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A NEW FORM OF ENVIRONMENTAL POLLUTION: WIRELESS AND NON-IONIZING ELECTROMAGNETIC FIELDS

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The wireless revolution and the expansion of the internet of things is rapidly increasing our exposure to non-ionizing electromagnetic fields (EMFs) now considered a new form of environmental pollution (Russell, 2018, Bandara & Carpenter, 2018). Health and medical professionals recommend that we reduce these EMF exposures because of a growing body of research that documents adverse biological effects from low level exposures (Miller, 2019).

This chapter will introduce what EMFs are, how people are exposed, science documenting health effects of exposure, U.S. and international policy on protection from EMFs and nursing implications for clinical practice and advocacy in concert with ANA's principles.

WHAT ARE EMFS?

EMFs are invisible energy waves consisting of electric and magnetic fields. For thousands of years, humans have been exposed to natural EMFs - such as the magnetic field of the earth and light from the sun. However, exposure to human-made EMFs are a relatively recent phenomenon and the more complex data carrying signals of cellular networks have been found to have significant biologic effects. (Panagopoulos, 2015).

Humans are electrical beings. Our cells communicate with tiny electrical impulses which affect our heart, our brain, our nervous system, and our endocrine system. In health care, these electrical impulses are recorded as electric waves on electrocardiograms and electroencephalograms.

IONIZING RADIATION VERSUS NON-IONIZING RADIATION

Electromagnetic fields include two types of radiation: ionizing and non-ionizing. Ionizing radiation has intense high energy, high frequency waves which can remove electrons from atoms or "ionize them" causing cellular damage and directly breaking DNA. Ionizing radiation is known to cause cancer.

Ionizing radiation is used in healthcare both diagnostically (e.g. x-rays and CT scans), and therapeutically to reduce tumors (radiation treatment). Protective precautions such as lead shields and minimizing exposure are required. Health care institutions have procedures for nurses and other staff who with patients receiving ionizing radiation therapy to minimize the health care providers' exposures (Kaiser, 2001).

In contrast, non-ionizing radiation (e.g. Wi-Fi, wireless networks, cell tower radiation) has much lower energy and lower frequency waves. Decades ago, cell phones and wireless networks were brought to market without long term safety studies because the frequencies were non-ionizing and assumed to be safe. While non-ionizing radiation is not thought to cause DNA damage in the same way that ionizing radiation does, recent studies indicate that DNA damage and other adverse health effects can result from non-ionizing radiation, via a more

The American Nurses Association Principles of Environmental Health for Nursing Practice were based on a Foundation of Principles including (among them):Human health is linked to the quality of the environment.

- A healthy environment is a universal need and fundamental human right.
- Current generations should meet their needs without compromising the ability of future generations to meet their own needs.
- Pollution prevention should occur at its source. The concern of nurses is the promotion, maintenance, and restoration of people's health.
- Nurses have an obligation to address health disparities and environmental injustice. The nurse collaborates with other professionals, policy makers, advocacy groups, and the public in promoting local, state, national, and international efforts to meet health needs.

(ANA's Principles of Environmental Health for Nursing Practice with Implementation Strategies, 2007)

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complex indirect process (Lai, 2021, Panagopoulos et al., 2021).

There are two main categories of non-ionizing EMF's of scientific research conducted to identify possible biological and environmental effects for over four decades.

- Magnetic Field Extremely Low Frequency (ELF-EMFs)- which are generated anywhere electricity flows such as powerlines, electrical wiring and charging cords.
- Radiofrequency (RF- EMFs) - also known as Radiofrequency Radiation (RFR) -which are the data/ information carrying waves of cell phones and wireless networks (Moon, 2020).

In this chapter, unless otherwise noted, the acronym "EMF refers to both ELF and RFF.

WHY ARE EMF EXPOSURES IMPORTANT?

A large and increasing body of research in both human and animal studies have found that even legally allowed low level exposures are linked to a myriad of harmful biological effects including cancer, DNA damage and impacts to reproduction, nervous system and brain development (Bandara & Carpenter, 2018). The effects of new technology on human health are challenging to study because there is no unexposed control group in humans (Russell, 2018.)

SOURCES OF EMF EXPOSURES

Home and School Exposures

People are directly and indirectly exposed to EMFs from cell phones, computers, smart electronics and the myriad of Wi-Fi networks in their homes, workplaces and schools (see table 1). The use of wireless electronics by every age group continues to increase each year (Common Sense Media, 2019). Many school districts have robust Wi-Fi networks and students now use computers in school and at home for hours a day.

