Impacts of Wireless Technology on Health:
A symposium for Ontario’s medical community
May 31st, 2019

Health Canada’s Safety Code 6
and
Global Trends Regarding
Radiofrequency/Microwave Radiation Safety

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Outline

1. The Electromagnetic Spectrum
2. Health Canada’s Safety Code 6
4. Global Trends
5. International Actions
6. C4ST Recommendations
7. Next Steps
Personal background and Organizations’ Focus

• 40+ years in the technology industry
• Retired - most recent position, President of Microsoft Canada

C4ST: Canadians for Safe Technology (CEO and Chairman)

• Not-for-profit, completely volunteer-based, national coalition of parents, citizens and experts
• To educate and inform Canadians about the dangers of the exposures to unsafe levels of radiation from wireless technology
• To work with all levels of government to create healthier communities for children and families from coast to coast to coast.

Environmental Health Trust (Co-Chairman Business Advisory Group)

The only nonprofit in the world today that both:
• Carries out high-level critical research on controllable environmental health hazards
• Works directly with local communities, teachers, parents and students as well as policy makers to understand and mitigate these hazards through research, education and advocacy.
"radiofrequency" and "microwaves" are often used interchangeably.
**IONIZING**

**NON-IONIZING**

SAFETY CODE 6 – thermal only

**5G**

Common wireless devices: 600 MHz to 6 GHz, Wi-Fi: 2.45 and 5 GHz

5G (5th Generation): > 6 GHz, includes millimeter wavelengths

*Thermal AND Peripheral Nerve Stimulation*
• The purpose is to establish safety limits for human exposure to radiofrequency (RF) fields in the frequency range from 3 kHz to 300 GHz.
• Originally intended for individuals working at, or visiting, federally regulated sites.
• Health Canada recommends limits for safe human exposure

• Health Canada does not regulate the general public's exposure to RF radiation
• Many provinces, territories and school boards apply the exposure limits in Safety Code 6 for general public exposure.
• Industry, Science and Economic Development Canada (ISED) regulate wireless devices and their associated infrastructure (such as cell towers) which are required to comply with Safety Code 6.
Health Canada’s Safety Code 6 Guidelines

  - “Far-field” (> 20 cm) - Power density –
    - e.g. radar emitting devices, cell-tower antennae
    - Set at 10 W/m² for the public
    - Rate of flow of energy per unit area
- 1991 “Near-field” added (< 20 cm) – Specific Absorption Rate (SAR) –
  - For devices close to the body (cell phones and tablets)
  - Set at 1.6 W/kg per 1 gram of a cube of tissue
  - SAR is a measure of the rate at which energy is absorbed by the body
  - SAR is calculated from tissue conductivity, electric field strength induced in the tissue and mass density of the tissue

- The only “established” adverse effect in range commonly used for wireless devices (100 kHz to 300 GHz) is thermal
  i.e. if no heating, no harm.
Evidence for Non-thermal Effects

Martin Pall, Ph.D.
Professor Emeritus of Biochemistry and Basic Medical Sciences
Washington State University, Unpublished report - 2017

“List of 170 Reviews on Non-thermal Effects of Microwave/Intermediate Frequency EMFs”

• Each review cites at least a dozen primary literature citations showing non-thermal effects
• An indication of “the size of the literature that contradicts the industry and Health Canada’s contention that there are no non-thermal effects of microwave frequency EMFs”
Shortcomings of Safety Code 6

- Does not take into account proven biological effects, only tissue heating
- No significant changes since its first publication in 1979 for power density and 1991 for SAR
- SAR compliance testing is based on science conducted on a 220 lb (100 kg) mannequin
- No distinction for children, elderly, or other sensitive groups
- ISED does NOT measure the output from cell towers/antenna they license under Safety Code 6
- There are no measurements taken for the cumulative effect from multiple devices over a 7/24 timeframe
- 5G is automatically assumed to be safe since it lies between arbitrary limits of Safety Code 6 established in 1979
Global Trends Regarding Radiofrequency/Microwave Radiation Safety
Comparison of Standards Internationally

Power density e.g. for cell towers:
• 100x safer in China, Italy, Russia and Switzerland

SAR e.g. for cell phones and tablets:
• Canada and US safer than most other counties
  • 1.6 W/kg (over 1 gram of tissue) vs 2.0 W/kg (over 10 grams of tissue)
1. International Commission on Non-Ionizing Radiation Protection (ICNIRP)
   - Exposure guidelines used by many agencies worldwide
   - Based only on established short term thermal effects
   - Industry friendly, not accountable to any other body

