

Summary of Findings

Cell Phone Patterns of Use



Use of cellular devices for voice conversations is declining as texting and other forms of non-verbal communication increase.

- **Cellular Device Adoption Rates:** There are nearly 276 million cell phone subscribers in the United States, up from 97 million subscribers in 2000. Rapid growth in the access to cellular technology has been accompanied by steadily increasing frequency and duration of personal cell phone use. The volume and speed of data transmitted have increased rapidly, and demand for data-intensive video applications seems insatiable.
- **Technological Innovation and Marketplace Lifespan:** Most cell phones have a market life of only nine to 24 months, meaning product availability normally ends within this time span. Newer models often are built on earlier hardware platforms, offering additional features or greater speed. Consumers replace phones, on average, every two years, a rate influenced by the duration of their service contracts.
- **Changing Patterns of Use:** Use of cellular devices for voice conversations is declining as texting and other forms of non-verbal communication increase. Texting is now the predominant method of communicating among adolescents, followed by calls, talking face-to-face, use of social network sites, and email. More than 75 percent of teens own cell phones, and one third of them text more than 100 messages per day. Children between the ages of eight and 18 spend an average of 7.5 hours per day on smartphones, computers, televisions, or other electronic devices.
- **New Features Motivate Increased Cell Use:** Patterns of use are strongly affected by the development of new features such as GPS locational services, video chats, internet radio and

television broadcasts, photo editing, video games, social networking applications, and educational programs.

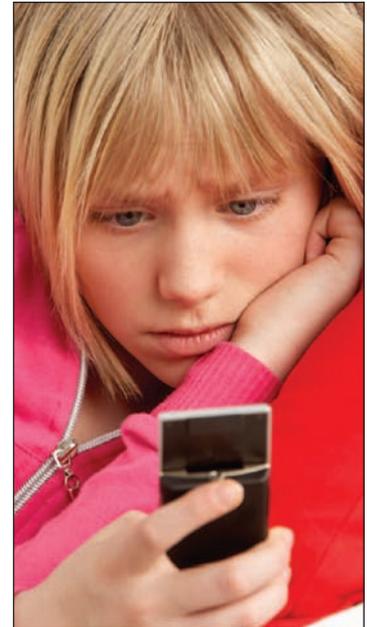
- **Psychological Dependency:** The rise in psychological dependency on cell phones is well documented in the peer-reviewed social scientific literature. The need to “stay in touch” and the ever-strengthening expectation of a near term, if not immediate response, can lead to obsessive and compulsive patterns of use. It can also distract users from work, play, relaxation, safe driving practices, and from more traditional forms of social interaction, such as a face-to-face conversation.

Cell Phone Exposures

- **Electromagnetic Radiation (EMR) Exposure Varies by Phone Model Signal Strength:** Exposure to electromagnetic radiation emitted from cellular devices varies by model of phone, antenna configuration, and signal strength.

Weak signal strength leads to higher levels of exposure, as the device routinely seeks a stronger signal. The energy emitted by specific models is measured in watts per kilogram (W/kg). The recommended limit in the United States is 1.6 W/kg, which is the amount absorbed by the body, known as the Specific Absorption Rate (SAR).

Subscribers can visit the Federal Communications Commission website to identify the intensity emitted by any brand and model of phone. Because exposure varies by proximity of the device to human tissues, most models include warnings in packaging materials about the need to hold the device a safe distance from the body. Since the intensity of exposure falls exponentially as the distance from the body increases, users can limit their exposure dramatically by using speakerphones.



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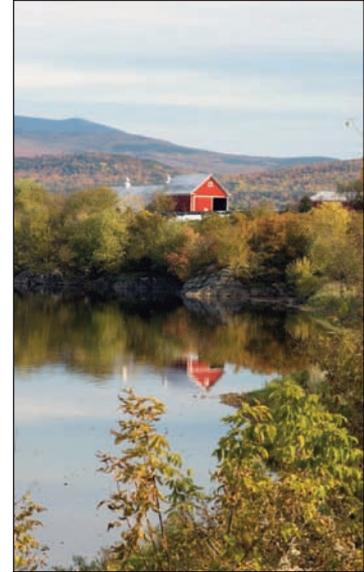
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- **Children's Exposure is Greater Than Adults:** The thinner skulls of young children permit cell phone radiation to penetrate more deeply into the brain than is the case with adults. Children and fetuses' rapidly developing nervous systems, their more rapid rates of cell division, and longer potential lifetime exposure all heighten their risks for adverse health effects.
- **Exposure Standard Based Upon 1986 Study:** The FCC's exposure standard (1.6 W/kg) is based upon a 1986 U.S. Air Force study that estimated safe thermal-level references for a healthy adult male. The authors cautioned that the results would differ for a person of a different size, age, or general health condition, yet this limitation has not resulted in any public health advisory. Nor has it led the FCC to conduct additional studies to explore health implications for groups who are more exposed or more susceptible.
- **Heat is Not the Only Worry:** The FCC's current limit for public exposure assumes that the devices only affect health via the heating of tissues. However, molecular, cellular, and organ system changes and damage that are not explained by heat have been reported in numerous peer-reviewed studies. A 2011 National Institutes of Health study confirms that changes in the brain occur from exposure to cell phone radiation at non-thermal levels. This study included 47 healthy people using a cell phone for a 50-minute call.
- **Use and Storage:** How cell phones are held and carried while in standby mode affects the intensity of user exposure to electromagnetic radiation. During calls the devices commonly contact the head, and electromagnetic radiation can enter the skull, exposing human brain tissues. Devices stored in pants pockets while in standby mode expose sensitive reproductive organs to radiofrequency energy. Storage in shirt pockets will increase exposure to breast tissues.

