December 7, 2020

M.C.G. Keijzer, State Secretary for Economic Affairs and Climate

T. van Ark, Minister for Medical Care and Sport

S. van Veldhoven - Van der Meer, State Secretary for Infrastructure and Water Affairs

Health Council of the Netherlands

Regarding: 5G and health

On September 2, 2020 the Health Council of the Netherlands released their evaluation of 5G and health (No. 2020/16/16e/16Ae). The Committee consists of 9 members. 2 scientific secretaries, 1 incidentally consulting expert, and 3 observers. (https://www.healthcouncil.nl/documents/advisory-reports/2020/09/02/5g-and-health).

Of large concern as to impartiality is that one member of the Committee, Anke Huss, is a member of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) since May 2020. Furthermore, one of the two secretaries, Erik van Rongen, has been a long-time commission member of ICNIRP since 2010, chair 2016 to 2020 and vice chair since May 2020 (https://www.researchgate.net/profile/Eric_Rongen).

In addition Anke Huss receives research funding from a telecom industry sponsored Swiss Foundation and she is also member of this foundation's scientific committee . (https://www.emf.ethz.ch/en/foundation/organisation). Further, Eric van Rongen is a long time member of the industry organisations the Institute of Electrical and Electronics Engineers/the International Committee on Electromagnetic Safety (IEEE/ICES), see below..

These facts give concern of conflicts of interest in the Heatlh Council Committee. Members of ICNIRP tend to adhere also in other settings to the ICNIRP no-risk paradigm regarding radiofrequency (RF) radiation. This may also be the case in this report. In fact it should be noted that the Ethical Board at the Karolinska Institute in Stockholm, Sweden concluded already in 2008 that being a member of ICNIRP may be a conflict of interest that should be stated officially whenever a member from ICNIRP makes opinions on health risks from EMF on behalf of another organization, as in this case (Karolinska Institute Diary Number 3753-2008-609). This verdict related to Prof. Anders Ahlbom, ICNIRP Commission Member from

1996 until 2008, and that is a general statement. Anke Huss and Eric van Rongen omitted to state that conflict of interest.

The committee has made four recommendations to Parliament.

1. Because the lower frequency bands for 5G (up to 3.5 GHz) have already been used for telecommunications applications and Wi-Fi for years without resulting in any proven adverse health effects, the committee sees no reason to stop or restrict the use of these frequency bands. It does however recommend that the exposure should be monitored before, during and after the rollout of the 5G systems. This will make clear to what extent exposure to radiofrequency electromagnetic fields changes as a result of the introduction of 5G and any long-term health risks can then be estimated better. The WHO analysis can also be used in estimating the risks.

2. The committee recommends doing more research:

- *epidemiological research into the relation between exposure to the 5G frequencies used and the incidence of cancer, reduced male fertility, poor pregnancy outcomes and birth defects. An ongoing international study into the use of mobile telephones, in which the Netherlands is participating, can play a role in this.*
- *experimental research into the health effects of exposure to electromagnetic fields in the 26 GHz frequency band.*
- *scenario studies to get a picture of the exposure of individuals as a result of wireless communication systems (3G, 4G and 5G).*

3. The committee recommends not to use the 26 GHz frequency band for 5G for as long as the potential health risks have not been investigated.

4. Finally, the committee recommends using the latest guidelines from the International Commission on Non-Ionising Radiation Protection (ICNIRP) as the basis for exposure policy in the Netherlands. Because it cannot be excluded that exposure under the latest ICNIRP standards also has the potential to affect health, the committee recommends to take a cautious approach and keep exposures as low as reasonably achievable.

Of these conclusions number 3 is in agreement with an appeal to EU asking for a moratorium on the roll-out of 5G until research has been done on potential health risks (www.5gappeal.eu). The appeal has currently been signed by more than 400 international scientists and/or medical doctors.

The claim that *the lower frequency bands for 5G (up to 3.5 GHz) have already been used for telecommunications applications and Wi-Fi for years without resulting in any proven adverse health effects* is incorrect.

Evidence, from research on cells, animals and humans, shows that the frequencies used so far for telecommunications are harmful for humans and also the environment, for overviews see (1-3).

There is no substantial research on health effects from the frequencies in the range between 3 and 4 GHz intended to be used for 5G as noted by the French authority ANSES in an expert report published in January 2020 (https://www.anses.fr/fr/system/files/AP2019SA0006Ra.pdf).

The Committee has mainly based its review on a 2014 draft report from the WHO and the reports from the Swedish Radiation Safety Authority (SSM). Anke Huss and Eric van Rongen have been coauthors of the Swedish SSM reports and Eric van Rongen was furthermore a member of the WHO draft report's core group of members, see Table 1

The committee recommends using the latest ICNIRP 2020 guidelines which in turn relies on the 2014 draft report from WHO, the reports from the Swedish Radiation Safety Authority (SSM) and the 2015 report from the Scientific Committee on Emerging and Newly Identified Health Risk (SCENIHR).

