EMR and Health

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Mobiles and infertility

New research shows mobile phone use impairs sperm motility and can impact fertility

Infertility currently affects between 7 and 15 percent of married couples or 186 million people world-wide – and half of these are men.

One of the critical factors affecting male fertility is sperm motility – the ability of sperm to move forward at a reasonable rate in order to achieve fertilisation. Research has shown that sperm motility has declined in recent years and one of the reasons for this is mobile phone use, says Lanfeng Xing, from the Department of Reproductive Endocrinology at Zhejiang University, China.

To explore the link between mobile phone use and sperm motility, Xing's team investigated 1634 healthy men aged 20 to 40 years, with an average age of 31. They conducted a survey of the men to ascertain their mobile phone use and collected samples of their sperm for analysis.

The researchers found that mobile phone use did affect sperm motility and that the more men used their mobile phones, the less motile were their sperm. '[T]he daily duration of mobile phone use had a statistically significant effect on sperm motility. When the daily duration of mobile phone use increased by 1 unit, the percentage of progressively motile spermatozoa decreased by 1.29% …, the percentage of rapid progressive motile spermatozoa decreased by 0.88% …, and the percentage of total motile spermatozoa decreased by 1.47%,' the authors wrote.

The reduction in motility was not affected by whether or not the participants used earphones with their mobiles or where on their bodies the men carried their mobile phones.

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In This Issue

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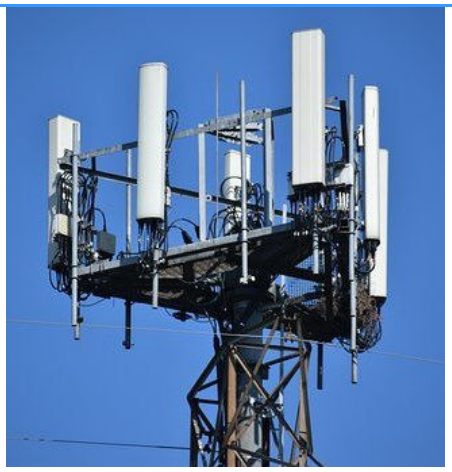
The authors say that that the radiation emitted by the phone is likely to damage sperm by causing oxidative stress – free radicals that have been shown in previous research to decrease sperm motility and, in some cases, damage sperm DNA.

The authors offer a word of warning to mobile phone users.

'We believe that mobile phone RF-EMR [radiofrequency electromagnetic radiation] may be the main cause of sperm motility decline. These trends suggest that recent concerns about long-term exposure to RF-EMR from mobile phones should be taken more seriously, given the growing trend of deterioration of the male reproductive system. Thus, the duration of mobile phone use should be reduced in daily life in order to avoid further declines in sperm motility…'

Zhang S et al, 'Effects of mobile phone use on semen parameters: a cross-sectional study of 1634 men in China'. *Reprod Fertil Dev*. 2022 May;34(9):669-678. doi: 10.1071/RD21234. PMID: 35436442.

Mobile phones and phone towers—are they safe?



Is the radiation from mobile phones and their base stations safe?

To answer that question, Professor Ganesh Jagetia conducted a review of the relevant research and, in a paper published recently, reached some alarming conclusions.

'The twenty-first century can be regarded as the age of cell/mobile phones,' he said and pointed out that there are now one and a half mobile phones for every person on the planet!

The radiation from these devices and the base stations that support them adds to the electromagnetic fields found in nature and is more dangerous to human health than the natural fields are. One of the reasons for this that, he says, is that, unlike naturally-occurring radiation, man-made radiation is coherent and polarized.

In his review, Jagetia found studies showing that the radiation from wireless communications did not produce any harmful effects. However, he found more studies showing they did cause harmful effects than those that didn't. 'These investigations indicate that WC [wireless communications] EMF radiation has adverse health effects on humans/animals,' he wrote.

Jagetia referred to research showing that people living near mobile phone towers developed unpleasant symptoms such as:

- headaches
- tiredness

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- tinnitus
- memory, concentration and cognitive problems
- depression
- skin problems
- cardiovascular problems
- and hormonal issues.

Other research showed that mobile phone use caused 'tactile hallucinations, dry eyes, De Quervain's tenosynovitis, nomophobia, computer vision syndrome, weakness in thumbs, rigidity of hands, and wrist, stiff neck, insomnia insecurity, delusions, auditory and sleep disturbances, insomnia, hallucinations, reduced self-confidence, anxiety, stress, and mobile phone addiction disorders.'

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Further, these problems occurred at levels of exposure allowed by Australian standards and international (ICNIRP) Guidelines and at levels too low to cause the heating effects that they are designed to protect against.