- **People Living in Rural Communities Experience Higher Exposures:** Those who live in rural areas farther away from cellular transmission towers may be receiving higher doses of EMF radiation than people in urban areas. Lower signal strength causes a cell phone to search often for a signal, even in standby mode, and it is this increased frequency of transmission that leads to higher exposures.

Health Effects

- **Cell Phone Use and Cancer:** In 2011, the World Health Organization's International Agency for Research on Cancer (IARC) classified electromagnetic fields as possibly carcinogenic to humans, based on an increased risk for glioma, a malignant type of brain cancer associated with wireless phone use.
- **Susceptibility of the Developing Nervous System:** The brain is especially susceptible to numerous environmental insults that can produce irreversible damage during critical periods of nervous system development between conception and the age of 21. This vulnerability is well recognized for ionizing radiation, alcohol, tobacco, some pharmaceuticals, cocaine, and stress. The effects of these agents are dependent on dose and timing of exposure. However, even small exposures during periods of neurogenesis have a more profound effect than exposures during adulthood.
- **Effects on the Nervous System:** A number of peer-reviewed studies reported changes in the nervous systems of rats, mice, and humans following exposure to cell phone radiation. These include diminished learning, diminished reaction time, decreased motor function, reduced memory accuracy, and diminished cognition. Also, higher mobile phone use has been associated with faster but less accurate response



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to high-level cognitive tasks. Prenatal and postnatal cell phone exposure have both been associated with behavioral problems, such as hyperactivity in children around the time of entry into primary school at the age of six.

- **Effects on Reproductive Health:** Many studies report molecular and cellular effects following cell phone EMF exposures in organs responsible for reproduction, especially in males. Oxidative stress on human semen, declining sperm counts, reduced sperm motility, and diminished sperm viability all have been reported to be associated with EMF exposures from cellular devices.
- **Difficulty in Understanding Long-Term Effects:** The short lifespan of many cellular products makes patterns of individual exposure to electromagnetic radiation emitted from devices difficult to reconstruct historically, and nearly impossible to predict. Some types of tumors exist for a decade or longer before they are discovered. By the time most long-term studies are published, their findings are irrelevant to predict future public health risk, since networks, device technologies, and exposure patterns change so rapidly.
- **Psychological Health:** Cell phones create a sense of freedom to communicate quickly with those in remote locations. Yet this freedom, if not managed carefully, can create feelings of psychological dependency. Common effects, both reported in the literature and easily recognized, include distraction from social contact among those nearby, the inability to focus on complex and long term tasks, and a heightened sense of anxiety.
- **Genotoxic Effects and DNA Damage:** Cell phones emit non-ionizing electromagnetic radiation that can energize nearby tissues in a manner that can alter the biochemistry of human tissues and change the structure of human DNA. Among 101

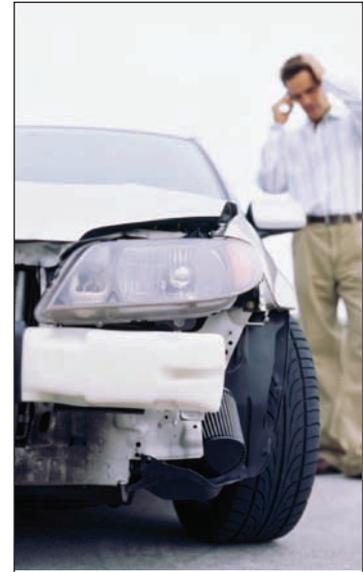
papers that examined the genotoxic effects of radiofrequency EMF, nearly half reported damage to genetic material. Other studies found that exposures impair the ability to repair DNA damage.