There is an "ICNIRP cartel" of experts in different organizations and evaluating bodies that dominate these expert evaluations (ICNIRP, WHO, SSM, SCENIHR), and seems to have influenced also this report, see Table 1 and (5G-mass-experiment-ICNIRP-cartel-Investigate-Europe.pdf (cqlpe.ca)

As a general rule scientists that are of the opposing opinion, i.e. that there is an increased health risk from exposure to RF radiation, have ever been invited to take part of these expert groups. Thus, the opinions expressed in these reports are not representative of the opinions in the scientific community on effects from electromagnetic fields (www.emfscientist.org).

It is pertinent to evaluate the current ICNIRP 2020 conclusions on cancer risks from RF radiation since the Health Council of the Netherlands recommends using the ICNIRP 2020 guidelines. The recommendation to *"take a cautious approach and keep exposures as low as reasonably achievable"* is certainly difficult to achieve on a market with expanding wireless communication and may be of no practical use. It is assumed that the ICNIRP 2020 guidelines will be used in most countries. Thus, the influence by ICNIRP and its members on reports that form the basis for guidelines by different organizations is necessary to elucidate.

ICNIRP

In the following the evaluation of increased cancer risks according to ICNIRP 2020 is discussed in more detail. It should be mentioned that ICNIRP relies only on thermal (heating) effects from RF radiation. Non-thermal effects are dismissed thereby neglecting a large amount of scientific evidence on harmful non-thermal effects for instance DNA-damage (4), oxidative stress (5) and cancer (2). It is also to be noted that the IARC at WHO evaluation from 2011 is not included in the report. IARC concluded that RF radiation in the frequency range 30 kHz–300 GHz is a possible human carcinogen, Group 2B after an evaluation by 30 international experts (6,7).

ICNIRP is a non-governmental organization (NGO) based in Germany. It has obtained major influence world-wide on health risks from RF radiation through its recommended guidelines for limiting RF radiation exposure published in 1998, 2009, and 2020 (8-10).

ICNIRP maintains the same attitude to health effects from RF-radiation as the Institute of Electrical and Electronics Engineers (IEEE) and its standards setting committee, the International Committee on Electromagnetic Safety (ICES). Several members of ICNIRP are also members of IEEE/ICES, for instance Eric van Rongen, member of ICES since 2000. ICES is dominated by industry and military representatives (11). ICES within IEEE also sets limits for RF exposure which are in line with the ICNIRP's opinion that there are only

immediate thermal effects and no effects below those that cause immediate effects due to increased temperature.

An EU report (12) pointed out the fact that ICNIRP's chairman Eric van Rongen, in 2016 invited the industry organization ICES to comment and thereby influence the upcoming ICNIRP 2020 guidelines. The report concluded that it is "*clear from ICES minutes that ICNIRP worked very closely with IEEE/ICES on the creation of the new RF safety guidelines that were published in March 2020. And this implies that large telecom-companies such as Motorola and others, as well as US military, had a direct influence on the ICNIRP guidelines, which are still the basis for EU-policies in this domain."*

This adds to the evidence that Eric van Rongen, one of two secretaries of this Health Council, seems to have conflicts of interest.

In 2020 ICNIRP published new guidelines on health risks in Appendix B (10). These updated guidelines were based on documents from the WHO, the SSM and the SCENIHR, as mentioned earlier without any new thorough evaluation of its own.

No one of these three reviews has been published after peer-review in a scientific journal. In fact, substantial critique from the scientific community has been expressed against these reviews but has been ignored (13,14). Furthermore, these older documents do not cover the most recent research. In the following comments are given to these three reviews since the ICNIRP 2020 is based on these older evaluations with no new and further evaluation of its own (10).

WHO

A draft of a Monograph on health effects of electromagnetic field (EMF) exposure was released by WHO in 2014 (15). It was open for public consultation until December 31, 2014, but has never been published as a final version and it is unclear why it was never finalized.

It should be noted that WHO in 2014 issued the following statement: "*THIS IS A DRAFT DOCUMENT FOR PUBLIC CONSULTATION. PLEASE DO NOT QUOTE OR CITE.*" (15). Nevertheless, this WHO draft from 2014, issued by a group dominated by ICNIRP members,

among them Eric van Rongen, was used as a basis for the ICNIRP guidelines 2020 and this new report. Five of six members of the WHO core group were members of ICNIRP, see Table 1 (16). The WHO group was nearly identical to ICNIRP.

SCENIHR

The following quotes are from the SCENIHR report 2015 (17):
"Overall, the epidemiological studies on mobile phone RF EMF exposure do not show an increased risk of brain tumours. Furthermore, they do not indicate an increased risk for other cancers of the head and neck region." …"*The results of cohort and incidence time trend studies do not support an increased risk for glioma while the possibility of an association with acoustic neuroma remains open."*

The SCENIHR report was criticized for its biased presentation and conclusions (13,14). Like the WHO draft report and the Swedish reports by SSM, it was written by a group of experts with no representation from the many scientists that report increasing evidence of harmful effects below the ICNIRP guidelines and demand better protection against health risks (www.emfscientist.org). SCENIHR included scientist with financial ties to industry or membership in ICNIRP or IEEE (https://www.stralskyddsstiftelsen.se/wp-content/uploads/2015/03/Annexe-3-Encl.-3-SCENIHR-Experts-2015.pdf).