2. The World Health Organization (WHO)
   1) International Agency for Research on Cancer (IARC)
      - Reviews agents for carcinogenicity
      - In 2011, a working group of about 30 experts designated radiofrequency/microwave radiation as a Class 2B, possible carcinogen
      - Comprehensive monograph published – thermal and non-thermal effects
   2) International EMF Project
      - Currently working on a monograph for RF/MW radiation to be used as a basis for guidelines
      - The draft released to the public for comment was incomplete
      - 5 of the 6 members of the core group are also ICNIRP members

Medical Experts Worldwide Recommend Reducing Exposure

“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.” - AAP

“It is wise to reduce exposure…”
- Connecticut Department of Health

Over 220 scientists from 41 Nations have appealed to the United Nations for Action.
Legislation in Other Countries

- **China, Russia, Italy and Switzerland** have guidelines that are 100 times safer than the US.
- **France** 2017 - Cell Phones fully banned in all areas of elementary and middle schools.
- **France** 2015 – Wi-Fi Banned in Nursery Schools; Restrictions on advertisements promoting cell phones.
- **Taiwan** 2015- Ban on children under the age of two from using electronic devices.
- **Belgium** 2014 - Illegal to market cell phones to children less than 14 years of age; Phones designed for children under 7 years are prohibited from sale.
- **Korea** 2014 - mandated SAR labeling on cell phones and portable devices; public health recommendations to reduce exposure to cell phone radiation.
- **Chile** 2012 - “Antennae Law” prohibiting cell antennae/towers in “sensitive areas” (educational institutions, nurseries, kindergartens, hospitals, clinics, nursing homes).
- **India** 2012 – limits EMF levels to 1/10th of FCC guidelines.
- **Greece** 2000 - Mandates lower RF exposures near schools, nurseries and hospitals.
National Policies, Recommendations and Warnings

- 2018 - Sri Lanka’s Ministry of Health press release to reduce exposure
- 2016 – France declaration to protect workers against the risks arising from EMF’s
- 2015 – France mandate for SAR Radiation Labeling on cell phone packages
- 2016 - European Academy for Environmental Medicine Guideline for the prevention, diagnosis and treatment of EMF-related health problems and illnesses
- 2016 - The Italian Society for Preventive and Social Pediatrics officially called to prohibit cell phones for children under 10 years old
- 2015/2009 – Finland Radiation and Nuclear Safety Authority recommendations to reduce exposure, especially to children
Why we are concerned

- 2019 - 9 billion mobile connections Worldwide¹
- 2019 - 23 billion internet connected devices Worldwide²
- 2020 - Cisco predicts 500 billion internet connected devices³
- Equates to 59 devices per person given the UN projection of 9.7 billion people⁴

¹https://www.bankmycell.com/blog/how-many-phones-are-in-the-world
C4ST Recommendations

• A moratorium on 5G and other deployment of microwave radiation infrastructure to which the public is exposed until science showing safety is conducted.

• We must shift responsibility to industry to prove technology is safe before it is released to the market.

• Need protection for those with electromagnetic hypersensitivity (EHS) and other vulnerable populations.
Next Steps Until Safety Code 6 is Adequately Revised

• Stay current and educated:
  • https://ehtrust.org/ and https://www.saferemr.com/

• Practice Safe Tech:
  • Handout cards at the back (take a bunch)
  • http://c4st.org/reduce-exposure-from-wireless-transmitting-devices/
Appendix
Actual Use vs. Tested Emissions

- Most industry warnings are buried several layers inside the cell phone
- CBC Marketplace “The Secret Inside your Cell Phone”¹
  - 81% of Canadians have not seen the warning message in their phone or manual
  - 67% of Canadians say they carry their phones in their pocket or directly against their body
- All 3 phones tested had emissions 3-4 times above Health Canada guidelines

- The National Agency ANFR of France²
  - Found 90% of the 450 phones tested exceeded guidelines
  - The % increase in SAR from the recommended distance to against the body ranged from 10% to 25%

- Industry states “We meet Federal Guidelines if used correctly”

¹[https://www.youtube.com/watch?v=Wm69ik_Qdb8](https://www.youtube.com/watch?v=Wm69ik_Qdb8) 2.3 million views
History - Biological Effects and Setting of US Standard

- **1885 to 1940**: early work on benefits of short-waves and therapy
  - 1928: with medically accepted applications, debate over thermal and thermal effects “started in earnest”
  - 1929: “the burden of proof still lies on those who claim any biological action of high frequency currents other than heat production”

- **Early 1940s to 1960s**: shift in research from medical benefits to military and industrial concerns about hazards to health
  - 1942 - US military concerned about health effects reported by radar workers (headaches, flushing)
  - “…radar was virtually the only source of concern re public health over microwaves until the marketing of microwave ovens”

- **1996**: adoption of US standard for exposure to microwave radiation (based on thermal effects only)

C4ST: An example of evidence not assessed by Health Canada

- C4ST identified 140 studies that showed harm at levels at, or below Safety Code 6 that the Royal Society’s panel omitted in its 2015 report.