Neurodevelopmental and Behavioral Effects Following Fetal Exposure

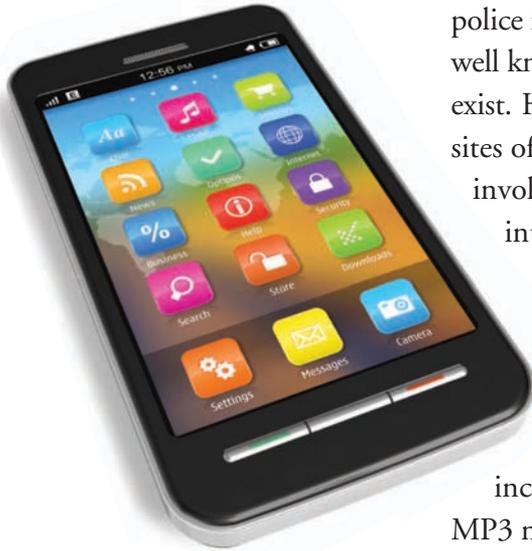
- Aldad, Gan, Gao, and Taylor (2012) report that fetal radio-frequency radiation exposure led to neurobehavioral disorders in mice. Mice exposed *in utero* were hyperactive, had impaired memory, and demonstrated behavioral changes due to an alteration of normal neuronal developmental programming.

Vehicle Accidents, Injury, and Mortality

- Cellular device use while driving poses a serious threat to public health and safety. The National Safety Council attributes 23 percent of all traffic accidents to cell phone use — at least 1.3 million crashes per year. Nearly 1.2 million of these are associated with phone calls, while 100,000 are associated with texting.
- At any one time, approximately 11 percent of all drivers are using their cell phones. Nearly 5,000 fatalities and 500,000 injuries are associated with distracted driving each year. Approximately 20 percent of fatalities are associated with cell phone use, and this percentage is an underestimate due to underreporting of cell use at the time of accidents — some states do not examine the coincidence of accidents and cell use. All of these losses are certainly avoidable.
- By January of 2012, nine states and the District of Columbia had prohibited cell phone use while driving, and many states had banned texting while driving. Widespread disregard for these statutes poses a serious enforcement challenge to local and state



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police forces. The exceptionally small probability of being caught is well known, so many people behave as if the prohibitions do not exist. Hartford, Connecticut, and Syracuse, New York, were the sites of a Department of Transportation (DOT) experiment involving tough municipal laws, intensive police surveillance, intensive enforcement, and public education about the dangers of cell phone use while driving. In Hartford, cell phone use dropped 57 percent and texting fell 75 percent as a result of the campaign.

- The number of electronic distractions in vehicles is increasing quickly. Televisions, video games, internet access, and MP3 music player connections to sound systems have all been added to traditional electronics, such as CD players, radios, radar detectors, GPS locators, and increasingly complex electronic controls.
- Technologies exist that would block receipt or transfer of signals from cellular devices while a vehicle is in motion. However, none have been required by federal or state governments.

Regulations

- **Lack of Federal Oversight of Health, Safety, and Environmental Effects:** Cell phones have enjoyed freedom from government scrutiny and control that would protect public health and the environment.

No enforceable standards limiting human exposure to cell phone radiation exist. No precautionary language on packaging is required by the FCC to warn consumers about cell phone radiation emissions, or how people can reduce exposures. By contrast, special precautionary health warnings are required to be printed on the packaging for many pharmaceuticals, alcohol, tobacco products, and pesticides.

- **Chemical Content:** The U.S. federal government does not regulate the content of cell phones, or their method of disposal. Cell phones contain lead, copper, mercury, flame retardants, plastics and batteries that contain nickel and cadmium.
- **Federal Communication Commission Authority:** The FCC relies on medical, public health, or toxicological expertise in other agencies to conduct research on cell phone health hazards.
- **Regulating Producer Responsibility for Waste:** Currently, producers maintain no responsibility for cell phone waste. In 2011, nearly 220 million cell phones will be discarded in the U.S., and fewer than 10 percent of them will be recycled.

Nearly 70 percent of recycled cell waste is exported to China, where environmental and health regulations are lax, leading to dangerous occupational exposures and contamination of soil, water, fish, and wildlife. This waste is especially hazardous when burned because of the release of dioxins from some plastic polymers. The discarded cell phones also contain diverse metals that will not break down into nontoxic components, and which are also known to be hazardous to human health.

- **Warnings in Other Nations:** Although the U.S. does not require any regulations to restrict advertising or warn against use of cellular devices by pregnant women or children, many other nations do impose restrictions.



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