SSM

Between 2003 and 2019 the SSM group has published reports in English on its webpage, three cited by ICNIRP 2020 (18-20). All reports since 2003 have consistently refuted or ignored evidence of health risks and biological effects from non-thermal exposure in line with the views by ICNIRP, the WHO and the SCENIHR. Since the first report in 2003 until today around half of the group's members have also been present or previous ICNIRP members. Both Eric van Rongen and Anke Huss have been part of this group of SSM experts. In consequence the conclusions have generally been that there are no health risks below the limits recommended by themselves, i.e. in agreement with ICNIRP.

The 2018 annual report was the twelfth in this series and covered studies published from October 2015 up to and including March 2017. The conclusion was that *"No new health risks have been identified."* (20).

It should be noted that SSM in April 2020 published a new report from the SSM expert group which concluded: "*The results of the research review give no reason to change any reference levels [ICNIRP's] or recommendations in the field*. ". Of the ten members in the scientific group five were present or past members of ICNIRP (21).

Current ICNIRP evaluation

Eric van Rongen, at that time chair of the ICNIRP Commission, claimed in a press release of the new ICNIRP 2020 guidelines that the 1998 version was "*conservative in most cases"* and *"still provide adequate protection for current technologies".* He also argued that: *"The most important thing for people to remember is that 5G technologies will not be able to cause harm when these new guidelines are adhered to"* (22). Since there is still no published peer-reviewed research showing no health effects from the new 5G technology, not even from short term exposure, that is a statement without scientific foundation.

Many other incorrect statements were made in the recent ICNIRP 2020 paper (10) contrary to an objective evaluation of the available scientific evidence. In the following the section on cancer is commented. That section starts at page 41 in the ICNIRP 2020 article with: "*There is a large body of literature concerning cellular and molecular processes that are of particular relevance to cancer. This includes studies of cell proliferation, differentiation and apoptosis-related processes, proto-oncogene expression, genotoxicity, increased oxidative stress, and DNA strand breaks. Although there are reports of effects of radiofrequency EMFs on a number of these endpoints, there is no substantiated evidence of health-relevant effects (Vijayalaxmi and Prihoda 2019)."*

Regarding studies on cancer risks no current evaluation is made. Several studies are not included or references are not even given to the discussed studies. One needs to be familiar with this topic to critically evaluate these ICNIRP statements. The uninformed reader may take the statements at face value and not understand that they are in fact not correct.

Regarding animal studies yielding a promoting effect from RF radiation (23,24) ICNIRP states that "*interpretation of these results and their applicability to human health [is] difficult, and, therefore, there is a need for further research to better understand these results"*. In the next paragraph the recent animal NTP studies (25,26) and Ramazzini Institute results (27 are disregarded stating that "*no consistency was seen across these two studies"* and "*within the context of other animal and human carcinogenicity research (HCN 2014, 2016), their findings do not provide evidence that radiofrequency EMFs are carcinogenic"*.

That is a remarkable statement on no risk by ICNIRP and is not based on what the science really shows. On the contrary animal studies indicate that RF radiation may both promote and initiate cancer. ICNIRP seems to be unwilling to consider the consistent findings and the whole pattern of increased cancer risks based on human epidemiology, animal research and experimental findings. In a review the Hardell group concluded that "*There is clear evidence that RF radiation causes cancer/tumor at multiple sites, primarily in the brain (glioma) and head (acoustic neuroma). There is also evidence of an increased risk of developing other tumor types. The results are similar in both the NTP studies (NTP 2018 a,b) and the Ramazzini Institute findings (Falcioni et al 2018). Based on the IARC preamble to the monographs, RF radiation should be classified as Group 1: The agent is carcinogenic to humans".* (28)

In a note published by ICNIRP it was claimed that the histopathological evaluation in the NTP study was not blinded as to exposure status (29). This was not correct and was rebutted by one of those responsible for the NTP study (30). However, the rebuttal seems to have had no impact on the current ICNIRP evaluation (10)

Regarding the 13 country Interphone case-control study on glioma (31) and acoustic neuroma (32) ICNIRP concluded that the studies do "*not provide evidence of an increased risk*.", which is not correct. On the contrary regarding glioma cumulative call-time of mobile phones ≥1,640 h resulted in odds ratio (OR) = 1.40, 95 % confidence interval (CI) = 1.03–1.89. The risk increased over time for exposure and was highest in the most exposed parts of the brain. These findings were of biological relevance.

In parts of Interphone RF radiation dose was estimated as total cumulative specific energy (TCSE; J/kg) absorbed at the tumour's estimated centre taking into account multiple RF

exposure determinants (33). The risk increased with increasing TCSE 7+ years before diagnosis, OR = 1.91, 95% CI = 1.05 - 3.47 (p-trend = 0.01) in the highest quintile. Comparing with glioma in other parts of the brain increased ORs were found for tumours in the most exposed part of the brain in those with 10+ years of mobile phone use, OR = 2.80, 95% CI = 1.13 - 6.94.

