


Research Article

A Woman aged 82 years with Electromagnetic Hypersensitivity since Almost Four Decades Developed the Microwave Syndrome after Installation of 5G Base Stations in her Living Vicinity – Ethical Principles in Medicine are violated

Lennart Hardell^{1*} and Mona Nilsson²

Abstract

Installation of the fifth generation (5G) for radiofrequency radiation started in Sweden in 2019/2020. Since then there has been a rapid development of this technology in the whole country. In previous case reports we have presented persons that developed the microwave syndrome caused by the radiation after installation of 5G in their neighborhood. Mostly these former healthy persons have tolerated previous generations such as 3G and 4G. After moving to another place without 5G the microwave syndrome disappeared in short time. Thus 5G seems to be a culprit for ill health, and these 5G exposure studies correspond to classic provocation tests on effects on well-being. This article presents a woman aged 82 years with electromagnetic hypersensitivity (EHS) since almost four decades. After deployment of 5G base stations close to her living place she developed severe ill health including fatigue, dysesthesia, dizziness, balance disorder, and light sensitivity that all are included in the microwave syndrome. Also her 83 years old husband was affected, although to a minor extent. The ethical and moral principles in medicine that can be adopted for RF radiation illness are respect for life, human dignity, self-determination, medical care, justice, and benefit. These principles are central for ethics among physicists and other health care staff. All these principles were violated and in fact microwave illness with the variety of symptoms is not acknowledged as a disease by the medical community. This is mostly based on lack of scientific knowledge on this topic.

Keywords: Base station; 5G; Radiofrequency Radiation; Electromagnetic Hypersensitivity; Microwave Syndrome; Health.

Introduction

The implementation of 5G for wireless communication has caused increasing environmental exposure to radiofrequency (RF) radiation [1-4]. In four case reports we have presented persons that developed the microwave syndrome after installation of 5G base stations close to their dwellings [5-8]. In spite of appeals asking for a moratorium on the deployment of 5G due to risks for human beings and the environment, the expansion of this technology continues at its own pace [9-11], (www.5gappeal.eu, www.emfcall.org, www.emfscientist.org).

As shown in our previous publications as well as in other scientific reports [12,13] the most common symptoms for the microwave syndrome

Affiliation:

¹The Environment and Cancer Research Foundation, Örebro, Sweden

²Swedish Radiation Protection Foundation, Adelsö, Sweden

Corresponding author: Lennart Hardell. The Environment and Cancer Research Foundation, Örebro, Sweden.

Email: lennart.hardell@environmentandcancer.com

Citation: Hardell L, Nilsson M. A woman aged 82 years with electromagnetic hypersensitivity since almost four decades developed the microwave syndrome after installation of 5G base stations in her living vicinity – ethical principles in medicine are violated. *Journal of Environmental Science and Public Health*. 8 (2024): 01-08.

Received: November 09, 2023

Accepted: November 16, 2023

Published: January 11, 2024

are headache, fatigue, concentration difficulty, insomnia, emotional distress, irritability, dysesthesia, skin lesions including burning sensation, cardiac and lung symptoms.

This case study

We present in this article an 82-year-old woman with electromagnetic hypersensitivity (EHS) since almost four decades, who developed aggravated symptoms, beginning around February/March 2023, inherent with the microwave syndrome shortly after installation of two 5G base stations in her neighborhood. These were provided by two different telecom companies. Her 83-year-old husband with no previous EHS also developed symptoms known to be caused by RF radiation, although to a minor extent. The couple lives in a one floor house with a cellar. The base stations are located at distances of 538 and 489 meters, respectively, Figures 1 and 2.

Methods

Measurement of RF radiation was made on June 9, 2023 by a professional company (Ama Konsult AB) on the initiative



Figure 1: Base stations placed on a mast 538 meters from the house.



Figure 2: Base stations placed on a building 489 meters from the house.

of the couple. The GigaHerz Solution HF 59B was used for the frequency range 0.7 to 3 GHz, and the GigaHerz Solution HFW 59D for the frequency range 2.4-10 GHz. These meters show the sum of all existing radiation for different frequencies at the place of measurement. Measurements were performed on the ground floor in the library, office, bedroom, living room, and kitchen. In the cellar the recreational room and the office were measured.

