

The Finnish Mobile Communication Research Programme HERMO (Health Risk Assessment of Mobile Communications)

In September 2007, another large national mobile communication research programme presented its results after more than 3 years of research at a final meeting. The summarized result of the research programme HERMO (Health Risk Assessment of Mobile Communications) is: There is no evidence of detrimental health risks from mobile communication. A total of 13 projects with a total cost of 1.9 million euros were carried out. The costs were mostly covered by government, but partly also by industry sources.

The research programme HERMO (Health Risk Assessment of Mobile Communications) is the fourth one in a series of national research programmes held in Finland since 1994 on effects of mobile communication.

The first national research programme „Biological Effects of Electromagnetic Fields“ (1994-1997) was performed in cooperation with the University of Kuopio, the Finnish Institute of Occupational Health and the Finnish STUK Radiation and Nuclear Safety Authority, besides projects of the European Action COST 244. It was coordinated by the independent expert organisation VTT Technical Research Centre of Finland, and financed by the governmental organizations and the industry (mobile communication manufacturers).

The second and third national research programmes („Electromagnetic Fields from Mobile Telephones as a Possible Health Risk“ 1998-2000 and „Health Risk Assessment of Mobile Communications“ 2000-2003) were coordinated by the University of Kuopio. These programmes were performed at the same time as the European Actions COST 244bis and COST 281. About 70% of funds were obtained from a state agency (TEKES - Finnish Funding Agency for Technology and Innovation); mobile communication manufacturers, network operators and international organizations (among others the FGF) contributed as well. In these first programmes EMF exposure systems were developed, dosimetry was improved and the EMF exposure conditions of cell cultures, laboratory animals and humans were modelled. Moreover, epidemiological and laboratory studies examined possible associations between EMF and cancerous diseases and hypersensitivity as well as effects of mobile telephony on cognition, auditory and inner ear nerve processes as well as



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on brain function, blood circulation and basic cellular functions.

The research programme HERMO continued this successful research activity within a following research programme in 2004-2007 [1]. The research topics were identified after a review of recent scientific literature and on the basis of the research priorities of the WHO (WHO research agenda 2003 [2]).

The HERMO research programme was coordinated by the University of Kuopio. Professor Jukka Juutilainen acted as coordinator and Chairman of the Steering Committee including both the research partners and the funding agencies. Decisions were unanimously made at the meetings of the steering committee, which took place 2-4 times a year.

The planned study period of 3.5 years began in February 2004. The overall budget was 1.9 million euros. TEKES was the main funding agency with a contribution of 46%. Other sponsors from industry contributed 17% (Nokia, Elisa, Sonera Mobile Networks, Finnet Networks), the research partners contributed about 37% of expenses. So overall 83% of the budget came from state funds.

The reason behind the continuation of the Finnish research programme was the substantial increase in exposure of the general population to radiofrequency electromagnetic radiation over the last years. At the moment, there are already more mobile phones in Finland than inhabitants. Despite low individual exposure levels the general concern about possible negative health effects of electromagnetic fields of base stations and mobile phones grew due to the great number of users and some provocative, but not validated scientific study results.

The third generation of mobile communication technology will expand the possibilities of mobile communication to other applications (fax, e-mail, internet access, etc.), so a further increase in usage is expected. There are still many open questions, despite intensive international research on mobile communication risk assessment.

Therefore it was the objective of the HERMO programme to investigate possible health effects and risks of mobile communication, especially of radiofrequency (RF) electromagnetic fields and their effects on the nervous system and the sensory organs.

The HERMO programme comprised 13 research projects of 7 research partners (4 universities and 3 research institutions):

- the University of Kuopio
- the University of Helsinki
- the University of Turku
- the Tampere University of Technology
- STUK - Radiation and Nuclear Safety Authority
- the VTT Technical Research Centre of Finland
- the Finnish Institute of Occupational Health

The studies comprised human, animal and laboratory studies on the following to-

Organisation and funding

Aims and foci

The projects

pics of effects of mobile communication electromagnetic fields:

- hypersensitivity
- effects on auditory perception
- effects of GSM and TETRA signals on body functions (temperature, blood circulation and respiration)
- effects on the brain and the development of the nervous system
- possible associations with cellular changes.

