

ARE THE ELECTROMAGNETIC FIELDS A DANGER TO THE PUBLIC HEALTH?

C. G. MATEI¹ R. A. ADAM¹

Abstract: *Electromagnetic fields of all frequencies represent one of the most common and fastest growing environmental influences, about which anxiety and speculation are spreading. All populations are now exposed to varying degrees of EMF and the levels will continue to increase as technology advances. As part of its activity to protect public health and in response to public concern, the World Health Organization (WHO) and other international organizations and scientists all over the world established increased politics and studies for analyzing the effects of EMF in the people's lives. The International EMF Project in 1996 established, according to the scientific evidence of possible health effects of EMF in the frequency range from 0 to 300 GHz.*

Key words: *electromagnetic fields, mobile phone, public health, environment.*

1. Introduction

In the medical sense, the environment includes the surroundings, conditions or influences that affect an organism.

Along these lines, in 2001 the environment was defined for the International Epidemiological Association as “all that which is external to the human host. It can be divided into physical, biological, social, cultural, etc, any or all of which can influence health status of populations” [2].

According to this definition, the environment would include anything that is not genetic, although it could. It is argued that even genes are influenced by the environment in the short or long term. Included environmental factors which can have an impact on our health are the

modifiable parts of: pollution of air, water, or soil with chemical or biological agents; UV and ionizing radiation; noise, electromagnetic fields; occupational risks; built environments, including housing, land use patterns, roads; agricultural methods, irrigation schemes; man-made climate change, ecosystem change; behaviour related to the availability of safe water and sanitation facilities, such as washing hands and contaminating the food with unsafe water or unclean hands. Electromagnetic fields are created by differences in voltage; the higher the voltage, the stronger will be the resultant field.

Magnetic fields are created when electric current flows; the greater the current, the stronger the magnetic field.

¹ Department of Private Law, *Transilvania* University of Braşov.

An electric field will exist even there is no current flowing. If current does flow, the strength of the magnetic field will vary with power consumption but the electric field strength will be constant [5].

Electromagnetic fields are present everywhere in our environment but are invisible to the human eye. Electric fields are produced by the local build-up of electric charges in the atmosphere associated with thunderstorms.

The earth's magnetic field causes a compass needle to orient in a North-South direction and is used by birds and fish navigation. Besides natural sources the electromagnetic spectrum also includes fields generated by human-made sources: X-rays are employed to diagnose a broken limb after a sport accident.

The electricity that comes out of every power socket has associated low frequency electromagnetic fields. And various kinds of higher frequency radio waves are used to transmit information – whether via TV antennas, radio stations or mobile phone base stations [6].

Wavelength and frequency determine an important characteristic of electromagnetic fields: Electromagnetic waves are carried by particles called quanta.

Some electromagnetic waves carry so much energy per quantum that they have the ability to break bonds between molecules. In the electromagnetic spectrum, gamma rays given off by radioactive materials, cosmic-rays and X-rays carry this property and are called “ionizing radiation”. Fields whose quanta are insufficient to break molecular bonds are called “non-ionizing radiation”.

Man-made sources of electromagnetic fields that form a major part of industrialized life – electricity, microwaves and radiofrequency fields – are found at the relatively wavelength and low frequency end of the electromagnetic spectrum and their quanta are unable to break chemical bonds.

After summarizing this information, especially addressed to the ones that are not familiar with scientific professional knowledge and experience, we intend to give a more important relevance to scientific analysis and their results, taking in view that more and more people have started to be interested in this field of study.

2. Health Hazard

2.1. Biological Effects or Health Effects?

Biological effects are measurable responses to a stimulus or to a change in the environment.

These changes are not necessarily harmful to your health. Changes that are irreversible and stress the system for long periods of time may constitute a health hazard. It is not disputed that electromagnetic fields above certain levels can trigger biological effects.

A look at the news headlines of recent years allows some insight into the various areas of public concern.

Over the course of the past decade, numerous electromagnetic field sources have become the focus of health concerns, including power lines, microwaves ovens, computer and TV screens, security devices and most recently mobile phones and their base stations. In 1996, the World Health Organization (WHO) started an International Electromagnetic fields (EMF) Project in order to bring together current knowledge and available resources of important international and national agencies and scientific institutions.