Professor Jagetia also referred to research showing that mobile phone use increased the risk of several types of brain tumours and pointed to increased rates of brain tumours in young people in the USA.

Mobile phone radiation can also have harmful effects on reproduction in humans and animals, he found. He referred to research showing that:

- female rats, exposed when pregnant, had more dead embryos and foetal damage
- women exposed during pregnancy had more miscarriages, more children with low birth rates and more preterm births
- human semen, exposed to mobile phone radiation, had reduced quality, motility and viability
- rat sperm, exposed to mobile phone radiation, had reduced fertilising ability.

Given the widespread use of mobile phones in society, Professor Jagetia's findings have important implications for all of us.

Professor Ganesh Jagetia is formerly from the Department of Zoology, Cancer and Radiation Biology Laboratory at Mizoram University in India.

Ganesh Chandra Jagetia, 'Genotoxic effects of electromagnetic field radiations from mobile phones', Environmental Research, 2022, 113321, ISSN 0013-9351,https://doi.org/10.1016/j.envres.2022.113321; https://www.sciencedirect.com/science/article/pii/S001393512200648X)

Nurses address electromagnetic pollution

There's no doubt that electromagnetic fields affect people's health and now nurses are taking an interest, too.

In a new open-access textbook for nurses, The Alliance of Nurses for Healthy Environments (ANHE) addresses the issue of electromagnetic pollution and makes recommendations about what nursing staff – and families – can do to reduce exposure.

'Humans are electrical beings. Our cells communicate with tiny electrical impulses which affect our heart, our brain, our nervous system, and our endocrine system,' say Catherine Dodd and Theodora Scarato, writing in the second edition of 'Environmental Health in Nursing'. They point out the importance of the environment for human health and say that 'a healthy environment is a universal need and fundamental human right.'

The authors explain the harmful effects of exposure – including damage to DNA, reproduction, the nervous system and brain development. They discuss its impact on different systems of the body and how it contributes to electromagnetic hypersensitivity (EHS) – the myriad of unpleasant symptoms that people can develop when they've been exposed.

The most vulnerable to exposure are children, the authors say. They not only absorb more radiation than adults, but actively growing cells are more sensitive to it as well.

The authors refer to policies that governments of different countries have introduced to reduce people's exposure, and make recommendations about how exposure can be reduced, for example, during pregnancy, at home and when using mobile phones.

'Nurses can integrate their understanding of EMFs into their clinical practice and include interview questions about technology use and EMF exposure in their assessments. When patients present with EHS symptoms, such as headache, insomnia, irritability, they should be further assessed for EMF sensitivity,' the authors say.

Catherine Dodd and Theodora Scarato. "A New Form of Environmental Pollution: Wireless and Non-Ionizing Electromagnetic Fields." 'Environmental Health in Nursing', 2nd Edition, edited by Ruth McDermott-Levy, Kathryn P. Jackman-Murphy, Jeanne Leffers, and Adelita Cantuz, Mt. Rainier, MD: Alliance of Nurses for Healthy Environments, 2022, pp. 136-153. URL: https://envirn.org/e-textbook/.

Children and mobile phones

Children's use of mobile phones has increased dramatically and a part of the body that is most exposed to the radiation they emit is their lips and cheeks. To see whether mobile phone use affected this part of the body, researchers from India conducted a study on the buccal mucosa of different groups of children.

The buccal mucosa is the lining of the lips and cheeks and is one of a number of mucosa in the mouth that play important protective roles. They protect deeper tissues from mechanical damage and help prevent toxins from entering the body and sensing pain, temperature and taste.

Voleti Sri Srujana Aravinda and team selected 90 children and divided them into three groups according to how much time they spent using a mobile phone each day. The groups consisted of children who used a mobile for 1 -2 hours; 3-6 hours or more than 6 hours a day.

The researchers took swabs from each child and analysed them.

They found that the more time children spent using mobile phones, the greater the harmful effects (cell death and chromosome damage) on the buccal mucosa. Not surprisingly, children who used mobile phones for more

than 6 hours a day had the most damage.

Srujana Aravinda VS, Kandregula CR, Muppa R, Krishna MM, Nikitha BS, Yenni M. A cross-sectional and histological analysis to understand the cytological effects of cell phone radiation on buccal mucosa of children. J Indian Soc Pedod Prev Dent. 2022 Jan-Mar;40(1):74-80. doi: 10.4103/jisppd.jisppd_28_22. PMID: 35439887.

Bacteria

Wireless radiation has been shown to affect bacteria in a study from the Slovak Republic.

