5G Wireless Deployment and Health Risks: Time for a Medical Discussion in Australia and New Zealand



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INTRODUCTION TO THE ISSUE

There is an urgent need for clinicians and medical scientists in the Australia-New Zealand region to engage in an objective discussion around the potential health impacts of the fifth generation (5G) wireless technology currently being deployed. The statements of assurance by the industry and government parties that dominate the media in our region are at odds with the warnings of hundreds of scientists actively engaged in research on biological/health effects of anthropogenic electromagnetic radiation/fields (EMR/EMF).[1] There have been worldwide public protests as well as appeals by professionals and the general public[2] that have compelled many cities in Europe to declare moratoria on 5G deployment and to begin investigations. In contrast, there is no medically-oriented professional discussion on this public health topic in Australia and New Zealand, where 5G deployment is being expedited. 5G is untested for safety on humans and other species and the limited existing evidence raises major concerns that need to be addressed. The vast body of research literature on biological/health effects of 'wireless radiation' (radiofrequency EMR)[3,4] indicates a range of health-related issues associated with different types of wireless technologies (1G-4G, WiFi, Bluetooth, Radar, radio/TV transmission, scanning and surveillance systems). These are used in a wide range of personal devices in common use (mobile/cordless phones, computers, baby monitors, games consoles etc) without users being aware of the health risks. Furthermore, serious safety concerns arise from the extra complexity of 5G as follows:

- 5G carrier waves use a much broader part of the microwave spectrum including waves with wavelengths in the millimetre range (hence called 'millimetre waves') which will be used in the second phase of 5G). Until now, millimetre waves have had limited applications such as radar, point-to-point communications links and non-lethal military weapons.[5]

- Extremely complex modulation patterns involving numerous frequencies form novel exposures.

- Beam formation characteristics can produce hotspots of high unknown intensities.

- A vast number of antenna arrays will add millions of microwave transmitters globally in addition to the existing RF transmitters thereby greatly increasing human exposure. This includes 5G small cell antennas to be erected every 200-250 metres on street

fixtures, such as power poles and bus shelters, many of which will be only metres from homes with the homeowners having absolutely no say in where the antennas will be located.

This massive leap in human exposure to RF-EMR from 5G is occurring in a setting where the existing scientific evidence overwhelmingly indicates biological interference,[3,4] therefore suggesting the need to urgently reduce exposure. It is already late to educate the population on the risks of wireless radiation and to take public health measures such as those taken with tobacco to reduce exposure by recommending safer wired communications for regular use while leaving wireless communications for short emergency communications. Some European countries have been taking steps to reduce children's exposure to RF-EMR by limiting or discouraging wireless use e.g. France banning WiFi in small children's facilities and limiting use at schools.

As for the new 5G technology, it is concerning that leading experts in the technical field[6] have reported the possibility of damaging thermal spikes under the current exposure guidelines (from beam forming 5G millimetre waves that transfer data with short bursts of high energy) and some animals and children may be at an increased risk due to smaller body size. Even working within the entirely thermally-based current regulatory process, they pointed out 5G millimetre waves "may lead to permanent tissue damage after even short exposures, highlighting the importance of revisiting existing exposure guidelines".[6] Microwave experts from the US Air Force have reported on 'Brillouin Precursors' created by sharp transients at the leading and trailing edges of pulses of mm waves, when beam forming fast millimetre waves create moving charges in the body which penetrate deeper than explained in the conventional models, and have the potential to cause tissue damage.[7] In fact, concerns about moving charges affecting deep tissue are associated with other forms of pulsed RF radiation currently used for wireless communications. This may be one factor explaining why the pulsed radiation used in wireless communication technologies is more biologically active than continuous RF radiation.[8] Such effects of high energy 5G mm waves could have potentially devastating consequences for species with small body size and also creatures that have innate sensitivity to EMF, which include birds and bees that use nature's EMFs for navigation.[9] Unfortunately, non-thermal effects and chronic exposure effects are not addressed in the current guidelines.[10]

As scientists and medical doctors from Australia and New Zealand who have been conducting independent research on the health-related literature of RF-EMR, we would like to urge the medical community to take an active role to encourage investigation into this important issue. Australia and New Zealand have the world's highest and second highest cancer incidence rates out of 185 countries respectively.[11] Our region also has the highest rates of allergic immune diseases on a global scale.[12] When we examine the biological effects of RF-EMR presented in the scientific literature (the ORSAA database is the largest categorised database of peer-reviewed studies on RF-EMR),[13] applying the Bradford Hill criteria, we find compelling evidence suggesting a causal link with many chronic diseases, including cancer, cardiovascular disease, immune diseases and neurodegenerative diseases.[14-18] Moreover, published research shows that Australia has relatively high RF-EMR exposure levels.[19] Therefore, given the scientific evidence of biological/health effects of RF-EMR[3,4] and given the region's concerning health statistics in chronic diseases, it is concerning that no medical input has been made in the health risks assessment process on the part of government health departments.