2.2. Conclusion from the Scientific Research

Based on a recent in-depth review of the scientific literature, the WHO concluded that current evidence does not confirm the existence of any health consequences from

exposure to low level electromagnetic fields.

However, some gaps in knowledge about biological effects exist and need further research. Some individuals reported symptoms such as headaches, anxiety, suicide and depression, nausea, fatigue and loss of libido, because of the electromagnetic fields from home.

But the scientific evidence does not find a link between these symptoms and exposure to electromagnetic fields.

2.3. Electromagnetic Fields and Cancer

Despite many studies, carried out especially by WHO, the evidence for any effect remains highly controversial. [3] However, any increase in risk will be extremely small.

The scientific studies concluded that there is no link between increased risk of childhood leukaemia and exposure to low frequency magnetic fields in the home. But some individuals report hypersensitivity to electric or magnetic fields.

They ask whether aches and pains, headaches, depression, lethargy, sleeping disorders or epileptic seizures could be associated with electromagnetic field exposure.

The studies of electromagnetic fields related to cancer have increased lately.

The long-term health effects of mobile telephone use are another topic of much current research. No obvious adverse effect of exposure to low level radiofrequency fields has been discovered.

However, given public concerns regarding the safety of cellular telephones, further more research aims to determine whether any less obvious effects might occur at very low exposure levels, concluded the WHO's scientists.

2.4. The Level of Exposure to Electromagnetic Fields Regarding Portable Telephones

Portable telephones operate at much lower intensities than mobile phones. This is because they are used very close to their home base station and so do not need strong fields to transmit over long distances. The radiofrequencies are negligible.

3. Mobile Phones' Effect in the Environment

3.1. Research Regarding the Mobile Phones Electromagnetic Fields

It was shown that the user of a mobile phone is exposed to radiofrequency much higher than those found in the general environment.

Mobile phones are operated very close to the head. Thus, the scientists have thought that it is important to determine the distribution of absorbed energy in the head of the user.

The result was that the absorbed energy from a mobile phone is not excess of current guidelines. Concerns about the so-called non-thermal effects arising from exposure to mobile phone frequencies have also been raised. These include suggestions of subtle effects on cells that could have an effect on cancer development.

Effects on electrically excitable tissues that may influence the function of the brain and nervous tissue have also been hypothesized.

The available evidence says that the use of mobile phones has any detrimental effect on human health.

3.2. Effects of Diseases in the Developed and Developing Countries

According to statistics, developing regions carry a disproportionately heavy burden for communicable diseases and injuries. For example, in developed countries, the impact of cardiovascular diseases and cancer is higher.

The number of healthy life years lost from cardiovascular disease, as a result of environmental factors, was 7 times higher, in certain developed regions than in developing regions and cancer rates were 4 times higher.

Maybe, along with the physical inactivity which is the main risk factor, the electromagnetic fields and especially the use of mobile phones are another factor for this difference.

All known cancer-inducing agents — including radiation, certain chemicals and a few viruses — act by breaking chemical bonds, producing mutant strands of DNA. Not until the ultraviolet region of the electromagnetic spectrum is reached, beyond visible light, beyond infrared and far, far beyond microwaves, do photons have sufficient energy to break chemical bonds.

Microwave photons heat tissue, but they do not come close to the energy needed to break chemical bonds, no matter how intense the radiation [4].

Other scientists mention that the ionizing radiation can break the electron bonds that hold molecules like DNA together and is carcinogenic. But the photon energy of cell phone or mobile phone EMF is more than 10 million times weaker than the lowest energy ionizing radiation.

So, it is simply not possible for the photons associated with either a power line or a cell phone to cause cancer.

3.3. National Research Council Studies

Many people fear that EMFs cause cancer; however, a causal connection between EMFs and cancer has not been established.

The National Research Council spent more than three years reviewing more than 500 scientific studies that had been conducted over a 20-year period and found "no conclusive and consistent evidence" that electromagnetic fields harm humans.

The chairman of the NRC panel, neurobiologist Dr. Charles F. Stevens, said that "Research has not shown in any convincing way that electromagnetic fields common in homes can cause health problems, and extensive laboratory tests have not shown that EMFs can damage the cell in a way that is harmful to human health.

Numerous epidemiological (population) studies and comprehensive reviews have evaluated magnetic field exposure and risk of cancer in children. Since the two most common cancers in children are leukaemia and brain tumours, most of the research has focused on these two types.

