones and glioma.·

The cohort study included 257 cases of glioma among 420 095 subscribers to two Danish mobile phone companies between 1982 and 1995. Glioma incidence was near the national average for the whole population. In the study, reliance on subscription to a mobile phone provider, as a surrogate for mobile phone use, could have resulted in considerable misclassification.

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World Health Organization
6.1 Cancer in Humans

There is *limited evidence* in humans for the carcinogenicity of radiofrequency radiation. Positive associations have been observed between exposure to radiofrequency radiation from wireless phones and glioma, and acoustic neuroma.

6.2 Cancer in Experimental Animals

There is *limited evidence* in experimental animals for the carcinogenicity of radiofrequency radiation.

6.3 Overall Evaluation

Radiofrequency electromagnetic fields are *possibly carcinogenic to humans* (Group 2B).

6.4 Rationale of the evaluation of the epidemiological evidence

The human epidemiological evidence was mixed. Several small early case–control studies were considered to be largely uninformative. A large cohort study showed no increase in risk of relevant tumours, but it lacked information on level of mobile-phone use and there were several glioma and acoustic neuroma and mobile-phone use; specifically in people with highest cumulative use of mobile phones, in people who had used mobile phones on the same side of the head as that on which their tumour developed, and in people whose tumour was in the temporal lobe of the brain (the area of the brain that is most exposed to RF radiation when a wireless phone is used at the ear). The Swedish study found similar results for cordless phones. The comparative weakness of the associations in the INTERPHONE study and inconsistencies between its results and those of the Swedish study led to the evaluation of *limited evidence* for glioma and acoustic neuroma, as decided by the majority of the members of the Working Group. A small, recently published Japanese case–control study, which also observed an association of acoustic neuroma with mobile-phone use, contributed to the evaluation of *limited evidence* for acoustic neuroma.

There was, however, a minority opinion that current evidence in humans was *inadequate*, therefore permitting no conclusion about a causal association. This minority saw inconsistency between the two case–control studies
Health Risk Assessment

Problem Formulation

Hazard Identification
Review key research to identify any potential health problems that an agent can cause

Exposure Assessment
Determine the amount, duration and pattern of exposure to the agent

Exposure-Response Assessment
Estimate how much of the agent it would take to cause varying degrees of health effects that could lead to illnesses

Risk Characterization
Assess the risk for the agent to cause cancer or other illnesses in the general population

All studied outcomes

International EMF Project
Environmental Health Criteria
Electromagnetic Fields

- Static Fields (2006)
- Extremely Low Frequency Fields (2007)
- RF fields (2014)
Scope

- Frequency range:
  - 100 kHz - 300 GHz
  - Include UWB, pulses, mm-waves

- Sources:
  - RFID, EAS, mobile telephony, radar, smart meters, …

- Health benefits not included
  - Hyperthermia, MRI, medical treatments, diathermy, RF ablation surgery

- Systematic review of scientific evidence of health risks

- Update on research recommendations

- Review of national RF policies
OUTLINE

- Introduction

- Assessing the health risk

- Managing the health risk
  - Developing standards and regulations
  - Communicating the scientific knowledge
Norms, Standards and Guidelines

- **Emission standards** have specifications that limit the EMF emissions from devices.
- **Exposure standards** have specifications that limit EMF exposure to people.
Relevant Authorities
Non-governmental and international organizations

- Emission standards
- Exposure standards

- Measurements standards

- IEEE
- CENELEC
- IEC
- ICNIRP
- ITU
- IEEE World Health Organization
Policy documents ....

http://www.who.int/peh-emf/standards/
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Worldwide EMF standards
Survey on EMF Standards
May 2013

Test: Electromagnetic Fields Exposure Standards

Many countries have put in place standards or limits to control exposures to electromagnetic fields (EMFs) over the frequency range from 0 Hz to 300 GHz. WHO is creating a new database of such standards and invites your assistance.

For simplicity, the term "standard" is used throughout this questionnaire and is intended to include any limit, guideline or policy that is used to control exposures to EMFs.

This questionnaire is divided into three broad frequency ranges:

- **static** – static or DC fields
- **low frequencies** – frequencies from 1 Hz to 100kHz, i.e. including power frequencies
- **radio frequencies** – frequencies from 100kHz to 300 GHz, i.e. including broadcast radio and TV, mobile telephony and wireless technologies.

Please fill in as many of these frequency ranges as you are able to, leaving aside any questions that lie outside your knowledge or responsibility - we recognise that the responsibility for different frequency ranges may rest with different organisations or sections of government (e.g. Ministry of Health, Ministry of Environment, Ministry of Telecommunications, Ministry of Labor, Radiation Protection Agency, ...). Feel free to forward this survey to whom it may concern in your country.

Within each frequency range, the questionnaire asks separately about standards applying to the public and to workers. For each of these divisions, the questionnaire asks about the existence of standards, their legal status, and the values at specific frequencies within each range to allow easy comparison of different standards.

The results of this survey will be made publicly available on WHO’s website [www.who.int/emf](http://www.who.int/emf). If you have questions, please contact us at: [emfproject@who.int](mailto:emfproject@who.int)

Thank you in advance for completing this survey by May 27 2013.

**NOTE:** The mention of actions/policies in this survey does not constitute endorsement by WHO that risks exist or that the actions are appropriate. Merely, they represent examples of actions/policies that are in effect or that have been proposed in some countries.

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## Exposure standards for electromagnetic fields (EMF)

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National management approaches

- Relevant authorities
  - National level (different ministries)
  - Provincial level
  - Local level
Management Options

Reduce concern
- No action
- Communication

Reduce uncertainty
- Research
- Planning measures

Reduce exposure
- Engineering measures
- Exposure limits
- ....
Risk Perception and Communication

WHO Risk Handbook

- For programme managers who need basic information on EMF risk perception, communication and management
- Available in English
- Translated into Spanish, Italian, German, French, Russian, Bulgarian, Dutch, Polish, Portuguese, Hungarian and Japanese
- Available on the web
  [www.who.int/emf](http://www.who.int/emf)
Announcement of
International Stakeholder Seminar on Radiofrequency Policies

5 June 2013, 9:00am - 5:30pm
French Agency for Food, Environmental and Occupational Health & Safety (ANSES)
27-31 avenue du Général Leclerc - 94701 Maisons-Alfort, France

and

Call for examples of good risk management practices

by 30 June 2013
emfproject@who.int
OUTLINE

- Introduction
- Assessing the health risk
- Managing the potential risk
- Conclusions
Challenges to governments….

- Rapidly evolving RF technologies
- Launched on the market before health evaluation
- Disparities in risk management measures and regulations around the world
- Concern from the public
Conclusions

- Need for clear roles and responsibilities in government on this topic
- Need for adoption and compliance of health-based standards
- Need for a public information program and dialogue with stakeholders
- Need for promoting research to reduce uncertainty

*We are a "global village"*