

ICNIRP NOTE

RESPONSE TO: JOHN WILLIAM FRANK “ELECTROMAGNETIC FIELDS, 5G AND HEALTH: WHAT ABOUT THE PRECAUTIONARY PRINCIPLE?” J EPIDEMIOL COMMUNITY HEALTH 2021. DOI:10.1136/JECH-2019-213595

John William Frank recently published an essay in the Journal of Epidemiology and Community Health, entitled “Electromagnetic fields, 5G and health: what about the precautionary principle?” (doi:10.1136/jech-2019-213595). Among other things, that essay included false, unsupported accusations about ICNIRP and its members, and used those false claims to paint a misleading picture of radiation protection, especially in so far as it relates to 5G. Although ICNIRP limits its response to such claims, as it has become apparent that the inaccuracies of the essay are being used by community influencers to mislead society, ICNIRP submitted a letter of response to the journal to clarify the inaccuracies. Given the limited length (400 words) allowed for this response by the journal, this focuses only on false claims related to conflicts of interest. However, as that represents only a small proportion of the inadequacies of the essay, we have provided a more detailed letter of response below to help provide the radiation safety community with a more balanced perspective on radiation safety.

Response to: *John William Frank* “Electromagnetic fields, 5G and health: what about the precautionary principle?”

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We welcome the essay of John William Frank critically reflecting on the rollout of 5G. It fits the overall aim of the International Commission on Non-Ionizing Radiation Protection (ICNIRP), which is to increase awareness and ensure a comprehensive and consistent system of protection of the public from harmful effects of exposure to non-ionizing radiation (NIR) [1]. However, the essay of Frank contains several inaccurate statements about not only 5G, but also its relation to the radiation protection science, and related to this, ICNIRP’s guidance and integrity more generally. These errors need to be corrected for the sake of both scientific accuracy and the development of effective public health policy.

Introduction

5G technologies emit radiofrequency electromagnetic fields (RF-EMFs), a physical agent that can cause harm at sufficiently high levels. It is thus important to limit exposure to safe levels. ICNIRP has published RF-EMF exposure guidelines to assist regulatory and health authorities to protect people from exposure to dangerously high RF-EMF levels [2]. These guidelines specify RF-EMF restrictions that have been set substantially lower than the lowest exposure level that science has found to cause harm. That is, science has not been able to verify the presence of any harm associated with RF-EMF exposures below the restrictions.

Contrary to this, Frank’s principal thesis is that there should be a moratorium on 5G deployment because the restrictions specified in the ICNIRP Guidelines are not sufficient to provide protection. In arriving at this conclusion he makes the following principal claims. 1/ That 5G-related exposure has not yet been specified (and presumably that if we do not know what it is, we cannot use the science and Guidelines to protect against it). 2/ That exposure from 5G technologies represents a qualitatively different type of exposure to previous generations such as 4G (and presumably, that being new, we cannot use the current science and ICNIRP Guidelines to protect against it). 3/ That there is ‘rapidly emerging’ evidence of harm that is relevant to 5G technologies, from both experimental (in vitro and in vivo) and epidemiological research domains. 4/ That the apparent contradiction between Frank’s exposition of the science and that contained in the ICNIRP Guidelines is due, Frank suggests, to ICNIRP having a ‘pro-industry bias’, and some of

its members representing 'giant multinational telecommunications firms'. ICNIRP strongly disagrees with each of these points.

5G Technology Issues

Frank claims that there is a lack of clarity regarding the RF-EMFs that will result from a 5G rollout, with the suggestion (presumably) being that this precludes adequate evaluation of the potential health impact of 5G. However, it is important to note that the ICNIRP RF-EMF Guidelines have been developed to be independent from particular technologies, requiring merely that the physical agent that can affect our biology, the RF-EMFs themselves, remains below specified levels. Further, to demonstrate compliance with the ICNIRP Guidelines, 5G installations would need to show that the exposure parameters relevant to health (e.g. power, frequency, exposure duration and spatial extent) will not exceed the Guidelines' safety restrictions. It is thus not clear what uncertainty Frank is referring to here.

The essay's confusion appears to be due to a misunderstanding about what 5G is. That is, 5G is not a particular frequency or modulation scheme, but rather is a new protocol for managing RF-EMFs in order to achieve larger data transfer rates and/or shorter time delays. Indeed the 5G communication protocol is suitable for a very wide frequency range, including those used for 3G and 4G, and is not restricted to higher frequencies (e.g. 'millimeter-waves', or mmWs). In situations where high data rates are needed, mmWs can be used to achieve this, whereas lower frequency bands can be used to ensure coverage of larger and more sparsely populated areas with less data needs. It is noteworthy that compared to older technologies, the Shannon-Hartley theorem shows that for every unit of data transferred, the improved efficiency of the 5G network that results from its broader bandwidth actually reduces the associated RF-EMF exposure.

Frank also claims that, relative to previous generations of mobile telecommunications such as 4G, 5G will result in qualitatively different electromagnetic fields (EMFs) and thus exposure to the community. This might be important if, for example, this qualitative difference was something that was both relevant to health and not considered in the science of the ICNIRP Guidelines. However, the only such difference that he cites is that there will be higher RF-EMF frequencies (for some) 5G systems, and although not a necessary component of 5G systems, the effect of frequency has been researched in great detail in the scientific literature and is explicitly accounted for within the Guidelines. Frank also refers to components of the 5G systems as being new (e.g. MIMO), but does not provide any indication of what it is about these components that has not been addressed by science or the Guidelines. Again it should be noted that the Guidelines account for all RF-EMF transmission protocols and modulation schemes, and so in terms of biological or health effects, these factors are not new.