These studies were supported by projects for development of exposition equipment, for dosimetry-modelling and -measurement as well as for measurement of tissue properties particularly as prerequisite for the animal- and laboratory studies.

Other investigated research topics were:

- uncertainties and sources of error in mobile communication risk assessment from epidemiological studies and
- the interaction between mobile phones and metallic implants.

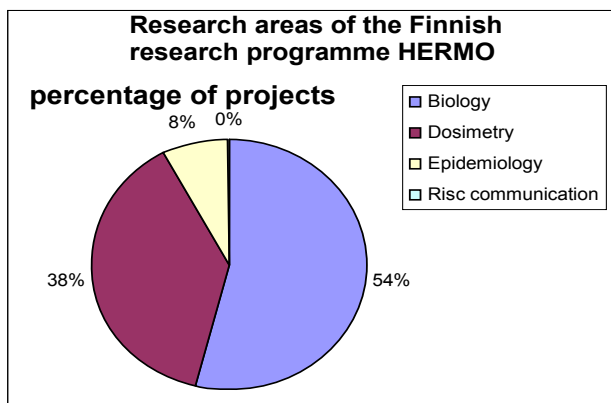


Figure 1: Percentage of scientific research areas of the overall programme

All projects of the programme have been completed and are documented in a final report [3].

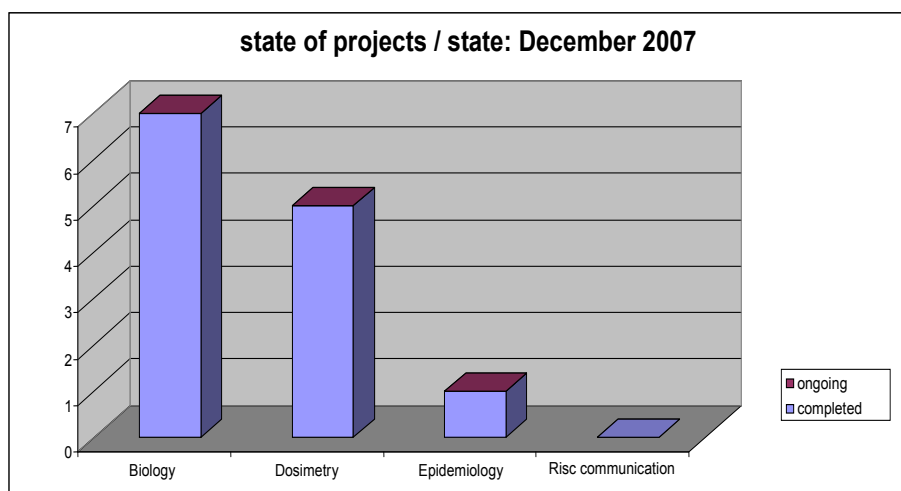


Figure 2: State of the projects

Present state and results

Overall no evidence of health risks of electromagnetic fields used in mobile communication were found in the projects of the HERMO programme. However, some interesting biological effects were observed which require further experimental investigation.

In the following some results of the studies are briefly summarized.

Hypersensitivity: In a comprehensive study on hypersensitivity related to exposure to fields of mobile phones 84 young adults were examined, part of which reported to be able to perceive electromagnetic fields (EMF) or even suffered from health symptoms like headaches or nausea. But the tests showed no differences between persons reporting hypersensitivity and the rest of the volunteers after exposure. Overall the results showed no higher significance than a random distribution and hence did not provide further evidence against effects of mobile communication electromagnetic fields on well-being.

