

EMR and Health

Quarterly report on Electromagnetic radiation, health and well-being

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WiFi and reproduction

New studies suggest WiFi signals could have harmful effects on reproduction for both males and females.

At a time when wireless networks are proliferating in homes, schools and preschools, three studies published this year have found that WiFi radiation could negatively impact reproduction.

In one, scientists exposed a group of adult rats to a WiFi-type signal continuously for a year. The exposed group had more testicular problems than the unexposed control group. There were defects in sperm head and reductions in the weight and thickness of parts of the testicular anatomy. The scientists concluded that long-term exposure can affect the testes and advised people against long-term exposure to WiFi radiation.¹

In a second study, scientists exposed male mice to a 2.45 GHz signal for two hours a day for 30 days. They found that exposed mice had lower sperm counts and their sperm was less viable than unexposed mice. Their seminiferous tubules—where sperm develop—had decreased diameters and signs of degeneration and there was evidence of free radical activity. The scientists concluded that exposure to radiation of this sort may result in infertility.²

A third study found that female rats exposed to WiFi signals, particularly those exposed before birth, had reduced postnatal growth and delayed puberty, compared to unexposed rats. They also showed signs of chronic stress.³



Concerns about the long-term effects of wireless radiation have led eminent international bodies to call for children to use wired rather than wireless technologies. Among them are the American Academy of Environmental Medicine (p 3), a Council of Europe committee, the Viennese Chamber of Medical Practitioners, the Russian National Committee of Non-Ionizing Radiation Protection as well as groups of doctors and scientists.

1. Dasdag, S et al, *Electromagn Biol Med*, Jan 24, 2014.)

2. Shahin, S et al, *Free Radic Res*, Feb 4, 2104.)

3. Sangun, O et al, *Electromagn Biol Med*, Jan 24, 2014.)

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SCENIHR science update

The European Commission has published a review of recent scientific literature on EMR and health. Entitled 'Preliminary opinion on potential health effects of exposure to electromagnetic fields (EMF)', it is open to public comment till 16 April.

The document was prepared by the Commission's Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) in order to update the Committee's opinion by considering scientific studies published since its last review in 2009.

The overall finding of the document is that there is little evidence to link exposure to electromagnetic radiation of different frequencies with health problems.

The Committee concluded there is little evidence that exposure to wireless radiation is a problem. 'Epidemiological studies on RF [radiofrequency] exposure do not unequivocally indicate an increased risk of brain tumours, and do not indicate an increased risk for other cancers of the head and neck region, or other malignant diseases including childhood cancer.' It observed that wireless radiation can affect sleep and said that there is little evidence that it can affect reproduction or development.

On the topic of electromagnetic hypersensitivity, the Committee was equally dismissive. 'Symptoms that are attributed by some people to RF exposure can sometimes cause serious impairments to a person's quality of life. However, research conducted since the previous SCENIHR opinion adds weight to the conclusion that RF exposure is not causally linked to these symptoms, but awareness of or belief in presence of exposure is sufficient to trigger the symptoms.'

The Committee did recognise some risk from magnetic fields from electrical sources. 'The new epidemiological studies are consistent with earlier findings of an increased risk of childhood leukemia with daily average exposure above 0.3 to 0.4 μ T [3-4 mG].'

Magnetic fields can also affect spatial memory—both negatively and positively—and can increase anxiety and stress. There is some evidence that exposure caused genetic damage and free radical activity and more research on these needs to be conducted, the Committee concluded. It did not, however, consider there was evidence that magnetic fields could interfere with reproduction.

Further research is also needed on findings that these fields can modify the effect of chemicals and other physical agents, the document concluded.

Exposure to static magnetic fields comes primarily from MRI machines and is likely to increasingly come from DC power lines. The Committee found that high exposures can affect cells and gene expression and more research needs to consider the effects on DNA.

The document 'Preliminary opinion on potential health effects of exposure to electromagnetic fields (EMF)' can be accessed on the European Commission's website at: http://ec.europa.eu/health/scientific_committees/emerging/docs/scenih_r_o_041.pdf;

Guidelines for submissions and the link for online submissions can be found at: http://ec.europa.eu/health/scientific_committees/consultations/public_consultations/scenih_r_consultation_19_en.htm;

A public hearing will be held in Athens on 27 March. Details and online registration are available at: http://ec.europa.eu/health/scientific_committees/events/ev_20140328_en.htm.

UK report

The UK Mobile Telecommunications and Health Research (MTHR) Program has published the remaining results of its 11-year research project. Its 58-page report, released in February, summarises the results of research released since the Program's 2007 report.

Overall, the conclusions of the program are that wireless radiation from mobile sources did not contribute to health problems. It did not find evidence that prenatal exposure radiation from base stations contributed to childhood cancer or that mobile phone radiation increased the risk of leukemia. It did not find evidence that TETRA signals adversely affected health or that modulation affected the way in which living systems respond to radiofrequency radiation.

