Health Risks of Wireless Technology

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Wireless Technologies in Schools

- Wireless Radiation as a Toxicant
- Unique Vulnerabilities of Children
- Best Practices for Safe Technology in Schools

- Teachers
- Staff
- Administration
- Buses
- Students
- Classrooms
- Janitors
Digital Technology Risks

- Distraction/Addiction/Learning
- Psychosocial- Depression, Anxiety, ADHD, Suicide
- Commodification of Children’s Data-Ed Tech
- Privacy and Security- EdTech
- Eye Health

- Physical Health Effects of Wireless Radiation
Wireless Technology Biologic and Health Effects
Cell Tower Health Effects?

- Neurologic Symptoms: Insomnia, headaches, fatigue, memory loss, depression
- Cancer
- DNA damage
- Hormone imbalance
- Blood cell abnormalities
What I learned About Wireless Radiation

- Wireless radiation passes through bodies and organisms
- Wireless radiation is absorbed by anything containing water
- Wireless radiation can interfere with and harm cellular biological processes (not through heat)
- Wireless radiation is a mix of artificial electromagnetic frequencies
- We are electrical beings: Brain, Heart, Nervous and Endocrine Systems
I Also Learned...

- There are 7 Decades of military and basic science on harm from RFR
- Wireless radiation affects all living organisms
- Acts as an environmental and human toxicant
- Effects are cumulative
- Biological effects are seen at levels well below current guidelines. Safety guidelines are obsolete, not protective of human or environ
Variables in EMF Exposure

- Time
- Distance
- Location
- Power Density
- Frequencies
- Modulation
- Buildings
- Trees
- Walls

Radiofrequency radiation from nearby mobile phone base stations—a case comparison of one low and one high exposure apartment. (2022) Koppel T, Hardell L. et al
Wireless Radiation Surrounds Us
THE ELECTROMAGNETIC SPECTRUM

Penetrates Earth Atmosphere?

Wavelength (meters)

Radio  Microwave   Infrared  Visible  Ultraviolet  X-ray  Gamma Ray

10^3  10^-2  10^-5  .5 x 10^-6  10^-8  10^-10  10^-12

About the size of...

Buildings  Humans  Honey Bee  Pinpoint  Protozoans  Molecules  Atoms  Atomic Nuclei

Frequency (Hz)

10^4  10^8  10^12  10^15  10^18  10^20

Temperature of bodies emitting the wavelength (K)

1 K  100 K  10,000 K  10 Million K

Non-Ionizing Radiation  RFR  EMF  EMR  ---------  Ionizing Radiation
Classroom & Home Sources of Wireless RF Radiation

- Wi-Fi Routers
- Tablets/Laptops
- Wireless White Boards
- Wireless Printers
- Cell phones
- Cordless phones
- Smart meters
- Cell Towers
Is Wireless Radiation Safe or Toxic?
Toxic Exposures Affects Our Health

- Cumulative harm
- Synergistic toxic exposures
- Affects all organ systems
- Vulnerable populations- pregnancy, children, elderly,
- Genetics
- Nutrition
Children Are More Vulnerable to Toxic Exposures

- Rapid growth, cell division and differentiation
- Metabolic processes are immature until after puberty
- Critical windows during organ development
- Longer life and more accumulation of toxic injury
The Developing Brain is the Most Vulnerable

- **Critical windows** of development-
- **Extraordinary complexity** and fragility of human brain development
- **Wide range of toxins** affect the brain
- **Decades to identify** a neurotoxin
- **Scientific Stages Toxins:** First occupational toxicity at high doses, then poisoning, then subclinical effects in children, then silent pandemic

Grandjean P and Landrigan PJ. Developmental neurotoxicity of industrial chemicals. The Lancet. 2006
Biologic Mechanism of Toxins
What is the Mechanism of Harm From Toxins?

