Cell Phones and Cancer Risk

Why is there concern that cell phones may cause cancer or other health problems?

There are three main reasons why people are concerned that cell phones (also known as "mobile" or "wireless" telephones) might have the potential to cause certain types of cancer or other health problems:

Cell phones emit radiofrequency radiation (radio waves), a form of non-ionizing radiation, from their antennas. Parts of the body nearest to the antenna can absorb this energy.

The number of cell phone users has increased rapidly. There were over 400 million cell phone subscribers in the United States in 2017, according to the Cellular Telecommunications and Internet AssociationExit Disclaimer. Globally, there are more than 5 billion cell phone usersExit Disclaimer.

Over time, the number of cell phone calls per day, the length of each call, and the amount of time people use cell phones have increased. Because of changes in cell phone technology and increases in the number of base stations for transmitting wireless signals, the exposure from cell phone use—power output—has changed, mostly lowered, in many regions of the United States.1

What is radiofrequency radiation and how does it affect the human body?

Radiofrequency radiation is a form of electromagnetic radiation. Electromagnetic radiation can be categorized into two types: ionizing (e.g., x-rays, radon, and cosmic rays) and non-ionizing (e.g., radiofrequency and extremely low frequency, or power frequency). Electromagnetic radiation is defined according to its wavelength and frequency, which is the number of cycles of a wave that pass a reference point per second. Electromagnetic frequencies are described in units called hertz (Hz).

The energy of electromagnetic radiation is determined by its frequency; ionizing radiation is high frequency, and therefore high energy, whereas non-ionizing radiation is low frequency, and therefore low energy. The NCI fact sheet Electromagnetic Fields and Cancer lists sources of radiofrequency radiation. More information about ionizing radiation can be found on the Radiation page.

The frequency of radiofrequency electromagnetic radiation ranges from 30 kilohertz (30 kHz, or 30,000 Hz) to 300 gigahertz (300 GHz, or 300 billion Hz). Electromagnetic fields in the radiofrequency range are used for telecommunications applications, including cell phones, televisions, and radio transmissions. The human body absorbs energy from devices that emit radiofrequency electromagnetic radiation. The dose of the absorbed energy is estimated using a measure called the specific absorption rate (SAR), which is expressed in watts per kilogram of body weight.

Exposure to ionizing radiation, such as from x-rays, is known to increase the risk of cancer. However, although many studies have examined the potential health effects of non-ionizing radiation from radar, microwave ovens, cell phones, and other sources, there is currently no consistent evidence that non-ionizing radiation increases cancer risk in humans.[2]

The only consistently recognized biological effect of radiofrequency radiation in humans is heating. The ability of microwave ovens to heat food is one example of this

effect of radiofrequency radiation. Radiofrequency exposure from cell phone use does cause heating to the area of the body where a cell phone or other device is held (e.g., the ear and head). However, it is not sufficient to measurably increase body temperature. There are no other clearly established effects on the human body from radiofrequency radiation.

What has epidemiologic research shown about the association between cell phone use and cancer risk?

Researchers have carried out several types of epidemiologic studies in humans to investigate the possibility of a relationship between cell phone use and the risk of malignant brain tumors, such as gliomas, as well as benign tumors, such as acoustic neuroma, meningiomas (usually benign tumors in the membranes that cover and protect the brain and spinal cord), and parotid gland tumors (tumors in the salivary glands).[3]

In one case–control study, cell phone use is compared between people with these types of tumors and people without them. In another type of study, called a cohort study, a large group of people who do not have cancer at study entry is followed over time and the rate of these tumors in people who did and didn't use cell phones is compared. Cancer incidence data can also be analyzed over time to see if the rates of brain tumors changed in large populations during the time that cell phone use increased dramatically. These studies have not shown clear evidence of a relationship between cell phone use and cancer. However, researchers have reported some statistically significant associations for certain subgroups of people.

What are the findings from experimental studies?

In 2011, two small studies were published that examined brain glucose metabolism in people after they had used cell phones. The results were inconsistent; whereas one study showed increased glucose metabolism in the region of the brain close to the antenna compared with tissues on the opposite side of the brain,[26] the other study[27] found reduced glucose metabolism on the side of the brain where the phone was used.