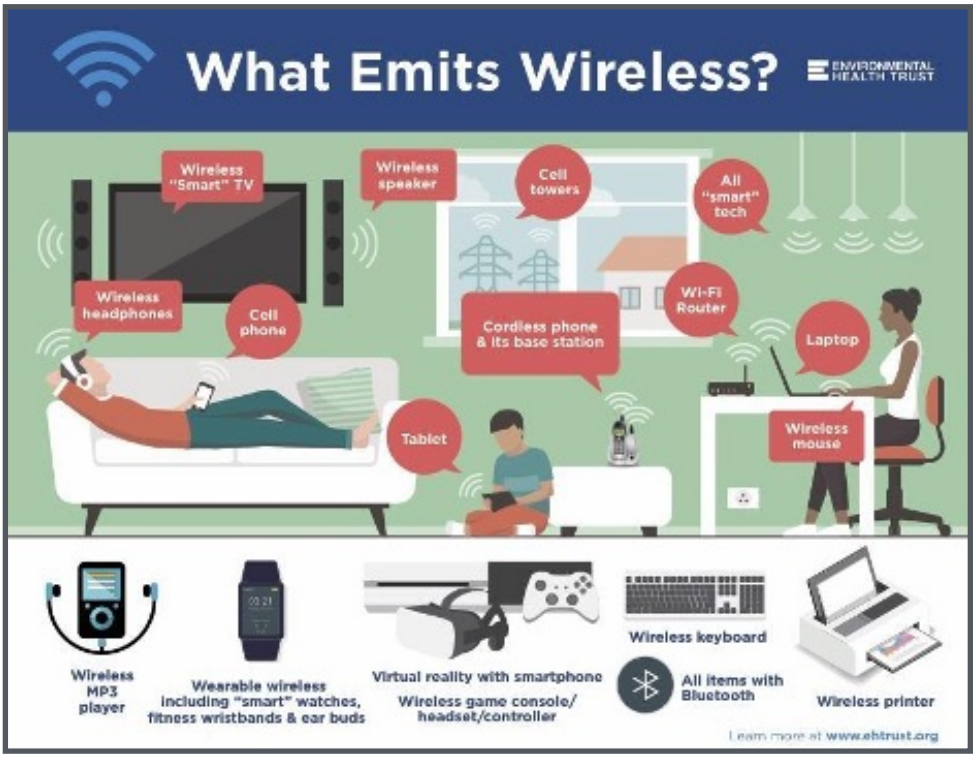
The use of electronics close to the body -e.g. laptops on laps, cell phones carried in a pocket or bra- create two kinds of intense EMF exposures to the body part closest to the device- RF from the wireless and ELF from the electricity. In addition, ELF exposures are elevated near charging cell phones, appliances, and electronics (Behrens et al., 2004).

Occupational Exposures

Cell phones, and wireless networks are common in today's workplace -e.g. in hospitals, schools, retail, transportation and numerous industries. There is a critical need to gather health data on these exposures (Stam, 2021). For example, many delivery drivers use cell phones and tablets to track packages and hospital workers often have a cell phone in their pocket, a walkie talkie clipped to their chest, and they use numerous wireless devices over the course of one day.

Cell tower/antenna maintenance workers, physical therapists using diathermy, and operators of dielectric welders have elevated EMF exposures. The latter two directly use high frequency EMFs to generate heat produced by EMFs (Aniołczyk et al., 2015). Overexposure has been documented to induced central nervous system demyelinating disease mimicking Multiple Sclerosis (Raefsky et al., 2020). Although U.S. National Institute for Occupational Safety and Health (NIOSH) scientists developed recommendations to reduce EMF, they were never implemented (Bowman, 2016).

Figure 1



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Table 1: Types and sources of EMF exposures

First-Hand Exposure (Devices Used Close to the Body)	Second-Hand Exposure (Devices and Networks Inside Homes, Schools and Buildings)	Environmental Exposure
ELF- EMF and Magnetic fields (*Also emit RF if wireless)		
• Cell phones, tablets and laptops * • Electric blankets • Charging phones and electronics * • Alarm clocks and radios plugged in directly near the body such as near beds	• Wiring errors in electrical systems • Electric cars **Occupational sources** • Microwave ovens • Welding equipment • Appliances • Electrical equipment • Motors	• High-voltage power lines • Power cables • Electrical transformers • Substations • Railways and electric trains
RF-EMF		
• Cell phones • Cordless phones • Wi-Fi tablets, laptops & computers • Walkie talkies • Wearable technology • Smart watches • Wireless keyboard and mouse • Bluetooth • Wireless Toys	• Wi-Fi networks • Wi-Fi routers • Cordless phone base station • Wireless devices such as: • Baby monitors • Gaming consoles • Speakers • Security systems/hubs- doorbells with cameras • Virtual Assistants • Wireless printers	• Cell towers • Small cell towers aka: Personal Wireless Facilities • Antennas mounted on buildings • Smart Meter networks

Environmental Exposures

Environmental exposures to non-ionizing EMFs have dramatically increased over the last few decades (Bandara& Carpenter, 2018). People who live near high voltage powerlines and substations may have elevated ELF-EMF throughout their home (Gagsek et al., 2013, Amoon et al., 2020).