Similar results were reported by Grell et al (34): ..”*we found a statistically significant association between the intracranial distribution of gliomas and the self-reported location of the phone…Taken together, our results suggest that ever using a mobile phone regularly is associated with glioma localization in the sense that more gliomas occurred closer to the ear on the side of the head where the mobile phone was reported to have been used the most.”*

Canadian data from the Interphone Study were evaluated separately (35). For glioma, when comparing those in the highest quartile of use (>558 lifetime hours) to those who were no regular users, the OR was 2.0, 95% CI = 1.2 - 3.4. After adjustment for selection and recall biases somewhat higher OR was found, 2.2, 95 % CI = 95% CI = 1.3 - 4.1.

Also for acoustic neuroma the Interphone study yielded statistically significant increased risk. Thus, ipsilateral cumulative mobile phone use > 1,640 hours gave OR = 2.33, 95 % CI = 1.23-4.40 (32).

Regarding the Hardell group studies ICNIRP writes: ….”*a set of case-control studies from the Hardell group in Sweden report significantly increased risks of both acoustic neuroma and malignant brain tumors already after less than five years since the start of mobile phone use, and at quite low levels of cumulative call time*.” No reference is given to the studies that seem not to have been seriously evaluated. ICNIRP’s writing is not consistent with what the studies reported. Overall there was no statistically increased risk in the shortest latency period >1-5 years for glioma or acoustic neuroma (36,37). Also in the Hardell group studies the risk increased with latency and cumulative use and was highest in the most exposed areas of the brain that would be expected for carcinogenesis. Concepts of both promotion, initiation and biological relevance for RF radiation carcinogenesis must be considered when discussing results in different studies. That is obviously not the case for ICNIRP.

In addition, ICNIRP claims that the Hardell group results may be caused by recall bias. For meningioma no statistically significant increased risk was found in the same study. Using meningioma cases as "controls" (the comparison entity) still yielded statistically significant increased risk for glioma and mobile phone use (36). Similar results were found for acoustic neuroma using meningioma cases as the comparison group (37). These results clearly show that the increased risks for glioma and acoustic neuroma were not caused by recall bias, i.e. cases tending to overestimate exposure. That would have applied to all cases regardless of tumor type. This was neglected or maybe not understood by ICNIRP.

The CERENAT study by Coureau et al (38) was omitted by ICNIRP. The study strengthened the evidence of increased risk for glioma associated with mobile phone use. Life-long cumulative duration ≥896 h gave OR=2.89, 95% CI 1.41 - 5.93 for glioma. Number of calls ≥18,360 gave OR=2.10, 95% CI 1.03 - 4.31. Higher risks were obtained for the highest exposed area, the temporal brain lobe, as well as occupational and urban mobile phone use.

The Danish cohort study on mobile phone use with serious methodological limitations, was included adding to the ICNIRP no-risk paradigm. This study, funded by Danish telecom operators, first published in 2001 (39), and updated in 2011 (40), reported no increased risks of tumours in the central nervous system. It was based on 420,095 mobile phone private subscribers. This group's incidence of brain tumours was compared to the incidence within the rest of the Danish population (control group). However, there are severe methodological faults that led to erroneous results:

-Inclusion only of mobile phone private subscribers in Denmark between 1982 and 1995 in the exposure group.
-Exclusion of the most exposed group, consisting of 200,507, corporate users of mobile phones. They were instead included in the unexposed control group if not private subscribers.
-Users with mobile phone subscription after 1995 were not included in the exposed group and were thus treated as unexposed: "*individuals with a subscription in 1996 or later were classified as non-users*".
-Actual exposure data is unknown and no analysis by laterality (the side were the phone is hold in relation to the position of the tumour) was performed.
-All users of cordless/DECT phones were treated as unexposed for that exposure although they were also exposed to the same kind of RF radiation as from mobile phone use. The

Hardell group has shown that use of cordless phones increased the risk for brain tumours (36,37).

The study has been called *"The most severely biased study among all studies published so far"* (41). Certainly, there were severe methodological flaws. The Danish cohort study was regarded by IARC in the 2011 evaluation (7) to be uninformative regarding cancer risks due to serious exposure misclassification. However, it was included by SCENIHR (2015), WHO (2014), SSM (2013), and ICNIRP as evidence of no risk. The statement by SSM 2013 (42) that: *The Danish cohort studies make an important contribution to the total assessment in the field."* is remarkable taking the critique of that study that should have been well known to the SSM expert panel. The many shortcomings in the study were discussed in a peer-reviewed article (43) concluding that: *"After reviewing the four publications on the Danish cohort study, one might rightly wonder whether this cohort was initially set up to show no increased risk."*

The ICNIRP 2020 (10) reference levels for RF radiation are based on time averaged exposure over 6 min or 30 min. However, supra-additive effects between pulses from different RF radiation sources may give much higher peak radiation from short time pulses than the power density average. Using time averaging in reference values, as in the ICNIRP guidelines, may underestimate the risk. In addition, ICNIRP 2020 suggests higher guidelines. According to Table 6 in the article the reference level for e.g. >2 to 6 GHz is suggested to increase to 40 W/m^2 averaged over 6 minutes. This is contrary to the increasing scientific evidence on detrimental effects of human health and the environment from RF radiation. The previous guideline was 10 W/m^2 (8,9).

