



European Health Risk Assessment Network on
Electromagnetic Fields Exposure

Report on priorities of health risk management and communication on EMF exposure

Deliverable Report D8 of EHFRAN project

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This report is based on the findings of the EFHRAN activities reported in deliverables D2 (Report on the analysis of risks associated to exposure to EMF – Human exposure), D4 (Report on the level of exposure (frequency, patterns and modulation), D6 (Health risk characterization related to EMF exposure), D7 (Report on health risk characterization of EMF exposure in Europe), and on the results of discussions held during the workshop on *Risk Assessment on Electromagnetic Field Exposure: the activities of the European Project EFHRAN, which was held in Brussels on 5th July 2012*. This workshop comprised project partners presenting detailed descriptions of the main contents of the cited deliverables. Participants discussed a number issues relating to the presentations and to the project in general. The workshop closed with a Round Table discussion, chaired by Guglielmo d'Inzeo, whereby the main points were summarised and conclusions drawn from the discussions of the day.

This report details and evaluates the main items and considerations identified during the workshop, and outlines how these constitute possible inputs to policy and health authorities and which should be considered as priorities for future health risk management and risk communication initiatives on electromagnetic field (EMF) exposure.

Executive Summary

The main inputs and priorities to future risk management processes that were identified are as follows:

- Investment in the collection of data on the actual levels of EMF exposure among the European population, for all frequency ranges. Currently, few data are available and these are collected in an uncoordinated way. Policy and health authorities should invest in actions focused on providing harmonized data, collected using the same or similar protocols across Europe, and with sufficient statistical power so as to maximise reliability of the results.
- Investment in the study of biophysical and biological mechanisms of interaction, using innovative theory and techniques, such as quantum mechanics (QM) molecular simulations, systems biology and proteomics.
- Investment in studies related to specific novel uses of EMF-emitting devices, in particular Intermediate Frequency technologies, such as radio frequency identification systems (RFID), anti-theft gates, and specific population subgroups, such as children.
- Building upon existing epidemiological resources (birth cohorts, INTEROCC, Mobi-Kids etc) with improved exposure assessment and exposure validations to provide answers to outstanding questions on EMF health effects (reproductive, behavioural, cancer, etc.) in relation to RF and IF wherever possible rather than setting de novo expensive epidemiological studies to investigate specific outcomes and exposures. Evaluating, where possible, joint effects of EMF and of other environmental agents to which humans are exposed in the general environment and at work,
- Investment in (technical and non-technical) methods for reducing exposure of the population, and to improve and facilitate health risk communication to the general public. This should include a quantitative analysis of the effect that such methods might have on reducing any potential health

impacts in the EU population (combining dose-response assessment and risk characterization). This should be achieved both through modelling and through experimental measurement studies.

- Improvement in health risk communication to reduce the gaps between relevant scientific evidence and European citizens' health risk perception.

Survey on EMF exposure levels in Europe

An important priority for future risk management and communication actions relates to the lack of an accessible, structured database of the levels of the exposure to EMF across all EU Member States. These data are missing across all the frequency bands.

As to Extremely Low Frequency fields (ELF, i.e., in the range from few Hertz to 3 kHz), the lack of measurement surveys could be compensated for by studying emission levels and distributions of major ELF EMF environmental sources, together with collecting data on their numbers and the possibility to calculate magnetic fields based on the characteristics of these installations. Most of those studies come from northern and western Europe and, with the exception of Hungary, little information is available for the central and eastern European region. In addition, specific investigations should be carried out into ELF near-field exposures, that is, exposure of part of the body to ELF sources close to it, such as electrical appliances.

Little is known about exposure levels to intermediate frequencies (IF – between 300 Hz and 100 kHz, but sometime referred as in a range of 300 Hz - 10 MHz); information compiled in the course of the EFHRAN exposure assessment, indicates that though exposure sources are increasing, few of them affect the general public (the main source being induction cookers), and most are occupational. Of particular concern for workers are anti-theft portals and the increasing use of readers for RFID. Additional information on exposure levels need to be collected and compliance with current protection guidelines should be better investigated, especially in the case of sensitive subpopulations, such as pregnant women.

In the RF and MW range (100 kHz or 10 MHz to 300 GHz), the measurement surveys are focused on some specific sources (mobile phones and, in more general terms, telecommunication devices) and little is generally known about personal exposure.