Frank argues that the introduction of 5G will result in a massive increase of RF-EMF exposure to the population, based on the application of "the 'inverse square law'", which means that the exposure level reduces in relation to the square of the distance to the emitting source. However, a mobile phone network is much more complex and dynamic than that consideration suggests. Exposure levels do not only depend on distance to the source, but also on a range of other factors including the output power of the sources. Indeed technological gains have meant that less exposure is required to transmit a unit of data using 5G than previous technologies. Frank's argument for a moratorium on 5G would thus appear to run counter to the author's desire to reduce RF-EMF exposure; to achieve the latter would presumably require the deployment of 5G, coupled with a mechanism to limit society's demand for additional data. However, regardless of the politics of

conflicting demands, from a radiation protection perspective it is important to note that as long as exposure from 4G and 5G base stations are both below the ICNIRP RF-EMF restrictions, neither represent a threat to health and safety.

5G Health Issues

Part of Frank's support for a 5G moratorium is based on what he refers to as "[in]adequate scientific investigation of its suspected adverse health effects". However, the RF-EMF that Frank claims to be inadequately investigated has been the subject of many thousands of research papers – there is a great deal of knowledge concerning its relation to health, including within the mmW range relevant to some 5G installations. Presumably the author believes that novel technologies (as opposed to older RF-EMF technologies) would differ in terms of their biological effects, but there are no substantiated interaction mechanisms nor health research findings to support such a view.

In terms of in vitro and in vivo research, Frank does claim that there is a rapidly accumulating body of studies documenting harm from in vitro and in vivo research, but as Frank then goes on to point out limitations in those research domains, it is not clear whether they are meant to be taken as providing evidence of harm or not (i.e. "laboratory studies of EMF exposure are fraught with both internal and external validity issues, and cannot replace high-quality human epidemiological studies", p3). However, although we do not agree that such research is uninformative, we do agree that the quality of research is quite variable, which makes it important to consider the research in detail when evaluating the science. This contrasts with the essay's approach, which cites the percentage of positive claims from one particular, non-representative report [3] as evidence that concern is warranted, without consideration of the validity of those claims.

In terms of Frank's preferred method of evaluation, the essay claims that there is "increasing epidemiological evidence of serious health effects from previous generations of RF-EMF exposures" (p.3). This statement is based on the selection of a very small proportion of the scientific literature. Conversely, high quality national reports from numerous countries have reviewed literature in a more systematic manner and consistently failed to find evidence for the health effects that Frank refers to (e.g. [4]; [5]). Nevertheless, ICNIRP continues to review new evidence from all fields of research in order to ensure that new findings are incorporated into its guidance.

In relation to ICNIRP's RF-EMF Guidelines, there are some additional errors that would be useful to resolve: The essay correctly notes that not all countries adopt the ICNIRP Guidelines. However, this is not generally due to differences in the science (which ICNIRP's guidance is based on, and which does not differ as a function of geography), but rather it represents different choices that have been made by different jurisdictions. For example, the lower restrictions in India that were cited in the essay have emerged because India decided to set their limits at 1/10th of the ICNIRP restrictions, rather than providing a science-based derivation. The essay also claims that ICNIRP restrictions are "based solely on the acute thermogenic (heat-producing) effects of RF-EMF in animal tissues" (p. 2), which is not true. The ICNIRP restrictions are based on all substantiated adverse health effects, regardless of mechanism. Indeed a great deal of the literature, such as the epidemiology, does not comment on mechanisms at all. The reason why heating is important in the Guidelines is merely that the lowest exposure levels that have been found to cause harm, cause that harm via heating. By setting the restrictions below the lowest level that produces harm, it follows that all adverse health effects are protected against. Similarly, if future research verified adverse health effects at levels below the ICNIRP restrictions, then regardless of whether they were due to thermal or other

mechanisms, the Guidelines would need to be amended to account for that. For the same reason, the essay's claim that only acute effects are accounted for in the Guidelines is incorrect.

Accusations of Industry Influence

The essay accuses ICNIRP of unmanaged conflict of interests, and uses this accusation to attempt to throw doubt on ICNIRP's scientific evaluations. However, ICNIRP has a very rigorous procedure to avoid conflict of interests (<https://www.icnirp.org/en/about-icnirp/commission/index.html>), and Frank did not provide any evidence for his statement but merely referred to 'persistent allegations' from a Swedish epidemiologist (Lennart Hardell, who also does not provide evidence for his accusations). For example, Frank repeats claims made by Hardell that "ICNIRP's membership includes over-representation of vested interests, especially the giant multinational telecommunications firms who are heavily invested in the roll out of 5G systems internationally"; no supporting evidence was provided by either author. To be clear, there are no industry representations within ICNIRP; people working for industry are not permitted to be ICNIRP members, and ICNIRP does not receive any funding or in-kind contributions from industry. Moving beyond funding, Frank claims that the "the most damning evidence adduced by Hardell is a table of the cross-appointments held by six members of the WHO Monograph Group, across five major international advisory panels on the health effects of non-ionising radiation". However, this merely reflects the relatively small EMF research community together with the high public interest that has resulted in many national and international advisory boards. Frank does not tell the reader why this would in any way bias ICNIRP's work. Thus, the essay's accusations of industry influence are incorrect.

Conclusion

In conclusion, ICNIRP fully supports and contributes to critical debate related to the 5G rollout, and supports effective, evidence-based public health measures that provide appropriate protection to the public. For ICNIRP it is imperative to avoid situations whereby personal interests of its members could affect the independence of ICNIRP's guidance, and so has strong conflict of interest procedures, including transparent reporting of members' declarations of interest.

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Conflicts of Interest

The authors declare no Conflicts of Interest. Further details are available at <https://www.icnirp.org/en/about-icnirp/commission/index.html>.

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