Cell tower networks are a significant source of a person's daily RF-EMF exposure, especially in urban areas (Sagar et al., 2018). Cell tower RF-EMF penetrates into homes, especially through windows facing the beam of a nearby wireless antenna (Hardell et al., 2018). The newest generations of wireless - 4G and 5G- will increase RF-EMF as these networks consist of thousands of new "small" cell towers built closer to homes (El Hajj and Naous, 2020, Mzloum et al., 2019). It is estimated that 800,000 new cell towers will be needed in the U.S. (Shepardson, 2018). Researchers caution that increasing cell antennas closer to the ground, close to homes and schools will increase ambient RF exposures to people (Frank 2021, Koppel et al 2022, Pearce 2020).

WHO ARE MOST VULNERABLE TO HEALTH EFFECTS OF EMFS?

Children

When cell phones first came on the market, no one could imagine the need for a child to use one. Now they are a favorite toy and used as babysitters. Children are uniquely vulnerable to EMFs just as they are to other environmental toxins. As wireless technology is now ubiquitous, children will receive a greater cumulative exposure than today's adults, with exposure starting before they are born (Miller et al., 2019). Both their ongoing physical development and physiology put them at greater risk.

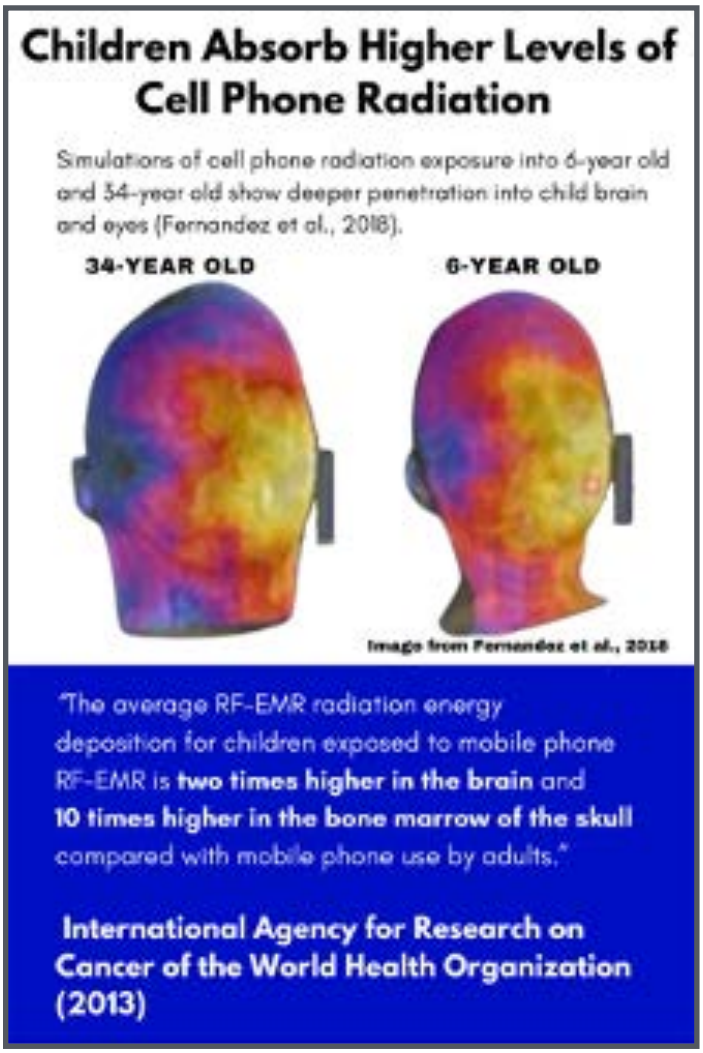
- Children absorb proportionally higher doses of cell phone RF-EMF in the eyes and critical brain regions than adults due to their smaller heads, thinner undeveloped

skulls and the higher water content in both their bodies and brain (Fernandez et al., 2018).

- Children's developing brains are more susceptible to neurotoxic exposures (Redmayne and Johansson, 2014 and 2015).
- Children have more active stem cells and stem cells have been found to be more sensitive to RF-EMF exposure (Markova et al., 2010).
- Safety limits for RF-EMF from cell phones and cell towers are outdated as they were set over two decades ago in 1996 and are based on the body of a large adult, not a child (Gandhi et al., 2012).

