RF and Health: A WHO Perspective

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ITU/UNESCO Forum on Human Exposure to Electromagnetic Fields (EMFs) in Latin America
Montevideo, Uruguay, 13 March 2014
OUTLINE

- Introduction
- Assessing the health risk
- Managing the potential risk
- Conclusions
World Health Organization

- **Function**: act as the UN directing and coordinating authority on international health work

- **Objective**: "the attainment by all peoples of the highest possible level of health"

- **Definition**: "HEALTH is a state of COMPLETE physical, mental and social well-being and not merely the ABSENCE of disease or infirmity" (*Constitution, 1948*)
When diplomats met in San Francisco to form the United Nations in 1945, one of the things they discussed was setting up a global health organization. WHO's Constitution came into force on 7 April 1948—a date we now celebrate every year as World Health Day.

Delegates from 53 of WHO's 55 original member states came to the First World Health Assembly in June 1948. They decided that WHO's top priorities would be malaria, women's and children's health, tuberculosis, mental illness, nutrition, and environmental sanitation—many of which we are still working on today. WHO's work has since grown to cover a host of public health problems that were not even known in 1948. Including relatively rare diseases such as MERS-CoV.

1948

International Classification of Diseases

1952

N. Jacobson develops the first successful polio vaccine.

1952–1964

Global polio eradication

One of the first diseases to claim WHO's attention was polio, a crippling and disabling disease that affected some 1.5 million people in 1960. The global polio control programme, fully operational between 1955 and 1960, used live-attenuated vaccines to treat more than one million infections. By 1965, the global programme had exceeded 300 million children in 46 countries and reduced global polio prevalence by more than 95%.

1974

Pneumococcal vaccine programme

WHO started for 10 years to eliminate and control - or even eradicate - one disease: polio. In 1980, the global polio eradication programme was declared successful, with only a handful of cases remaining. A few years later, polio was declared eradicated.

1979

Eradication of smallpox

The eradication of smallpox—in a disease which had ravaged and killed millions as the line 1960s is one of WHO's proudest achievements. The campaign to eradicate the deadly disease throughout the world was coordinated by WHO between 1966 and 1979. It was the first and so far the only time that a major infectious disease has been eradicated.

1983

Identification of HIV

1988

Global Polio Eradication Initiative established

Since 1988, the Global Polio Eradication Initiative has reduced the number of cases of polio by more than 99%—from more than 350,000 per year in 1988 to 22 in 2020. Supported by national governments, WHO, Rotary International, the US Centers for Disease Control and Prevention and Sabin Vaccine Institute, the initiative has reached more than 2 billion people, and health workers. As a result, five of the eight polio-endemic countries have stopped outbreaks, and will soon be certified polio-free.

2003

Global Polio Eradication Initiative

Reduction of the global incidence of polio from 350,000 cases per year in 1988 to 22 cases in 2020.

2004

Aids is the Global Strategy on Diet, Physical Activity and Health

2005

World Health Assembly resolves the Global Health Security

The goal is to eradicate polio worldwide so that no child will ever again be paralyzed by this disease.

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WHO Department of Public Health, Social and Environmental Health

- Water sanitation and health
- Climate change
- Air pollution (indoor and outdoor)
- e-waste
- Energy and health
- Housing and health
- Radiation (electromagnetic fields, ultraviolet)
- ...
The Present EMF Context

- Increasing EMF human exposure due to electricity demand, medical technologies and wireless devices
- Increasing concern from the public
Applications using radiofrequency fields
(100 kHz – 300 GHz)

Wi-Fi
Telecommunications

Residential sources

Navigation/Radar

Commercial

Emerging technologies

Security scanners

Broadcasting

Applications using radiofrequency fields
(100 kHz – 300 GHz)
Applications using radiofrequency fields

Smart Meters

- Smart meters are increasingly being installed in homes and businesses to collect/report on electrical, water and natural gas consumption.
- Allows remote real-time monitoring using two-way (radio) communication to relay information to the utility companies and to the consumers to help manage their energy use.
- Increased public resistance due to concerns about health, privacy and cost to consumers.
Mobiles ‘boost cancer’

Radiation may make tumours grow faster.

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 recommended a precautionary approach, particularly in children.

The World Health Organisation has called for more research and has urged people to limit mobile use.

Now Italian scientists believe they could be closer to the truth.

Dr Fiorenzo Marinelli, of the National Research Council in

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 or tumour.

The results of the Italian study support the belief of some scientists who say radiation can damage DNA and destroy the cell repair system – making tumours more deadly.

Dr Peter de Pomerai of the University of Nottingham, who studied effects on the body car.

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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
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?

- Frequency
  - 100 kHz
  - 300 MHz
  - 10 GHz
What do we know?
Mechanisms of interaction

- Induced currents
- Induced currents and heating
- Surface heating
- Non-thermal effects??