Alasdair Philips of consumer group Powerwatch said, 'When the MTHR 2012 Report is properly examined, it is really the collective opinion of a few scientists, padded out by some old MTHR documents. It was Press Released in a heavily distorted way by the Science Media Centre (SMC) from their Wellcome Trust London HQ office on behalf of the MTHR. The main statements in the SMC press release were neither accurate nor evidence-based.' His detailed analysis of the report will soon be available on the Powerwatch website at <http://www.powerwatch.org.uk>.

The results of the MTHR program are available online at <http://www.mthr.org.uk/documents/MTHRreport2012.pdf>

Smart meter study

Victoria's Energy Minister, Nicholas Kotsiras, will undertake an energy audit of the smart meter network that has largely been rolled out in the state.

In an interview with Neil Mitchell on radio 3AW, Mr Kotsiras said that his decision was prompted by a review which found that 69 percent of the public were worried about the health effects of the technology which emits radiofrequency signals on a regular basis.

'I've asked the department to commission a safety audit on smart meters and I'll make that report publicly available,' he said on the program.

When EMR Australia asked for details about the study, Mr Kotsiras's office replied only, 'The Minister has asked the Department to commission a larger technical study expanding on earlier work which showed that the electro-magnetic emissions from smart meters fall well within the national health and safety standards set by the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA).'

At the time of publication, the Minister has not responded to our questions about how the study will address the relevant issues of smart meter radiation:

- Will the study be limited to measuring emissions from smart meters?
- Will the results be expressed in measurable units or as percentages of the Australian standard

(Continued on page 6)

Warning labels for phones

The Hawaiian Senate is considering legislation to enforce warning labels on mobile phones. The bill, introduced by Senator Josh Green, says that 'Consumers in the State must be made aware of the potential health dangers that have been linked to the electromagnetic radiation emitted by cellular telephones.'

The bill would require all phones sold or leased in the state to carry the following warning: "This device emits electromagnetic radiation, exposure to which may cause brain cancer. Users, especially children and pregnant women, should keep this device away from the head and body."

The bill requires the warning to be in bold text, to be obvious, located on both the front and the back of the packaging and attached to the back of the phone itself.

The bill passed its second reading on 11 February and has been referred to the Senate Committee on Consumer Protection. Retailers who failed to comply with the bill would be subject to penalties.

A copy of the bill can be found <http://www.capitol.hawaii.gov/session2014/Bills/SB2571 .HTM>

Doctors advocate precaution

The American Academy of Environmental Medicine (AAEM) has advised against the use of wireless technologies in schools.

In a statement issued in November, the Academy's Board said, 'The AAEM strongly supports the use of wired internet connections, and encourages avoidance of radiofrequency such as from WiFi, cellular and mobile phones and towers, and "smart meters".'

In its letter, the Board advanced the reasons that had persuaded it to this view. It referred to the fact that wireless radiation has been classified as a class 2B carcinogen by the International Agency for Research on Cancer. It referred to research showing that WiFi radiation from a laptop has been shown to cause changes to human sperm. It also mentioned that many of the Academy's physicians are treating patients with radiation-related health problems.

'The peer reviewed, scientific literature demonstrates the correlation between RF exposure and neurological, cardiac, and pulmonary disease as well as reproductive and developmental disorders, immune dysfunction, cancer and other health conditions,' the Board wrote. 'The evidence is irrefutable.'

Schools should implement precautions to protect children from wireless radiation, the AAEM advised. 'While more research is being conducted, children must be protected. Wired technology is not only safer, it {is} also stronger and more secure.'

The Board's statement can be read on the AAEM website at: <http://aaemonline.org/docs/WiredSchools.pdf>

"The AAEM strongly supports the use of wired internet connections. ..."

RESEARCH UPDATES

ELF fields (from electrical sources)

Magnetic fields from power lines and wiring may increase the risk of childhood leukemia, say L Zhao and team. The researchers examined data from nine studies, involving close to 24,000 subjects, and found a link between higher exposures and the disease. Children exposed to more than 4 mG had over one and a half times the rate of all childhood leukemias and nearly two and a half times the rate of acute lymphocytic leukemia. This level has been classified as possibly carcinogenic by the International Agency for Research on Cancer. The study also found that children exposed to just 2 mG had 1.3 times the expected rate of the disease. (Zhao, L et al, *Leuk Res*, Dec 15, 2013.)

Working in a high electromagnetic field environment could lead to problems of the endocrine system. R Tiwari and colleagues took blood samples from 142 subjects who worked in a high voltage substation and compared them with samples from unexposed controls. Exposed workers had higher concentrations of the stress hormone epinephrine (adrenalin) as well as DNA damage and oxidative stress. (Tiwari, R et al, *Electromagn Biol Med*, Jan 24, 2014.)

Exposure to magnetic fields may have harmful genetic effects, according to the results of a study published in January. C Mihai and colleagues exposed cells to a high magnetic field (100 Hz, 5.6 mT) for 45 minutes and found that the cells had higher levels of DNA damage than unexposed controls. (Mihai, CT et al, *J Environ Health Sci Eng*.;12(1), 2014.)