Members of ORSAA previously reported on the serious flaws of the health risk assessment conducted by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). An analysis of ARPANSA's 2014 literature review report TRS-164 titled "Review of Radiofrequency Health Effects Research – Scientific Literature 2000 – 2012"[20] revealed that its conclusions were not substantiated by their nominated evidence.[21-23] Moreover, a review of 1955 peer-reviewed studies on the ORSAA database[13] (which contained the studies ARPANSA reviewed) revealed 68% of those publications had reported on significant biological/health effects. This refutes the claim that there is no evidence indicating health risks. However, ARPANSA has merely rejected our reported findings without presenting any evidence to substantiate their position.[24] Furthermore, ARPANSA continues to make assurances of safety about wireless technologies (RF-EMR) in general and also about the new and untested 5G. Such unfounded statements jeopardise the safety of Australians because the Australian healthcare professionals and organisations solely depend on ARPANSA's advice. Remarkably, the ARPANSA health risk assessment was conducted by only four reviewers with reported academic qualifications in physical sciences, psychology and epidemiology. Such a lack of biomedical expertise in a "Health Effects" assessment is an unsatisfactory composition for our government advisory body. Moreover, ARPANSA's disclaimers on their website suggests a lack of accountability: "Nothing contained in this site is intended to be used as medical advice and it is not intended to be used to diagnose, treat, cure or prevent any disease, nor should it be used for therapeutic purposes or as a substitute for your own health professional's advice. ARPANSA does not accept any liability for any injury, loss or damage incurred by use of or reliance on the information." In spite of this disclaimer, but likely due to many misleading statements by ARPANSA, the medical community continues to reject health complaints made by patients relating their symptoms to wireless radiation. The situation in New Zealand is very similar. Claims of safety for RF-EMR, and 5G in particular, by ARPANSA and the respective health departments of Australia and New Zealand have been readily accepted even though they have failed to present the primary scientific studies that can support those claims. To our knowledge, based on the published scientific literature, they do not exist.

CLAIMS OF SAFETY MADE BY ARPANSA WITHOUT MEDICAL EXPERTISE

A public information sheet published by ARPANSA in 2019[25] claimed that: "At exposure levels below the limits set within the ARPANSA safety standard, it is the assessment of ARPANSA and international organisations such as the World Health Organization (WHO) and the International Commission on Non-Ionising Radiation Protection (ICNIRP) that there is no established scientific evidence to support any adverse health effects from very low RF EME exposures to populations or individuals." It further stated: "Dr Ken Karipidis, Assistant

Director of ARPANSA's Assessment and Advice Section is an expert on how radiation affects the human body."

The claim of "no established scientific evidence to support any adverse health effects" is refuted by several thousand peer-reviewed scientific studies[3,4] that have demonstrated a wide range of biological or health effects, some of which we highlighted in our previous papers.[21-22] These effects include oxidative stress, DNA damage, mitochondrial/cell membrane damage (including that of RBC), disruption of neurotransmitter levels and ion channels, altered immune/endocrine functions, cancer initiation and promotion.

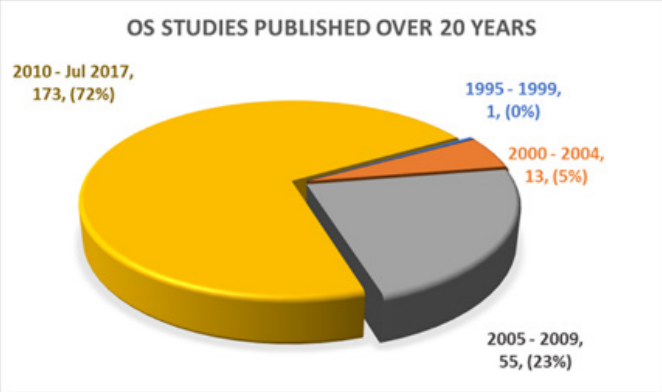
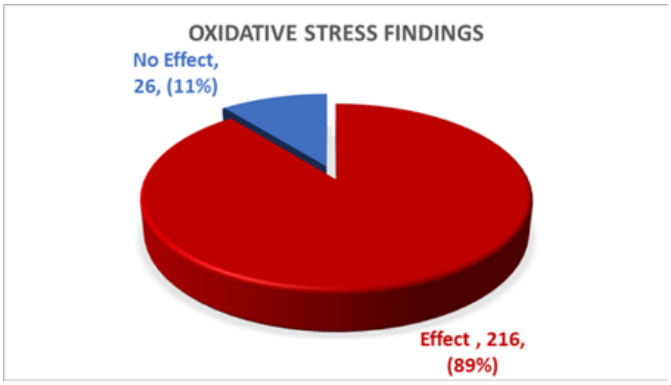