From the perspective of RF surveying, three questions are of particular interest:

- 1) What is the distribution of integrated RF exposure levels (from all sources) of the general population in different locations in Europe?
- 2) Do the sources contributing to total integrated RF exposure level vary with location? I.e., which field sources contribute most to the overall exposure?
- 3) Are exposure levels lower in areas with defined precautionary measures (such as protection limits lower than those given by ICNIRP, as in Brussels, Italy or Switzerland)?

Work performed in the course of the EFHRAN exposure assessment stresses the importance of well-designed and representative measurement campaigns to monitor exposure distribution at different locations in Member States. The monitoring must be complete and accurate to adequately support the communication process discussed below in this report.

Different protocols might be proposed for carrying out population measurement surveys (the sample has to be representative of the target population, and the timing of measurement representative of study participants' usual activity patterns) and/or other measurements for microenvironment surveys (the target being microenvironments under normal operating conditions; population exposure will be estimated based on time spent in each microenvironment).

Among the main methodological issues requiring attention, there is a need to further improve personal exposure meters to characterise exposure of individuals to ELF, IF and RF fields and to develop a standard for a measurement protocol to enable the comparison of measurements made in different studies and various countries, etc.

Effort should be also spent in the quality of the dissemination of the future surveys on monitoring of EMF levels. In that perspective standardisation of reported values is strongly needed, considering that the few data currently available are hardly comparable. A web portal can be a useful instrument for exchange collected information and data among EU national and local authorities, improving coordination of the various national initiatives.

The scientific community in the field recently submitted a proposal for a COST Action aimed at identifying and preparing the methodological instruments for these monitoring campaigns.

Studies on EMF Interaction Mechanisms

A further priority is to reinforce and support research into mechanisms of interaction between electromagnetic fields and biological systems. This argument is a key problem across the whole arena of bioelectromagnetics research, spanning the whole frequency range.

Some interaction models, such as radical-pair mechanisms, are increasingly considered to be more likely candidates for a mechanism than others; preliminary results on the action of EMF on molecular structure indicate that only high intensity electric fields are capable of inducing an effect.

These investigations should be continued and supported, specifically since they have the potential to provide mechanistic explanation of associations seen in epidemiological studies and of other possible health effects which are currently only considered to present "limited evidence of effect", as was done in the EFHRAN reports on the health risk analysis.

The introduction of promising new theory and techniques such as quantum mechanics (QM), molecular simulations, systems biology and proteomics applied to EMF and health issues should be also specifically supported.

Studies on specific EMF devices: the case of radio frequency identification systems

RFID (Radio Frequency IDentification) is an emerging technology, already diffuse in a huge number of applications in Europe and globally. This technology allows the identification of objects and persons using remote wireless radio-frequency interrogation of tags contained or attached to them. After a long period of international standardization, the technology is currently applied in a huge number of environments as a means of managing distribution systems, libraries, markets, hospitals, etc. It can be used in almost any

complex environment as a means of tracking objects and reading information about their characteristics and state.

The frequencies used by RFID are allocated in several different regions of the electromagnetic spectrum (from kHz to GHz).

Apart from the evident need of funding studies on RFID exposure assessment and investigation into their possible health effects (specifically addressing exposure from EMF emitted by the readers, since the tags are known to emit extremely low level EMF fields), attention should also be paid to the risk perception of the public regarding these devices.

Similar considerations hold for anti-theft gates and systems, particularly important for occupational exposure, taking into account, also in this case, the possible exposure of subjects such as pregnant women.

In that perspective, even in this case, high-quality, evidence-based scientific information is needed, to allow policy and health authorities to establish a health risk communication process. To that end, specific studies should be supported both on the possible health effects of RFID and on their levels of exposure among the European population.

EMF exposure of adolescents, children and pregnant women/foetuses

Studies on the EMF exposure of adolescents, children and pregnant women/foetuses should be strongly supported. These groups might be expected to be more sensitive to EMF fields, considering that they represent the first generation of Europeans to be exposed to diffuse EMF fields since conception and birth.

Studies on possible health effects should be supported across the whole frequency range, together with ad hoc exposure assessment techniques that should be also improved. Although some recent computational human models of foetuses and children have been developed for scientific purposes, many issues should be still investigated, such as change in dielectric properties of different tissues with age. The issue of sensitive groups should also be considered by regulatory bodies, which so far publish regulations geared towards adults (i.e. only taking into account the dielectric properties of adult bodies), and do not explicitly include consideration of younger subjects.