Magnetic fields interfered with reproduction and caused genetic damage in an experiment by Greek scientists. D Panagopoulos and colleagues exposed

groups of *Drosophila melanogaster* (fruit flies) to strong magnetic fields (1, 11 or 21 G) for five days after birth. The researchers found that exposure impaired the ability of the insects to reproduce and the higher the intensity of the field, the higher the decline in reproduction. The authors attributed the effect to DNA damage in the insects' reproductive cells. (Panagopoulos, D et al, *Cell Biochem Biophys* 67:703-716, 2013.)

Patients undergoing MRI scans are often exposed to both the ferromagnetic element Gadolinium and magnetic fields. S Cho and colleagues exposed human lymphocytes to Gadolinium with or without exposure to a 60Hz magnetic field. They found that gadolinium caused genetic damage and that this damage was increased by magnetic field exposure. (Cho, S et al, *Drug Chem Toxicol* Jan 30, 2014.)

Other studies on ELF exposure

A 50 Hz field inhibited low-voltage-gated calcium channels in human cells. (Cui, Y et al, *Cell Calcium*, Dec 5, 2013.)

Electromagnetic fields regulated calcium-related activities in cardiomyocytes (cells in heart muscle). (Wei, J et al, *Electromagn Biol Med*, Feb 5, 2014.)

RF wireless radiation

Exposure to radiofrequency radiation could lead to an increase in tumours, according to a study from the Ukraine. A Burlaka and colleagues investigated the production of free radical species—associated with cancer—in the embryos of Japanese quails. They exposed the embryos to a discontinuous GSM signal of



Magnetic fields from power lines and wiring may increase the risk of childhood leukemia”

Abbreviations

RF radiofrequency radiation (including mobile technology)

ELF extra-low frequency radiation (including electrical sources)

EMF electromagnetic fields (often used alternatively for ELF)

mG milliGauss (measurement of magnetic field)

T Tesla - alternative measurement of magnetic field; also millitesla (mT) and microTesla (μ T)

0.1 mT = 1000 mG

0.01 mT = 100 mG

1 μ T = 10 mG

Hz Hertz - a measure of frequency (cycles per second).

Megahertz (MHz) - million Hz

GigaHertz (GHz) thousand million hertz

900 MHz for 158-360 hours early in their development and assessed the levels of free radicals in exposed and unexposed embryos. The researchers found that exposed embryos had an overproduction of free radicals, reactive oxygen species and DNA damage and suggested these changes could lead to cancerous outcomes. (Burlaka, A et al, *Exp Oncol* 35 (3):219-225, 2013.)

The link between radiation from mobile phone base stations and uncomfortable health symptoms has been reaffirmed in a recent study from La Nora, Spain. C Gómez-Perretta and colleagues conducted a reanalysis of data from an earlier study in La Nora, factoring in subjects' concerns about their exposure and mobile phone use. Radiation levels were low at the time of the test.

Nevertheless, the researchers found that exposure to GSM signals from the towers was related to fatigue, irritability, lack of appetite, sleep troubles, depression and concentration problems. These symptoms were unrelated to subject's concerns about the radiation from the towers. The researchers also found that people who used mobile phones had a tendency towards vertigo and loss of appetite. The authors recommended precautions to reduce exposure and further studies on the effects of radiation on the population. (Gómez-Perretta, C et al, *BMJ Open*, 2013; 3(12): e003836.)

Heavy mobile phone use was linked to depression in a study of over 2,700 high school students in Japan. From the results of their questionnaire, the authors found that students used their mobile phones for an average of 24 hours a week. Girls tended to use their phones for longer than boys and heavy users were less likely to take part in sporting activities and to sleep less. Spending long periods of time on a mobile phone was linked with 'depressed mood', 'tension and excitement' and 'fatigue'. The authors suggested that limiting mobile phone use might benefit mental health. (Ikeda, K and Nakamura, K, *Environ Health Prev Med*, Dec 18, 2013.)

Exposure to WiFi signals caused oxidative stress, but treatment with olive leaf extract

counteracted the effects. Scientists exposed rats to a wireless signal of 2.45 GHz for one hour a day for 21 days. They found that exposed rats had problems with glucose metabolism and found diabetes-like effects that they concluded were caused by oxidative stress. Rats who had been pretreated with olive leaf extract did not exhibit these symptoms. (Salah, MB et al, *Environ Toxicol Pharmacol* 36(3):826-34, 2013.)

Exposure to mobile phone radiation was associated with lesions in various body organs. The authors exposed 20 male rats to a GSM mobile phone signal of 900 MHz at different intensities for 30 days. They found that exposed rats had more lesions in tissues of the heart, liver or kidneys. (Sepehrimanesh, M et al, *Comparative Clin Pathology*, Nov 2013.)

Mobile phone radiation has can cause oxidative stress in phone users. Researchers took saliva samples from 12 males before and after they used a mobile phones for 15 or 30 minutes. The scientists found that phone use increased the level of superoxide dismutase which is one of the body's primary antioxidant defences. (Abu Khadra, KM et al, *Electromagn Biol Med*, Feb 5, 2014.)

WiFi radiation was shown to cause physiological problems in a study by L Tök and team. The scientists exposed rats to a WiFi signal for one hour and found damage to the eye lens. This damage was ameliorated by pretreatment with the free-radical scavenger, melatonin. (Tök, L et al, *Indian J Ophthalmol* 62(1):12-5, 2014.)