Both persons were asked to assess different health issues attributed to the microwave syndrome both before and after the implementation of 5G. The list of symptoms is adapted after Belpomme et al [14] and similar as the one we have used in our previous studies on this topic.

Results

Measurement of RF radiation

Table 1 displays results for the measurements of RF radiation. Clearly the 5G base stations yielded high values of RF radiation in the frequency range used for 5G, highest in the kitchen 166,700 $\mu\text{W}/\text{m}^2$. The exposure was high also in the living room, 147,100 $\mu\text{W}/\text{m}^2$, library 20,000 $\mu\text{W}/\text{m}^2$, and office 13,100 $\mu\text{W}/\text{m}^2$. These results contrast to the results for the cellar recreation room with 0.9 $\mu\text{W}/\text{m}^2$, and cellar office 0.8 $\mu\text{W}/\text{m}^2$.

As shown in the table exposure to previous generations for wireless communication was also much lower. Thus, highest levels were found for UMTS 3G = 178.1, GMS 900 = 150.1, and GSM 1800 = 130.2 $\mu\text{W}/\text{m}^2$, all in the bedroom.

Health symptoms

As shown in Table 2 the 82-year-old woman had since before symptoms that can be attributed to EHS. On the 10-grade scale she graded them at most as grade 3, thus not unbearable to live with. However, exposure to 5G RF radiation gave symptoms, grade 4 or more, typical for the microwave syndrome. Thus, headache, dysesthesia (unusual skin sensations), myalgia/arthritis, hyperacusis (reduced tolerance for sound), dizziness, balance disorder, concentration difficulty, fatigue (extreme tiredness), waking nighttime, light sensitivity, global body dysthermia (temperature regulation disorder), dyspnea (shortness of breath), and skin disorders were prominent. Most serious were dysesthesia grade 9, and fatigue, grade 8.

The woman's 83-year-old husband was since before rather healthy, only with some myalgia/arthritis and dyspnea that were not attributed to RF radiation. These symptoms increased to grade 8 and 9, respectively, see Table 3. He also developed new symptoms such as hyperacusis, fatigue, waking nighttime, irritability, and burning skin – all grade 4 or more. Less prominent new symptoms were dysesthesia, dizziness, balance disorder, depression tendency, emotional distress, chest squeeze, cough, nausea, and bruises/hemorrhages on the skin.

Table 1: Measurement of RF radiation June 9, 2023

Frequency in MHz	380-400	480-800	925-960	1805 -1870	1880 - 1900	2110 - 2170	2400 - 2484	2400 - 10000
Device	Tetra	DVB-T	GSM 900	GSM 1800	DECT	UMTS 3G	WLAN	4G/5G
Library	0.2	8.1	40.5	5.0	0.1	13.3	0.1	20,000
Office	0.1	23.9	47.7	13.7	0.1	85.7	0.1	13,100
Bedroom	0.2	10.1	150.1	130.2	0.1	178.1	0.1	19,600
Living room	0.2	10.9	10.2	1.7	0.1	7.2	0.1	147,100
Kitchen	0.2	8.5	15.5	2.0	0.1	12.4	0.1	166,700
Cellar, recreation room	0.2	0.9	5.9	0.1	0.1	0.1	0.2	0.9
Cellar, office	0.1	0.9	1.4	0.1	0.1	1.1	0.1	0.8

Results are given in $\mu\text{W}/\text{m}^2$

Tetra = digital radiocommunication, e.g. Rakel for national communication in Sweden

DVB-T = Digital Video Broadcasting - Terrestrial, second generation

GSM = Global System for Mobile Communications

DECT = Digital Enhanced Cordless Telecommunications

WLAN = Wireless Local Area Network

4G = fourth generation of broadband cellular network technology

5G= fifth generation of cellular network

Table 2: Clinical symptoms grades 0-10. Grade 0 = no symptoms, 10 = unbearable pain and/or discomfort in a woman aged 82 years assessed 28 August 2023.