The evidence for cancer

Several meta-analyses have during the last years reached the conclusions that all together the available evidence shows increased risk of cancer from mobile phone use, e.g. (2). One additional method is to use Sir Bradford Hill's viewpoints from 1965 on association or causation written at the height of the tobacco and lung cancer controversy (44). In an article published in 2017 these viewpoints were used to evaluate RF radiation carcinogenesis based on epidemiology and laboratory studies (45). It was concluded that based on these Hill

'criteria' RF radiation should be regarded as a human carcinogen causing glioma. Since then the evidence has strengthened.

As discussed above studies have shown an association between glioma and acoustic neuroma and mobile-phone use especially in:
-people with longest latency (time from first use until tumour diagnosis),
-people with highest cumulative use of mobile phones,
-people who had used mobile phones on the same side of the head as that on which their tumour developed,
-in people whose tumour was in the temporal lobe of the brain.

In addition the Hardell group studies from Sweden found similar results for use of cordless phones. Thus, based on these findings that are of biological relevance and supported by the Hill viewpoints a causal interpretation is possible. Thus RF radiation should be classified as a human carcinogen, Group 1 according to the IARC criteria (45,46)

Discussion

In order to achieve sustainable development policies must be based on the precautionary principle. No doubt there are threats of serious or irreversible damage by exposure to RF radiation, not the least the increased risk for glioblastoma with short survival for those affected. Lack of full scientific certainty, as proposed by certain public health organisations, should not be used as a reason for postponing measures to prevent environmental degradation. Thus a moratorium on the deployment of 5G and considerable reduction of RF radiation from existing systems is urgently needed. In short:

"The precautionary principle provides justification for public policy actions in situations of scientific complexity, uncertainty and ignorance, where there may be a need to act in order to avoid, or reduce, potentially serious or irreversible threats to health or the environment, using appropriate strengths of scientific evidence, and taking into account the likely pros and cons of proportionate actions and inactions" (47).

In contrast to that, as a general rule ICNIRP, WHO, SSM and SCENIHR have for many years dismissed available studies showing harmful effects from non-thermal RF radiation exposure

and have based their conclusions mainly on studies showing no effects. Results showing risks are criticized, disregarded or not even cited while studies showing no risks are accepted as evidence of no risk in spite of severe methodological problems. Many of the statements by these agencies are misleading and not correct. They are easily rebutted by reading the relevant publications. In fact Italian court ruling linked mobile phone use to tumour already in 2012 (https://www.reuters.com/article/italy-phones-idUSL5E8LJFFW20121019). Also later court rulings in Italy have come to the same conclusion (https://www.stralskyddsstiftelsen.se/2020/01/22/italiensk-domstol-bekraftar-mobilen-orsakade-hjarntumor).

These ICNIRP cartel dominated expert groups consequently reach similar conclusions that there are no health effects below ICNIRP guidelines, which is beneficial to the telecommunications industry. No representative from the scientific community that is of the opinion that there is increasing evidence of health risks below the ICNIRP guidelines, e.g. as expressed in the EMF Scientists Appeal (https://www.emfscientist.org/index.php/emf-scientist-appeal), has ever been a member of the expert groups at the WHO, the EU (SCENIHR), the SSM or ICNIRP. Table 1 clearly illustrates that few persons constitute different groups aimed at preventing hazards and risks to the health and the environment. The ICNIRP view is thereby influencing these expert reports, which also formed the basis for this Health Council report.

The resistance to the abundant and growing scientific evidence on health risks from the RF radiation emitted by the telecommunications systems prior to 5G is remarkable and not within the realm of public health. In addition, 5G will lead to an increase of radiation, including new technique, which leads to the conclusion that hazardous exposure will increase. However, it is unacceptable that there is scanty research being performed on the risks or hazards from the new 5G technology and the new frequencies that will be used. This means an experiment on human health and the environment that should not be accepted. Thus informed consent would be needed from each involuntary exposed person. Increasing the allowed exposure as in ICNIRP 2020 (10) is a hazard to public health and the environment since evidence is abundant on harmful effects below previous ICNIRP guidelines, including DNA-damage, oxidative stress and cancer.

The Health Council Committee argues that "*epidemiological research into the relation between exposure to the 5G frequencies used and the incidence of cancer, reduced male fertility, poor pregnancy outcomes and birth defects"* should be performed after the roll-out of the 5G and its increase in radiation. However, the same committee in the same report claims that "*The committee has however classified relations as 'possible' for cancer, male fertility, pregnancy outcomes and birth defects*" (No. 2020/16e page 21).

Further the Committee states that; *"The conclusions from those earlier reports are also relevant for 5G as far as the frequency bands around 700, 1400, 1800 and 2100 MHz are concerned*. (No. 2020/16e page 9)….*The committee sees no reason to limit or stop the use of the lower frequency bands for 5G. Frequencies near 700 MHz and 3.5 GHz have been in use for current telecommunication systems or other applications such as Wi-Fi for years, without any demonstrable health damage as a result"* (No. 2020/16e page 27).