Biology: Due to the rapid increase in mobile phone use and the vicinity of the radiation source to the head, effects of electromagnetic fields on human brain function, memory capacity, nerve conduction as well as neural circulatory and sensory organs in the area of the head are of special interest for science. Especially the examination of auditory functions is interesting, as many cerebral processes are involved in the identification of auditory stimuli (perception, differentiation, attention, memory, etc.) and systems for sensitive measurement are available. Therefore the effects of short- and long-term exposure to electromagnetic fields on the processing of auditory stimuli in adults and children (aged 11-12 years) were examined as well within the HERMO programme. No evidence of effects on stimulus conduction or the processing of stimuli in the brain could be found in relation to EMF-exposure.

Other human volunteer studies were devoted to the effects of EMF of GSM and TETRA phones on the circulation as well as on body temperature and blood flow regulation. No effect of EMF fields in the 380-MHz and 1800-MHz range on heart rate or blood flow were found in the examined age groups. Because of the concern about the safety of children and adolescents also EMF effects on the developing nervous system were examined in rats. These studies did show no significant effects on brain morphology or behaviour either (except an interesting improvement of learning and memory capacity of the EMF-exposed group in a maze test that might warrant further studies).

Studies of EEG signals in pig brains at EMF exposure showed no obvious correlation with EMF-on conditions, despite evidence of temperature changes.

Two other studies investigated possible alterations in cellular chemistry due to mobile communication radiation and found statistically significant changes in proteins, the health relevance however is unclear. Other examined parameters (oxidative stress, DNA breaks) showed no radiation dependency.

Epidemiology: One of the HERMO studies investigated possible sources of error in the determination of epidemiological brain tumour risks from the use of mobile

communication. In contrast to cellular and animal studies, epidemiological studies cannot precisely and sufficiently control exposure conditions and the environment in order to differentiate the effects of other influential factors from that of electromagnetic fields. Hence the results of such studies can be falsified by the conditions of the study without being noticed. An evaluation of results of the INTERPHONE project concluded that possible confounders can be caused by selection effects (selection bias). Heavy mobile communication users e.g. showed a higher readiness to participate in a detailed data collection than control groups. Another source of error is the uncertainty of the determination of exposure history, as far as it was based on the recall of volunteers (lack of precision). Compared to the data of network operators it was found that the duration of mobile phone use was clearly overestimated. These sources of error should be considered when evaluating future epidemiological case-control studies, because otherwise there is danger to underestimate risks.


Dosimetry: The dosimetry projects, besides developing exposure systems, advanced the development of protocols for the numerical determination and simulation of exposure by modelling exposure conditions (technical setup and exposure object, e.g. for animal tests with a head phantom) and verified them by SAR measurements.

Moreover, the effects of mobile communication EMF on the SAR distribution and temperature increase close to passive metallic implants were examined using numerical simulations. The strongest effects (SAR values and heating) were found near the metallic surfaces. The simulations show that the local absorption of electromagnetic fields in a limited volume near metallic implants close to the skin surface can be considerably amplified (near a mobile phone by up to several hundredfolds). Because of the low radiation power and the overall low temperature elevations however it is assumed that this poses no health risk. In another project, the usefulness of magnetic resonance imaging for the determination or estimation of electric tissue properties (conductivity and current density distribution) was examined in order to assess the electromagnetic absorption properties (in vivo). The use of these techniques could allow in future to visualize electric tissue properties as well as the effect of external electromagnetic field sources (like e.g. of mobile phones) by induced currents in human tissue. Before these technologies can be practically used, however, considerably more research will be needed. The respective HERMO studies could only address some first basic questions on feasibility.

The HERMO project was completed in June 2007. The final seminar took place on 4 September 2007 in Helsinki. Some publications of project results are already available, but the most of them are still in preparation.

Links to the published reports and publications are found on the website of the program [1]. The final report of the programme has been published on 30 November 2007 and is also available on the internet [3].

Project completion and outlook



[1] homepage of the Finnish research programme HERMO:
<http://www.uku.fi/hermo/english/index.shtml>

[2] WHO research agenda 2003:
<http://www.who.int/peh-emf/research/rf03/en/>

[3] final report of the HERMO programme:
http://www.uku.fi/hermo/english/Final_report.shtml

Literature and internet links