

Editorial

Health effects of Radiofrequency Electromagnetic Fields (RF EMF)

Recent technological development made the natural electromagnetic environment affected by man-made sources of EMF. People are exposed to man-made EMF both in their occupational environments and in everyday life. Most common technology-related EMF include radiofrequency (RF) EMF, i.e. radiowaves and microwaves (100 kHz–300 GHz), and power frequency EMF (50, 60 Hz). RF-emitting devices are extensively used in industry (welding machines, induction heaters), telecommunication (TV and radio broadcast stations), medicine (NMR, diathermy), and in everyday life (microwave ovens, mobile phones and 5G—the newest generation of mobile communication)¹⁾.

The possible adverse health effects of exposure to RF EMF are a source of great concern not only among mobile phone users and people living in the vicinity of the base stations, but also among governmental and non-governmental organisations responsible for public health. Although EMF exposures related to mobile phone use are well within the current safety standards, it should be noted that these standards have been based solely on the expected thermal effects of EMF, disregarding any possible non-thermal effects. Numerous studies are currently undertaken to explain the possible health effects of weak, “non-thermal” radiofrequency electromagnetic fields²⁾.

The best evidence on the possible health effects of EMF exposure can provide an epidemiologic studies. The studies performed thus far were intended mostly for assessment of EMF exposure-related risk of developing various cancers, especially to explain the relationship between intracranial cancer and mobile phone using. It is worth noting that the findings of older studies does not yield definite evidence for an increased cancer risk in association with exposures to micro- and radiofrequency EMF^{3, 4)}. It should, however, be remembered that these were retrospective studies and it was difficult to assess exposure levels or control the confounders. Moreover, carcinogenesis is an extremely slow process and mobile phones have not been in common use longer than 20 years. However, already at the beginning of the 21st century, some authors reported positive results^{5–7)}.

In 2011 yr, an International Agency of Research on

Cancer (IARC) classified radiofrequency electromagnetic fields (RF EMF) as possibly carcinogenic to humans (group 2B)⁸⁾. In 2015 yr was published by the Scientific Committee on Emerging and Newly Identified Health Risks – SCENIHR⁹⁾ report on the effects of exposure to EMF on frequencies in ranges already used in mobile telephony. According to this report, an epidemiological studies on mobile phone RF EMF exposure do not show an increased risk of brain tumors and for other cancers of the head and neck region, however some studies raised questions regarding increased risk of glioma and acoustic neuroma in heavy users of mobile phones. Since then new data was published, also meta-analyses, indicating that longterm (over 10 yr) use of mobile phone increases the risk of intracranial tumors, most of all glioma, especially in the case of ipsilateral exposure^{10–14)}.

Due to this data, an IARC advisory committee has recommended to reassess the cancer risks associated with RF radiation¹⁵⁾. This should be a “high priority,” according to the panel’s report, which was issued on April 2019. A number of scientists argued that IARC should upgrade RF to a “probable” cancer agent [Group 2A] or simply “carcinogenic to humans” [Group 1].

Apart from the carcinogenic activity of RF EMF, subjective ailments caused by both hand-held telephones and base stations are also taken into account. However, up to now only few epidemiological studies on non-carcinogenic effects of radio- and microwave EMF exposures have been reported on. The first data on headaches caused by exposure to micro- and radio-wave frequency EMF appeared over 20 years ago, but the exposure to EMF at these frequencies was not then widespread¹⁶⁾. Questionnaire studies on subjective effects reported by mobile phone users in Sweden, Norway, England, USA, New Zealand, Australia, and Poland revealed that the most frequent complaint was feeling of warmth around the ear and headaches¹⁷⁾. In addition to headaches, mobile phone users complained of fatigue and general malaise, muscle pain, nausea, sleep disturbances, short-term memory loss¹⁷⁾.

The general opinion seems to be considerably concerned about not only hand held devices, but also the base stations. Hypothesizing about possible adverse effects at

the present state of our knowledge is encumbered with a high degree of uncertainty. Exposure of base stations is characterised by low EMF intensities and very long time (24h/day for many years), therefore precise exposure assessment creates problems^{18, 19}. Evaluation of the long-term relationship of exposure to EMF emitted by base stations with subjective symptoms requires better methodological observational studies than the majority of publications published so far. In 2017, the results of a large cohort study, conducted in a Dutch population of 14,829 people aged 31–65 yr, were published²⁰. The authors found a relationship between the overall number of reported subjective complaints and the perception of exposure, while the lack of relationship between the occurrence of ailments and the exposure estimated using the geospatial model. Authors suggested that *“there is a need for more multidisciplinary studies that consider the role of both actual environmental exposures and perception in relation to self-reported health outcomes”*.

Conclusion

The problem of health effects of RF EMF has not been definitively resolved, but due to the results of previous research on possible health effect of RF EMF, it seems necessary to use precautionary principles and ALARA (As Low as Reasonably Achievable) principles, when the new sources of electromagnetic emissions will be planned and installed.

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