Researchers at Penn State Medical Center found reducing EMFs improved health outcomes in preterm infants (Passi et al., 2017). NICU equipment is linked to various impacts to the autonomic nervous system including melatonin production and heart rate and a 2017 review concluded that incubators should be redesigned to reduce exposure to the babies and caregivers (Bellieni et al., 2017).

Figure 2



Used with permission from Environmental Health Trust and Professor Claudio Fernandez.

Pregnancy

As with other environmental toxins, the developing fetus is particularly sensitive to exposure during critical developmental windows. Although more research needs to be done to fully understand the risk during windows of vulnerability, research on pregnant people has linked prenatal cell phone radiation exposure to oxidative stress and DNA damage in cord blood (Bektas et al., 2021); increased risk for miscarriage (Mahmoudabadi et al., 2015), lower birth weight (Lu et al., 2017), fetal growth impacts (Boileau et al., 2020), and preterm birth (Tsarna et al., 2019); as well as emotional/behavioral problems (Divan et al., 2012, Sudan et al., 2016) and hyperactivity (Birks et al., 2017) in their children. Animal studies have linked prenatal wireless exposure to DNA damage (Smith-Roe et al., 2020), brain damage (Tan et al., 2017), memory problems (Shahin et al., 2018) and hyperactivity (Aldad et al., 2012).

A Kaiser Foundation Research Institute team took measurements of the magnetic field ELF-EMF exposure of pregnant people and followed their pregnancies and subsequent birth and health of their children over time. They published a series of studies documenting links between higher prenatal magnetic field exposure (ELF-EMF) and miscarriage (Li et al., 2017) as well as ADHD (Li et al., 2020), obesity (Li et al., 2012), and asthma (Li et al., 2011) in children exposed prenatally.

Watch BabySafe Project press conference where Hugh Taylor MD, Chief of OBGYN at Yale Medicine and Devra Davis PhD, MPH presented on the scientific basis for the recommendations to reduce exposure.

PHYSIOLOGICAL IMPACTS OF ELECTROMAGNETIC FIELDS

Oxidative Stress and Preexisting Conditions

Reviews of animal and cell studies consistently find even very low EMF exposure associated with increased oxidative stress. Oxidative stress plays a role in the development of many diseases, such as cancer, diabetes, immune and neurodegenerative syndromes. The young, old and/or medically compromised individuals, whose immune system and defense mechanisms are already compromised, are more likely to experience health effects from the increased oxidative stress (Yakymenko et al., 2015, Schuermann & Mevissen, 2021).

Cancer

Researchers have long studied EMFs for their relationship to causation. In 2002, magnetic field ELF-EMF was classified by the World Health Organization International Agency for Research on Cancer (WHO/IARC) as a Group 2B possible carcinogen due to research findings that showed a relationship between residential exposure and increased childhood leukemia risk (WHO/IARC 2002). This association continues to be reported in more recent studies (Carpenter 2019, Seomun et al., 2021).

In 2011, the WHO/IARC concluded that wireless radiofrequency radiation (RF-EMF) was a Group 2B possible carcinogen largely based on studies of long term cell phone users with increased tumors-glioblastomas and acoustic neuromas (WHO/ IARC 2011). Several international experts conclude RF-EMF is a proven Group 1 human carcinogen (Miller et al., 2018, Peleg et al., 2018 Carlberg and Hardell 2017, Belpomme et al., 2018).

Examples of new scientific research that finds a carcinogenic effect for RF-EMF include:

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- Two major animal studies investigating long-term exposure found the same tumors as found in human studies (U.S. National Toxicology Program, 2018, Falcioni et al., 2018).
- A 2020 meta-analysis linked cumulative cell phone use over 1000 hours increased tumor risk (Choi et al., 2020).
- Studies have found women who carry cellphones in the bra have elevated breast cancer risk (West et al., 2013, Shih et al., 2020).
- A Yale study funded by the American Cancer Society found elevated thyroid cancer risk in heavy cell phone users with specific genetic susceptibilities (Luo et al., 2020).

Reproduction

Systematic reviews associate RF-EMF with impacts to sperm (Kim et al., 2021, Yu et al., 2021) and decreased testosterone (Maluin et al., 2021) leading many researchers to conclude "it is recommended to keep the cell phone away from the pelvis as much as possible" (Hassanzadeh-Taheri et al., 2021).

Nervous System Impacts

The nervous system is sensitive to EMFs (Bertagna et al., 2021). Cell phone radiation has been found to alter brain activity (Volkow et al., 2011, Bin et al., 2014), impact neurotransmitters and alter neuron development (Kaplan et al., 2015, Li et al., 2021, Chen et al., 2021). Teenagers were found to experience memory damage to the area of the brain most exposed to cell phone radiation after just one year (Foerster et al., 2018).