Figure 1. *A. Oxidative stress-related significant findings were reported by 89% of 242 peer-reviewed experimental studies that investigated biomarkers of oxidative damage or altered antioxidant levels. B. Most of the studies on oxidative stress, i.e. 173 (72%) were published after 2010 and therefore comprise the more recent evidence for biological harm from RF-EMR.*

OXIDATIVE STRESS

Our investigation into the scientific literature has found RF-EMR to be a potent inducer of oxidative stress even at so-called "low-intensity" exposures (which are in fact billions of times higher than in nature[26]) such as those from commonly used wireless devices. An analysis[22] of 242 publications (experimental studies) which had investigated endpoints related to oxidative stress - biomarkers of oxidative damage such as 8-oxo-2'-deoxyguanosine (indicating oxidative DNA damage) and/or altered antioxidant levels - revealed that 216 studies (89%) had reported such findings (Fig. 1). This evidence base on RF-associated oxidative stress from 26 countries (only one study from Australia and none from New Zealand) is relatively new and mostly post 2010, i.e. after the WHO's International Agency for Research on Cancer (IARC) classified RF-EMR as a Group 2B possible carcinogen. Moreover, 180 studies out of the 242 (74.7%) were in vivo studies (including several human studies) which presents strong evidence. It refutes the conclusion in ARPANSA's health risk assessment TRS-164: "the putative link between RF energy and altered ROS production remains tenuous".[20] Only one physical scientist was tasked by ARPANSA to perform this important review assessing the in vivo and in vitro studies and the reviewer was working outside his area of expertise when assessing the oxidative stress literature. In contrast, the medical fraternity has knowledge of the pathophysiological importance of oxidative stress in many diseases, and needs to further investigate RF-induced oxidative stress (as well as other bioeffects) and enact measures to reduce risks associated with current population-wide chronic exposure to RF-EMR. An urgent medical investigation into the safety of existing wireless signals (WiFi, 3G, 4G) and the new 5G is required. Such investigations need to use real-life signals because simulated signals are different from real-life ones in their physical characteristics and have been found to be less bioactive.[8]



Unfortunately for all Australians, ARPANSA has made their health risks assessment without involving medical expertise. ARPANSA's in-house RF-EMR expert Dr. Karipidis who is described as "an expert on how radiation affects the human body" has reported academic training in physics and epidemiology. Similarly, the International EMF Project (IEMFP) at the WHO that has been entrusted to protect public health from man-made EMR/EMF is headed by an electrical engineer. There is an apparent shortage of biomedical expertise within the IEMFP and also the NGO professional body they depend on for exposure regulation of RF-EMR – International Commission on Non-Ionizing Radiation Protection (ICNIRP).[23] One of ARPANSA's four health effects reviewers, psychology researcher Prof. Rodney Croft is the newly appointed Chairman of the ICNIRP having previously served as the Chair of the ICNIRP's RF Guidelines Project Group, setting international exposure guidelines. Croft also was the lead researcher for RF health research in Australia for many years as the head of the Australian Centre for Electromagnetic Bioeffects Research (ACEBR) (https://www.uow.edu.au/acebr/) and its previous form, the Australian Centre for Radiofrequency Bioeffects Research (ACRBR) that operated from 2004-2011 with direct wireless industry partnership. Croft does not have medical expertise, and it is therefore questionable how he could lead or advise on a true investigation into the biological and health effects of RF-EMR.

The lack of clinicians and biomedical experts within the ARPANSA expert panel for their health risk assessment, along with their seriously questionable conclusions appear to have mislead the Australian medical system. While scientists other than medical scientists are able to read scientific studies and learn that RF-EMR exposure can alter the transcription of certain genes, alter levels of certain neurotransmitters, hormones, enzymes, cytokines, antioxidants etc, how do they interpret the significance of these biological effects in a health context without biomedical training and experience providing an in-depth knowledge of biology: including biochemistry, physiology, and clinical medicine? A health risk assessment of this nature requires input from a large panel of multidisciplinary experts –

predominantly with strong biomedical backgrounds.

