**Myth:** Cell phones and other similar technology increase the risk of brain tumors.

**Answer:** Lawsuits and news headlines have fueled the myth that cell phones cause cancer, particularly brain cancer. According to a survey by Gansler (2008), about 30% of Americans believe the myth.

Cell phones are clearly visible in society. Statistics show that 79% of the U.S. population and 90% of European and Asian teens own a cell phone (Infoplease, 2008; Jannsens, 2005). Cell phones are convenient and can be used at almost any location. New technology such as cameras, computer data storage with downloads, and wake-up calling have led to increased use (Janssens).

A cell phone works like a radio, with both the portable phone and the ground antennae emitting nonionizing electromagnetic radiation in radiofrequency zone from 824–924 megahertz (MHz). Digital phones use frequencies up to 1,900 MHz. In comparison, the average household microwave uses 450 MHz of electromagnetic radiation (Jannsens, 2005).

The primary concern of cell phone use has been the risk of cancer to exposed tissues close to the phone. Meninges, brain, parotid gland, and acoustic nerves all are exposed to nonionizing electromagnetic radiation (Auvinen et al., 2006; Hardell et al., 2002).

Jannsens (2005) questioned whether radiowaves or electromagnetic radiation in general cause biologic responses with detrimental effects on normal health. The evidence is complex and has to consider the biologic target as well as the length of the wave, spectrum absorption rate, and density. The human body can tolerate an electromagnetic field up to 5 milligauss. An electromagnetic field greater than 5 milligauss can damage the body and cell constituents; ionizing gamma irradiation destroys DNA and large molecules. Electromagnetic fields are invisible lines of force that surround any electrical device, including power lines (National Institute of Environmental Health Sciences, 2008).

House (1999) contended that the increased use of cell phones has resulted in the installation of numerous radio transmitters to relay calls, therefore giving weight to concerns about radiofrequency radiation emissions. Klaeboe, Blaasaas, and Tynes (2007) stated that radiofrequency does not have enough energy to break chemical bonds or damage DNA. For nonionizing radiation in lower frequencies, the health effect appears to be different. Living cells phenotypically adapt to environmental stimuli by metabolic alterations, including the induction of oxidates, stress, and heat shock (Jannsens, 2005). Based on a study of mice exposed to radiofrequency irradiation, the calcium signal transmissions to the inner cell space were modified with exposure. Exposure was carried out using the antenna of a cell phone working at a frequency of 800 MHz in the center (Anghileri, Mayayo, Domingo, & Thouvenot, 2006).

**Worldwide Studies**

According to the U.S. Food and Drug Administration ([FDA], 2003), the research completed has produced conflicting results and many of the studies have suffered from flaws in their research methods.

The first large-scale epidemiology studies were conducted in the late 1990s (Auvinen et al., 2006). A study by Hardell et al. (2002) found an “increased risk of brain tumors associated with the use of analog cellular phones” (p. 380) over a 10-year period in 1,358 adults. The findings were similar to those of previous studies (Hardell, Nasman, Pahlson, Hallquist, & Mild, 1999; Hardell, Nasman, Pahlson, & Hallquist, 2000; Hardell, Mild, Pahlson, & Hallquist, 2001). Digital cell phone and cordless phone use, however, showed no significant increased risk for brain tumors overall with a five-year latency period (Hardell et al., 2002). Other studies have found no increase in brain tumors associated with the use of cell phones (Johansen, Boice, McLaughlin, & Olsen, 2001; Klaeboe et al., 2007).

Auvinen et al. (2006) analyzed 15 epidemiologic studies on cell phone use and cancer published through 2005 and found that “overall there is substantial evidence indicating that ever or regular mobile phone use is not associated with the risk of intracranial tumors” (p. 517).
Study Limitations

Numerous limitations do exist in studies of cell phone use. Some of the first pioneering studies had methodological flaws, including short duration of cell phone use for risk assessment, exposure of radiofrequency not rigorously determined, little if any data about wave or power density, and controls that were not well defined (Janssens, 2005). Janssens also found that research on nonionizing radiation is difficult to conduct because radiation is everywhere, causing difficulty when studying human and animal groups in the test and control settings.

Auvinen et al. (2006) stated that, in their study, a distinction between neoplastic and nonneoplastic might not have been made and that the processes may not have been completely accurate because of a possible misclassification after the diagnoses were identified with-out histological evaluation. The authors also stated that the metastatic lesion of cancer from other tissues may be classified as the primary tumor (Auvinen et al.). Exposure assessment also was an issue because it was difficult to determine whether the user was the sole user of the phone or if self-report of use was overestimated (Auvinen et al.; Johansen et al., 2001; Klaeboe et al., 2007; Kuster, Froehlich, Shepard, & Kelsh, 2004).

Klaeboe et al. (2007) found that potential selection bias may have occurred in the case study because 30% of nonresponses occurred in both case and control groups. Recall bias was another issue, particularly in patients with glioma interviewed after surgery. Klaeboe et al. felt that the patients may have given inaccurate estimates of exposure because of memory loss. Other factors that may have affected the data were the distance from the base station, whether the phone was used indoors or outdoors, phone design, and the position of the antennae in relation to the head (Klaeboe et al.).

Conclusion

Cell phone use has become a large part of the world communication system. Several studies recommended more research be conducted into this myth, most notably by using dosimeters for further measurements (Auvinen et al., 2006; Kuster et al., 2004). In addition, Janssens (2005) stressed that more research is needed on subcellular systems. Auvinen et al. stressed that exposure assessment should be continuously modified. However, even with a prospective study, exposure assessment will still be a challenge with future changes in technology and patterns of use (Internet browsing, data downloads, TV, and video calls) (Auvinen et al.). The FDA (2003) suggested a combination of laboratory and epidemiologic studies of people using cell phones to determine needed data. In addition, the FDA is working with several national organizations (U.S. National Toxicology Program and the World Health Organization International Electromagnetic Fields) to study the health effects of cell phone use. But, as of now, no definitive proof exists of increased brain tumor risk with the use of cell phones and similar technology.

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References


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