Experimental animal research has found a variety of RF-EMF impacts especially in the brain regions critical to memory and learning (Sonmez, et al., 2010, Dasdag et al., 2015, Shahin et al., 2018, Obajuluwa et al., 2017, Tan et al., 2021, Hasan et al., 2021).

Electromagnetic Hypersensitivity

In 2021, scientists published a consensus statement calling for the acknowledgement of electrohypersensitivity as a distinct neuropathological disorder (Belpomme et al., 2021) and exposure to non-ionizing radiation has a series of ICD 10 codes.

Electromagnetic hypersensitivity (EHS) is characterized by the development of numerous symptoms linked to EMF exposure including: headaches, sleeping problems, concentration problems, nosebleeds, unexplained skin rashes, digestive problems, neurological problems, heart palpitations and disabling fatigue (Belyaev et al., 2016).

Synergistic Effects

EMFs can add to our total body burden of carcinogens. Research has found that EMF exposure can act synergistically with other environmental pollutants potentiating harmful effects (Kostoff and Lau, 2017). For example, prenatal and postnatal mobile phone exposure has been linked to greater neurobehavioral effects in children with elevated lead levels (Choi et al., 2017, Byun et al., 2017).

It is challenging to isolate an association epidemiologically because there is no unexposed control group (Russell, 2018.) Scientists must therefore rely on animal experiments which are carefully controlled to understand if the effects are caused by the exposure.

Animal studies have found combining ELF-EMF exposure with known carcinogens can increase tumors (Soffritti et al., 2016, Soffritti et al., 2016). EMFs can increase permeability of the blood brain barrier, thus, allowing more toxic agents to reach the brain (Sirav and Seyhan, 2016, Tang et al., 2015).

EMFs and the Environment

There are reports that the proliferation of cell antennas will have numerous environmental effects. Analysis are accumulating that electricity and energy consumption of 5G and new wireless networks will contribute to greenhouse gasses and exacerbate climate change (The Shift Project, 2019, Williams et al, 2022).

Further, trees are critical to a healthy environment. They filter toxic chemicals from the air, reduce ground-level ozone and absorb carbon dioxide emissions that are driving climate change (Terzaghi et al., 2020, Bastin et al., 2019). There are studies finding that cell antenna RF- EMF can injure trees (Waldmann-Selsam, C., et al., 2016, Breunig, 2017, Haggerty, 2010) and impact plant growth (Halgamuge, 2017, Pall, 2016).

A 2021 research review on effects to wildlife published in Reviews on Environmental Health references more than 1,200 scientific references which found impacts to wildlife, including pollinators, from even very low intensities of non-ionizing EMFs including impacts to orientation and migration, reproduction, mating, nest, den building and survivorship (Levitt et al., 2021a, b, c). The authors assert that the current body of science should trigger urgent protective regulatory action to protect wildlife.

A COMPLEX SCIENCE WITH LIMITED PROTECTIVE FEDERAL REGULATION AND HEAVY INDUSTRY INFLUENCE

U.S. and international scientists are calling for an update to the 1996 federal regulations and the need for independent research reviews in order to ensure the public is protected (Hardell & Carlberg, 2020). Similar to other environmental pollutants, literature reviews show conflicting results and industry funding has long been found to influence the results both in ELF and RF research (Hardell et al., 2006, Carpenter 2019, Huss et al., 2017). The official reports of many authorities have been criticized as having major conflicts of interest (Hardell 2017, Buchner & Rivasi, 2020).

The book, "Captured Agency" (Alster, 2015) identified a "revolving door" between industry, Congress and the Federal Communications Commission. The investigation compared the tactics of the wireless industry to Big Tobacco citing the heavy industry lobbying, the funding of science that shows no effect and the massive public relations campaigns designed to attack the credibility of the science and of scientists who do find harmful effects.

U.S. Policy

The Federal Communications Commission (FCC) established human exposure limits for cell phones and cellular network RF-EMF in 1996 and they have not been updated despite the dramatic changes in wireless communications in the last 25 years. The FCC is not a health agency and does not have medical or public health experts on staff. In 2021, a federal court ruled that the FCC needed to reexamine their decision to retain the 1996 limits (No. 20-1025, 2021). To date, governmental health and environmental agencies such as the Environmental Protection Agency (EPA), the Food and Drug Administration (FDA), the Department of Health and Human Services and National Cancer Institutes have not reviewed the totality of the latest science on health effects of EMFs.