Similar to the Australian situation, the health risk evaluation of RF-EMR in New Zealand has been undertaken without medical expertise. A publication that questioned this risky approach by one of the authors (SP) was unilaterally retracted by the journal based on an anonymous complaint despite three thousand downloads in three months.[27] Furthermore, the same author was denied an author response to a rebuttal of a publication in the New Zealand Medical Journal.[28] What is becoming apparent is there is a gagging of those who are trying to refute claims of safety by highlighting poor risk management, conflicts of interest, and inadequate expertise by government scientists.

MISLEADING OF PRIMARY CARE PHYSICIANS BY ARPANSA

Dr. Karipidis was advising Australian clinicians in an article[29] titled "What do GPs need to know about the new 5G network?" ARPANSA has claimed "Dr Ken Karipidis, Assistant Director of the Australian Radiation Protection and Nuclear Safety Agency's (ARPANSA) Assessment and Advice Section, wants GPs and their patients to know there is no evidence to support the concern that 5G technology, which uses radio waves and emits low-level radiofrequency (RF) electromagnetic energy (EME), will cause harms to the public." Dr. Karipidis stated in that report: "There's been a lot of research into whether radio waves cause adverse health effects, and the only established health effects of radio waves are very high power levels, where they raise temperature." This article further claimed: "While the increased presence of 5G base stations is often perceived negatively, Dr Karipidis has found this to be more of a psychological issue than a cause of genuine harm."

While our previous papers[21-23] alone provide ample scientific evidence for low-intensity non-thermal biological effects such as oxidative stress, refuting the obsolete notion that RF EMR causes thermal effects only ("raise temperature"), it is necessary that ARPANSA be asked by the medical community in Australia to provide details of their research that found "a psychological issue than a cause of genuine harm". We understand that extensive research needs to be conducted to rule out biochemical, and physiological causes before suspecting a psychological origin underlying a health complaint. To our understanding, such research has not been done by ARPANSA or any other body in Australia or New Zealand.

In several media reports on Australians complaining of adverse health effects which they attributed to exposure to wireless radiation, Prof. Croft has promoted the nocebo theory discouraging medical investigations into RF-EMR. For instance, a report titled "Woman claims severe health problems are caused by wi-fi but international studies find no link"[30] about a female who had to abandon her home due to debilitating neurological symptoms which she attributed to a new NBN WiFi tower erected near her home, claimed: "Professor Rodney Croft, director of the Australian Centre for Electromagnetic Bioeffects Research, said the symptoms experienced by sufferers of EHS were recognised as genuine, but the cause was something other than exposure to wi-fi."

"He said the symptoms appeared as a result of anticipation by the sufferer that they were going to be affected."

"Professor Croft said there needed to be research into causes other than electromagnetic radiation (EMR)."

The reported position of the patient's GP alerts to the problems faced by clinicians in assessing/managing EMR/EMF-associated health problems: "Ms Southern's local GP, Dr Gudrun Muller Grotjan, said the difficulty for GPs was that there was no evidence of a cause, so there was no clear path to treating the problem.

Dr Muller Grotjan said she was aware that research was finding no link with wi-fi, but accepted Ms Southern's attribution of wi-fi as the cause was credible, so she was keeping an open mind about the possible cause."

A medical discussion in our region will certainly help to close the existing large gap between the research front and clinical medicine in this field. It is unfortunate that the expert findings/recommendations of reputable medical organisations such as the European Academy for Environmental Medicine (EUROPAEM)[31] and its American counterpart AAEM[32] on adverse health effects of anthropogenic EMF/EMR and their management have not reached the medical community in our region.

OCCUPATIONAL EXPOSURES TO MILLIMETRE WAVES

In a separate public information sheet titled "Misinformation about Australia's 5G network" [33] ARPANSA has made several questionable claims regarding safety:

"Higher frequency radio waves are already used in security screening units at airports, police radar guns to check speed, remote sensors and in medicine and these uses have been thoroughly tested and found to have no negative impacts on human health."