The authors of these studies noted that the results were preliminary and that possible health outcomes from changes in glucose metabolism in humans were unknown. Such inconsistent findings are not uncommon in experimental studies of the biological effects of radiofrequency electromagnetic radiation in people.[4] Some factors that can contribute to inconsistencies across such studies include assumptions used to estimate doses, failure to consider temperature effects, and lack of blinding of investigators to exposure status.

Another study investigated the flow of blood in the brain of people exposed to the radiofrequency radiation from cell phones and found no evidence of an effect on blood flow in the brain.28

Early studies involving laboratory animals showed no evidence that radiofrequency radiation increased cancer risk or enhanced the cancer-causing effects of known chemical carcinogens.[29–32]

Because of inconsistent findings from epidemiologic studies in humans and the lack of clear data from previous experimental studies in animals, in 1999 the Food and Drug Administration nominated radiofrequency radiation exposure associated with cell phone exposures for study in animal models by the U.S. National Toxicology Program (NTP), an interagency program that coordinates toxicology research and testing across the U.S. Department of Health and Human Services and is headquartered at the National Institute of Environmental Health Sciences, part of NIH.

The NTP studied radiofrequency radiation (2G and 3G frequencies) in rats and mice.[33,34] A research overview of the rodent studies, with links to the peer-review summary, is available on NTP website. The primary outcomes observed were a small number of cancers of Schwann cells in the heart and non-cancerous changes (hyperplasia) in the same tissues for male rats, but not female rats, nor in mice overall.

These experimental findings raise new questions as to the potential for radiofrequency radiation to result in cellular changes and offer potential avenues for further laboratory studies. The NTP has stated that they will continue to study this exposure in animal models to further advance our understanding of the biological underpinnings of the effects reported above.

Another animal study, in which rats were exposed 7 days per week for 19 hours per day to radiofrequency radiation at 0.001, 0.03, and 0.1 watts per kilogram of body weight was reported by investigators at the Italian Ramazzini Institute.[35] Among the rats with the highest exposure levels, the researchers noted an increase in heart schwannomas in male rats and non-malignant Schwann cell growth in the heart in male and female rats. However, key details necessary for interpretation of the results were missing: exposure methods, other standard operating procedures, and nutritional/feeding aspects. The gaps in the report from the study raise questions that have not been resolved.

What have expert organizations said about the cancer risk from cell phone use?

In 2011, the International Agency for Research on Cancer (IARC), a component of the World Health Organization, appointed an expert Working Group to review all available evidence on the use of cell phones. The Working Group classified cell phone use as "possibly carcinogenic to humans," based on limited evidence from human studies, limited evidence from studies of radiofrequency radiation and cancer in rodents, and inconsistent evidence from mechanistic studies.[4]

The Working Group indicated that, although the human studies were susceptible to bias, the findings could not be dismissed as reflecting bias alone, and that a causal interpretation could not be excluded. The American Cancer Society (ACS) stated that the IARC classification means that there could be some cancer risk associated with radiofrequency radiation, but the evidence is not strong enough to be considered causal and needs to be investigated further. Individuals who are concerned about radiofrequency radiation exposure can limit their exposure, including using an ear piece and limiting cell phone use, particularly among children.

In 2018, the ACS issued a statement on the draft NTP reports noting that the findings were still inconclusive, and that, so far, a higher cancer risk in people has not been seen, but that people who are concerned should wear an earpiece when using a cell phone.

The National Institute of Environmental Health Sciences (NIEHS) states that the weight of the current scientific evidence has not conclusively linked cell phone use with any adverse health problems, but more research is needed.

The U.S. Food and Drug Administration (FDA) notes that studies reporting biological changes associated with radiofrequency radiation have failed to be replicated and that the majority of human epidemiologic studies have failed to show a relationship between exposure to radiofrequency radiation from cell phones and health problems.

The U.S. Centers for Disease Control and Prevention (CDC) states that no scientific evidence definitively answers whether cell phone use causes cancer.

The Federal Communications Commission (FCC) concludes that currently no scientific evidence establishes a definite link between wireless device use and cancer or other illnesses.

In 2015, the European Commission Scientific Committee on Emerging and Newly Identified Health Risks concluded that, overall, the epidemiologic studies on cell phone radiofrequency electromagnetic radiation exposure do not show an increased risk of brain tumors or of other cancers of the head and neck region.[2]

For full-lnegth article and references, please see the online version of this article.

Source: National Cancer Insititute.

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- **Hair Dyes and Cancer Risk** http://bit.ly/2Mn11yH
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