



Scientific Research on Wireless & Health

Daily Exposures

All wireless devices emit radiofrequency (RF) radiation. This non-ionizing radiation is absorbed into the body. Sources include cell phones, laptops, tablets, Bluetooth, Wi-Fi as well as cell towers, and 5G/4G cellular antennas.

An Environmental Health Issue

While not all studies find effects, substantial scientific evidence has linked wireless RF radiation to a range of adverse biological effects, even at low intensities, exposure levels considered safe by government regulations.

Cancer & Tumors

- Glioblastoma brain cancer
- Acoustic neuromas
- Thyroid cancer
- Prostate cancer
- Breast cancers developing where women carried phones in their bra

Reproductive

- Decreased and damaged sperm
- Decreased testosterone
- Testicular damage
- Impacts to ovarian environment and follicles

Synergistic

When RF is combined with toxic exposures such as carbon black, lead and ionizing radiation, studies have found:

- Enhanced toxicity
- Tumor promotion
- Impacts to immune response
- Genotoxicity
- Behavioral Impacts

Symptoms

Reported in people living in close proximity to cell towers:

- Headaches
- Dizziness
- Sleeping problems
- Neurological impacts

Brain

- Loss of brain cells
- Altered brain activity
- Memory damage
- Neurotransmitter changes
- Blood-brain barrier disruption

Endocrine

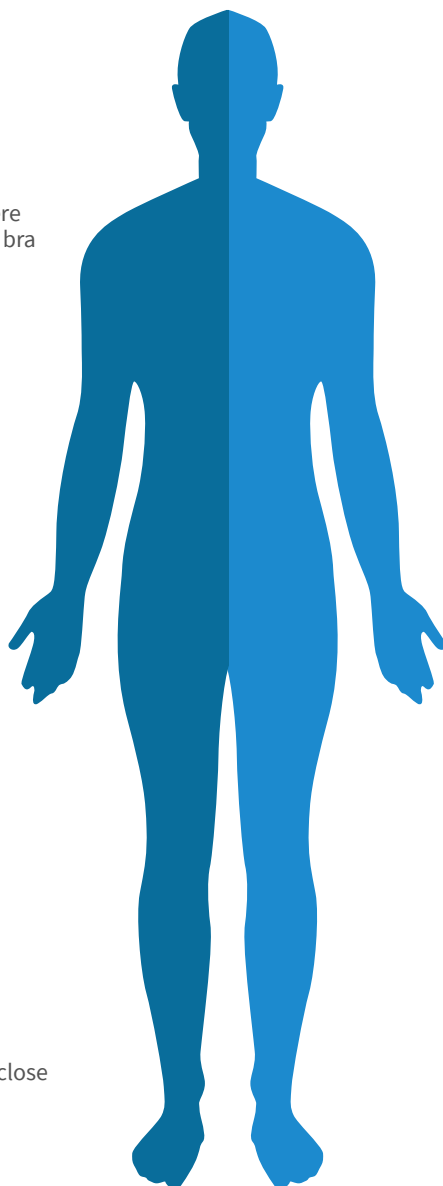
- Thyroid hormone disruption
- Adrenal gland impacts
- Corticosterone changes
- Thymus impacts

Cellular Level

- Cellular stress response
- Genetic impacts
- Dysfunction of ion channels
- Mitochondrial dysfunction

Oxidative Stress

- Prolonged oxidative stress can lead to chronic inflammation that disrupts cellular communication and damages critical components like DNA
- This cascade of biological effects has been linked to the onset and progression of health conditions, including cancer and neurodegenerative disease





Children & Wireless Radiation

CHILDREN ARE UNIQUELY VULNERABLE

- A child's thinner skull, higher brain water content, and smaller head allows wireless RF radiation to penetrate deeper into brain regions critical for learning and memory.
- Their rapidly developing brains are more sensitive.
- They will experience a lifetime of exposure.

EXPERT RECOMMENDATIONS

Numerous scientific, medical and public health organizations have issued recommendations to reduce exposure, especially for children.