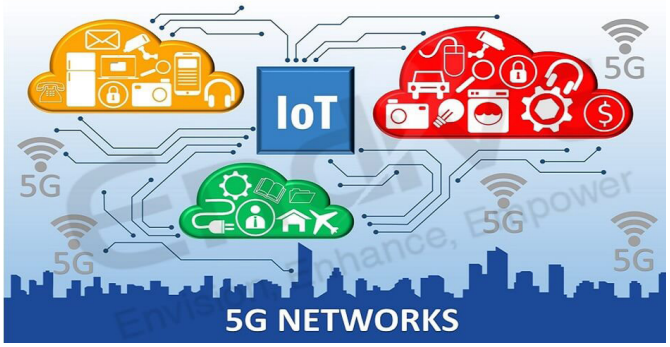
"ARPANSA and the World Health Organization (WHO) are not aware of any well-conducted scientific investigations where health symptoms were confirmed as a result of radio wave exposure in the everyday environment."

ARPANSA has not produced any evidence from the scientific literature that supports the above claim – that thorough testing of security screening units at airports, police radar guns, and remote sensors used in medicine has been conducted and found to have no negative impacts on human health. Given the chronic 24/7 exposure scenarios expected with high frequency 5G microwaves for the entire population, unlike acute exposures with security scanners or limited occupational exposures of radar, establishing the evidence of safety is of paramount importance. Australian doctors need to urge ARPANSA to publish a list of these studies confirming safety for evaluation by the medical community.

Contrary to the ARPANSA claims, the limited number of studies that have investigated effects of millimetre waves (carrier waves of 5G in the next phase), have found concerning evidence. A search for airport screening/radar safety studies, did not find a single Australian/New Zealand investigation while studies from

elsewhere appear to have mostly found evidence of biological impact. For example, a study by researchers at Shiraz University, Iran[34] published in 2013, but later retracted without an expressed reason, reported a high prevalence of neuro-behavioural problems in the occupationally exposed people significantly associated with their time at work. Their test cohort of airport radar personnel exposed to mm waves (14-18 GHz) revealed neurological, behavioural and cognitive problems despite being young (33 ± 6.8 years). The first author informed us that there was pressure from the government authorities that researchers would face litigation unless they withdrew the publication. Their findings were similar to a number of studies that have found adverse health effects in people exposed to radar.[35-37] Neurological problems (such as migraine, headache and dizziness) were found in exposed residential populations around military radar in a study in Cyprus with a dose response (more severe effects closer to the radar).[35] However, the authors of this military-funded study attempted to attribute their findings to antenna visibility (a nocebo effect) or aircraft noise without evidence to substantiate this claim and also ignoring a large body of evidence demonstrating that RF-EMR exposure can cause neurological symptoms.[4] Moreover, researchers at University of Washington Medical Center had previously reported an increased risk of testicular cancer in personnel exposed to hand-held police radar units.[36]

Researchers at the Institute for Medical Research and Occupational Health of Croatia studied people occupationally exposed to marine radar (including millimetre waves at 9.4 GHz) comparing them to those without such occupational exposure.[37] They found that RF exposure was associated with increased oxidative cell damage including DNA damage and reduced antioxidant defence. They concluded: "Results suggests that pulsed microwaves from working environment can be the cause of genetic and cell alterations and that oxidative stress can be one of the possible mechanisms of DNA and cell damage." This is in agreement with our finding that oxidative stress associated with RF-EMR exposure.[22] On the basis of the evidence of oxidative stress in disease pathology,[38] (and a range of other bioeffects) we have urged Australian authorities to take measures to reduce the exposure of people to all forms of RF-EMR to prevent deleterious effects on health, but our calls have been ignored/dismissed without counterevidence. Therefore, a great risk to the health of the population has been left unattended; undermining the health and wellbeing of the population and the surety of a viable work force of the future.



In a quick investigation of the literature into the effects of millimetre waves (associated with 5G in the next phase), we extracted all the papers from the ORSAA database that mention millimetre waves in the abstract. Table 1 below compares the number of these papers that report significant biological effects for exposures versus those that report no effects versus those that are uncertain. These studies must be further evaluated to assess all effects: thermal and non-thermal.