Researchers exposed three different strains of bacteria to radiofrequency radiation of different frequencies (1-5 GHz for three hours and 2.4 GHz for 24 hours).

They found that exposure caused changes to the bacterial biofilm. [A biofilm is a colony of microbial organisms that can cause infections.]

The production of bacterial biofilm was either increased or decreased, depending on the frequencies. The researchers observed an increase in biofilm production at 1, 2 and 4 GHz and a reduction in biofilm production at 2.4, 3 and 5 GHz.

Bujňáková D, Bucko S, Češkovič M, Kmeť V, Karahutová L. The effect of exposure to non-ionising radiofrequency field on *Escherichia coli, Klebsiella oxytoca* and *Pseudomonas aeruginosa* biofilms. Environ Technol. 2022 May 4:1-21. doi: 10.1080/09593330.2022.2074317. Epub ahead of print. PMID: 35506486.

Phone tower turned off

The court of Clermont-Ferrand in France has ruled that a 4G mobile antenna on a phone base station be turned off for two months after a dairy farmer claimed that it was negatively affecting his herd. Frédéric Salgues, whose farm is located 200m from the base station, said that shortly after the antenna was installed, there was a 15-20% drop in milk production and 20% of his herd died.

In his testimony in the court case, Mayor Philippe Molhérat, described the situation as ‘a catastrophe’ and expressed concerns about the impact of the radiation on the residents of the village.

https://www.connexionfrance.com/article/French-news/French-court-orders-4G-antenna-switch-off-over-cow-health-concerns

Cognition

Researchers from the United States have found that wireless radiation affects brain cells of the hippocampus.

Ibtissam Echchgadda and team exposed primary hippocampal neurons to a low dose of radiofrequency at a frequency of 3 GHz for an hour.

They found that exposure changed the excitability of the neurons [their ability to generate a change of membrane voltage] and the level of calcium within the neurons and increased activity at the neuron synapses.

‘The results show that RF-EMF can alter neuronal activity,’ the authors said and this may play a role in learning and cognition.

Echchgadda I, Cantu JC, Tolstykh GP, Butterworth JW, Payne JA, Ibey BL. Changes in the excitability of primary hippocampal neurons following exposure to 3.0 GHz radiofrequency electromagnetic fields. Sci Rep. 2022 Mar 3;12(1):3506. doi: 10.1038/s41598-022-06914-0. PMID: 35241689; PMCID: PMC8894459.

Why size matters

Why is it that some people react differently to wireless radiation than others?

Why is it that some animal and bird species are more affect than others?

The answer has to do with their size – and the size of the wavelength of the signals they're exposed to.

Professor Om Gandhi is an electrical engineer who should know. He is Chair of the Department of Electrical Engineering at the University of Utah and one of the pioneers of research on this issue. (You can see some of his publications on this topic below.)

Professor Gandhi says that humans, animals, birds and insects all absorb wireless (radiofrequency) radiation and that they absorb more radiation at some frequencies than others.

We see the relationship between size and frequency in everyday life. If you've seen a musician play a stringed instrument, you'll know that the length of the string determines the sound (or frequency) it produces. If you take a look at your rooftop TV antenna, you'll see it has small antennas of various lengths – to pick up broadcasts in different frequencies.

People are antennas of different lengths, too.

Gandhi says that it's possible to calculate how much radiation they absorb or, put another way, what frequencies will cause them to absorb most radiation.

This can be done using the following formula:

F|res. = [12/Length of the body L in centimeters] in GHz

In simple terms, the maximum absorption will occur at the frequency that is 12 divided by the length of the body (in cms).

So that means that an insect with a body length of half a centimetre, like a bee, would absorb most radiation at a frequency of 24 GHz which is an important frequency used for 5G technologies.

An insect with a slightly longer body would absorb most radiation at lower 5G frequencies and one with a shorter body would absorb most at higher 5G frequencies.

This helps explain why 5G signals have had such a devastating effect on wildlife, for example on the Greek island of Samos, as reported recently. It also explains why a decline in bee populations has been observed worldwide and why 5G technologies pose such a threat to agricultural industries that rely on these pollinators.

When it comes to humans and animals, Gandhi says, 'The max. absorption occurs when the wavelength is approximately twice the size of the human or the animal. That means, for a man with an average height of 175cm, maximum absorption would occur at a frequency of 68 MHz. For a woman with an average heigh of 150cm, maximum absorption would be approximately 80 MHz.' Gandhi confirmed these calculations with experiments he conducted as well.

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"It ... explains why a decline in bee populations has been observed worldwide and why 5G technologies pose such a threat to agricultural industries that rely on these pollinators.'