- Health Canada ignored all of this evidence-based information but did admit that some of the studies meet their criteria, However, no weight-of-evidence analysis was provided.

- When inquiries are made about the reasoning in excluding this evidence, Health Canada may provide an unpublished discussion paper “Safety Code 6 (2015) –Rationale” that has no rationale except to cite other authorities.
Biological effects deemed “in scope” by Health Canada for which no Weight-of-Evidence analysis has been provided:

- DNA repair inhibited in blood cells #4
- Thyroid: cell stress #28
- Brain/Central Nervous System: oxidative injury #30
- Brain: increased antibodies and stress reactions #16
- Jaw, ear: Increased microcirculation (vasodilatation) #22
- Decreased memory #23
- Brain: resting activity affected #24
- Mouth cells: gene impairment #33
- Brain: increased activity #7
- Brain: abnormalities #1

Safety Code 6: Head, neck, trunk
Safety Code 6 Controversy

- External reviewers, Anthony Miller and Martin Blank Ph.D., of the RSC 2014 report are critical of lack of adequate revisions to Safety Code 6 (2009)

- Series of articles by Paul Webster in the Canadian Medical Association Journal (CMAJ):
  - 2013. Chair of Wi-Fi safety panel steps down.
  - 2013. Federal Wi-Fi panel criticized for undisclosed conflict.
  - 2014. Federal Wi-Fi safety report is deeply flawed, say experts.
  - 2015. Scientists decry Canada’s outdated Wi-Fi safety rules.
Wireless Device Proliferation

- Car phones were installed in some police cars in Detroit starting in 1921¹
- The first commercially available service from fixed to mobile telephones was offered in St. Louis in 1946²

1983⁴
- 150k subscribers WW⁵

1994 first mass-produced GSM phone⁴
- 55m subscribers WW⁵

- There are currently 8.98 billion mobile connections WW⁶
- There are currently 23.14 billion internet connected devices WW⁷
- Cisco predicts 500 million internet connected devices by 2020⁸
- That equates to 59 devices per person given the UN projection of 9.7 people⁹
Health Canada’s response to international actions

• The limits in Safety Code 6 are science-based exposure limits that are consistent with the science-based standards used in other parts of the world, including the United States, the European Union, Japan, Australia and New Zealand.

• Internationally, a few jurisdictions (cities, provinces or countries) have applied more restrictive limits for RF field exposures from cell towers, although there is no scientific basis to support the need for such restrictive limits.

• In many instances these more restrictive limits are not applied to other wireless devices in these same jurisdictions.


2. Augner (2010). Effects of Exposure to GSM Mobile Phone Base Station Signals on Salivary Cortisol, Alpha-Amylase, and Immunoglobulin A. *Biomedical and Environmental Sciences. (Austria)*


12. Deshmukh (2013). Detection of Low Level Microwave Radiation Induced Deoxyribonucleic Acid Damage Vis-à-vis Genotoxicity in Brain of Fischer Rats. *Toxicology International (India)*


15. Furtado-Filho (2014). Effect of 950 MHz UHF electromagnetic radiation on biomarkers of oxidative damage, metabolism of UFA and antioxidants in the livers of young rats of different ages. *International Journal of Radiation Biology (Brazil)*


22. Loos (2013). Is the effect of mobile phone radiofrequency waves on human skin perfusion non-thermal? Microcirculation (France)


25. Maaroufi (2013). Spatial learning, monoamines and oxidative stress in rats exposed to 900MHz electromagnetic field in combination with iron overload. Behavioural Brain Research. (France)


29. Moretti (2013). In-vitro exposure of neuronal networks to the GSM-1800 signal. Bioelectromagnetics (France)

30. Naziroğlu (2012). Melatonin modulates wireless (2.45 GHz)-induced oxidative injury through TRPM2 and voltage gated Ca(2+) channels in brain and dorsal root ganglion in rat. Physiology & Behavior. (Turkey)


32. Sonmez (2010). Purkinje cell number decreases in the adult female rat cerebellum following exposure to 900 MHz electromagnetic field. Brain Research. (Turkey)


34. Valbonesi (2014). Effects of the exposure to intermittent 1.8 GHz radio frequency electromagnetic fields on HSP70 expression and MAPK signaling pathways in PC12 cells. International Journal of Radiation Biology (Italy)

35. West (2013). Multifocal breast cancer in young women with prolonged contact between their breasts and their cellular phones. Case Reports in Medicine. (USA)

36. Zhang (2013). Effects of 1.8 GHz radiofrequency radiation on protein expression in human lens epithelial cells. Human & Experimental Toxicology. (China)