EMF Exposure assessment and epidemiology

So far, the interpretability of the results of epidemiological studies has been limited due to the low reliability of exposure information. It is crucial to invest in new methods and new approaches for exposure assessment applied in such studies. This also implies the use of new statistical approaches, improvement of real-time exposure assessment devices (also in terms of personal measurement devices), improved capability in data processing and analysis of large masses of data.

While there are new questions of importance in the field of EMF and health (effects of new IF emitting technologies, effects of RF, effects of mixtures of exposures as the IARC Monographs evaluation evaluated the animal evidence on the carcinogenicity of RF mainly based on results of co-carcinogenicity experiments) efforts should be made to explore these, where possible, in the framework of existing epidemiological studies (birth cohorts, studies of brain tumours in young people, studies of occupational exposures such as

INTEROCC) – increasing follow-up time, adding additional questions to existing questionnaires, building exposure surveys in subsets of the study participants to validate and improve exposure assessment – rather than on setting up costly de novo studies. An exception may be, however, studies of new IF applications which may have been too rare in existing populations to be addressed properly. The feasibility and informativeness of any new such study, however, should be evaluated carefully.

Reduction of EMF exposure levels

Investment is needed in better understanding potential technical and non-technical methods for reduction of the exposure of the population. Apart from identifying the best available techniques for exposure reduction (that differ across the EMF frequency range), efforts should be made to investigate quantitatively the actual change in potential health impacts attributable to EMF when each of these methods is used. This should be, for example, performed by application of both computational electromagnetism and/or experimental measurements, by which the impact on population exposure of the different reduction systems can be estimated and compared, and by application of different exposure-response models for specific frequency bands and health effects. The action that the European Commission already started supporting the running FP7 Project LEXNET Low EMF Exposure Future Network is in that direction.

These initiatives could also help to improve and facilitate health risk communication to the general public, taking also into account the issue of risk perception.

Improvement of EMF and health risk communication

As described in the various EFHRAN reports on risk analysis^{1,2,3}, there is, at present, no health outcome for which there is “sufficient evidence” of a relationship with EMF exposure on the basis of the current scientific evidence-based knowledge, if the international safety standards are applied and respected.

There is, however, “limited evidence” of a possible relationship between some EMF frequencies and some health outcomes (for example ELF magnetic fields and childhood leukaemia, RF from mobile communication devices and brain tumours) and these should be investigated and clarified more thoroughly in the near future.

The current state of scientific knowledge about possible health effects of EMF does not fully correspond to the perception the general public has of the effects of EMF although this varies strongly from EU country to country, as clearly shown in the Eurobarometer report⁴, as shown, for example in Fig. 1.

The fact that the EMF and health risk perception in the population differs from the health risk assessment outcomes should suggest to policy and health authorities in Europe, starting from the European Union, that

¹ EFHRAN Report on Risk analysis of human exposure to electromagnetic fields - revised version (2012). Available at: http://efhran.polimi.it/docs/D2_Finalversion_oct2012.pdf

² EFHRAN Report on Risk analysis of human exposure to electromagnetic fields (2010). Available at: http://efhran.polimi.it/docs/EFHRAN_D2_final.pdf

³ Report on the analysis of risks associated to exposure to EMF: in vitro and in vivo (animals) studies (2010). Available at: http://efhran.polimi.it/docs/IMS-EFHRAN_09072010.pdf

⁴ Electromagnetic fields. Report. Special Eurobarometer 347 / Wave 73.3 – TNS Opinion & Social, June 2010

they need to invest in improving communication strategies related to EMF, allowing Europeans to have access to high quality and referenced information about the scientific state of the art on EMF and health issues.

The European Union could achieve this through the use of the (new) electronic means to communicate and distribute the information. The development of an ad hoc website (portal) at the European level (possibly integrating blogs and Twitter information) might be a good means of aiding the European Union and national authorities to serve the population with referenced, high-quality and evidence-based information on EMF and health issues.

This portal should be designed in such a way that it links the knowledge coming from the scientific community and the expertise of communication experts. This could represent a first positive step in the direction of improving the quality of communication between policy and health authorities and citizens on EMF and health issues.

To increase the efficacy of this communication instrument a continuous link between the scientific community and the EU Offices should be established and maintained, as was done in the recent past by means of the two projects, EMF-NET (Effects of the Exposure to Electromagnetic Fields: from Science to Public Health and Safer Workplace, FP6 Coordination Action 2004-2008), as well as EFHRAN. Both were as instruments that provided evidence-based information to the European Commission, assisting the EU in scientific evidence and responding to the public and stakeholders. This process could be improved using instruments such as the Fast Response Team on EMF and Health that was established in the course of the EMF-NET Coordination Action, as a team of scientists, organized to provide quick answers to scientific questions coming from the EU Parliament and the Commission Officers.