American Academy of Pediatrics

- Letter to FCC requesting updated safety limits
- Recommendations to Reduce Cell Phone Radiation

California Department of Health

- Cell Phone Advisory

Santa Clara County Medical Association

- Best Practices for Safe Technology in Schools

Maryland State Environmental Health And Protection Advisory Council

- Guidelines to Reduce Wireless & EMF

New Hampshire State Commission

- Report on 5G Health and Environment

STUDIES FIND HIGHER CELL PHONE RF RADIATION ABSORPTION RATES INTO A CHILD'S HEAD AND EYES

34-YEAR OLD

6-YEAR OLD

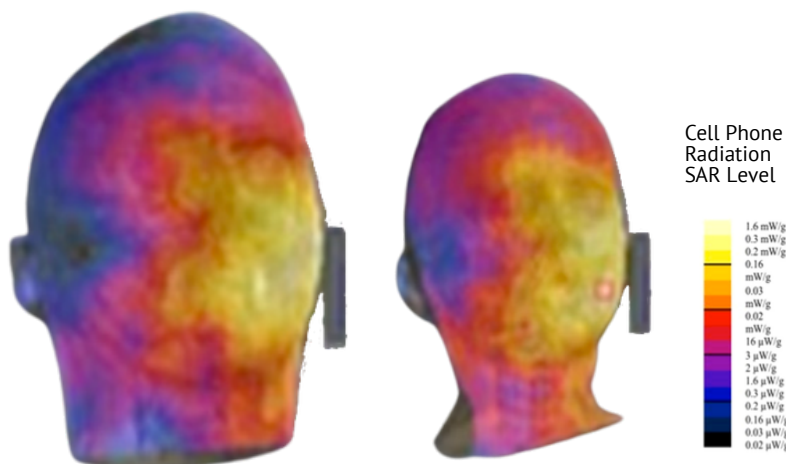


Image: Scientific research by Fernandez et al (2018) published in *Environmental Research*

This engineering study found wireless absorption psSAR is ~2-fold greater in the cerebellum and ~30-fold greater in the hippocampus of the brain of children as compared to adults. The youngest child model's eyes absorb between 2 to almost 5-fold higher doses.

The average exposure from use of the same mobile phone is higher by a factor of 2 in a child's brain and higher by a factor of 10 in the bone marrow of the skull.

-WORLD HEALTH ORGANIZATION INTERNATIONAL AGENCY FOR RESEARCH ON CANCER, 2011





Wireless Safety is Not Assured

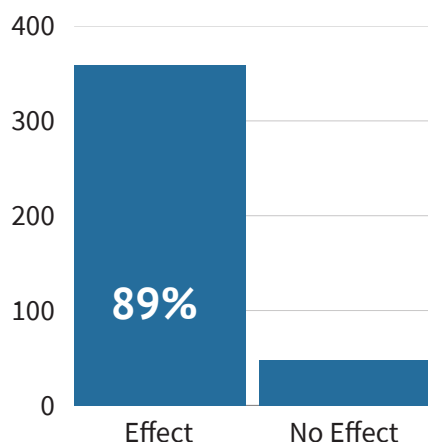
The majority of research has reported significant effects according to Dr. Henry Lai, Professor Emeritus of Bioengineering at the University of Washington and Editor-in-Chief of *Electromagnetic Biology and Medicine*.

Dr. Joel Moskowitz, Director of the Center for Family and Community Health, School of Public Health, at the University of California, Berkeley, posts Dr. Lai's updates along with the latest research on his website Safer EMR.