- Reactive Oxygen Species
- Free Radicals
- Oxidation
- Oxidative Stress
Mechanism of Action for Chemical Toxicity: Oxidation (ROS)

- DDT creates Reactive Oxygen Species,
- Lead, Mercury, Arsenic, OP pesticides, Dioxins, PAH’s all induce oxidative stress by depleting the major intracellular antioxidant, glutathione
- Diesel Exhaust induces reactive oxygen (ROS) species in bronchial tissues
- Oxidation causes rust- non biologic reaction equivalent
Oxidative Stress → Inflammation → Human Disease

- **Cancer** via activation of transcription factors of inflammatory pathways and ROS (Reuter 2010)
- **Alzheimer’s Disease**
- **Type-2 Diabetes Mellitus** via Reactive Oxygen Species (ROS) Toxicity (Ahmad 2017; Attara 2009)
- **Aging, CV and Metabolic Disease** from lipid peroxidation via ROS- (Hauck 2016)

Is There a Biologic Mechanism of Harm From Wireless Radiation?

Physicists say NO!

Biologists say YES! It’s Oxidation!
RFR Biological Damage to Cellular Molecules

RFR-Oxidative Stress & Free Radical Formation

- DNA Damage
- Lipid Peroxidation
- Membrane Disruption

BioInitiative Report - Lai - 203/225 - 89% show effects; Yakymenko - 93/100 studies show oxidation
RFR Oxidative Damage to Cells

- Sperm and Ovaries
- Nerve Cells
- Cardiac Cells
- Blood Cells
- Immune System

Antioxidants Reverse the Effects
RFR Oxidative Stress → Inflammation → Modern Human Disease

- Cancer (Lerchi 2015)
- Reproductive Harm (Kesari 2018)
- Neurologic Dysfunction/Alzheimer’s Disease (Othman 2017) (Gupta 2018)
- Cardiac Disease (Tuerdi 2015)
- Immune Suppression (Szmigielski 2013)

National Institute of Health 2019 Cancer and Inflammation
Children are More Vulnerable to Wireless EMR

- Skulls thinner
- Higher content of water in brain
- More absorption of radiation - 2 to 5 times
- Deeper absorption to hippocampus (Christ 2010)
- Organ, and reproductive systems are not developed

Short Term and Long Term Health Effects
ElectroHypersensitivity (EHS)

“A phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic or electromagnetic fields (EMFs)”. Bergqvist et al. (1997) Sweden.
ElectroHypersensitivity
Many Disabled and Cannot Work

- **ElectroHypersensitivity**: Headaches, nausea, fatigue, brain fog, insomnia, heart palpitations
- 5% to 30% of people have mild EHS
- 1.5 to 5% of people have Moderate EHS
- 0.65% Restricted access to work = 435,500 people in the UK. (2 Million in USA)

1971: Naval Medical Research Institute
Neurologic Effects of Non-Ionizing RFR

- Headaches
- Insomnia
- Fatigue
- Restlessness/Anxiety
- Lack of Concentration
- Memory Loss
- Dizziness
- Irritability
- EEG changes/Seizures
- Cardiac changes

Bibliography of reported biological phenomena ("effects") and clinical manifestations attributed to Microwave and Radiofrequency Radiation- 2300 studies- by Zorach Glaser, PhD
RAINES Report on Occupational Injury and Microwave Illness in workers in electromagnetic fields showed symptoms headaches, irritability, fatigue, dizziness, disturbed sleep, nervous tension, mental depression, memory impairment, loss of hair, pain in muscles, breathing difficulties

• Showed 19 neuropsychiatric effects associated with occupational RFR
• *Showed increasing prevalence of neuropsychiatric symptoms with cumulative years of exposure*

NASA 1981: Electromagnetic Field Interactions With the Human Body: Observed Effects and Theories
Firefighters
Cell Tower Health Effects

- **First Responder Cell Towers**: Headaches, extreme fatigue, sleep disruption, unexplained anger, depression, profound memory loss
- Firefighter on 911 call got lost in city he grew up in
- **2004 IAFF Study** firefighters in fire stations with cell towers
- **IAFF Resolution 2004; CA AB57-2016, AB357 (2021)** - firefighters exempt from cell tower placement due to health
What’s the Diagnosis Doctor?
Dr. Scott Eberle

- Headaches
- Dizziness
- Nausea
- Heart palpitations
- Irritability
- Poor concentration

Neurologic Symptoms and Cell Towers

- Fatigue, headache, difficulty concentrating, depression, memory loss,

- Symptoms within 500 meters – 1640 feet

- Shinjyo and Shinjyo 2014- Most symptoms disappeared 3 months after cell tower removed.