Mobile phone radiation could have a harmful effect on hearing. D Maskey and M Kim found that mice exposed to mobile phone-type radiation had decreased levels of two neurotrophic factors which help protect against hearing defects. (Maskey, D and Kim, MJ, *Neurosci Lett*, Feb 15, 2014.)

Studies showing no effects

Long-term mobile phone use was not found to increase the risk of acoustic neuromas. (Pettersson, D et al, *Epidemiology* Jan 15, 2014.)

Exposure to mobile phone radiation was associated with lesions in various body organs...



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Exposure to a pulsed signal did not affect IVF-fertilization success in mice. (Hafizi, L et al, *Cell J* 15(4):310-5, 2014.)

Powerlines and leukemia

A study by British scientists published in the *British Journal of Cancer* has sparked controversy on the connection between magnetic fields from high voltage powerlines and childhood leukemia. Findings of the study, by Kathryn Bunch and colleagues, contradicted those of many earlier studies which linked these fields with increases in the disease.

‘Overhead power lines don’t raise leukaemia risk in children’, the authors wrote in their press release. Instead, they attributed increased risks of the disease to ‘changing population characteristics’. However, the plethora of studies that have found and confirmed this association are not so easily dismissed.

Alasdair Philips, Director of Powerwatch, says the Bunch study is misleading. ‘The supplementary data tables (not in the actual paper) do show a relative risk of about 1.5-fold up to 199 metres over 4 decades 1962-2000 for 132 kV powerlines—the type generally close to residential housing,’ he said.

Also relevant to the discussion is that high magnetic fields are produced by other electrical sources—such as wiring or appliances. In other words, just because children don’t live near powerlines does not mean they are not exposed and this exposure can skew the results of the study towards a nil effect.

Reviews have found increased risks of childhood leukemia at exposures of 4 mG and above. Based on this evidence, the International Agency for Research on Cancer classified such fields as class 2B carcinogens in 2001.

*Bunch, K.J. et al Residential distance at birth from overhead high-voltage powerlines: childhood cancer risk in Britain 1962-2008 *British Journal of Cancer* (2014) DOI: 10.1038/bjc201415; Powerwatch press release, 07.02.14.)

Mobile phones and children

At the very time that many international authorities are urging precautions to limit children’s exposure to mobile phone radiation, the amount of children’s exposure is growing, if the results of a study in Korea are any indication.

Korean scientists investigated how many children and teens used mobile phones and how often. They found, not surprisingly, that in 2011 more children owned mobiles than they had three years previously and that children’s use of the phones had also increased during that period. In 2011, children first acquired a mobile around the age of eight and a half (compared to 12 and a half previously) and 90 percent of children owned mobiles by the time they reached fifth grade.

They also found that mobile phone ownership was associated with lower socioeconomic status and less-educated parents.

Based on their findings, the authors recommended precautions to limit children’s exposure to mobile phone radiation. (Byun, YH et al, *Environ Health Toxicol* 31 Dec, 2013.)

(Continued from page 3)

(which is based on the heating, rather than non-heating effects of radiation)?

- Will the study provide information about the waveform of signals from smart meters?
- Will it include opportunity for people to provide comment about their health experiences since the installation of smart meters?
- In what ways will the study differ from the technical report by EMC Technologies for the Victorian government?
- What are the terms of reference for the study?
- When will the study begin and the results to be available?

Mark Florio, spokesman for ‘Stop Smart Meters Australia’, called on the Victorian government to suspend the rollout of the network pending the results of the investigation and called for the audit to be genuinely independent. He said, ‘it is imperative that the personnel concerned have no vested interest in the outcome.’

(3AW, 29.01.14, www.3aw.com.au/blogs/neil-mitchell-blog/minister-signals-energy-overhaul/20140129-31m0r.html)

Smart meter measurements

Australia’s radiation authority has released its measurements of a smart meter in Victoria. ‘Technical Report Series, No 163, <http://www.arpana.gov.au/pubs/technicalreports/tr163.pdf>

UPDATES FROM AROUND THE WORLD

Tower rejected

A US city has won a lengthy legal battle to stop a mobile phone tower being constructed. Surf City originally approved plans for T-Mobile to construct two mobile phone antennas but later asked the company to delay construction till voters approved the project.

In mid December, the 9th US Circuit Court of Appeals affirmed the city's position. Unless constituents have a change of heart, construction of one of the two towers will not go ahead. (*HB Independent*, 16.12.13.)

School WiFi concerns

A New Zealand school has removed WiFi from junior classrooms following concerns about the impacts of the radiation on students' health. The board of the Te Horo School made the decision to replace the wireless internet with cabled connections following the death of a 10-year-old student from a brain tumour. Concerns were raised that the death might have been connected with wireless exposure. (*TVNZ*, 29.12.13.)

Phone tower study

A pilot study conducted in India suggests that exposure from mobile phone base stations may trigger unpleasant symptoms. The *Times of India* reports that the study was conducted by scientists from the Netaji Subhas Chandra Bose Cancer Research Institute on 200 subjects living under or within 50 metres of mobile phone antennas. The most commonly-reported symptoms were tiredness, memory and concentration problems, dizziness, sleep problems, skin problems, hearing problems and heart problems. Many reported feeling better when they were away from home. (*Times of India*, 17.12.13.)