Effect V. No Effect: Studies on Wireless

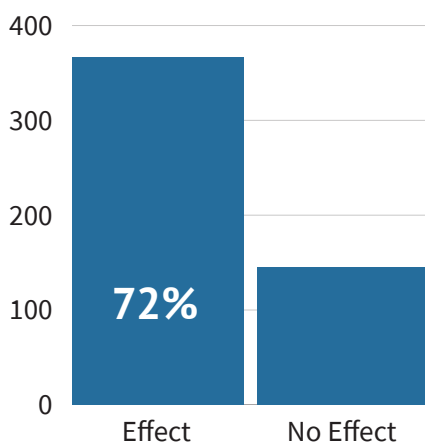
Oxidative

Effects in 359 of 407 studies since 1997



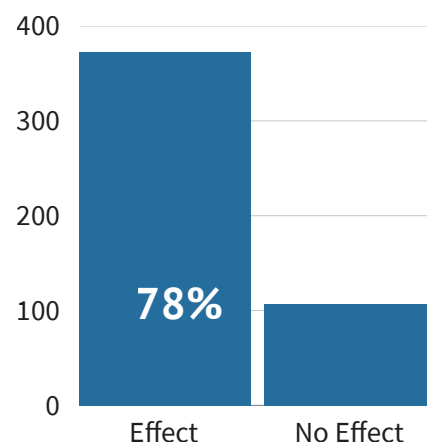
Genetic

Effects in 366 of 511 studies since 1990



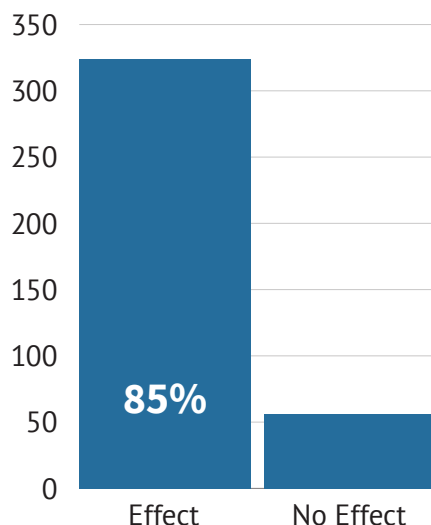
Neurological

Effects in 373 of 480 studies since 2007



Reproduction & Development

Effects in 324 of 380 studies since 1990



According to Dr. Lai, 242 low-intensity (SAR < 0.40 W/kg) RF radiation exposure studies published since 1990 reported significant effects:

"This means that biological systems are very sensitive to RFR." Moreover, "It is clear that the current RFR exposure guidelines are not valid in the protection of the health detrimental effects of RFR."

-Dr. Henry Lai



How To Protect Your Health

INCREASE DISTANCE

- Don't carry phones in pockets or bras.
- Use speakerphone.
- Keep laptops off your lap.

DECREASE TIME

- Limit overall time on wireless
- Power down phones, devices, and Wi-Fi router when not in use
- Airplane mode + turn off Wi-Fi, Bluetooth, and other antennas when not needed.

PROTECT CHILDREN

- No wireless while holding babies.
- Avoid giving kids phones/tablets.
- Use Ethernet, not Wi-Fi, for schoolwork
- Minimize exposure and distance phones and devices away from your abdomen while pregnant.

SAFER CHOICES

- Use Ethernet instead of Wi-Fi.
- Prefer corded tech over Bluetooth.
- Use corded phones—they don't emit RF like cordless phones.
- Opt out of smart meters—choose analog.

RF RADIATION IS HIGHER

- When streaming and FaceTiming
- In cars and trains
- When moving large files.
- In areas of low-signal.

Decrease exposure in higher RF situations: use wired tech, predownload podcasts and videos. Power off and decrease usage.

CREATE A LOW-EMF SLEEP SANCTUARY

- No phones, screens or tech in bedrooms
- Battery-powered alarm clock
- Don't charge devices near the bed
- Keep it dark—or wear a sleep mask
- Turn off Wi-Fi at bedtime (replacing Wi-Fi with ethernet is best.)
- Keep electrical cords away from the bed

More Safety Tips at EHSciences.org

If you plan to watch a movie on your device, download it first, then switch to airplane mode while you watch in order to avoid unnecessary radiation exposure.

— AMERICAN ACADEMY OF PEDIATRICS





US Regulations Require Reform

OUTDATED 1996 US REGULATIONS

The U.S. Federal Communications Commission's (FCC) wireless RF exposure limits are unchanged since 1996, and remain without a comprehensive scientific review despite a 2021 federal court mandate (EHT et. al. v the FCC) to explain how FCC limits ensure safety.