The latest buzz on power lines

We've seen that wireless radiation harms bees and other insects. But what about high voltage powerlines? Can they affect these vital pollinators, too?

A new study from Poland suggests that they can.[1]

The magnetic fields [MFs] from high voltage powerlines have been linked with childhood leukemia and the International Agency for Research on Cancer (IARC) classified fields of above 4 mG (one five-hundredth of the level allowed by Australian & international limits) as a Class 2B (possible) carcinogen.

Dr Pawel Migdal, from the Wroclaw University of Environmental and Life Science in Poland, and his team were interested to see if these fields would affect bees as well. Bees play a vital role in pollination. He says, 'It is estimated that 75% of main crops need animal pollinators. The financial benefits of pollinators are estimated at USD 153 billion, or 9.5% of the total value of the world food market.'

Further, bees are known to have a magnetic sense, as do animals such as dolphins, sea turtles, salmon, wasps and molluscs.

To see whether bees would be affected by high magnetic fields, such as those emitted by high voltage power lines, the researchers exposed one-day-old worker honeybees to a 50 Hz magnetic field generated in a laboratory. The bees were exposed to fields of 10,000 mG or 17,000 mG for 10 minutes, one hour or three hours.

The researchers filmed the exposed and unexposed bees and compared seven types of behaviour, including walking, flight, body cleaning, contact between individuals, wing movement, stillness and loss of balance.

They found that 'All groups exposed to MF presented significant differences in behaviour compared to the control [unexposed group].' One of the obvious differences was loss of balance, where bees fell from the walls of their enclosure, landing upside down on the floor. The researchers described this as a 'disturbing symptom' and observed that it did not occur in any of the unexposed bees.

These changes in behaviour could negatively impact bees' success in foraging and pollination, the authors said.

The results of the study are consistent with those found in a 1981 investigation in which the authors observed disturbances to bee colonies exposed to high magnetic fields. [2]

The magnetic fields that the bees were exposed to in Migdal's study were generated in a laboratory and so differed from real-life exposures in a number of ways. Firstly, the magnetic fields were much higher than would normally be

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Mobile phone protection

Wavewall mobile phone cases protect the head , body and the phone

Airtube headsets—no wire to conduct radiation into the head

'One of the obvious differences was loss of balance, where bees fell from the walls of their enclosure, landing upside down on the floor.'

found at ground level under high voltage powerlines. Further, they did not have the additional spikes and troughs (transients) that are normally present in electricity that passed through the power grid, turning it into what is sometimes described as 'dirty' electricity.

Nevertheless, the study suggests that we need to consider the potential for bees to be impacted by man-made electromagnetic fields and locate bee colonies away from them as a precaution.

Migdał P, Berbeć E, Bieńkowski P, Plotnik M, Murawska A, Latarowski K. Exposure to Magnetic Fields Changes the Behavioral Pattern in Honeybees (Apis mellifera L.) under Laboratory Conditions. Animals. 2022; 12(7):855. https://doi.org/10.3390/ani12070855

Greenberg, B.; Bindokas, V.P.; Frazier, M.J.; Gauger, J.R. Response of Honey Bees, Apis mellifera L., to High-Voltage Transmission Lines 1. Environ. Èntomol. 1981, 10, 600–610.

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For insects and smaller animals such as birds, maximum radiation will be absorbed at the higher frequencies of 20-25 GHz.

It's not just body length that is important either. There is also the length of other critical organs – such as the heart or the brain.

Gandhi conducted research on how the brain absorbs radiation, too. In a much-quoted study published in 1996, he and his team calculated the amount of mobile phone radiation absorbed by the head of an adult male, a ten-year-old child and a five-year-old child. He observed that the ten-year-old absorbed much more radiation than the adult, but the five-year-old absorbed much more again. '…children, women, and people with smaller heads with thinner pinnae [ears] will absorb more RF energy as compared to adult males with larger heads and thicker pinnae,' he wrote. This is because the phone is closer to their brains. In fact, Gandhi found that each millimetre closer to a radiating mobile phone the brain is, it will absorb 10 to 15% more radiation.

And what about the growing foetus? It's no stretch of the imagination to consider that it could be more vulnerable to radiation at some stages of growth than others.

Gandhi's research has implications for all animal life – and that includes humans. Until we better understand the effects of this exposure, we should think twice about what technologies we use.

EMR Australia would like to thank Dr Gandhi for his correspondence and assistance with this article. Details of Dr Gandhi's significant publications will be posted on our website.

June 16 is International Electromagnetic Hypersensitivity Day.

What can you do to mark it?

Can you find ways to reduce your exposure?