Frequency:
- 100 kHz
- 300 MHz
- 10 GHz
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

Mobile phone related experimental studies

From http://www.emf-portal.de/
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

Mobile phone related epidemiological studies

From http://www.emf-portal.de/
Epidemiological studies
Studies on mobile phones

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

- Numerous 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 > 10 years

- Indications of increased risk of glioma for heavy users
  - But biases and errors prevent a causal interpretation

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

- Studies on children ongoing
Centro de prensa

Campos electromagnéticos y salud pública: teléfonos móviles

Nota descriptiva N°193
Junio de 2011

Datos y cifras

- El uso de teléfonos móviles se ha universalizado: en el mundo hay unos 4600 millones de contratos de telefonía móvil.
- El Centro Internacional de Investigaciones sobre el Cáncer ha clasificado los campos electromagnéticos producidos por los teléfonos móviles como posiblemente carcinógenos para los seres humanos.
- Hay estudios en curso para analizar más a fondo los posibles efectos a largo plazo del uso de los teléfonos móviles.
- En 2012, la OMS realizará una evaluación formal de los riesgos a partir de todos los resultados de salud estudiados en relación con campos de radiofrecuencias.

http://www.who.int/mediacentre/factsheets/fs193/es/index.html
Epidemiological studies
Base stations and wireless networks

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

● Difficulty of personal exposure assessment

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Campos electromagnéticos (CEM)

Los campos electromagnéticos y la salud pública

Estaciones de base y tecnologías inalámbricas

Nota descriptiva N°304
Mayo 2006

Conclusiones

Teniendo en cuenta los muy bajos niveles de exposición y los resultados de investigaciones reunidos hasta el momento, no hay ninguna prueba científica convincente de que las débiles señales de RF procedentes de las estaciones de base y de las redes inalámbricas tengan efectos adversos en la salud.
.... subject to proper siting
How do we evaluate the health risk from EMF?
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

Cancer
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?

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

RF fields classified as "possibly carcinogenic to humans" (Group 2B) based on

- **limited evidence in humans**, based on positive association between glioma and acoustic neuroma and exposure to RF-EMF from wireless phones (epidemiologic studies)
- **limited evidence in experimental animals** for the carcinogenicity of RF-EMF
- **weak mechanistic evidence** relevant to RF-EMF-induced cancer in humans

Evidence for other exposures (e.g. base stations, Wi-Fi) and outcomes (other cancers) considered insufficient for any conclusion
## Agents Classified by IARC (950)

<table>
<thead>
<tr>
<th>IARC Classification</th>
<th>Examples of Agents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinogenic to humans (107) (usually based on strong evidence of carcinogenicity in humans)</td>
<td>Asbestos</td>
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<tr>
<td></td>
<td>Alcoholic beverages</td>
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<tr>
<td></td>
<td>Benzene</td>
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<td></td>
<td>Mustard gas</td>
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<td></td>
<td>Radon gas</td>
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<tr>
<td></td>
<td>Solar radiation</td>
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<td></td>
<td>Tobacco (smoked and smokeless)</td>
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<tr>
<td></td>
<td>X-rays and Gamma</td>
</tr>
<tr>
<td>Possibly carcinogenic to humans (59) (usually based on strong evidence of carcinogenicity in animals)</td>
<td>Creosotes</td>
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<tr>
<td></td>
<td>Diesel engine exhaust</td>
</tr>
<tr>
<td></td>
<td>Formaldehyde</td>
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<tr>
<td></td>
<td>Polychlorinated biphenyls (PCBs)</td>
</tr>
<tr>
<td>Possibly carcinogenic to humans (267) (usually based on evidence in humans which is considered credible, but for which other explanations could not be ruled out)</td>
<td>RF fields</td>
</tr>
<tr>
<td></td>
<td>Coffee</td>
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<tr>
<td></td>
<td>Gasoline engine exhaust</td>
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<tr>
<td></td>
<td>Pickled vegetables</td>
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<tr>
<td></td>
<td>ELF magnetic fields</td>
</tr>
<tr>
<td></td>
<td>Styrene</td>
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</tbody>
</table>
Health Risk Assessment (cont'd)

- **Problem Formulation**

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

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

- **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

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International EMF Project

Environmental Health Criteria 249
Extremely Low Frequency Fields
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
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
- Measurements standards
- Exposure standards

- Relevant Authorities
- Non-governmental and international organizations

- Emission standards
- Measurements standards
- Exposure standards
Reference Levels
National management approaches

- Relevant authorities
  - National level
National management approaches

- Relevant authorities
  - National level
  - Provincial level
  - Local level
    - Dispense building and planning permits
    - Direct contact with public and operators
    - May introduce further conservative measures based on politics rather than science
## Local Authorities

<table>
<thead>
<tr>
<th>Role</th>
<th>Possible responsibilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planning authority or regulator</td>
<td>Protect public health&lt;br&gt;Authorise siting of transmitters&lt;br&gt;Establish planning rules for transmitters&lt;br&gt;Approve land use near transmitters&lt;br&gt;Coordinate with other stakeholders</td>
</tr>
<tr>
<td>Landowner of transmitter site</td>
<td>Decide whether to lease site&lt;br&gt;Act as a good neighbour&lt;br&gt;Use position as landowner to encourage or promote local priorities.</td>
</tr>
<tr>
<td>Network operator</td>
<td>Operate radio telemetry network to monitor status of local infrastructure&lt;br&gt;Operate mobile radio network to communicate with staff&lt;br&gt;Operate WiFi network for public use&lt;br&gt;Comply with regulatory requirements</td>
</tr>
<tr>
<td>Employer</td>
<td>Meeting occupational health and safety responsibilities for staff working near wireless network transmitters.</td>
</tr>
<tr>
<td>Source of information</td>
<td>Lead public communications about health issues.&lt;br&gt;Respond to questions about wireless networks</td>
</tr>
</tbody>
</table>
Management Options

- No action
- Communication
- Research
- Planning measures
- Engineering measures
- Exposure limits
- ....

Reduce concern

Reduce uncertainty

Reduce exposure
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
OUTLINE

• Introduction
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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"*
The International EMF Project
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Public Health and Environment
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