Study Outcome	Number of publications	Percentage of total
Effect	53	77.9%
No Effect	13	19.1%
Uncertain Effect	2	2.9%
Total	68	100%

Table 1: *Outcomes of publications investigating millimetre waves (RF-EMR similar to carrier waves of second phase 5G) based on the ORSAA database.*

While there are no epidemiological studies on millimetre waves from the Australia-NZ region, we would like to also highlight that the highest RF-EMR exposure source at the ABC's Toowong studios where a breast cancer cluster was identified (site now demolished) was also a millimetre wave source: "The THL RF Hazard control document10 indicates that the most prominent RF source is the 7 meter satellite dish on the TV Building rooftop, operating at 14 Ghz. The three VHF Comms 3-metre antennae have high maximum power and operate between 168 and 172 MHz. Overall the RF sources on site cover a wide range of frequencies and power outputs."[39]

While acknowledging that sufficient data do not exist to draw conclusions, it cannot be ruled out that RF exposure at the Toowong site, including the millimetre wave exposure, contributed to the development of those breast cancers given that there is evidence linking RF-EMR exposure to cancer.[14-15,40] Other disease statistics were not investigated at the Toowong site.

CHIEF MEDICAL OFFICER'S STATEMENT ON 5G

Recently the then Chief Medical Officer of Australia, Prof. Brendan Murphy on behalf of the Australian Government's Department of Health issued a statement[41] on the safety of 5G. In this statement Prof. Murphy declared: "I'd like to reassure the community that 5G technology is safe." While it appears that the CMO (since departed from this role) was operating on the advice of ARPANSA, it warrants that the medical community request the Department of Health provide the list of studies with the scientific evidence for this claim of the safety of 5G. It would be appropriate to publish this evidence on the department's website for evaluation by anyone. Unsubstantiated claims of safety on a public health matter are risky. In this case, it involves population-wide exposure to a novel man-made form of microwave radiation that can put people's health and quality of life at serious risk.

AUSTRALIAN PARLIAMENTARY INQUIRY ON 5G 2019-2020

Unlike the 2001 Australian Senate Inquiry on the health effects of RF-EMR,[42] the recent Australian parliamentary inquiry into 5G did not address the potential health impacts of 5G deployment by calling on independent expert witnesses. Despite the vast majority of the 500+ submissions from the general public expressing concern about the potential adverse health effects, very little hearing time was allocated to investigating those concerns. Out of the total hearing time (1065 minutes), only 6% was allocated for opponents of 5G, while 91% was provided to proponents. Not a single medical expert was called upon as a witness. In an extraordinary move prior to the completion of the inquiry, the government announced that it would allocate $9 million of public funds to educate the public on 5G (and counter so-called "misinformation" warnings of detrimental health effects). Based on the scientific evidence that has been collated and analysed, authors are extremely concerned about the lack of independence and medical expertise in this field of study, and the rush in Australia and New Zealand to deploy 5G without safety testing.

Proponents of 5G often dismiss concerns about health risks claiming that 5G microwaves will minimally penetrate the skin and therefore any effects are limited to minor skin heating (and they acknowledge that there is some uncertainty around heating effects on the eyes). The medical community understands that skin is the largest organ of the human body and a key part of the neuro-immune and neuro-endocrine systems. Natural UVA and UVB (also so-called non-ionizing radiation) that penetrate the skin less than 5G millimetre waves have profound effects on health and wellbeing of humans. Therefore, artificial 5G waves must be subjected to rigorous safety testing.

Unfortunately, the questionable conduct of regulatory agencies such as ARPANSA and WHO's international EMF Project[43] with conflicts of interest due to funding links to the wireless industry[44] remains to be investigated. More open questioning and protests are appearing in Europe and North America where there is some level of engagement on the part of government bodies in response to warnings of adverse health effects of anthropogenic EMF/EMR by expert medical bodies such as EUROPAEM and AAEM[31,32] (despite industry opposition). In contrast, there is a strong media censorship on the 5G safety issue in Australia and New Zealand. This gagged situation is a major blow to the evidence-based approach to health management, and to science in general. As informed scientists and clinicians, authors urge an open and constructive discussion on the safety of 5G in order to protect public health. Planetary electromagnetic pollution[26] is already excessive and it is impacting the health and wellbeing of life on Earth. The plan to deploy 30,000 satellites in space and millions of 5G transmitters on Earth without any formal health or environmental assessments is both reckless and negligent. We appeal to the medical community in Australia-New Zealand to actively engage with this important topic in order to protect public health.

References

1. EMF Scientist Appeal: https://www.emfscientist.org/ (last accessed on 3rd May 2020).

2. International Appeal -Stop 5G on Earth and in Space: https://www.5gspaceappeal.org/ (last accessed on 3rd May 2020).

3. ORSAA database: www.orsaa.org (last accessed on 3rd May 2020).

4. The Bioinitiative Group. BioInitiative Report: A Rationale for Biologically-based Public Exposure Standards for Electromagnetic Radiation. http://www.bioinitiative.org/ (2012).