Thus this report states that 5G at the lower frequencies has no "*demonstrable health damage, although relations [are].. 'possible' for cancer, male fertility, pregnancy outcomes and birth defects*".

The least to say is that the Committee is not transparent regarding health risks – they are '*possible*' but for the roll-out of 5G they are not '*demonstrable*'. Research on health hazards must be done before exposure, not after, something that is suggested for the higher frequencies "*The committee recommends not to use the 26 GHz frequency band for 5G for as long as the potential health risks have not been investigated."*

For implementation of 5G, regardless of frequency, ethics in medicine should be applied. In medicine the patient must be informed about the risks but also benefits in experimental studies and give written consent for the participation. That should apply also to the deployment of 5G. However, it has not been done so far – the participation is forced upon everybody which is of course unacceptable from a human rights perspective.

Conclusion

In conclusion regarding cancer current scientific evidence clearly demonstrates an increased risk for glioma and acoustic neuroma for use of mobile and/or cordless phones. In this review

other tumour types and health endpoints are not discussed. The increased risk for brain and head tumours is based on human cancer epidemiology studies and is supported by similar tumour types found in animal studies. In fact these animal studies confirmed the earlier results in case-control studies on increased tumour risk for use of wireless phones; both mobile and cordless phones. Mechanistic aspects on carcinogenesis come from laboratory findings on e.g. increase of reactive oxygen species (5) and DNA damage (4).

The current evaluation by the Health Council of Netherlands is based on a WHO draft, and SSM report. It also recommends using ICNIRP guidelines, considered to be insufficient to protect against health hazards, as for instance cancer, by the majority of the scientists in this field (www.emfscientist.org). The report does not represent a thorough, balanced, objective, and up-to-date evaluation of cancer risks and other hazardous effects from RF radiation. It is also strikingly contradictory as it concludes that serious health effects as cancer and birth defects are "*possible*". Yet it has no objection to the roll-out of 5G and recommends that later studies are performed to study health outcomes such as cancer and birth defects. Thus, no lessons are learned from existing observations on increased cancer risks

The conclusion by the Commission that there is no reason to stop the use of lower frequencies for 5G up to 3.5 GHz because of no "*proven adverse health effects"*, merely reflects the biased conclusions by ICNIRP dominated groups. Thus that conclusion must be dismissed and new guidelines for previous and new frequencies must be established considering also the new technology, the different propagation pattern for 5G, and increased RF radiation.

A moratorium is urgently required on the implementation of 5G for wireless communication. Ultimately wired solutions are preferred.

Respectfully submitted

Lennart Hardell, MD, PhD, Professor
Department of Oncology, Faculty of Medicine and Health, Örebro University, SE-701 82 Örebro, Sweden (retired)
and The Environment and Cancer Research Foundation, SE-702 17, Örebro, Sweden (present address) E-mail: lennart.hardell@environmentandcancer.com

References

1. Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshammer H, Lercher P, Müller K, *et al*: EUROPAEM EMF Guideline 2016 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses. Rev Environ Health 31: 363–397, 2016.

2. Belpomme D, Hardell L, Belyaev I, Burgio E and Carpenter DO: Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective. Environ Pollut 242: 643–658, 2018.

3. Miller AB, Sears ME, Morgan LL, Davis DL, Hardell L, Oremus M, Soskolne CL Risks to health and well-being from radio-frequency radiation emitted by cell phones and other wireless devices. Front Public Health 7: 223, 2019.

4. Smith-Roe SL, Wyde ME, Stout MD, Winters JW, Hobbs CA, Shepard KG, Green AS, Kissling GE, Shockley KR, Tice RR, et al: Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure. Environ Mol Mutagen 61: 276-290, 2019

5. Yakymenko I, Tsybulin O, Sidorik E, Henshel D, Kyrylenko O and Kyrylenko S: Oxidative mechanisms of biological activity of low-intensity radiofrequency radiation. Electromagn Biol Med 35: 186-202, 2016.

6. Baan R, Grosse Y, Lauby-Secretan B, El Ghissassi F, Bouvard V, Benbrahim-Tallaa L, Guha N, Islami F, Galichet L and Straif K: Carcinogenicity of radiofrequency electromagnetic fields. Lancet Oncol 12: 624–626, 2011.

7. IARC Working Group on the Evaluation of Carcinogenic Risks to Humans: Non-ionizing radiation, Part 2: Radiofrequency electromagnetic fields. IARC Monogr Eval Carcinog Risks Hum 102: 1–460, 2013.

8. International Commission on Non-Ionizing Radiation Protection: Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz). Health Phys 74: 494–522, 1998.

9. International Commission on Non-Ionizing Radiation Protection: ICNIRP statement on the "Guidelines for limiting exposure to time-varying electric, magnetic, and electromagnetic fields (up to 300 GHz)." Health Phys 97: 257–258, 2009.

10. International Commission on Non-Ionizing Radiation Protection: Guidelines for Limiting Exposure to Electromagnetic Fields (100 kHz to 300 GHz). Health Phys 118: 483–524, 2020.