Scientist's advice

A prominent Indian scientist is reported as advising that children should not be exposed to electromagnetic radiation. According to the *Deccan Chronicle*, Dr Kogelen Govvin, an expert in DNA repair, recommended keeping children away from high fields from electrical or wireless sources to prevent them developing cancer. Dr Govvin is the chief scientist in DNA repair for Aaride International Inc. (*Deccan Chronicle*, 03.12.13.)

Canadian tower vote

The Canadian city of Guelph has voted on a temporary halt to the construction of base stations in its administration. According to the *Guelph Mercury*, the city decided not to approve applications for the towers until the Royal Society of Canada decides whether or not to review the country's safety standard. (*Guelph Mercury*, 10.12.13.)

Californian tower regulations

The Californian city of San Marcos has developed a draft plan to regulate the location of mobile phone antennas. According to *The San Diego Union-Tribune*, the draft ordinance was developed to regulate the number of antennas that can be constructed on a single property. Currently Federal regulations prevent cities from refusing applications for base stations on health grounds. (*San Diego Union-Tribune*, 11.12.13.)

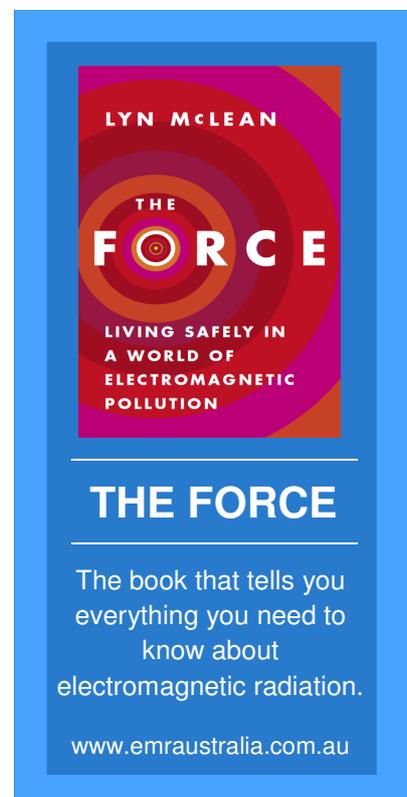
French legislation

On 23 January, the French Assembly endorsed a bill to limit public exposure to wireless radiation. The new legislation will prevent the advertising of mobile phones to children under 14 and encourage the

use of hands-free sets. It will also prevent the use of WiFi in facilities caring for children under the age of three. (*Le Monde*, 24.01.14.)

In his speech to the National Assembly on the Bill, André Chassaigne referred to the increase in electromagnetic smog and said that the WHO had classified radiofrequency radiation as a possible carcinogen. He said that the aim of the bill is not to restrict technology, but to improve consultation on the location of base stations, to protect vulnerable people such as children and to consider people with electromagnetic hypersensitivity.

Mr Chassaigne said that the principle of ALARA—As Low As Reasonably Achievable—should be applied to exposure and that there should be a limit of 0.6 volts per meter for public exposure to wireless signals. (André Chassaigne, Speech to National Assembly, 23.01.14.)



Cell phone radiation, health risk & precaution

Guest writer Professor Dariusz Leszczynski shares his views on the state of the science and what is needed for protecting the public from mobile phone radiation.

On April 23, 2010 I gave a remote presentation to the scientists at the US Food and Drug Administration. The topic of my presentation was “To assure mobile phone safety we need further research” and I called for a new research program. However, I was not calling for just another research program to study cell phone radiation. I was not calling for what we have done for the last few decades – some haphazard research, the waste of lots of money and scientific data that are useless for safety standards and policy-setting committees. I called for targeted research where, whenever ethically permissible, the bulk of work would be examining effects of cell phone radiation on human volunteers. Such information is needed to assure society that cell phones are safe for use.

When debating cell phone radiation and health, the opponents of further research often argue that we have many thousands of studies and we know enough to say that cell phone radiation does not cause health effects now and it is unlikely that situation will change in the future. Moreover, we have in place safety standards with broad safety margins that protect all persons, no matter how young or old, no matter how sick or healthy, no matter whether pregnant or not.

Both of the above claims are myths. They are dangerous myths that are propagated by many organisations and individuals under the umbrella of “scientific validity” given to them by the World Health Organization (WHO) and the International Commission on Non-Ionizing Radiation Protection (ICNIRP).

How much of research on cell phone radiation and health is really available?

The [EMF Portal](#) is a specialised database collecting all publications on the effects of electromagnetic fields, including cell



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phone radiation.

Currently the EMF Portal lists a total of 18,799 studies. However, the vast majority of these studies are irrelevant to cell phone issue. Cell phone radiation was used in only 182 studies in the epidemiology category and 807 studies in the experimental category. This means total of only 989 studies on cell phone effects up to Feb. 10, 2014! It is important to remember that the vast majority of these 989 studies were done using animal models and have no direct relevance to evaluating human health risks.

This is not much research at all and it is relatively recent.