1996 FCC limits:

- Only prevent tissue overheating, ignoring biological effects from lower levels.
- Address short-term, not long-term, exposure risks.
- Were not designed to protect against cancer or harm to the nervous, reproductive, endocrine, and immune systems.
- Are based on a large adult male, ignoring children's vulnerability and real world usage.
- Ignore impacts to wildlife, plants and trees.

The overall weight of evidence reported in peer-reviewed scientific studies strongly supports greater precautionary measures to be taken to reduce or eliminate EMF exposure.

— INTERNATIONAL EMF SCIENTISTS APPEAL

MAJOR REGULATORY GAPS

- No premarket safety testing for new technology.
- No post market surveillance program for health and environmental effects.
- No monitoring or measuring program.
- No oversight, compliance and enforcement program for cell towers and 5G/4G.
- No risk analysis or review of up to date science.
- No reporting system for medical professionals.
- No nationwide database of all wireless sites.
- A lack of transparency regarding public exposures and government agency activities.



An Uninsurable “High Risk” Liability

Insurer reports rank wireless, cell towers, and 5G radiation as a “high” risk, comparing the issue to asbestos. They will not insure wireless companies for health damages.

Telecommunication companies warn their stockholders about the financial risk, but do not warn consumers nor people living near their towers.

Our wireless business also faces personal injury and wrongful death lawsuits relating to alleged health effects of wireless phones or RF transmitters. We may incur significant expenses in defending these lawsuits. In addition, we may be required to pay significant awards or settlements.

— VERIZON 10-K REPORT



Federal Government Accountability



RESEARCH

- Reinstatement of coordinated RF bioeffects research across key federal agencies.
- Modernize RF limits based on current science for long-term safety.
- Develop protective limits for wildlife.
- Expand research to ELF, wireless power transfer, LEDs, and emerging tech.



DATA GATHERING

- Monitor and map EMF levels nationwide, including wildlife areas.
- Establish post-market medical and environmental surveillance, with reporting mechanism for devices and infrastructure.
- Monitor with technologies that do not emit EMF.



COMPLIANCE AND OVERSIGHT

- Require rigorous pre-market safety testing and ongoing post-market health surveillance.
- Enforce post-market compliance with regular audits of devices and infrastructure.
- Update device testing to reflect real-world, multi-device, and environmental conditions.
- Standardize RF compliance procedures.
- Conduct environmental impact assessments for emerging technologies.



WORKER PROTECTION

- Establish a comprehensive RF protection program for workers.
- Implement medical surveillance and exposure tracking.
- Provide training and exposure mitigation guidance.



TRANSPARENCY

- Clear labeling of RF Information labeling on all wireless products.
- Create a national registry of all wireless infrastructure with RF compliance data.
- Publish RF measurements and transmitter locations on a public map.
- Report surveillance data, complaints, and agency responses annually.



RISK MITIGATION AND SOLUTIONS

- Launch national public education campaigns on safer tech use.
- Issue recommendations for institutions and the public to reduce exposure.
- Prioritize investment in wired broadband—faster, safer, and more secure.
- Fund and incentivize R & D for no/low EMF tech design.



How to Advance Safer Technology



STATE AND LOCAL GOVERNMENTS

- Request federal agencies update safety regulations.
 - Enact a wireless ordinance to responsibly control deployment.
 - Require point of sale labeling for wireless phone/device RF exposure information.
 - Educate the public on ways to reduce exposure.
 - Require public posting of all proposed and current wireless sites, permits, and RF compliance data.
 - Ensure libraries have EMF meters to measure levels at home.
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SCHOOL BOARDS

- Prohibit cell towers and 4G/5G sites on school property.
 - Promote wired connections and reduce exposure in classrooms.
 - Educate students and staff on how to reduce exposure.
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COMMUNITY

- Start a community conversation: screen a movie or talk.
 - Meet with your representatives and local decision makers.
 - Speak at local Council meetings.
 - Share information at the farmers market or local fair.
 - Start a group to raise awareness.
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TIME FOR COMPANIES TO COMPETE ON SAFETY

- Design networks with wired connectivity prioritized—safer, faster, and more secure.
- Provide wireless-free tech options.
- Default antennas to “off” and auto-disable them near the body.
- Offer one-step, physical on/off switches for all wireless functions.
- Include Ethernet ports/adapters for all devices; auto-disable wireless when wired.
- Provide low-power and “sleep” modes for antennas when idle.
- Offer wired modem/router options from service providers.