Symptom	Before	August 2023, with 5G
Headache	2	4
Dysesthesia	3	9
Myalgia, arthralgia	2	6
Ear heat/otalgia	0	0
Tinnitus	0	0
Hyperacusis	2	4
Dizziness	3	7
Balace disorder	3	7
Concentration/Attention deficiency	2	4
Loss of immediate memory	0	0
Confusion	0	2
Fatigue	3	8
Sleeping difficulty		
- insomnia	0	2
- waking night time	0	5
- early wake-up	0	0
Depression tendency	1	2
Sucidal ideation	0	0
Cardiovascular abnormalities		

- transitory high pulse	0	0
- irregular pulse	0	0
- slow pulse	0	0
Blood pressure high/low	0	0
Occular deficiency	0	0
Light sensitivity	3	7
Anxiety/Panic	0	2
Emotional	1	3
Irritability	1	3
Global body dysthermia	3	6
Dyspnoea	1	4
Chest squeeze	0	2
Chest pain	0	0
Cough	0	0
Nausea	1	3
Diarrehea (involuntary)	0	0
Abdominal pain	0	0
Urinary system, urgency	0	0
Skin (face, arms, legs))	2	6
-burning, lancinating skin on hands and arms	3	6
-bruises, hemorrhages	3	6
Nose bleeding	0	0
Hair loss	0	0

Table 3: Clinical symptoms grades 0-10. Grade 0 = no symptoms, 10 = unbearable pain and/or discomfort in a man aged 83 years assessed 28 August 2023.

Symptom	Before	August 2023, with 5G
Headache	0	0
Dysesthesia	0	2
Myalgia, arthralgia	5	8
Ear heat/otalgia	0	0
Tinnitus	0	0
Hyperacusis	0	5
Dizziness	0	3
Balace disorder	0	3
Concentration/Attention deficiency	0	0
Loss of immediate memory	0	0
Confusion	0	0
Fatigue	0	8
Sleeping difficulty		
- insomnia	0	0
- waking night time	0	5
- early wake-up	0	0
Depression tendency	0	2
Sucidal ideation	0	0
Cardiovascular abnormalities		
- transitory high pulse	0	0
- irregular pulse	0	0
- slow pulse	0	0
Blood pressure high/low	0	0
Ocular deficiency	0	0
Light sensitivity	0	0
Anxiety/Panic	0	0
Emotional	0	2
Irritability	0	4
Global body dysthermia	0	0
Dyspnoea	5	9
Chest squeeze	0	2
Chest pain	0	0
Cough	0	3
Nausea	0	1
Diarrehea (involuntary)	0	0
Abdominal pain	0	0
Urinary system -urgency	0	0
Skin (face, arms, legs))	0	1
-burning, lancinating skin on hands and arms	0	4
-bruises, hemorrhages	0	3
Nose bleeding	0	0
Hair loss	0	0

Discussion

There are no measurements of the RF radiation in the home before the implementation of 5G. However, in previous publications we have shown that 5G gives a substantial increase in the radiation [5-8] which also seems to be the case in this report.

Most countries use thermal (heating) effects from RF radiation as the single basis for safety limits. These are based on short time exposure at very intense exposure where immediate effects are observed (within an hour). Thereby long-term exposure effects as well as effects not based on heating (non-thermal) as for instance symptoms of the microwave syndrome, are excluded [15-17]. The guidelines are established by ICNIRP, a self-appointed private organization based in Germany [15,17]. This unscientific and clearly biased evaluation of available evidence on health risks from ICNIRP is in the interest of industry, thereby facilitating the deployment of 5G and the wireless society [9,10].

The levels of exposure from 5G in this study, as well as in our previous case studies, causing ill health within a short time period, are well below the ICNIRP limits.

Therefore these case reports confirm that ICNIRP limits are not adequate for health protection from exposures from base stations.

A large number of organizations have called for a revision of the limits for better protection of humans and the environment (www.5gappeal.eu; www.emfcall.org; www.emfscientist.org). Also many groups of scientists have challenged the ICNIRP ‘safety limits’ [18] and have asked for considerably lower values for RF radiation, Table 4. Thus lower guidelines were proposed in the Salzburg resolution [19], the EU Parliament STOA Report [20], and the Salzburg precautionary exposure limit [21]. More than 10 years ago, 2012, the BioInitiative Report [22] established a safety limit of 30-60 $\mu\text{W}/\text{m}^2$, and yet lower for sensitive persons and children, 3-6 $\mu\text{W}/\text{m}^2$. The EUROPAEM EMF guidelines proposed in 2016 maximum exposure to be 10-1 000 $\mu\text{W}/\text{m}^2$, and lower at nighttime 1-100 $\mu\text{W}/\text{m}^2$, and yet lower for sensitive persons 0.1-10 $\mu\text{W}/\text{m}^2$ [23]. The RF radiation exposure in this case study is well above these recommended maximum levels of exposure.

