Cell phones in a Nutshell

A guide for journalists prepared by the Science Media Centre of Canada

This is part of the Science in a Nutshell series produced by the Science Media Centre of Canada. It offers a simple explanation of the science of cell phones and cell phone towers.

Cell phone use is global; cell phone towers, ubiquitous. The list of benefits is long, but what of the health risks? Could radiofrequency fields coming to and from cell phones and cell towers or more accurately, cellular base stations, cause health problems like brain tumours or other cancers?

You are just one of more than 4.6 billion people who use a cell phone. More than 1.4 million base stations exist worldwide, and that number is growing as cell phone use spreads. In Canada, the proportion of wireless households—those with no landline—is predicted to grow from 8% in 2008 to 20% by the end of 2015. As base stations and local wireless networks increase, so do our exposures to electromagnetic radiation, also called radiofrequency (RF) fields.

When energy is emitted from a source—heat from the sun or microwaves from an oven—it is called radiation. But many people associate the word 'radiation' with the kind that can damage DNA within our cells and cause cancers to develop—the ionizing kind. Only the high-frequency end of the electromagnetic spectrum is ionizing (e.g. X-rays, gamma rays). Cell phones produce non-ionizing radiation, which can't damage DNA, but can produce heat.

Most base stations in urban areas operate at an effective radiated power (ERP) of 100 watts per channel or less. (A typical base station might have 63 transmitters or channels.) The level of exposure to RF at ground level is very low; typically up to 1,000 times lower than the limits set out in Health Canada's Safety Code 6. At work here is the 'inverse square law' of electromagnetics. If you double your distance from a radiation source, the intensity of the radiation goes down by a factor of four (that is two, squared).

The intensity of the electromagnetic radiation emitted by the phone's antenna is much weaker—usually around 0.75–1 watts. Because you hold the phone next to your head it increases the chance some of the radiation will be absorbed, but it is still well below the safety threshold.

Are there health risks associated with cell phones and towers?

Could this repeated long-term exposure to RF fields—even at low levels—cause health problems? In the last two years, several authoritative groups, including the Royal Society of Canada, have reviewed more than 1,000 studies examining electromagnetic radiation from mobile phones. The RSC panel concluded that, "to date, human health studies have examined the relationship between exposure to radiofrequency fields and different types of cancer, reproductive problems, congenital anomalies, epilepsy, headache and suicide. Overall, these studies do not provide conclusive evidence of adverse health effects from RF exposure."

So what's the problem? 'To date,' is an important qualifier. While the evidence does not support health risks, the proliferation of wireless technology and its increased use over the years may yield different results in future. This uncertainty, which is part of scientific risk research, should not be interpreted as problematic.

Are the Canadian regulations up to date?

Scientists have been studying the thermal effects of non-ionizing radiation for decades and have confidence in the exposure limits set to protect us from harm. Manufacturers of phones and base stations must comply with Health Canada's Safety Code 6, which sets RF limits. The code includes research results published since the last review in 2009.

Safety Code 6 is based on an irreversible effect threshold, rather than on a "no observable adverse effect level". This means that although there are safety limits in place, these are only the limits under which irreversible effects do not occur. The "no observable adverse effect level" is normally given preference when developing environmental health standards.

The non-thermal effects associated with long-term cell-phone use are not part of the current safety code in Canada because the evidence from over ten years of research remains inconclusive.

Evidence-based information

The International Agency for Research in Cancer (IARC) coordinated a series of multi-national case-control studies on cell phone use and cancer risk, called INTERPHONE. Thirteen countries, including Canada, looked for evidence of malignant and benign tumors in the head and neck areas related to cell phone use. Countries began publishing results in 2004, but the final results, long overdue, were not published until May 2010. INTERPHONE concluded that there was no increased risk of brain tumors observed in association with mobile phone use. Researchers said that while data wasn't strong enough to warrant a causal interpretation, some observations of users who logged the most time on a cell phone suggested there might be an increased risk of glioma, and that more research was needed in that area.
In 2009, the Swedish Radiation Safety Protection Authority released its 6th annual report on electromagnetic field (EMF) safety and health. In addition to looking at cell phone use, it studied cancer risk for those living close to cell phone towers and cautiously determined that "one cannot conclusively exclude the possibility of an increased cancer risk in people exposed to RF from transmitters based on these results. However, these results in combination with the negative animal data and very low exposure from transmitters make it highly unlikely that living in the vicinity of a transmitter implicates an increased risk of cancer.''

What will it take to know if cell phone use is safe?

One study that could probably confirm a health risk (in science you can't fully dismiss a risk) would be a cohort study of a few hundred thousand individuals followed over many years. You could link their cell phone usage from network operators with cancer registry data and investigate the risk. The Cohort Study on Mobile Communications (COSMOS) will track cell-phone use and the health of 250,000 Europeans for 20 to 30 years.

Little research has been done on the effect of RF exposures on children. Even so, in 2004 the British government, while acknowledging the lack of evidence linking cell phone use to cancer and tumours, recommended limiting children's access to cell phones because they have thinner skulls, smaller body mass and there was no compelling reason for them to be using cell phones frequently. In September 2009, a German panel of international RF field experts published the report *Children's health and RF EMF exposure* (financed by T-Mobile). It found that "the available evidence does not provide an indication for an association between RF EMF exposure and brain cancer in children. Although the results are less clear for the association between RF EMF exposure and childhood leukemia, the balance of evidence does not support an association with RF EMF."

An international epidemiological case-control study, similar to INTERPHONE, called MOBI-KIDS (www.mbkds.com) began in 2010. The University of Ottawa is one of the centres involved in the study.

As a journalist you need to consider the weight of the current evidence countering longstanding critics of EMF, and weigh the benefits against the risks. Several countries also publish ways to reduce your exposure to RF fields, including hands-free phones, limits on use and avoiding using a phone in areas (e.g. rural) where signal strength is weak so radiation is more intense.

For more information:
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Health Canada's Safety Code 6: http://www.hc-sc.gc.ca/ewh-semt/pubs/radiation/radio_guide-lignes_direct-eng.php
Plain language summaries of peer-reviewed research on RF fields: www.RFcom.ca
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