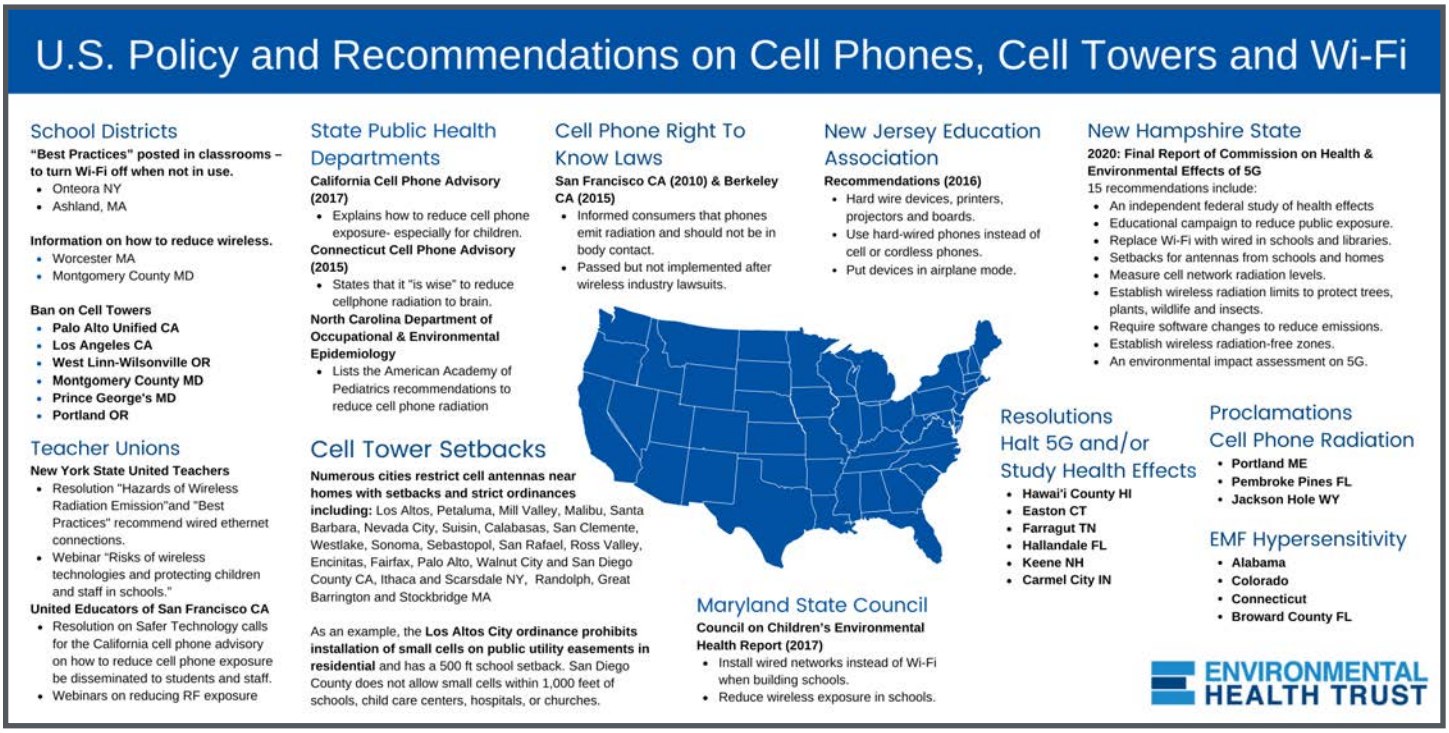
In 2018, the U.S. National Toxicology Program (NTP) found "clear evidence of cancer" and DNA damage in a large-scale animal study designed to evaluate the effects of long term exposure to radio frequency radiation from cell phones (U.S. National Toxicology Program, 2018). Although the FDA requested the studies, they rejected the study conclusions. Research analyzing the NTP findings conclude U.S safety limits need to be strengthened by 200 to 400 times to protect children according to current risk assessment guidelines (Uche & Naidenko ., 2021).

The American Academy of Pediatrics has long recommended that FCC limits be updated to protect children and pregnant people (AAP, 2012 & 2013). In addition, cell phones and electronics are not tested the way people use devices today- in body contact positions. Although it is now commonplace to see children watching videos with a cell phones pressed against their chest, research has found that when phones are tested for exposure levels in body contact positions, they can exceed government limits up to 11 times the FCC limit (Gandhi, 2019). Pregnant people rest cell phones laptops on their abdomens, and research finds these positions create RF-EMF exposures into the fetal brain (Cabot et al., 2014) and can induce ELF-EMF in the fetus Bellieni et al., 2012).

Magnetic and ELF Safety Limits

The United States has no federal safety limit for magnetic fields or ELF-EMF. In contrast, over a dozen countries have some level of protective policy in place and they limit building homes in areas with magnetic field levels higher than the levels associated with childhood leukemia (Stam, 2018).

