Using science to make decisions on EMF policy



EMF and Health - A global issue: Exploring appropriate precautionary approaches. Royal Society, London, 8-9 September 2008

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As Aldous Huxley said:

"The vast majority of human beings dislike and even dread all notions with which they are not familiar. Hence it comes about that at their first appearance innovators have always been derided as fools and madmen"

What about inventors of wireless RF technologies in our brave new world?

What is this meeting all about?



For science to progress there should be active debate on issues using sound science, logic and reasoning that convinces others to a viewpoint

This meeting provides a unique opportunity for those having strong views about health effects of EMF to discuss them with scientists involved in national and international reviews.

This meeting is ONLY about the science and risk management; it is not an arena to smear others or to show any disrespect their views

Lets use this opportunity promote those issues that are commonly held from those that need more discussion



- Now in 2008:
- > 50,000 mobile phone masts in the UK, many more to come with 3G
- 13% UK households use mobile instead of landline
- ~ 10,000 mobiles stolen in UK/month
- > 2.5 billion mobile phones worldwide
- 95 mobiles for every 100 people in Europe
- **6 million new mobiles in India/month**

Technology is advancing rapidly

New York 1893







Developing countries may have other health priorities; People are less worried about EMF if there are other benefits

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Children are exposed to technology



Child exposure is
 beginning at younger
 ages

>90% of <16yrs in UK
own mobiles, 10% spend
> 45 mins/day on them;
calling and texting

Wireless technologies are here to stay and have huge benefits



Personal Communications



Telecommunications

Wi-Fi



Why are people concerned about EMF?

> Some people are genuinely concerned that insufficient research has been conducted to assure safety

> There are a large number of very poor quality EMF studies that cause confusion about what can be concluded from the science

> Misinformation is available on many web sites and in the press; concerned citizens may not distinguish good sites from bad

> The press is only interested in a saleable story; unfortunately factual information is of secondary importance

> Politicians may be swayed by concerned citizens instead of using authoritative science-based information to develop policy

Press wants a saleable story; not giving authoritative info

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Risks in perspective: Where is El/IF'?

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Government authorities are criticized for relying on the science

QuickTime[™] and a decompressor are needed to see this picture. HPA is one of the most authoritative agencies in the world Activists agree with the press if their view promoted. If not.... QuickTime[™] and a decompressor are needed to see this picture.

Activist view of studies when they dont agree with the findings

BioInitiative Report (2007)

➤ Claims EIMF causes: Sleeplessness, headache, fatigue, skin disorders and skin sensitivity, loss of appetite, tinnitus, impairment of memory and concentration, Alzheimer's and Parkinson's disease, cardiac problems, changes in brain and nervous systems activity, stress reactions, inflammatory and allergic reactions, genotoxic effects, changes in immune system function, and many cancers including childhood leukaemia, adult brain and breast cancer and acoustic neuroma.

► If EMF really caused all these diseases it should be banned in the population.

➢ Fortunately no major review, national or international, concur with any of these claims.

Unfortunately, some politicians actually believe this report instead of WHO reports!

BioInitiative Report (2007) Brief critique (1)

>Co-edited by Cindy Sage and David Carpenter

> Chapters produced by individual authors; not a consensus report

Objective; to give reasons why current exposure limits [i.e. ICNIRP] are not sufficient to protect public health

Bases evaluations on simple listings of positive and negative results; a discredited approach since it values all studies equally

Assessment of research on DNA damage and genotoxicity is only a compendium of findings in 79 studies; doesn't consider the strengths and limitations of each study

➤ The criteria for applying scientific methods used by all national and international scientific review bodies are criticised for "adopting standards of evidence so unreasonably high as to exclude any finding of scientific concern, and thus justify retaining outdated thermal standards" without identifying any evidence to support this claim.

BioInitiative Report (2007) Brief critique (2)

➤ Basis for ELF guidelines is incorrectly characterized as relating to tissue heating. ICNIRP states "...these guidelines are based on short-term, immediate health effects such as stimulation of peripheral nerves and muscles, shocks and burns caused by touching conducting objects..." and "Exposure to low-frequency electric and magnetic fields normally results in negligible energy absorption and no measurable temperature rise in the body"

➤ Conclusions drawn based on data that reaches contrary conclusions. Section 2 states "Both ELF and RF exposures can be considered genotoxic under certain conditions, including exposure levels that are lower than existing safety limits" (p. 17). Yet, Drs. Xu and Chen who reviewed similar and overlapping research in section 5 state: "To explain and/or support epidemiological observations, many laboratory studies have been conducted, but the results were controversial and no clear conclusion could be drawn to assess EMIF health risk." (p. 3)

BioInitiative Report (2007) Brief critique (3)

The summary and conclusions are written in a polemical, emotive and scientifically unsupportable manner to elicit maximum impact on an unknowing lay public and media

➤ The B-report advocates the same strict measures to be undertaken as if there were high levels of agreement within the scientific community that EMF was a proven carcinogen and was effective in causing disease at very low exposures. Precautionary measures are invoked where there is considerable uncertainty about potential risks. The B-report dismisses all uncertainty, and hence the basis for using precautionary measures.