11. International Committee on Electromagnetic Safety: ICES (SCC-39) Annual Report: 2015 – 2016. Available at: https://www.ices-emfsafety.org/wp-content/uploads/2017/01/SCC39-Annual-Report-2015-2016.pdf (accessed on 1 December 2020).

12. Buchner K and Rivasi M: The International Commission on Non-Ionizing Radiation Protection: Conflicts of interest, corporate capture and the push for 5G. Available online:https://www.michele-rivasi.eu/wp-content/uploads/2020/06/ICNIRP-report-FINAL-JUNE-2020_EN.pdf (accessed on 1 December 2020).

13. Hardell L and Nyberg R: Appeals that matter or not on a moratorium on the deployment of the fifth generation, 5G, for microwave radiation (Review). Mol Clin Oncol 12: 247-257, 2020.

14. Hardell L and Carlberg M: Health risks from radiofrequency radiation, including 5G, should be assessed by experts with no conflicts of interest. Oncol Lett 20: 15, 2020.

15. World Health Organization. Electromagnetic fields (EMF). Available online: http://www.who.int/peh-emf/research/rf_ehc_page/en/ (accessed on 1 Decmber 2020).

16. Hardell L: World Health Organization, radiofrequency radiation and health - a hard nut to crack (Review). Int J Oncol 51: 405–413, 2017.

17. Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR): Opinion on potential health effects of exposure to electromagnetic fields (EMF). 20150120. Available online: https://ec.europa.eu/health/scientific_committees/emerging/docs/scenihr_o_041.pdf (accessed on 1 Decmber 2020).

18. Swedish Radiation Safety Authority 2015: Available online: https://www.stralsakerhetsmyndigheten.se/contentassets/ee7b28e0fee04e80bcaf84c24663a004/201519-recent-research-on-emf-and-health-risk---tenth-report-from-ssms-scientific-council-on-electromagnetic-fields-2015 (accessed on 1 Decmber 2020).

19. Swedish Radiation Safety Authority 2016: Available online: https://www.stralsakerhetsmyndigheten.se/contentassets/98d67d9e3301450da4b8d2e0f6107313/201615-recent-research-on-emf-and-health-risk-eleventh-report-from-ssms-scientific-council-on-electromagnetic-fields-2016 (accessed on 1 Decmber 2020).

20. Swedish Radiation Safety Authority 2018: Available online: https://www.stralsakerhetsmyndigheten.se/publikationer/rapporter/stralskydd/2018/201809/ (accessed on 1 Decmber 2020).

21. Swedish Radiation Safety Authority: Vetenskapligt råd för elektromagnetiska fält. Available online: https://www.stralsakerhetsmyndigheten.se/om-myndigheten/organisation/rad-och-namnder/vetenskapligt-rad-for-elektromagnetiska-falt/ (accessed on 1 December 2020).

22. ICNIRP. New guidelines released by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). Media Release, March 11, 2020. Available online: https://www.icnirp.org/cms/upload/presentations/ICNIRP_Media_Release_110320.pdf. (accessed on 1 December 2020).

23. Tillmann T, Ernst H, Streckert J, Zhou Y, Taugner F, Hansen V and Dasenbrock C: Indication of cocarcinogenic potential of chronic UMTS-modulated radiofrequency exposure in an ethylnitrosourea mouse model. Int J Radiat Biol 86: 529–541, 2010.

24. Lerchl A, Klose M, Grote K, Wilhelm AF, Spathmann O, Fiedler T, Streckert J, Hansen V and Clemens M: Tumor promotion by exposure to radiofrequency electromagnetic fields below exposure limits for humans. Biochem Biophys Res Commun 459: 585–590, 2015.

25. National Toxicology Program: NTP technical report on the toxicology and carcinogenesis studies in B6C3F1/N mice exposed to whole-body radio frequency radiation at a frequency (1,900 MHz) and modulations (GSM and CDMA) used by cell phones. NTP TR 596, March 26-28, 2018. Available online: https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/tr596peerdraft.pdf (accessed on 1 December 2020).

26. National Toxicology Program: NTP technical report on the toxicology and carcinogenesis studies in Hsd:Sprague Dawley sd rats exposed to whole-body radio frequency radiation at a frequency (900 MHz) and modulations (GSM and CDMA) used by cell phones. NTP TR 595, March 26-28, 2018. Available online: https://ntp.niehs.nih.gov/ntp/about_ntp/trpanel/2018/march/tr595peerdraft.pdf (accessed on 1 Decmber 2020).

27. Falcioni L, Bua L, Tibaldi E, Lauriola M, De Angelis L, Gnudi F, Mandrioli D, Manservigi M, Manservisi F, Manzoli I, *et al*: Report of final results regarding brain and heart tumors in Sprague-Dawley rats exposed from prenatal life until natural death to mobile phone radiofrequency field representative of a 1.8 GHz GSM base station environmental emission. Environ Res 165: 496–503, 2018.

28. Hardell L and Carlberg M: Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz. Int J Oncol 54: 111–127, 2019.

29. International Commission on Non-Ionizing Radiation Protection (ICNIRP): ICNIRP Note: Critical Evaluation of Two Radiofrequency Electromagnetic Field Animal Carcinogenicity Studies Published in 2018. Health Phys 118: 525–532, 2020.