Cell phone users are seriously misled when buying cell phones. They assume that this product was safety checked before it was put on the market. They assume that it is safe to use. But these assumptions might be wrong.

Cell phones were not tested for their safety before they were put on market

years ago. This is the first time in the history of human kind that we have put radiating devices directly to our heads and exposed our organs, including brain, to deep-penetrating microwave radiation. Any comparisons with TV stations, made to alleviate our worries, are a sham. We, the users, never have a working TV antenna touching our head. On the other hand we have a microwave radiation-emitting cell phone that, by design of modern engineers, works as an antenna itself.

Engineers and dosimetry experts try to convince us that cell phone-emitted microwave radiation causes only thermal effects and that any potential health danger caused by thermal effects is prevented by the 1998 ICNIRP safety standards.

These statements are, however, not true.

Non-thermal biological effects of cell phone radiation exist and were shown and confirmed in numerous experimental studies. The problem is, and this helps in dismissing non-thermal effects as either non-existent or irrelevant to human health, that the vast majority of studies showing non-thermal effects are animal studies and studies on cells grown in laboratories.

There has been a lack of funding for studies to examine non-thermal effects in human volunteers. There are in existence only three (!!!) human volunteer studies examining effects of cell phone radiation exposures on protein expression in skin ([Karinen et al. 2008](#)) and on glucose metabolism in brain ([Volkow et al. 2011](#); [Kwon et al. 2011](#)). All three studies were small pilot studies but all three have shown that cell phone radiation, at levels allowed by current safety standards, might induce biological effects in a living person.

There is ongoing debate whether cell

phone radiation causes health effects in humans but only three studies examined, and showed, the possibility of non-thermal effects of cell phone radiation in human volunteers.

There is an even bigger scientific problem with the radiation dosimetry itself. The model used by scientists to determine radiation distribution in human brain consists of plastic mould in a form of half-head that is filled with water solution of salt and sugar.

Scientifically, it is an absolutely ridiculous model. In it, exposed ions are free to move around in the liquid. There are no obstacles. In real living cells in our brains, the situation is absolutely the opposite. Ions do not move freely. There are compartments where some ions are permitted to be and some ions are not. The ions are prevented, by various mechanisms, from moving freely. There are gradients of ions forming gradients of electric potentials that are the basis of functioning in our cells and tissues, the brain included. The function of our whole body depends on electric currents.

That is why the dosimetry model of a mould with fluid where ions can move freely is scientifically ridiculous. It is a “dinosaur” — a relict from the times when computers had very little computing power and, to “crunch numbers”, the models had to be very simple.

Even with all the above-mentioned limitations of the scientific evidence, WHO and ICNIRP claim that current safety standards are sufficient to protect everyone.

However, there is evidence that this is not the case: safety standards are inadequate to protect users.

In 2011 a group of experts* met at the International Agency for Research on Cancer in Lyon, France and, for nearly two weeks, debated whether cell phone radiation can cause brain cancer. The result of this debate was the classification of cell phone radiation as a possible carcinogen to humans. The basis for this classification was provided by epidemiological, case-control studies

showing that avid use of cell phone (ca. 30 min/day for over 10 years period) leads to increased risks of brain cancer — glioma.

This IARC classification invalidates current safety standards.

In epidemiological, case-control studies used by IARC, participants used regular, off-the-shelf, cell phones. These cell phones were built to fulfill ICNIRP safety standards. However, avid use of such “safe” phones for period of over 10 years led to increased risk of brain cancer.

This means that the current safety standards do not sufficiently protect users of cell phones.

This situation of scientific uncertainty, until resolved, calls for implementation of the Precautionary Principle (PP).

There are several conditions that need to be fulfilled before debating implementation of the PP:

The PP can be implemented when the scientific information is insufficient, inconclusive, or uncertain. The IARC classification of cell phone radiation as a possible carcinogen has clearly shown that the information on health effects of cell phone radiation is “insufficient, inconclusive, or uncertain”

The PP can be implemented when there are indications that the possible effects on human health may be potentially dangerous. The IARC classification of cell phone radiation based on the evidence from epidemiological case-control studies has pointed out that avid long-term cell phone users are at an increased brain cancer risk — this is a potential danger to some 5 billion of cell phone users.

The PP can be implemented when the current situation is inconsistent with the chosen level of protection. The IARC classification pointing out to an increased brain cancer risk is based on epidemiological studies where subjects used regular cell phones meeting current safety standards; this means that the current safety standards are insufficient to protect users.

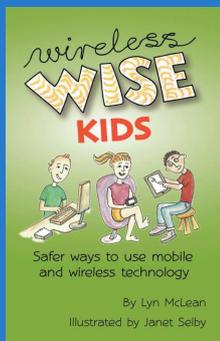
My final conclusion is that the outdated and obsolete 1998 ICNIRP safety

standards should be tightened to reflect the current status of the knowledge and to protect cell phone users. In the meantime, until more evidence about the safety of cell phones is gathered in targeted research programs, and based on IARC 2011 classification, authorities should consider implementing the Precautionary Principle.