Havana Syndrome

- Havana 2016, China 2018, Austria 2021, Arlington, VA 2021
- Incapacitating neurologic symptoms in diplomats, family and pets
- Headaches, fatigue, nausea, vomiting, dizziness, insomnia, imbalance, nosebleeds, memory loss, hives, ringing in the ears and hearing loss.
- National Academy of Sciences report 2020 concluded this was pulsed microwave radiation

Long Term Health Effects
The Brain
Wireless Radiation Acts as a Neurotoxin

- **Loss of brain cells in the Hippocampus** - Memory (Shahain 2018; Fragopoulou 2018; Sahin 2015)
- **Oxidative stress** and inflammation (headaches, sleep disturbance, fatigue, memory) (Yakymenko 2016; Shahin 2015; Fragopoulou 2012)
- **Decreased Neurotransmitter Levels** (mood) (Hu 2021; Eris 2015; Ismail 2015; Aboulezz 2013)
- **Demyelination with chronic exposure** (Kim 2017)
- **Disturbs Nervous System Signaling** required to regulate the body’s response to disease
Fetal Exposure to Cell Phone Radiation and ADHD

- Study looking at cell phone radiation effects on fetus and later development of ADHD. Study eliminated confounding factors - ignoring child during development.
- 2 groups of mice - 32 pregnant mice exposed to cell phone above the cage and 42 controls. Offspring tested as young adults.

- **Conclusions**: Offspring who were exposed to cell phone radiation had decreased memory, more hyperactivity, no fear. *Fetal radiofrequency radiation exposure led to neurobehavioral disorders in mice, such as ADHD*.
"It could be concluded that the alterations in amino acid neurotransmitters induced by EMR exposure of juvenile and young adult rats may underlie many of the neurological effects reported after EMR exposure including cognitive and memory impairment and sleep disorders. Some of these effects may persist for some time after stopping exposure." Ahmed 2018

The chronic effect of pulsed 1800 MHz electromagnetic radiation on amino acid neurotransmitters in three different areas of juvenile and young adult rat brain. Ahmed. Toxicol Ind Health. 2018
Wireless Radiation Opens the Blood Brain Barrier

- **Increased permeability** of blood brain barrier (Salford 2003; Nittby 2008; Sirava 2016; Eberhardt 2008)
- **Low level EMR** - 0.12mW/kg (1.6W/Kg standard)
- **Leakage of albumin** at 8 weeks with 2 hours of exposure - (Salford 2003)
- **Neuronal damage in the cortex**, hippocampus, and basal ganglia (Salford 2003)

Memory, Behavior & Learning

- **Speech Delay**: (Ma 2017) American Academy Peds - 30-min increase in screen time = 49% increased risk of expressive speech delay.

- **Memory**: (Foerster 2018) - 24 Swiss Schools - Decreased memory scores with cumulative phone use.

- **ADHD**: (Birks 2017) 83,000 Women - Perinatal study - 5 countries: Denmark, Korea, Netherlands, Norway, Spain - Increased maternal cell phones – more ADHD and emotional problems.
Adolescents’ Memory Performance and Long Term Use of Cell Phones (2018)

• Swiss prospective study of 843 adolescents in grade 7,8 and 9 in 24 secondary schools in Central Switzerland over 1 year
• Figural and verbal memory tasks evaluated along with minutes/hours of cell phone use
• Results: “We found preliminary evidence suggesting that RF-EMF may affect brain functions such as figural memory in regions that are most exposed during mobile phone use.”
• No Cell Phones to the ears
Cognitive Decline in Students Near Cell Towers

- 2 Year study
- 2 Schools, kids 13-16
- One School 2.010 µW/cm² for 6 hours a day
- Other School 10.021 µW/cm² for 6 hours a day
- Result: Higher exposure group had delayed fine and gross motor skills, spatial working memory, and attention

Cell Phone Use: 
Increases Distraction 
Decreases Learning 

- Mobile telephone use decreased cognitive function in adolescents (Abramson 2009)
- Higher test scores in schools where cell phones banned in classrooms (Beland- London school of economics)
- Note taking, Learning and recall higher without phone use (Kuznekoff 2013)
- “Brain Drain” of limited working memory and capacity in mere presence of cell phone
Reproduction
Risks to Reproduction