A study in 1979 pointed to a possible association between living near electric power lines and childhood leukaemia. Among more recent studies, findings have been mixed. Some have found an association; others have not.

These studies are discussed in the following paragraphs. Currently, researchers conclude that there is limited evidence that magnetic fields from power lines cause childhood leukaemia, and that there is inadequate evidence that these magnetic fields cause other cancers in children.

Researchers have not found a consistent relationship between magnetic fields from power lines or appliances and childhood brain tumours.

3.4. National Cancer Institute Studies Regarding Electromagnetic Fields

In one large study by the National Cancer Institute (NCI) and the Children's Oncology Group, researchers measured magnetic fields directly in homes.

This study found that children living in homes with high magnetic field levels did not have an increased risk of childhood acute lymphoblastic leukaemia.

The one exception may have been children living in homes that had fields greater than 0.4 microtesla (μT), a very high level that occurs in few residences. Another study conducted by NCI researchers reported that children living close to overhead power lines based on distance measurements were not at greater risk of leukaemia [7].

Although several studies have looked into the relationship of leukaemia, brain tumours, and breast cancer in adults exposed to magnetic fields in the home, there are only a few large studies with long-term, magnetic field measurements. No consistent association between magnetic fields and leukaemia or brain tumours has been established.

Several studies conducted in the 1980s and early 1990s reported that people who worked in some electrical occupations (such as power station operators and phone line workers) had higher than expected rates of some types of cancer, particularly leukaemia, brain tumours, and male breast cancer.

Some occupational studies showed very small increases in risk for leukaemia and brain cancer, but these results were based on job titles and not actual measurements. More recently conducted studies that have included both job titles and individual exposure measurements have no consistent finding of an increasing risk of leukemia, brain tumours, or female breast cancer with increasing exposure to magnetic fields at work.

3.5. Impact of EMF on European People

According to a European Commission study regarding EMF, which was published in June 2007, almost half (45%) of EU citizens believe that mobile phones handsets affect to some extent their health, while almost one third (28%) believe that they affect to big extent and about one fifth (22%) do not expect them to cause any harm.

The EU countries where this concern is felt the most is Greece (64%) and Italy (56%). Making up the EU average of 28% who believed that mobile phone handsets had a major effect on people's health were 30% of women compared with 25% of men.

Nevertheless, 71% of the EU citizens answered that mobile phones are an important source of electromagnetic fields, being the first cause which was mentioned before others.

When citizens across the EU are asked whether they are concerned about the potential health risk of EMF, opinion is divided between those who are very much concerned or fairly concerned (48%) and those who are not concerned at all or who are not very concerned (49%).

When individual countries are examined in detail, wide variations in the underlying data can be seen, while 27% of Swedes, 30% of Danes and 31% of Dutch are concerned with these issues, the figure rises to 69% in Italy and 86% in Greece.

Moreover, according to the European Charter of Human Rights, which came into full legal effect upon the entry into force of the Treaty of Lisbon, on 1 December 2009, the right to environment prevention is stipulated. Therefore, "a high level of environmental protection and the improvement of the quality of the environment must be integrated into the policies of the Union and ensured in accordance with the principle of sustainable development"(Art. no.37). [1]

4. Conclusion

Even though scientific' studies have not found yet a direct cause-effect link between electromagnetic fields generated by mobile phones and some modern symptoms or diseases, a closed approach on this subject is needed.

Maybe regarding the phenomenon from different and new scientific points of view might be a solution in order to inform correctly the public opinion about the side effects of using the mobile phones.

References

1. Borchardt, K.-D.: *The ABC of European Union law*, Publications Office of the European Union, Luxembourg. 2010.
2. Last, J. M.: *A Dictionary of Epidemiology. 4th edition*, Oxford University Press, United States.
3. Dr. Park, R. L. of the American Physical Society, New York Times, October 1st, 2002; www.WHO.org.
4. <http://www.cancer.gov>
5. WHO Regional Office for Europe in 1999, "Electromagnetic fields", Local authorities, health and environment briefing pamphlet series; 32.
6. www.WHO.org.
7. ec.europa.eu/health/EMF/emf_en.htm
8. The Official Journal of the European Union no. 2007/C 303/01, *The European Charter of Human Rights*.
9. The Official Journal of the European Union no.2007/C 303/02, *Explications regarding the European Charter of Human Rights*.