* Professor Dariusz Leszczynski was one of the 30 experts invited by IARC to evaluate carcinogenicity of cell phone radiation in May 2011

Disclaimer: opinions presented are author's own expert opinions and should not be considered as opinions of any of his employers

You can read more in Dariusz's science blog: [BRHP – Between a Rock and a Hard Place](#) and follow him on twitter: @blogBRHP



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Disability and EHS

Does the WHO's new report on disabilities herald a better future for people with electromagnetic hypersensitivity?

On 3 January the World Health Organization (WHO) released a draft plan for improving the health of people with disabilities. The plan is based on the World Report on Disability released the previous May which shows that approximately 15% of the population have disabilities and the incidence is rising.¹

The goal of the WHO's plan is to 'contribute to achieving optimal health, functioning, well-being and human rights for persons with disabilities.' It envisages a society in which people with disabilities have 'equal rights and opportunities' and can 'achieve their full potential'.

So what is a disability and does it apply to people with electromagnetic hypersensitivity?

The WHO says, 'this action plan uses "disability" as an umbrella term for impairments, activity limitations and participation restrictions, denoting the negative aspects of the interaction between an individual (with a health condition) and that individual's contextual (environmental and personal) factors.'

Certainly this definition appears to apply to the condition of electromagnetic hypersensitivity. Many people with this condition report serious impairments in their activities and their ability to function in society. Some are unable to venture into public areas where signals from mobile phones, WiFi and phone towers are present. This often prevents them accessing public transport, medical treatment and enjoying normal social interactions.

The WHO recognises the condition of electromagnetic hypersensitivity. In a fact sheet published in 2005, it described the condition as follows:

EHS is characterized by a variety of non-specific symptoms, which afflicted individuals attribute to exposure to EMF. The symptoms most commonly

experienced include dermatological symptoms (redness, tingling, and burning sensations) as well as neurasthenic and vegetative symptoms (fatigue, tiredness, concentration difficulties, dizziness, nausea, heart palpitation, and digestive disturbances).²

However, the Organization does not necessarily believe that these symptoms are caused by exposure to EMR, despite the fact that studies have found a correlation between symptoms and exposure. Another problem is that EHS has not been officially classified as a disability.

The WHO document includes an action plan designed to achieve its aim of better health for people with disabilities. The action plan talks about 'non-discrimination', 'accessibility' and 'respect' - basic rights that are not enjoyed by people with EHS.

In order for people with EHS to enjoy the full benefits of the WHO's action, plan, it would be necessary for authorities to, firstly, recognise EHS as a disability and, secondly, recognise that EHS is triggered by exposure to electromagnetic radiation. Because the incidence of EHS appears to be increasing, it is likely to be only a matter of time before this connection is recognised. When it is, how might the three objectives of the WHO plan be applied to this condition?

Here are our suggestions.

Objective 1:

'To remove barriers and improve access to health services and programs.'

How this might be applied to EHS:

Doctors could be given information and training in the existence of EHS;

Medical facilities (doctors' surgeries and hospitals) might be low-EMR zones and this could be achieved by use of shielding,

wired technologies and signage requesting patients and staff not to use wireless devices.

Doctors could make home visits to patients with EHS who find it difficult to travel to appointments.

Objective 2:

'To strengthen and extend rehabilitation, habilitation, assistive technology, assistance and support services, and community-based rehabilitation.'

How this might be applied to people with EHS:

EMF-free accommodation could be provided and low-cost shielding could be provided for homes.

Assistance with essential services could be provided, including shopping, banking, and low-EMR transport.

Objective 3:

'To strengthen collection of relevant and internationally comparable data on disability and support research on disability and related services'.

How this might be applied to EHS:

Resources could be made available for independent research on EHS focusing on causes, biological changes related to exposure and remediation.

References:

1. WHO Secretariat, 'Disability—Draft WHO global disability action plan 2014-2021: Better health for all people with disabilities,' Executive Board, 134th session, Agenda item 7.3, 3 January 2014.

2. WHO, 'Electromagnetic Fields and Public Health—Electromagnetic Hypersensitivity', Fact Sheet, December 2005, <http://www.who.int/peh-emf/publications/facts/fs296/en/>

WATT'S THE BUZZ?

Wireless action

A French man has taken drastic measures to reduce the suffering that he claimed was caused by wireless radiation from a school near his apartment. The 50 year-old man entered the school, removed a teacher and cut the power to the building to turn off the wireless signals. The court of Besançon fined the man 1000 Euros. (Macommune, 08.01.14, <http://www.macommune.info/article/un-homme-electro-sensible-condamne-pour-setre-introduit-dans-une-ecole-et-avoir-coupe-le-cou>)

Big mama

Wondering where your child is? Consult your wristband.

Technicians from British company KMS have developed a wristband that combines the functions of mobile phone and GPS. The wireless-emitting device allows parents to locate and track the location of their child on an internet map. Further, when a parent calls a child, the child's wristband automatically answers. (*The Guardian*, 10.01.14.)

Hot debate

Danish school students have provoked a debate about the safety of wireless radiation.

The fifteen-year-old girls conducted a school experiment to assess the impact of radiation from WiFi routers on cress plants. The girls placed half of the plants near two WiFi routers and the remainder in a room without wireless signals. The plants in the wireless-free environment grew, but many of those near the router died.