Ethical principles

The expansion of the wireless society is rapid with its own pathway. Protests and critical comments by scientists and non-governmental organizations (NGOs) are unheard. In fact media debate, interest among politicians and unbiased evaluation by governmental organizations are deficient or non-existing. Since this is a technology with potential for public health damage, some ethical principles used in medicine may be applied. So far that aspect has not been discussed.

Table 4: Guidelines on recommended limit exposure levels for the public by different organizations for microwave radiation in $\mu\text{W}/\text{m}^2$, see also [26].

Year	Power Density ($\mu\text{W}/\text{m}^2$)	Name	Description
1998	10,000,000	ICNIRP [18]	10,000,000 for 2–300 GHz
	9,000,000		9,000,000 for 1800 MHz and
	4,500,000		4,500,000 for 900 MHz
			Whole body exposure averaged over 6 min.
2001	1,000	Salzburg Resolution [19]	1,000 for the sum total of all pulse modulated high-frequency exposures
	100,000		100,000 for the total of all high-frequency irradiation
2001	100	EU Parliament STOA 2001 [20]	For chronic exposure from pulsed microwaves. ¹
2002	1	New Salzburg Precautionary Exposure Limit Indoor [21]	Indoor chronic exposure from GSM base stations. ¹
2012	3-6	Bioinitiative 2012 Recommendation [22]	For chronic exposure to pulsed RF. ¹
2016	0.1-100	EuropaEM EMF Guidelines [23]	For extended exposure at least 4 hours a day to frequencies between GSM 900 to WiFi 5.6 GHz depending on sensitivity, night time or daytime exposure. Peak maximum values.
2020	10,000,000	ICNIRP 2020 [15]	10,000,000 for >2–300 GHz
	9,000,000		9,000,000 for 1800 MHz and
	4,500,000		4,500,000 for 900 MHz
			Whole body exposure averaged over 30 min.
2020	10,000,000	ICNIRP 2020 [15]	10,000,000 for 400 MHz
	18,200,000		18,200,000 for 800 MHz
	36,600,000		36,600,000 for 1,800 MHz
	40,000,000		40,000,000 for 2 GHz
	40,000,000		40,000,000 for 6 GHz:
	26,600,000		26,600,000 for 60 GHz:
	20,000,000		20,000,000 for 300 GHz:
			Local exposure averaged over 6 min.

Citation: Hardell L, Nilsson M. A woman aged 82 years with electromagnetic hypersensitivity since almost four decades developed the microwave syndrome after installation of 5G base stations in her living vicinity – ethical principles in medicine are violated. Journal of Environmental Science and Public Health. 8 (2024): 01-08.

In the following ethical principles are discussed in relation to the implementation of 5G base stations. In principle RF radiation must be of benefit to the exposed person, it shall not hurt, it shall be fair, and respect self-determination and integrity. Before exposure the subject must be fully informed, approve the exposure, determine for how long time and under what conditions, and finally not to be under inappropriate pressure to participate to be exposed to RF radiation.

It may of course be problematic to fully adhere to all these principles, e.g. many persons in a household or community may use the wireless communication and see the benefit of the technology but no disadvantage. The crucial question is of course if disadvantage and ill health among the few shall overrule the benefit among other persons as well as if those who see only benefits and no problems are fully informed about health risks? Historically for e.g. cancer risks, regulations have been undertaken based on injury to few persons [24]. Also history has shown that the bigger the economic interests that are at stake, the more time it takes to implement actions to protect public health [25].

A more thorough discussion of fundamental ethical principles in medicine has been documented by Professor Veikko Launis at Åbo University in Finland (<https://www.laakariliitto.fi/lakaretik/lakaretikens-filosofiska-grunder/lakar-och-vardetikens-grundprinciper/>). He presents six basic principles as discussed briefly in the following. However, these may as well be used for the rollout of 5G and its detrimental effects on human health. Also the environment is harmed so this discussion may be applied in general.

Respect for life: This is the basis for all activities that concern all living creatures. In general biological life should be preserved. All life has a moral value.

