

Wireless radiation and health: The evidence is not settled yet

Adj. Prof. Dariusz Leszczynski, PhD, DSc

University of Helsinki, Finland & Frontiers, Lausanne, Switzerland (Contact: blogbrhp@gmail.com)

INTRODUCTION

The current deployment of the fifth generation of wireless communication technology (5G) has reignited the long-standing debate around the possibility of health effects from the radiation emitted by the existing wireless communication devices and networks and the new ones introduced by the 5G. The opposition of the part of society toward wireless communication technologies, including 5G, is caused by the uncertainty of whether radiation emitted by wireless devices and networks affects human health and the health of the fauna and flora. Furthermore, a sizable part of the population considers themselves sensitive to wireless radiation – having the so-called electromagnetic hypersensitivity (EHS) (1, 2). According to the definition of health by the World Health Organization - "health is a state of complete physical, mental, and social well-being and not merely the absence of disease and infirmity" - belief of having EHS is by itself a health effect of the wireless technology (3). When reviewing published scientific studies, there are claims from some scientists and from the telecommunication industry representatives that the possibility of health effects, of the radiofrequency modulated electromagnetic fields (RF-EMF) emitted by wireless communication devices and networks, was thoroughly researched and that thousands-and-thousands of studies attest to the opinion that there is no problem whatsoever. Such claims are inaccurate and misleading.

CALL for CONSENSUS DEBATE [4]

Database of published studies

A specialized database in Germany, the EMF Portal [<https://www.emf-portal.org/en/>], has collected 37,957 publications of all types of studies on various frequencies of EMF. Of these, 1,951 studies concerns wireless communication RF-EMF, and only 593 studies are on 5G (as of October 1, 2023). Of these 5G studies, 385 are technical/dosimetric, 187 are listed as miscellaneous, and only 21 studies are biological/medical. This *extremely* limited number of studies examining the biological and health effects of 5G RF-EMF is being *mis*-interpreted, either as evidence of a lack of health harm or as evidence of existing health harm.

Evaluation of the scientific evidence

The evaluations of the same scientific evidence come to different conclusions depending on the scientists performing the analysis. Evaluations of the research conducted by two groups of scientists, forming the International Commission on Non-Ionizing Radiation Protection (ICNIRP) [<https://www.icnirp.org/>] and the International Committee on Electromagnetic Safety of the Institute of Electrical and Electronics Engineers (IEEE-ICES) [<https://www.ices-emfsafety.org/>], are used to set international safety guidelines. Both ICNIRP and IEEE-ICES claim that scientific evidence shows a lack of harmful health effects. The opinion of ICNIRP is, historically, recommended by the World Health Organization (WHO). Recommendations of the WHO are followed by the telecommunications industry and the majority of the national governments. However, the evaluation of the same scientific evidence by other teams of scientists of the BioInitiative [<https://bioinitiative.org/>], the International Committee on Electromagnetic Safety (ICEMS) [<https://www.ices-emfsafety.org/>], or the recently established International Commission on Biological Effects of the Electromagnetic fields (ICBE-EMF) [<https://icbe-emf.org/>] leads to conclusions that the scientific evidence shows health harm.

The differences in the evaluation of scientific evidence by ICNIRP, IEEE-ICES, BioInitiative, ICEMS, and ICBE-EMF, are caused by the differences of opinions of participating scientists.

Each of the groups self-selects (at own discretion) member scientists. A close look at the composition of these groups of scientists shows that each group selects only scientists with the same opinion on the issue of RF-EMF and health. Hence, there is easily achievable internal consensus within each of these groups.

ICNIRP or IEEE-ICES groups, by selecting scientists considering that there is no evidence of harm caused by RF-EMF exposures, arrive at a consensus-opinion that RF-EMF is safe when manufacturers and users follow ICNIRP/IEEE-ICES safety guidelines.

BioInitiative, ICEMS, and ICBE-EMF groups, by selecting scientists considering that there is evidence of RF-EMF harming health, arrive at a consensus-opinion that RF-EMF is not safe also then when the user follows current safety guidelines. Hence, they advocate lowering RF-EMF exposures and implementing precautionary measures or precautionary principle, as defined by the European Union.

This way of self-selecting members, scientists with certain opinions, leads to and perpetuates the polarization of the view on the causality link between RF-EMF exposures and human health.

Primarily, these groups of scientists have not only different views on the meaning of the scientific evidence but also differing views on what exposures are safe and unsafe. The safety guidelines proposed by these groups of scientists differ.