SCIENTIFIC STUDIES ON WIRELESS

A Prospective Cohort Study of Adolescents' Memory Performance and Individual Brain Dose of Microwave Radiation from Wireless Communication by Foerster et al. *Environmental Health Perspectives* (2018)

A Review on the Effects of Thermal Inversions and Electromagnetic Fields on Cell Cultures and Wireless Communications by López-Álvarez et al. *Sensors* (2023).

An Exploration of the Effects of Radiofrequency Radiation Emitted by Mobile Phones and Extremely Low Frequency Radiation on Thyroid Hormones and Thyroid Gland Histopathology by Alkayyali et al. *Cureus* (2021).

Cellular and molecular effects of non-ionizing electromagnetic fields by Lai & Levitt. *Reviews on Environmental Health* (2023).

Comments on the US National Toxicology Program technical reports on toxicology and carcinogenesis study in rats exposed to whole-body radiofrequency radiation at 900 MHz and in mice exposed to whole-body radiofrequency radiation at 1,900 MHz by Hardell and Carlberg in *the International Journal of Oncology* (2019)

Development of health-based exposure limits for radiofrequency radiation from wireless devices using a benchmark dose approach by Uche & Naidenko published in *Environmental Health* (2021).

Effect of Radiation Emitted by Wireless Devices on Male Reproductive Hormones: A Systematic Review by Maluin et al. *Frontiers in Physiology* (2021).

Effects of non-ionizing electromagnetic fields on flora and fauna, Part 2 impacts: How species interact with natural and man-made EMF by Levitt et al. *Reviews on Environmental Health* (2021).

Electromagnetic Fields of Wireless Communications: Biological and Health Effects by Panagopoulos. *CRC Press* (2022).

Electromagnetic field and brain development by Kaplan et al. in *the Journal of Chemical Neuroanatomy* (2016).

Evaluation of the genotoxicity of cell phone radiofrequency radiation in male and female rats and mice following subchronic exposure by Smith-Roe et al in *Environmental and Molecular Mutagenesis* (2020).

Genetic susceptibility may modify the association between cell phone use and thyroid cancer: A population-based case-control study in Connecticut by Luo et al. *Environmental Research* (2020).

Histopathologic effects of mobile phone radiation exposure on the testes and sperm parameters: a systematic literature review of animal studies by Assefa & Abdu. *Frontiers in Reproductive Health* (2025).

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International Appeal: Scientists call for protection from non-ionizing electromagnetic field exposure by Kelley et al. *European Journal of Oncology* (2015).

Planetary electromagnetic pollution: It is time to assess its impact by Bandara et al. *The Lancet Planetary Health* (2018).

Polarization: A Key Difference between Man-made and Natural Electromagnetic Fields, in regard to Biological Activity by Panagopoulos et al. *Scientific Reports* (2015).

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Role of Mitochondria in the Oxidative Stress Induced by Electromagnetic Fields: Focus on Reproductive Systems by Santini et al. *Oxidative Medicine and Cellular Longevity* (2018).

Scientific evidence invalidates health assumptions underlying the FCC and ICNIRP exposure limit determinations for radiofrequency radiation: implications for 5G by the International Commission on the Biological Effects of Electromagnetic Fields. *Environmental Health* (2022).

The assumption of safety is being used to justify the rollout of 5G technologies by McCredden et al. *Frontiers in Public Health* (2023).

The roles of intensity, exposure duration, and modulation on the biological effects of radiofrequency radiation and exposure guidelines by Lai & Levitt. *Electromagnetic Biology and Medicine* (2022).

Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective by Belpomme et al. *Environmental Pollution* (2018).

Wireless technology is an environmental stressor requiring new understanding and approaches in health care by McCredden et al. *Frontiers in Public Health* (2022).

Wireless technologies, non-ionizing electromagnetic fields and children: Identifying and reducing health risks by Davis et al. *Current Problems in Pediatric and Adolescent Health Care* (2023).