Whether the plants suffered from the wireless signals themselves or from the heat from the wireless routers is not clear. (*Mail Online*, 23.12.13.)

Cold comfort

Is taking objects in and out of your fridge getting too hard for you?

Relax—the smart fridge is on its way.

Thomas Sandholm and scientists from South Korea have developed a CloudFridge that can do just about everything but the shopping.

The new fridge can take photos of foods as they go in or out of the fridge and send them off for image recognition. It can highlight foods that the householder needs to use or throw out. It responds when the owner voices the name of a food and it may even send information about the contents of the fridge to social networks! (*Technology Review*, 13.01.14.)

Strike out

Using wireless technology at the Australian Open netted a British man a court appearance. Thomas Dobson was arrested for sending point-by-point information about a tennis match to his employer, betting company Sporting Data, so that it could be used to place bets before the match aired on TV. Mr Dobson transmitted information about the match between Fernando Verdasco and Ze Zhang via a wireless device sewn into his shorts and connected to his mobile phone. (*Herald-Sun*, 17.01.14.)

Chatter-boxes

It's not just people who use wireless technology to chat with each other.

Soon cars will be doing it too!

The United States government has approved the use of wireless devices in cars to communicate traffic information such as approaching risks. A report on the project will be released for public comment. (*The Australian*, 04.02.14.)

Not-so-smart trial

Australia's government-funded Smart Grid, Smart City Program may not have been so smart after all.

The \$20 million project, run by AusGrid, aimed to enlist 30 000 households to gather information about the benefits and costs of smart technologies. However, the project did not retain sufficient participants for the trial to be effective, according to the Australian National Audit Office as approximately half of the original 8000 households dropped out during the 2010-2014 trial period. (*Itnews*, 20.01.14.)

Cold war

A refrigerator is among the smart devices implicated in a cyberattack that took place in late December and early January.

According to internet security firm Proofpoint, the smart devices were hacked and used to send hundreds of thousands of spam emails across the globe. The company said the smart devices are easier to infiltrate than mobile phones and computers. (*Science Recorder*, 18.01.14.)

Hybrid technology

Move over wireless phones and tablets. Make way for the phablet.

A smart phone with a 14 cm display, the phablet allows users to play games on their phones. So popular are the devices, that that sales are expected to exceed 120 million by 2018. (*Australian IT*, 22.01.13.)

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Wireless technology and happiness

Manufacturers of wireless gadgets would have us believe that owning the latest product will make us happier and better students. But that's not necessarily so—and now there's research to prove it.

Researchers from Kent University in the UK have found that not only can heavy use of wireless devices impede happiness, but it can increase anxiety and lower academic performance.

The study, conducted by Drs Andrew Lepp, Jacob Barkley and Aryn Karpinski, from the University's College of Education, Health and Human Services, looked at the relationship between students' mobile phone use and their satisfaction with life.

'In our study we surveyed over 500 undergraduate students representing 82 self-reported majors,' Dr Lepp told EMR and Health. 'We measured daily cell phone use, anxiety (using Beck's Anxiety Inventory), and happiness (using the Satisfaction with Life Scale). All participants gave us permission to access their official university records which we used to measure academic performance.'

The results showed a negative correlation between happiness and the use of wireless devices. 'Analysis showed that, as cell phone use increased, academic performance decreased, anxiety increased and, as a result, happiness decreased,' said Lepp. 'Thus our model ultimately connects daily cell phone use with happiness as the students in our study who used the cell phone more often were less happy than their peers who used the cell phone less.'

Lepp and his colleagues found some interesting consequences of mobile phone use. 'Interview data we collected as part of another study suggests that high frequency cell phone users feel more anxious than their peers who use the cell phone less because of a burdensome sense of obligation to remain constantly connected, at all times, to their social networks.'

'Also, high users were more likely to mention a fear of missing out and to experience this as stressful.'

'In a separate study, we found a negative relationship between cell phone use and physical activity and fitness. This could also play a role as we know that physical activity is a healthy stress reliever.'

The research findings have implications for students' use of mobile phones and other wireless devices. Lepp and his colleagues recommend that students monitor their mobile phone use and take steps to reduce their exposure, including unplugging the phone for a while each day.

'In several studies that we have conducted now, the healthiest individuals (mentally and physically) used the cell phone on average less than three hours per day. This seems like a lot but heavy users are on the device constantly – upwards towards eight hours a day. Thus the heavy users, who clearly are suffering from greater anxiety, reduced academic performance and reduced happiness, should try to limit their use of phones and similar devices to three hours per day,' Lepp advised.

'Take baby steps, reduce use gradually. Include all your friends because it is likely your social network which is contributing to your heavy use. Set limits, find alternative leisure activities to fill your free time.'

Andrew Lepp et al, 'The relationship between cell phone use, academic performance, anxiety, and Satisfaction with Life in college students', *Computers in Human Behavior*, Volume 31, February 2014, Pages 343–350

"Analysis showed that, as cell phone use increased, academic performance decreased, anxiety increased and, as a result, happiness decreased ..."



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