Hierarchy of science



RF \Rightarrow Matter (physics) \Rightarrow Molecules (chemistry) \Rightarrow Organisms (biology) \Rightarrow Disease (medicine)

The laws of physics are inviolate and form the basis of actions for chemistry, biology and medicine

RF interactions with matter

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Fundamental processes needed to result in an adverse health effect

Assessing EMF health risks

A problem in assessing health risk is the lack of consistency of EMF study results. EMF research has had publications that were the result of:

1. Deliberate manipulation of the data,

2. Selection of part of the data so a positive outcome would result,

3. Basic flaws in the methodology,

4. Various study biases or confounders, and

5. Insufficient power to determine whether an effect exists or not.

So no study, positive or negative, can be accepted into a database for health risk assessment unless it has been replicated or confirmed by independent studies; a WHO requirement.

Criteria for assessing EMF health risks

At the start of WHO's International EMF Project Repacholi and Cardis (Radiation Protection Dosimetry 72: 305-312, 1997) published "Criteria for EMF health risk assessment" so everyone would know what study quality WHO required and the criteria to assess research for health risks



All studies should be published in peer-reviewed scientific journals to be useful for health risk assessments



Criteria to accept studies for health risk assessments

Study uses methodology and biological systems appropriate to end points studied. Employ double blind techniques, blind scoring or codes and use appropriate controls. Study sensitivity adequate to detect an effect, if any exists.

 All data analyses objective, no relevant data deleted and appropriate analytical methods used.
 Data should be internally consistent.



> Published description of methods should have sufficient detail showing reasonable precautions taken to meet requirements above.

Results should demonstrate an effect of the relevant variable at a high level of statistical significance (p>0.05) using appropriate tests.

Hill criteria (1)

- To evaluate a database for health risks, address:
- Strength of the association: stronger associations between risk and exposure are more likely to be causal
- **Consistency:** causation enhanced when different investigators using different methodologies in different studies all see similar results
- Specificity: exposure causes a single effect Temporality: exposure must precede the disease



Hill criteria (2)

Biological gradient: causal association more likely if effect increases with exposure; but could be a "threshold effect"

Plausibility: should be a mechanism to explain the association

Coherence: cause-effect interpretation should not conflict with known facts about the natural history of the disease (e.g., temporal pattern, histopathology, animal findings) Experiment: well designed experimental studies provide strong evidence for causation

Evaluating all studies

cellular studies	clinical studies	animal studies	epidemiologic studies
	+		+







Weight-of-Evidence

The "weight-of-evidence" determines the degree to which available results support or refute a given hypothesis

Strengths and weaknesses of each study should be evaluated and results of each study should be interpreted as to how it alters the "weight-of-evidence" Once health risks have been determined using well-accepted procedures, they can be used to develop policies

✓ Science-based exposure

✓Precautionary measures

standards

✓Protective policies

Science

Policies

Development of standards: First determine the critical effect



Frequency

X = biological effect assessed as a health hazard

o = biological effect assessed as having no apparent health hazard



Worst case absorption conditions

Frequency dependence of RF energy absorption in humans, including children



The higher the absorption the lower is the exposure limit

BASIC RF LIMITS AND REFERENCE LEVELS

Basic limits: workers0.4 W/kggeneral public0.08 W/kg



Why different exposure limits?



Public safety factor of 50

Elderly

children

and

Worker exposure limits have safety factor of 10 x lower than threshold for health effects to **OCCUI**

Safety Factors are Precautionary

Exposure limits are determined assuming worst-case exposure/absorption conditions; almost never occurs .. very precautionary

In addition, safety factors are incorporated into the limits to compensate for unknowns and uncertainties in the science

Sources of uncertainty in threshold levels:
extrapolation of animal data to effects in people
differences in the susceptibility of different groups or individuals (workers vs public incl. children)
statistical uncertainties in the dose-response function
dosimetric uncertainty

RF fields

What is the way forward?

> Continue research: see WHO's RF research agenda (http://www.who.int/peh-emf/research/rf_research_agenda_2006.pdf) > Conduct risk assessments, using all the scientific studies and a weight-of-evidence approach > Adopt international standards and ensure compliance > Adopt realistic precautionary measures that don't undermine the science base of the standards > Advise national authorities on facts and policies > Disseminate results in an easily understood language

Over the past 12 years >\$250 million spent by researchers world wide to complete WHO's EMF research agendas and to determine whether non-thermal effects have any health consequences

Government must use science for policy

Governments establish high level scientific committees to advise on what health risks the scientific research indicates; they must know the facts before policy development.

The political process to develop policy may involve public/activists' input; but this is separate from the scientific process.

Fortunately the UK Government takes heed of their scientific bodies. In response to a phone mast petition in 2008 to the UK Prime Minster it is stated: The Stewart Report recommended in 2000 that the ICNIRP guidelines be adopted "as a precautionary measure". In its clarification statement the Stewart Group added: "Since there are no scientific grounds for setting guidelines below the levels set by the ICNIRP for the public, the Expert (Stewart) Group avoided setting exposure limits for school buildings and grounds below these limits." <u>http://www.number10.gov.uk/output/Page14249.asp</u> Always remember, when governments are in trouble, they should rely on sound science for their recommendations



Thank you

hand bags

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