QC1.12. Please tell me to what extent you think each of the following affects your health.

Mobile phone masts

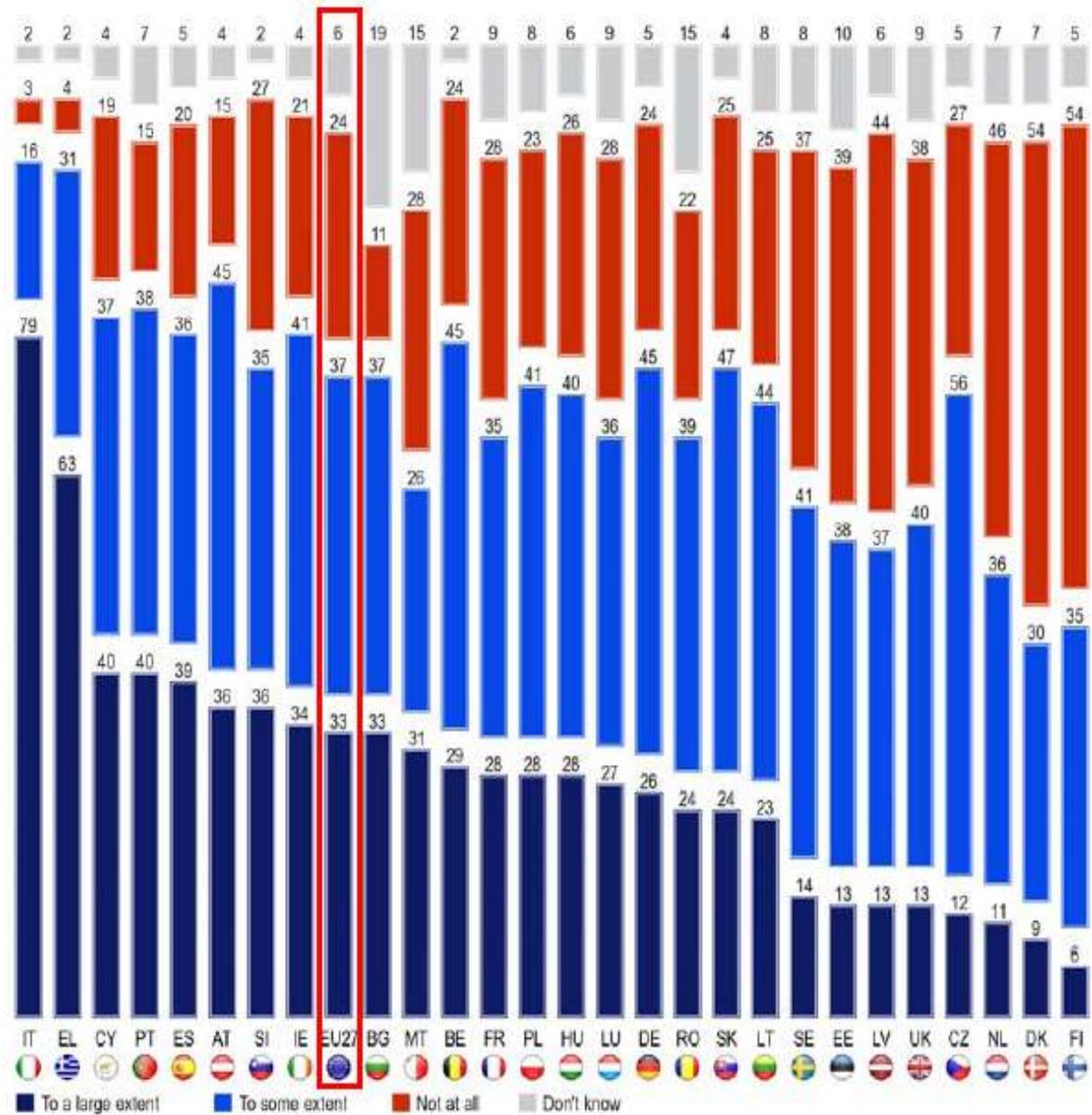


Fig. 1: EU citizen's perception of the risk associated to mobile masts exposure. From Electromagnetic fields. Report. Special Eurobarometer 347 / Wave 73.3 – TNS Opinion & Social, June 2010.