- **Sperm Damage** - 40+ studies - Motility, DNA, Testosterone
- **Ovarian Damage** - 9+ studies
- **Embryo Damage** - 6+ studies
- **Miscarriage** - Dr. De Kun Li - Kaiser - 913 pregnant women, highest levels of everyday EMF gave 3 fold increase in miscarriage

Wireless Devices and Miscarriage Kaiser Study

- Miscarriage is a sensitive indicator of EMR harm
- 913 pregnant women with exposimeters
- Controlled for other factors
- Three fold increase in miscarriage with everyday exposure

DNA Damage and Cancer
International Agency for Research on Cancer

PRESS RELEASE
N° 208

31 May 2011

IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

"This Classification applies to all RF–emitting devices, including Wi Fi.” Robert A. Baan, PhD, IARC

“This classification justifies the implementation of the Precautionary Principle.” Dr. Darius Leszczynski, IARC
DNA Damage and Cancer

- Oxidation major factor in DNA damage from toxins
- DNA repair mechanisms at work constantly
- If repair is overwhelmed leads to mutations
- Accumulation of mutations and epimutations leads to cancer
- Inherited gene variants in DNA repair enzymes are associated with higher probability of developing cancer
Wireless Radiation: Cancer and DNA Damage

- Dr. Lai Research Summaries on RFR Genotoxicity 224/346 showed effects (65%) , Comet Assays 78/125 showed effects (65%)
- NTP Study 2018 - Clear evidence of cancer and DNA damage
- Ramazzini Institute Study 2018 - Cancer and DNA damage
- Occupational Reviews of Military Personnel (Peleg 2018)
- Markova (2010) Low power RFR alters DNA repair in stem cells
NTP Study on Long Term Exposure To Cell Phones and Cancer 2018

- National Institutes of Environmental Health Sciences (NIEHS)- Research Triangle Park, North Carolina
- Gold Standard Study was 10 years and $30 million
- Shielded cages
- Robust study
NTP Study Key Findings: Clear Evidence of Cancer

- Clear evidence for heart tumor schwannomas – same as epidemiologic studies
- Some evidence for glioma brain tumors
- DNA Damage
- Unexpected Cardiomyopathy- aging of the heart
- Increases in tumors in several other organs, including pituitary gland, thyroid, pancreas, skin and liver compared to controls.
- Controls with very low cancer rates
“The radiation level the rats received was “not very different” from what humans are exposed to when they use cellphones,” Chris Portier, former associate director of the NTP who commissioned the study

“The assumption that non-ionizing radiation cannot cause cancer or other health effects, other than by tissue heating is WRONG.” Ronald Melnick, Ph.D., Retired Senior Toxicologist at NIEHS and lead study designer-Presented to NC Dept of Health & Human Services 3/22/19
Ramazzini Institute Cell Phone Study of Replicates NTP Study

- Worlds largest long-term study ever performed in rats on the health effects of RFR, including 2448 animals published in 2018
- Much lower levels of RF radiation than NTP
- DNA damage
- Significant increase in the incidence of heart Schwannomas at the highest dose,
  *Increase in heart Schwann cell hyperplasia and malignant glial tumors in female rats at the highest dose
- Same cell type as those observed in some epidemiological studies on cell phone users
Brain Cancer and Cell Phones

- Brain tumors are the most common solid tumors affecting children and adolescents, (John Hopkins)
- Brain tumors rising in England and France
- Significant association brain tumor and cell/cordless phone use on same side of head (Hardell and Carlberg)
- Interphone study - 13 countries found increase in brain tumors in the highest user groups and after 10 years
- First court case on cell phones and brain cancer was won in Italy in 2017
Cell Towers
Cell Towers and Cancer

- **Eger (2004) Bavaria** - Increase within 400 M (1200 ft)
- **Khurana (2010)** - 8 of 10 studies showed an increase neurobehavioral symptoms or cancer within 500M of cell tower.
- **Dode (2011) - Brazil** - Increase within 500 M
- **Balmori Review of 38 studies (2023)** - 77% showed increase in cancer near cell towers
Exposure of Wi-Fi in Schools
Wi Fi Radiation Effects

- Oxidative Stress brain and liver (Çelik 2015)
- Decreased plasma prolactin, estrogen, and progesterone levels and Uterine oxidative injury. 60 min/day (Yuksel 2016)
- Alteration of miRNA with 2.4 GHz Wi Fi for 1 year Dasdag S et al. (2015)
- Decreased reaction time with Wi Fi at home (Bamdad 2019)
- Decreased object recognition (Hassanshahi 2017)
Can Wi Fi Signals Stunt Plant Growth?
High School Experiment Wi Fi and Cress Seed Germination
Cell Phone Radiation Harms Tomato Plants