Figure 3



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State and Local Policies

In the US, many states and localities have enacted laws related to Cell/Tower/Antenna placement. Physicians for Safe Technology and the Environmental Health Trust track state legislation and local ordinances. In 2020, the New Hampshire State Commission on 5G issued 15 recommendations which included several recommendations including large setbacks to distance cell antennas from homes and schools, replacing Wi-Fi with wired in schools and a public health campaign to educate families. In 2023, Massachusetts state legislature proposed a bill (H.2158) that would recognize electromagnetic sensitivity (EMS) as a disease that is a public health issue and establish a state-wide EMS disease registry.

International Policies and Actions

Internationally governments have policies and regulations in place to inform the public and reduce exposures. Numerous scientists, medical and public health professionals have issued appeals and recommendations on the need to reduce exposure to electromagnetic radiation and pause the proliferation of new untested networks (EMF Scientists Appeal, 2015, Di Ciaula, 2018, Mallery-Blythe, 2020, Nyberg & Hardell, 2017)

- Switzerland, Italy, China, Russia, India, Israel and several European countries have far more stringent cell tower radiation emission limits compared to the US FCC and many define homes, schools and kindergartens as "sensitive areas" (Stam, 2017).
- Over a dozen countries have clear recommendations that people reduce exposure to cell phone radiation, especially for children (Redmayne, 2016, EHT, 2021).
- France has several policies including: limiting Wi-Fi in classrooms, banning the sale of cell phones designed for young children, banning advertisements aimed at children under 14 years old. Consumers are informed with instructions to use speakerphone, limit children's use and "keep away from the belly of pregnant people and lower abdomen of adolescents."
- Cyprus and French Polynesia have multimedia public education campaigns (EHT, 2021).
- A major hospital in Cyprus removed Wi-Fi from the pediatric Intensive Care Unit and Neonatal units (Cyprus Committee on Environment and Children's Health, 2019).

IMPLICATIONS FOR NURSING PRACTICE

In 1992, the International Council of Nurses made environmental health, preventing illness by eliminating environmental toxins a priority (as cited in ANA's Principles of Environmental Health for Nursing Practice

Table 2: Ways to reduce exposure to cell phone radiation

American Academy of Pediatrics Reducing Cell Phone Radiation Recommendations

- Prefer texting to voice calls
- Use cell phones in speaker mode or hands-free.
- Hold cell phone at a distance from head.
- Make only short or essential calls on cell phones.
- Avoid carrying your phone against the body like in a pocket, sock, or bra.
- Do not talk on the phone or text while driving.
- 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.
- Minimize use in areas of low signal (i.e. how many bars you have). The weaker your cell signal, the harder your phone has to work and the more radiation it gives off.
- Avoid making calls in cars, elevators, trains, and buses. The cell phone works harder to get a signal through metal, so the power level increases.
- Remember that cell phones are not toys or teething items.

(American Academy of Pediatrics, 2016)

Resources on How To Reduce Cell Phone Radiation

- EHT Steps to Reduce Cell Phone Radiation
- Cell Phone Tip Card from Grassroots Environmental Education
- Downloadable Posters on Reducing Cell Phone Radiation

Reducing EMFs During Pregnancy

During pregnancy, new parents are highly motivated to learn everything they can to have a healthy baby. This is a great opportunity for nurses to give parents information.

The Baby Safe Project website includes five simple ways to reduce exposure, downloadable brochures in French and Spanish.

Reducing EMFs at Home

- Replace cordless phones with corded telephones
- Minimize wireless use. Start by turning Wi-Fi off at night. Then install wired ethernet connections instead of Wi-Fi.

Reducing EMFs at Home (Cont.)

- Use wired mouse, keyboard, speaker, and printer.
- Use wired alarm systems and doorbells not wireless
- Keep devices on a table off the lap/body.
- Do not use wireless speakers or virtual assistants.
- Keep mobile devices and chargers out of bedrooms.
- Eliminate baby monitors and wireless cameras.
- Refuse Smart meters and request analog, non-wireless utility (water, electricity, gas) meter options.
- Safe Technology at Home
- Checklist for Reducing EMF at Home
- How to Connect Your Laptop with Ethernet Instead of Wi-Fi

Tips for Reducing Magnetic Field EMF

- Use tablets, laptops and electronics on a table, not the lap.
- Do not use a cell phone or device while it is charging.
- Charge phones and devices away from beds and away from your body.
- Remove screens and electronics from the bedroom - especially around your bed and the crib.
- Avoid sleeping with electric blankets and heating pads.
- Ensure you are not sleeping against a wall with the utility meter on the other side.
- Get magnetic field measurements, especially if you live close to high voltage power lines.
- Building science and radiofrequency radiation: What makes smart and healthy buildings: Reduce EMF
- Collaborative for High Performance Schools Reduce RF and Low EMF Criteria
- How to Reduce EMF in Schools
- Safe Tech for Kids: What to do about children's increased use of technology during Covid-19

with Implementation Strategies 2007). Nurses can protect human health and the environment through prevention, clinical practice, and advocacy.