Evaluation: The expansion of 5G does not respect human life. This principle is not fulfilled.

Human dignity: The moral value for all people should be the same. Human rights should be equal to all persons.

Evaluation: Human rights are not applied. People are uninformed about potential risks and forcibly exposed to harmful levels of RF radiation in their own homes. In some cases the harmful effects on health have been so severe that they could not continue to live in their own homes forcing them to move and find another place for living.

Self-determination: The right for self-determination is an essential part of moral. A person should have the possibility to consider, make decisions, and act on the implementation of base stations for 5G in the neighborhood. For that information and knowledge are required. As an ethical principle informed consent is necessary.

Evaluation: Installation of 5G base stations and the radiation penetration into people's private homes are mostly performed without information and approval by concerned parties. This principle is not fulfilled.

Medical care: The society is obliged to take care of the disabled. This is one of the elementary moral obligations. The principle is to improve health, reduce suffering, and avoid deterioration of health and increasing suffering.

Evaluation: Persons with EHS or suffering from the microwave syndrome are mostly ignored or rejected in the medical care. Most physicians do not recognize and understand that RF radiation can cause a range of health problems and the patient is often wrongly given a psychiatric diagnosis or prescribed medications that only are intended to treat the symptoms and not the cause of the problems. Reduction of RF radiation exposure is the most effective treatment but is ignored. This principle is not fulfilled.

Justice: All persons should be ensured equal possibility for adequate care.

Evaluation: Persons with severe sensitivity to this kind of radiation may not tolerate levels of radiation prevalent at hospitals and other medical care centres. Furthermore as long as this patient group is not recognized as being ill from the cause of their illness, adequate care is not given.

Benefit: The result of an action is the benchmark for the moral value. The expected benefit should be as large as possible in relation to the inconvenience. This is a central principle in medical care. Thus, the measure that is most beneficial in relation to inconvenience should be applied. This includes improved health in contrast to potential impairment of the use of this technology for the society.

Evaluation: The benefits of the rollout of 5G base stations for wireless communication leading to a massive increase in RF exposure, have never been shown to be larger than the negative effects on human health and the environment. The benefit of the 5G goes unilaterally to the telecommunication industry while the public and the environment are forced to bear the cost. This principle is not fulfilled.

All these six fundamental ethical principles are violated. It is about time for the medical community, including all professional groups, to recognize EHS and the microwave syndrome as multiple diseases. The patient must be treated respectfully and taken care of. It is not correct to give the patient a psychiatric diagnosis, and furthermore hospitalize in a psychiatric ward while ignoring the most effective treatment that is reduction of exposure. A psychiatric diagnosis would violate ethical principles. The medical profession needs to be educated. That would give the possibility to give these patients correct treatment. As we have shown in our case reports, and recommended in the EuropaEM EMF guidelines, reduction of RF exposure is necessary to be included in the treatment plan [23].

Conclusion

In this case report we present a woman with EHS since almost four decades. After installation of 5G base stations in

the neighborhood her health deteriorated. Also her husband was somewhat affected. So far little is presented in the scientific literature on health consequences due to the high pulsed RF radiation from 5G. It is urgent for the medical community to acknowledge the microwave syndrome, take action, investigate the disease, take professional care of the sick, and prescribe reduction of exposure to RF radiation as the fundamental principle to regain health.

Acknowledgements

RF radiation measurements made by Ama Konsult AB are acknowledged.

Funding

No funding was received.

Availability of data and materials

The information generated and analyzed during the current study is available from the corresponding author on reasonable request.

Authors' contributions

Both authors participated in the conception, design and writing of the manuscript, and have read and approved the final version

Ethics approval and consent to participate

Not applicable.