- Decreased seed gemination, photosynthesis and root growth
- Reduction of phenolic compounds, flavonoids, vitamin C and antioxidant levels

“Mobile communication agencies should be informed and installation of base stations for mobile communication towers should be prohibited at agricultural lands.” (2022)

Wildlife Effects

- Birds
- Bees
- Trees
- Mammals
- Reptiles
- Insects
- Bacteria
FCC Standards Outdated

• Based on short term (30 Min) thermal heating not long term biological effects
• Do not consider vulnerable populations- fetus, babies, elderly, chronic illness
• Do not consider those who are electrosensitive-
• Do not consider environmental effects
• Non–thermal biologic effects and mechanisms have been identified in scientific literature but not considered
FCC Standards Need Reevaluation

- American Academy of Pediatrics - “Current FCC standards do not account for the unique vulnerability and use patterns specific to pregnant women and children. It is essential that any new standard for cell phones or other wireless devices be based on protecting the youngest and most vulnerable populations to ensure they are safeguarded throughout their lifetimes.”

- California Department of Public Health Guidelines on Cell Phone Radiation 2017: REDUCE YOUR EXPOSURE

- Austrian Medical Association

- California Medical Association

- Government Accountability Office
People vs FCC

ORAL ARGUMENT REQUESTED
20-1025 (Lead); 20-1138 (Consolidated)

UNITED STATES COURT OF APPEALS
FOR THE DISTRICT OF COLUMBIA CIRCUIT

ENVIROMENTAL HEALTH TRUST; CONSUMERS FOR SAFE CELL PHONES; ELIZABETH BARRIS; THEODORA SCARATO
CHILDREN'S HEALTH DEFENSE; MICHELE HERTZ; PETRA BROKKEN;
DR. DAVID O. CARPENTER; DR. PAUL DART; DR. TORIL H. JELTER; DR.
ANN LEE; VIRGINIA FARVER, JENNIFER BARAN; PAUL STANLEY, M.Ed.

Petitioners

v.

FEDERAL COMMUNICATIONS COMMISSION;
UNITED STATES OF AMERICA

“We find the Commission’s order arbitrary and capricious in its failure to respond to record evidence that exposure to RF radiation at levels below the Commission’s current limits may cause negative health effects unrelated to cancer.”

DC Court of Appeals
August 13, 2021
BioInitiative Report: Biologically Based Exposure Limits

• Clear evidence of bioeffects at environmentally relevant levels

• The BioInitiative scientific benchmark is 0.003 uW/cm² for No Observable Effect (Current standard is 1000 uW/cm²)

• Report recommends that this precautionary limit should be adopted

BioInitiative.org
Re-Inventing Wires: The Future of Landlines and Networks

- Safer
- Faster
- More Secure

National Institute for Science, Law & Public Policy
Washington, DC
Reducing Exposure to Wireless

- Prefer wired connections over wireless
- Devices on a table and at least 8 inches from body
- Turn off wireless devices and Wi Fi when not in use
- Ban cell phone use at school
- Ban cell towers near schools, homes
- Fiberoptic network development

Recommendations to Reduce EMR Exposures in Schools

• The 2011 European Council Resolution 1815
• The German Parliament
• Collaborative for High Performing Schools Best Practices for Low EMF
• Maryland Children’s Environmental Health and Protection Advisory Council
• New Jersey Education Association
• Santa Clara County Medical Association Best Practices for Safe Technology
5G Wireless Technology and Public Health

5 G wireless telecommunications expansion: Public health and environmental implications*

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Abstract

The popularity, widespread use and increasing dependency on wireless technologies has spurred a telecommunications industrial revolution with increasing public exposure to broader and higher frequencies of the electromagnetic spectrum to transmit data through a variety of devices and infrastructures. On the horizon, a new generation of even shorter wave lengths 5G networks is being envisioned to power the Internet of Things.
Thank You!

Reduce Your Exposure!
“Our vision is a world where technology serves our needs without undermining our physical, psychosocial or environmental health.”

www.MDSafeTech.org