Therefore, the scientifically legitimate question is to ask whether the currently used safety guidelines developed by ICNIRP/IEEE-ICES and recommended worldwide by the WHO are sufficiently protecting users or should the safety guidelines be revised as proposed by ICBE-EMF or BioInitiative. This is the question to which those concerned with RF-EMF exposures would like to get a clear answer. This is also in the interest of governments and industry, to become assured by the scientific consensus that the guidelines are indeed correct. Having guidelines set by a same-minded group of scientists might not be scientifically assuring.

There was only one scientific evaluation of RF-EMF studies where the gathered group of scientists represented a "full spectrum" of diverse scientific opinions on RF-EMF and health, cancer in particular. This diverse group of scientists gathered in May/June 2011 at the Headquarters of the International Agency for Research on Cancer (IARC) in Lyon and following intense debate came up with a recommendation that RF-EMF is a possible human carcinogen: "Given the limited evidence in humans and experimental animals, the Working Group classified RF-EMF as "possibly carcinogenic to humans" (Group 2B). Evaluation was supported by the vast majority of the Working Group members.

The opinion of the International Agency for Research on Cancer (IARC) disagrees with the opinions of ICNIRP, IEEE-ICES, BioInitiative, & ICEMS (ICBE-EMF didn't exist in 2011).

The diversity of interpretations of RF-EMF science reflects a broader problem of RF-EMF research. When the results of experimental studies are difficult to interpret, and the outcomes of research studies are ambiguous, it is up to individual scientists and groups of scientists to determine the significance of the results of such studies. Scientists who are more worried about the possible health effects will provide a different final evaluation of the ambiguous science than the scientists who are less worried about the possible effects.

There is consensus opinion that the majority of the RF-EMF studies are of *poor and inadequate* quality, have too small a sample size for reliable statistics, and provide in vitro and in vivo evidence that has not been proven to occur in living humans. The most recent critical reviews showing the low quality of science have concerned the 5G technology and health (5, 6, 7). Hence, there is advocated a strong and urgent need for better quality research (8).

Despite the general agreement that the currently available scientific evidence is of poor quality and that there are significant gaps in the knowledge, this *poor and inadequate* scientific evidence is being used to claim that there is either no evidence of harm or that evidence of harm has been established. Such statements not only lack logic but also are *morally and ethically* questionable. When the scientific evidence used either to support claims of safety, or lack of it, is of *poor and inadequate* scientific quality, then **claims of safety**, or lack of it, are *unreliable* because they lack solid support from quality scientific studies.

Industry umbrella organizations, such as GSMA and Mobile and Wireless Forum (MWF), should consider the consequences of potentially possible incorrect scientific opinions provided by ICNIRP/IEEE-ICES that are recommended by the WHO and closely followed by the telecom industry. For example, members of ICNIRP do not have any legal responsibility for their opinions, but the telecom industry which uses ICNIRP-recommended safety guidelines has legal responsibility if the telecom-produced devices would be demonstrated to cause health harm.

CONCLUSION

In conclusion, I recommend conveying a round-table debate that would assess the current status of the science on RF-EMF and health and would review the adequacy of the current safety guidelines. Here are a few crude suggestions for conducting the debate:

Where: One possible place is the WHO in Geneva or the IARC in Lyon (evaluation should be expanded to include not only cancer but also all possible health effects).

Participants: Each of the two sides of the debate could select its own group of scientists for the debate. There could also be, amicably, a group of independent scientists who are experts in health risk evaluation, epidemiology, animal studies, and laboratory in vitro studies but who are never involved in RF-EMF research to bring an additional scientific angle to the debate. The total number of debating scientists should, preferably, not exceed 30 (+ a chairperson), which is a group size suitable to facilitate efficient scientific debate.

Convey rules: Evaluation of the science could use the protocols developed and used by IARC [9, 10] expanded to include all health effect studies.

Financing: Assuming that the WHO/IARC would provide facilities and that the scientists would provide their expertise and time pro publico bono free of charge, the only costs to cover would be for travel and lodging. Applying to the United Nations or WHO or any global institution to obtain funding to cover the travel of experts.

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The AUTHOR

Dariusz Leszczynski, semi-retired, is a former Research Professor at the Radiation and Nuclear Safety Authority in Finland. He was visiting professor at Harvard, Zhejiang and Swinburne Universities. He was member of the IARC 2011 Working Group that classified RF-EMF as 2B carcinogen. He testified before the US Senate & Parliament of Canada.