5. Active Denial System FAQs. Joint Intermediate Force Capabilities Office, U.S. Department of Defense Non-Lethal Weapons Program: https://jnlwp.defense.gov/About/Frequently-Asked-Questions/Active-Denial-System-FAQs/(last accessed on 6th July 2020).

6. Neufeld E, Kuster N. Systematic Derivation of Safety Limits for Time-Varying 5G Radiofrequency Exposure Based on Analytical Models and Thermal Dose. Health Physics doi: 10.1097/HP.0000000000000930 (2018).

7. Albanese, R., Blaschak, J., Medina, R. and Penn, J. Ultrashort electromagnetic signals: Biophysical questions, safety issues and medical opportunities (Report No. AL/OE-JA-1993-0055). Occupational and Environmental Health Directorate, Brooks Air Force Base, San Antonio, Texas, USA. (1994).

8. Panagopoulos DJ, Johansson O and Carlo GL. Real versus simulated mobile phone exposures in experimental studies. BioMed Research International 2015: Biomed Res Int. 607053. doi: 10.1155/2015/607053 (2015).

9. Thielens A, Greco MK, Verloock L, Martens L, Joseph W. Radio-Frequency Electromagnetic Field Exposure of Western Honey Bees. Scientific Reports 10(1):461. doi: 10.1038/s41598-019-56948-0 (2018).

10. Bandara P, Weller S and Leach V. Health Risks of Wireless Technologies. Radiation Protection In Australasia.; 35(2): 22-26 (2018).

11. International Agency for Research on Cancer (IARC). Cancer Today: https://gco.iarc.fr/today/home (September 2018).

12. The International Study on Asthma and Allergies in Childhood (ISAAC): http://isaac.auckland.ac.nz/ ((last accessed on 3rd May 2020).

13. Leach V, Weller S, Redmayne M. A novel database of bio-effects from non-ionizing radiation. Reviews on Environmental Health. 33(3):273-280. doi: 10.1515/reveh-2018-0017 (2018).

14. Miller AB, Morgan LL, Udasin I, Davis DL. Cancer epidemiology update, following the 2011 IARC evaluation of radiofrequency electromagnetic fields (Monograph 102). Environmental Research, 167:673-683. doi: 10.1016/j.envres.2018.06.043 (2018).

15. Carlberg, M, Hardell L. Evaluation of Mobile Phone and Cordless Phone Use and Glioma Risk Using the Bradford Hill Viewpoints from 1965 on Association or Causation. Biomedical Research International, 9218486 doi: 10.1155/2017/9218486 (2017).

16. Bandara P and Weller S. Cardiovascular disease: Time to

identify emerging environmental risk factors (Editorial). European Journal of Preventive Cardiology, 24(17):1819-1823. doi: 10.1177/2047487317734898 (2017).

17. Kimata H. Microwave radiation from cellular phones increases allergen-specific IgE production. Allergy, 60(6):838-9 (2005).

18. Comelekoglu U, Aktas S, Demirbag B, Karagul MI, Yalin S, Yildirim M, et al. Effect of low-level 1800 MHz radiofrequency radiation on the rat sciatic nerve and the protective role of paricalcitol. Bioelectromagnetics, 39(8):631-643. doi: 10.1002/bem.22149 (2018).

19. Sagar S, Adem SM, Struchen B, Loughran SP, Brunjes ME, Arangua L, et al. Comparison of radiofrequency electromagnetic field exposure levels in different everyday microenvironments in an international context. Environment International, 114:297-306 (2018).

20. Review of Radiofrequency Health Effects Research – Scientific Literature 2000 – 2012 (TRS-164). Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). 2014: https://www.arpansa.gov.au/sites/default/files/legacy/pubs/technicalreports/tr164.pdf (last accessed on 30 June 2020).

21. Leach V and Weller S. Radio frequency exposure risk assessment and communication: Critique of ARPANSA TR-164 report. Do we have a problem? Radiation Protection In Australasia, 34(2), pp. 9-18 (2017).

22. Bandara P and Weller S. Biological effects of low-intensity radiofrequency electromagnetic radiation – time for a paradigm shift in regulation of public exposure. Radiation Protection In Australasia, 34(2), pp. 2-6 (2017).

23. Bandara P, Weller S and Leach V. Health Risks of Wireless Technologies. Radiation Protection In Australasia 35(2): 22-26 (2018).