Patient consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

References

- Koppel T, Hardell L. Measurements of radiofrequency electromagnetic fields, including 5G, in the city of Columbia, SC, USA. *World Acad Sci J* 4(2022): 23.
- Koppel T, Ahonen M, Carlberg M, et al. Very high radiofrequency radiation at Skeppsbron in Stockholm, Sweden from mobile phone base station antennas positioned close to pedestrians' heads. *Environ Res* 208 (2022): 112627.
- Hardell L, Nilsson M. Very high radiofrequency (RF) radiation at Skeppsbron in the Old Town in Stockholm, Sweden. *Ann Clin Med Case Rep* 10 (2023): 1-7.
- Nilsson M, Hardell L, Ketti M, et al. Nordic Appeal: More stringent regulatory framework on microwave radiation from wireless technologies is needed - Stop further rollout of 5G. *Ann Clin Med Case Rep* 10 (2023): 1-4.
- Hardell L, Nilsson M. Case Report: The microwave syndrome after installation of 5G emphasizes the need for protection from radiofrequency radiation. *Ann Case Report* 8 (2023): 1112.
- Hardell L, Nilsson M. Case Report: A 52-year healthy woman developed severe microwave syndrome shortly after installation of a 5G base station close to her apartment. *Ann Clin Med Case Rep* 10 (2023): 1-10.
- Nilsson M, Hardell L. Development of the microwave syndrome in two men shortly after installation of 5G on the roof above their office. *Ann Clin Case Rep* 8 (2023): 2378.
- Nilsson M, Hardell L. 5G Radiofrequency radiation caused the microwave syndrome in a family living close to the base stations. *J Cancer Sci Clin Ther* 7 (2023): 127-134.
- Hardell L, Nyberg R. Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation. *Mol Clin Oncol* 12 (2020): 247-257.
- Nyberg NR, McCredden JE, Weller SG, et al. The European Union prioritises economics over health in the rollout of radiofrequency technologies. <https://doi.org/10.1515/reveh-2022-0106>.
- Hardell L. World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review). *Int J Oncol* 51 (2017): 405-413.
- Pollack H. The microwave syndrome. *Bull NY Acad Med* 55 (1979): 1240-1243.
- Carpenter DO. The microwave syndrome or electrohypersensitivity: historical background. *Rev Environ Health* 30 (2015): 217-222.
- Belpomme D, Campagnac C, Irigaray P. Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder. *Rev Environ Health* 30 (2015): 251-271.
- International Commission on Non-Ionizing Radiation Protection (ICNIRP). Guidelines for limiting exposure to electromagnetic fields (100 kHz to 300 GHz). *Health Phys* 118 (2020): 483-524.
- International Commission on the Biological Effects of Electromagnetic Fields (ICBE-EMF). *Environ Health* 21 (2022): 92.
- Lin JC. Incongruities in recently revised radiofrequency exposure guidelines and standards. *Environ Res* 222 (2023): 115369
- International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP guidelines for limiting

- exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz). *Health Phys* 74 (1998): 494-522.
19. Salzburg resolution on mobile telecommunication base stations. *Salzburg* 7 (2000). http://www.icems.eu/docs/resolutions/Salzburg_res.pdf?fbclid=IwAR3R4sB5VrAbqoHcFfPTFhbaKoYTRdktA9wQUChQQRxFrWcWi8Bl5nv49w.
 20. European Parliament. The physiological and environmental effects of non-ionising electromagnetic radiation. Final Study. Luxembourg (2001). [https://www.europarl.europa.eu/RegData/etudes/etudes/JOIN/2001/297574/DG-4_JOIN_ET\(2001\)297574_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/etudes/JOIN/2001/297574/DG-4_JOIN_ET(2001)297574_EN.pdf).
 21. Oberfeld G, Navarro AE, Portoles M, Maestu C, Gomez-Perretta C. The microwave syndrome - further aspects of a Spanish study (2002). https://www.researchgate.net/publication/237410769_The_Microwave_Syndrome__Further_Aspects_of_A_Spanish_Study.
 22. BioInitiative Working Group, Cindy Sage and David O. Carpenter, Editors. *BioInitiative Report: A Rationale for a Biologically-based Public Exposure Standard for Electromagnetic Radiation* (2022). www.bioinitiative.org
 23. Belyaev I, Dean A, Eger H, et al. EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. *Rev Environ Health* 31 (2016): 363–397.
 24. Hardell L, Carlberg M. Lost opportunities for cancer prevention: historical evidence on early warnings with emphasis on radiofrequency radiation. *Rev Environ Health* 36 (2021): 585-597.
 25. Late lessons from early warnings: science, precaution, innovation EEA Report No 1/2013.
 26. Hardell L, Nilsson M, Koppel T, et al. Aspects on the International Commission on Non-Ionizing Radiation Protection (ICNIRP) 2020 guidelines on radiofrequency radiation. *J Cancer Sci Clin Ther* 5 (2021): 250-283.