Prevention

Nurses are trusted advisors. Nurses must first protect themselves and their families, their patients, and their communities by learning how to decrease exposures to EMFs. Small lifestyle changes can significantly reduce cellular damage of our total lifetime exposure. We can then educate our patients- especially parents and vulnerable populations. Nurses can work in coalition with

other groups to educate why and how to reduce EMF exposures in the workplace, schools, and communities. People need to know how to eliminate unnecessary sources of EMFs and choose safe alternatives. Tips and checklists follow.

Clinical Practice

Nurses can integrate their understanding of EMFs into their clinical practice and include interview questions about technology use and EMF exposure in their assessments. When patients present with EHS symptoms, such as headache, insomnia, irritability, they should be further assessed for EMF sensitivity.

Helpful resources include:

- Physicians for Safe Technology EHS information includes Clinical Interview Questions
- Austrian Medical Association EMF Guidelines Has algorithms and a sample patient questionnaire.
- The Environmental Health Clinic, Women's College Hospital at the University of Toronto Practice Guidelines for Diagnosis and Treatment (Bray, 2020)
- EMF Medical Conference 2021 offers CME Online
- Electrosensitivity Society Providers in US and Canada

ADVOCACY

Protecting Health Requires Nurses To Be Advocates for Systematic Policy Change

Just as with other environmental issues, nurses have a responsibility to act to protect individuals and communities by supporting meaningful policy change.

Nurses bring credibility on health issues to advocacy and our voices are important in developing protective policy.Working in coalition with other organizations always strengthens the message (e.g parent groups, environmental organizations, faith-based organizations, etc.).

- Nursing organizations can adopt resolutions or policy positions on wireless and EMF exposures. See the resolution of the California Medical Association.
- Nurses can join "safe tech" organizations and coalitions to support policies that reduce EMF exposures in our workplaces, schools, and communities. These include the citing of small cell antennas in neighborhood and sensitive areas and advocate for wired internet connection to and into the building: FASTER, SAFER, RELIABLE, and if it is a municipal/community partnership, it will eliminate the digital divide. Learn more at: SafeG.net
- Nurses and nursing organizations fighting climate change can lobby elected officials to take into account the carbon footprint of wireless technology. Download Environmental Health Trust's Fact sheet on 5G and Climate Change which describes research showing escalating energy consumption from 5G networks.
- As environmental health advocates, nurses can educate and work with schools, parents, teachers, and unions to reduce EMF exposures in schools, replace Wi-Fi with wired internet connections and ensure cell towers are not built near schools or daycare centers.

RESOURCES

Resources for Safe Schools

Environmental Health Trust
Physicians for Safe Technology

Santa Clara Medical Association

Wi-fi In Schools: Are We playing It Safe With Our Kids?

Shallow Minds: How the Internet and Wi Fi in Schools Can Affect Learning

How To Reduce EMFs in Schools

New Jersey Education Association Article, PDF of Recommendations

Maryland State Children's Environmental Health and Protection Advisory Council

Collaborative for High Performance Schools Low EMF Criteria

Grassroots Environmental Education

Environmental Health Trust Checklist for Schools

Websites

Environmental Health Trust

Environmental Working Group

Physicians for Safe Technology

Americans for Responsible Technology

Dr. Joel Moskowitz, UC Berkeley School of Public Health, Director, Center for Family and Community Health

Educational Webinars

Dr. Joel Moskowitz "Health Effects of Cell Phones and Wireless: Implications for 5G" Center for Occupational and Environmental Health Webinar

Dr. Devra Davis "Children, Wireless Radiation and Health" Cyprus Pediatric Symposium

Expert Webinar "What Environmental Health Leaders Need to Know"

Downloads/Printables

EHT Posters and Factsheets

American Academy of Pediatrics Letters

Santa Clara Medical Organization

Books

Dunkley, V. (2015). Reset your child's brain: A four-week plan to end meltdowns, raise grades, and boost social skills by reversing the effects of electronic screen-time. New World Library.

Cohen, A.,& vom Saal, F.S. (2020). *Non-toxic: Guide to living healthy in a chemical world.* Oxford University Press.

Davis et al, (2018). Chapter 10: Microwave/Radiofrequency Radiation and Human Health: Clinical Management in the Digital Age, in Integrative Environmental Medicine Oxford University Press

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