

Scientific inadequacy of the to-date executed research on electromagnetic hypersensitivity

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INTRODUCTION

Part of the population considers themselves sensitive to the man-made electromagnetic radiation (EMF) emitted by powerlines, electric wiring, electric home appliance and the wireless communication devices and networks. This phenomenon is called electromagnetic hypersensitivity - EHS. EMF sensitivity is characterized by a variety of non-specific symptoms that the sensitive people claim to experience when exposed to EMF. While the experienced symptoms are commonly considered real-life impairment, the factor causing these symptoms remains controversial and unclear. So far, scientists were unable to find causality link between symptoms experienced by sensitive persons and the exposures to EMF. However, as presented in this systematic review of 263 research studies [1], the executed to-date scientific studies examining EHS are of insufficient quality to find the link between EMF exposures and sensitivity symptoms [for the full review of EHS science see reference #1 with on-line supplementary materials].

RESULTS of the SYSTEMATIC REVIEW

Does EHS exist –yes, but...

There is a well-known, and scientifically well-established, phenomenon of individual sensitivity [2]. Individual sensitivity means that, because of the genetic and epigenetic differences between people, different persons may have different sensitivity to the same agent, whether it is natural or man-made, radiation or chemical. The phenomenon of individual sensitivity to radiation is well known for ionizing radiation [3, 4], non-ionizing ultraviolet radiation [5, 6] and ultrasound [7]. Therefore, it is scientifically justified to suspect (assume) that the individual sensitivity might also exist for the EMF exposures. However, the essential, but still unanswered questions are:

- what are the levels of EMF that are tolerated without adverse health effects by the majority of the population
- what are the physiological pre-conditions (e.g. health status) for the occurrence of the higher sensitivity to EMF
- what counter-measures need to be considered to protect those more sensitive to EMF exposures

Scientific research of EHS consists of three types of studies

- Survey studies, where examined persons are not exposed experimentally to EMF. Surveys examine the prevalence of the self-diagnosed EHS persons in the whole population and attempts to determine whether there is any link between EHS symptoms and the environmental or personal exposures to various sources of EMF.
- Provocation studies, where the self-diagnosed EHS, or control volunteers, are exposed to a particular type of EMF at well-known and monitored quantity. During, or soon after, the end of exposure, volunteers are asked whether they feel any of the EHS symptoms induced during experimental exposure or sham exposure and whether they are able to recognize when the radiation source is emitting EMF and when it is not. Currently, results of provocation studies are considered as the “proof” of EHS not being caused by EMF exposures.
- Biochemical and physiological studies look for biochemical markers of EHS expressed in self-diagnosed EHS persons. Biochemical markers selected for examination are known to be likely associated with the symptoms in self-diagnosed EHS persons. In the biochemical studies, the examined self-diagnosed EHS persons are not exposed experimentally to EMF but provide detailed information on what kind of EMF sources they believe cause EHS symptoms and what kind of physiological symptoms.

The above listed three types of studies have two major overarching problems not addressed in EHS research. Firstly, researchers do not know whether the self-diagnoses of EHS persons that volunteer to participate in research studies are correct. Secondly, scientists analyze solely effects of exposures to EMF and do not address simultaneously occurring in real-life exposures to other environmental pollutants, like chemicals, particulate matter, or radiations other than EMF.

Problematic quality of the EHS research

There are several common problems with the to-date executed EHS studies:

- the majority of research data is subjective and describes non-specific symptoms
- lack of objective markers of EMF effects
- low numbers of EHS volunteers participating in the studies causing selection bias
- a large diversity of EMF exposure protocols
- acquiring data, either during the exposure or soon afterwards, precludes look at the delayed or chronic effects.

No matter whether provocation studies were prepared in collaboration with EHS affected persons, several major questions remain:

- Did co-designing experiments, where researchers and EHS volunteers collaborated closely, in any meaningful way, alleviated distrust of the volunteers?
- Are the self-diagnoses of EHS correct when done in collaboration with research team?
- Are the exposures sufficient enough to cause symptoms?
- Are the lag-times after exposure long enough to allow development of delayed symptoms?
- Responses provided by the volunteers remain subjective.
- Lack of objective way to assure that exposure protocol, and symptoms have causality link.

Drawbacks of EHS research

There is a number of drawbacks in the design of all of the to-date executed EHS studies that prevent making any conclusions on the causes of the EHS. The drawbacks [as proposed by D. Leszczynski] are the following:

- **Drawback #1:** It is not known whether the volunteers are indeed suffering of EHS. The group of self-diagnosed EHS persons participating in the research study might be contaminated by the misdiagnosed EHS persons. In extreme case none of the self-diagnosed EHS volunteers might suffer of EHS.
- **Drawback #2:** Two types of selection bias. The first one is introduced by the scientists who exclude persons with any pre-existing health problems. Scientists do not know whether pre-existing health problems might predispose a person to develop EHS. Exclusion of persons with pre-existing health problems is incorrect at the discovery stage. The second selection bias is introduced by the EHS sufferers who fail to volunteer or who initially agree but later withdraw their consent.
- **Drawback #3:** Psychological methods of inquiry used in psychological provocation studies were not examined for ability to detect EHS. Assuming that the EHS exists, none of the experimental methods of psychology used in the provocation studies, has been demonstrated to detect physiological outcomes of the EHS. Furthermore, provocation studies examine acute occurrences of EHS symptoms, not the chronic EHS symptoms.
- **Drawback #4:** Conclusions of the provocation studies performed using psychology methods might be affected or even invalidated because of the existence of the placebo and nocebo phenomena. Placebo and nocebo indicate the ability of the human mind to affect physiology of human body [8, 9]. There is a well-known phenomenon among medical students of the “medical students’ disease”. It is a condition frequently reported in medical students, who perceive themselves to experience symptoms of a disease they are studying. This condition is associated with the fear of contracting the disease in question. The same is likely happening when researchers show to the study subjects’ films presenting dangers of EMF exposures. It is obvious and expected that some persons will afterwards “experience” some of the symptoms presented in the film. Furthermore, all volunteers have preconceived opinions on EMF and health. Thus, claims that news media reports cause rise in the occurrence of EHS is incorrect. The responses of the self-diagnosed EHS persons given during the provocation experiments are influenced by their pre-existing opinions about EHS. Thus, the data collected in the psychological provocation studies is not only non-objective but its affected by pre-existing opinions.

CONCLUSIONS

- Subjective scientific data obtained in the to-date executed survey studies, psychological provocation studies and biochemical EHS studies is unreliable and insufficient to prove or disprove the existence of EHS because the scientists do not know whether the self-declared EHS volunteers have indeed symptoms caused by EMF exposures. Making conclusions on EHS from the data obtained using non-EHS-contaminated volunteer groups is incorrect.
- Claims that the subjective data of the provocation studies is scientifically reliable to diagnose EHS is incorrect. Scientifically subjective data from the psychological provocation studies does not prove, as some claim, that EHS is caused solely by a worry and not by EMF exposures.
- The opinion that there is a lack of causality link between EHS and EMF is unproven. Opinion claiming that EHS is not caused by EMF exposures, expressed by the World Health Organization EMF Project, the International Commission on Non-Ionizing Radiation Protection (ICNIRP), International Committee on Electromagnetic Safety (ICES) and numerous governmental organizations, should be revised because the scientific research data is of insufficient quality to use as a proof of the lack of causality.

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