24. Karipidis K and Tinker R. Letter to the Editor, Radiation Protection In Australasia, 35(1), 29-30 (2018).

25. 5G: the new generation of the mobile phone network and health. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 20 March 2019 : https://www.arpansa.gov.au/news/5g-new-generation-mobile-phone-network-and-health (last accessed on 30 April 2020).

26. Bandara P and Carpenter DO. Planetary Electromagnetic Pollution: It is Time to Assess its Impact. Lancet Planetary Health 2(12):e512-e514. DOI: https://doi.org/10.1016/S2542-5196(18)30221-3 (2018).

27. Pockett S. Conflicts of interest and misleading statements in official reports about the health consequences of radiofrequency radiation and some new measurements of exposure levels. Magnetochemistry 5(31); doi:10.3390/magnetochemistry5020031 (2019). Link

28. Pockett S. Public health and the radio frequency radiation emitted by cellphone technology, smart meters and WiFi. New Zealand Medical Journal.131: 96-106 (2018).

29. Amanda Lyons. What do GPs need to know about the new 5G network? News GP, 19 Aug 2019: https://www1.racgp.org.au/newsgp/clinical/what-do-gps-need-to-know-about-the-new-5g-network (last accessed on 30 April 2020).

30. Bill Brown, Woman claims severe health problems are caused by wi-fi but international studies find no link. ABC News, 12 September 2016: https://www.abc.net.au/news/2016-09-12/evidence-rejects-wi-fi-health-effects-claim/7580686

31. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, et al. EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Reviews on Environmental Health 2016;31(3):363-97.

32. American Academy for Environmental Medicine. Electromagnetic and Radiofrequency Fields Effect on Human Health: https://www.aaemonline.org/emf_rf_position.php (last accessed on 24th May 2019).

33. Misinformation about Australia's 5G network. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) 3 June 2019: https://www.arpansa.gov.au/news/misinformation-about-australias-5g-network (last accessed on 30 April 2020

34. Dehghan N, Taeb S. Adverse health effects of occupational exposure to radiofrequency radiation in airport surveillance radar operators. Indian Journal of Occupational and Environmental Medicine.17(1):7-11. doi: 10.4103/0019-5278.116365 (2013). Retraction in: Indian J Occup Environ Med.17(2):40 (2013).

35. Preece AW, Georgiou AG, Dunn EJ, Farrow SC. Health response of two communities to military antennae in Cyprus. Occupational Environmental Medicine. 64:402–408 (2007).

36. Davis RL, Mostofi FK. Cluster of testicular cancer in police officers exposed to hand-held radar. American Journal of Industrial Medicine. 24(2):231-3 (1993).

37. Garaj-Vrhovac V, Gajski G, Pazanin S, Sarolic A, Domijan AM, Flajs D, et al. Assessment of cytogenetic damage and oxidative stress in personnel occupationally exposed to the pulsed microwave radiation of marine radar equipment. International Journal of Hygienics and Environmental Health. 214:59–65 (2011).]

38. rigaray P, Caccamo D, Belpomme D. Oxidative stress in electrohypersensitivity self reporting patients: Results of a prospective in vivo investigation with comprehensive molecular analysis. International Journal of Molecular Medicine. 42(4):1885-1898. doi: 10.3892/ijmm.2018.3774 (2018).

39. Armstrong B, Aitken J, Sim M, Swan N. Breast Cancer at the ABC Toowong Queensland. Final Report of the Independent Review and Scientific Investigation Panel. 2nd June 2007. https://about.abc.net.au/wp-content/uploads/2013/04/BreastCancerABCToowongQLDFinalReportJune2007.pdf (last accessed on 30 April 2020).

40. West JG, Kapoor NS, Liao S, Chen JW et al. Multifocal Breast Cancer in Young Women with Prolonged Contact between Their Breasts and Their Cellular Phones. Case Rep Med:354682. doi: 10.1155/2013/354682 (2013).

41. Brendan Murphy. Safety of 5G technology. Australian Government Department of Health. 24 January 2020 https://www.health.gov.au/news/safety-of-5g-technology (last accessed on 3rd May 2020).

42. Inquiry into Electromagnetic Radiation, Parliament of Australia. (4 May 2001) https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Completed_inquiries/1999-02/emr/report/index (last accessed on 30 April 2020).)

43. Hardell L. World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review). International Journal of Oncology, 51(2):405-413. doi: 10.3892/ijo.2017.4046 (2017).

44. The 5G mass experiment - How much is safe? Investigate Europe. 2019: https://www.investigate-europe.eu/en/2019/how-much-is-safe/ (last accessed on 6th July 2020).

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