30. Melnick RL: Commentary on the utility of the National Toxicology Program study on cell phone radiofrequency radiation data for assessing human health risks despite unfounded criticisms aimed at minimizing the findings of adverse health effects. Environ Res 168: 1–6, 2019.

31. INTERPHONE Study Group: Brain tumour risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. Int J Epidemiol 39: 675–694, 2010.

32. INTERPHONE Study Group: Acoustic neuroma risk in relation to mobile telephone use: results of the INTERPHONE international case-control study. Cancer Epidemiol 35: 453–464, 2011.

33. Cardis E, Armstrong BK, Bowman JD, Giles GG, Hours M, Krewski D, McBride M, Parent ME, Sadetzki S, Woodward A, *et al*: Risk of brain tumours in relation to estimated RF dose from mobile phones: results from five Interphone countries. Occup Environ Med 68: 631–640, 2011.

34. Grell K, Frederiksen K, Schüz J, Cardis E, Armstrong B, Siemiatycki J, Krewski DR, McBride ML, Johansen C, Auvinen A, *et al*: The Intracranial Distribution of Gliomas in Relation to Exposure From Mobile Phones: Analyses From the INTERPHONE Study. Am J Epidemiol 184: 818–828, 2016.

35. Momoli F, Siemiatycki J, McBride ML, Parent MÉ, Richardson L, Bedard D, Platt R, Vrijheid M, Cardis E and Krewski D: Probabilistic Multiple-Bias Modeling Applied to the Canadian Data From the Interphone Study of Mobile Phone Use and Risk of Glioma, Meningioma, Acoustic Neuroma, and Parotid Gland Tumors. Am J Epidemiol 186: 885–893, 2017.

36. Hardell L and Carlberg M: Mobile phone and cordless phone use and the risk for glioma - Analysis of pooled case-control studies in Sweden, 1997-2003 and 2007-2009. Pathophysiology 22: 1–13, 2015.

37. Hardell L, Carlberg M, Söderqvist F and Hansson Mild K: Pooled analysis of case-control studies on acoustic neuroma diagnosed 1997-2003 and 2007-2009 and use of mobile and cordless phones. Int J Oncol 43: 1036–1044, 2013.

38. Coureau G, Bouvier G, Lebailly P, Fabbro-Peray P, Gruber A, Leffondre K, Guillamo JS, Loiseau H, Mathoulin-Pélissier S, Salamon R, *et al*: Mobile phone use and brain tumours in the CERENAT case-control study. Occup Environ Med 71: 514–522, 2014.

39. Johansen C, Boice J, McLaughlin J and Olsen J: Cellular telephones and cancer--a nationwide cohort study in Denmark. J Natl Cancer Inst 93: 203–207, 2001.

40. Frei P, Poulsen AH, Johansen C, Olsen JH, Steding-Jessen M and Schüz J: Use of mobile phones and risk of brain tumours: update of Danish cohort study. BMJ 343: d6387, 2011.

41. Microwave News: The Danish Cohort Study: The Politics and Economics of Bias. November 3, 2011. Available online: https://microwavenews.com/DanishCohort.html (accessed 1 December 2020).

42. Swedish Radiation Safety Authority 2013: Available online: Eighth report from SSM:s Scientific Council on Electromagnetic Fields (stralsakerhetsmyndigheten.se) (assessed December 1, 2020)

43. Söderqvist F, Carlberg M and Hardell L: Review of four publications on the Danish cohort study on mobile phone subscribers and risk of brain tumors. Rev Environ Health 27: 51–58, 2012.

44. Hill AB, The environment and disease: association or causation? Journal of the Royal Society of Medicine, vol. 58, no. 5, pp. 295–300, 1965.

45. 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. Biomed Res Int. 2017;2017:9218486.

46. Peleg M, Nativ O and Richter ED: Radio frequency radiation-related cancer: assessing causation in the occupational/military setting. Environ Res 163: 123–133, 2018.

47. Gee D. More or less precaution? In: European Environment Agency: Late lessons from early warnings: science, precaution, innovation. European Environment Agency, Luxembourg: Publications Office of European Union. EEA Report No 1, pp 643-669. 2013.

Table 1. Members of WHO Monograph core group and their involvement in different other groups, see Hardell 2017 (16).

Name	**WHO**	**ICNIRP**	**UK/AGNIR**	**SSM**	**SCENIHR**
Simon Mann	X	X	X		
Maria Feychting	X	X	X	X*	
Gunnhild Oftedal	X	X			
Eric van Rongen	X	X		X	
Maria Rosaria Scarfi	X	X*		X	X
Denis Zmirou	X				

**former*

WHO: World Health Organization

ICNIRP: International Commission on Non-Ionizing Radiation Protection

AGNIR: Advisory Group on Non-Ionising Radiation

SSM: Strålsäkerhetsmyndigheten (Swedish Radiation Safety Authority)

SCENIHR: Scientific Committee on Emerging and Newly Identified Health Risk