USA: Rapid growth in cell phone use

355 mil. connections
208 mil. smartphones
298,055 cell sites
$188 bil. annual revenue
$430 bil. investment

CTIA: Dec. 2014
Adolescent cell phone use

88% of 13-17 year olds in US have cell phones
73% have smartphones
Pew Internet (http://pewrsr.ch/1J03zea), 4/9/2015
Demise of the landline

US Households* (Jan-Jun, 2014)

- 44.0% wireless-only
- 33.1% wireless-mostly
- 20.3% landline-only
- 2.6% no phone

NHIS. NCHS, CDC. Dec., 2014.

IARC RF working group: Overview

- IARC - WHO (2011)
  - “Gold standard” for carcinogenicity
  - 31 member expert working group

- Reviewed carcinogenic mechanisms, animal & epidemiologic studies
IARC CLASSIFIES RADIOFREQUENCY ELECTROMAGNETIC FIELDS AS POSSIBLY CARCINOGENIC TO HUMANS

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B), based on an increased risk for glioma, a malignant type of brain cancer, associated with wireless phone use.
Christopher Wild, IARC Director: "it is important that additional research be conducted into the long-term, heavy use of mobile phones. Pending the availability of such information, it is important to take pragmatic measures to reduce exposure such as hands-free devices or texting."

Jonathan Samet: "the evidence, while still accumulating, is strong enough to support a conclusion and the 2B classification. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."
Glioma risk: 3 recent case-control studies

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<tbody>
<tr>
<td>“Heavy” Lifetime Use</td>
<td>1.40*</td>
<td>1.82*</td>
<td>1.75*</td>
<td>2.89*</td>
</tr>
<tr>
<td></td>
<td>1640+ hrs</td>
<td>1640+ hrs</td>
<td>1640+ hrs</td>
<td>896+ hrs</td>
</tr>
<tr>
<td>10+ years</td>
<td>0.98</td>
<td>2.18*</td>
<td>1.79*</td>
<td>1.61</td>
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Current estimated lifetime risk of glioma in US is from 1 in 200 to 1 in 250.
Hardell Research Group: 
Case-control studies since IARC

- Wireless phone use ≥ 25 years
  - Glioma: OR = 3.3 (95% CI: 1.6 – 6.9)

- Wireless phone use ≥ 20 yrs
  - Acoustic neuroma: OR = 4.4 (95% CI: 2.2 – 9.0)

Oxidative stress from low-intensity radiofrequency radiation

Yakymenko et al. (2015) review

- 93 studies (16 cellular, 73 animal / plant, 4 human) found significant effects
- 7 studies found no effects
- Cell signaling disrupted, stress proteins, free radical formation, DNA-damage
- Carcinogenicity, neurologic disorders including electrohypersensitivity
Child’s brain absorbs 2X the radiation

Figure 1. Estimation of the penetration of electromagnetic radiation from a cell phone based on age (Frequency GSM 900 Mhz) (On the right, a scale showing the Specific Absorption Rate at different depths, in W/kg) [1]

Gandhi et al., 2012
CEFALO: Children’s brain tumor risk

- Case-control study – Denmark, Sweden, Switzerland, Norway (2004-2008)
- Youth 7-19 years of age
  - 352 cases, 646 controls
- “Regular” cellphone use: OR = 1.36 (0.92-2.02)
  - 3 nations (OR’s = 1.49 to 1.73); Norway (OR = 0.51)
- Operator records: > 2.8 yrs cellphone use
  - OR = 2.14 (1.07-4.29)

Brain cancer incidence:
Recent increases over time

- **USA**: frontal lobe in adults 20-29 years of age; GBM in frontal & temporal lobes & cerebellum (overall population)
- **Norway & Finland**: overall population
- **Denmark**: GBM for males
- **England**: frontal & temporal lobes (overall)
- **Australia & New Zealand**: over age 70
- **Sweden**: tumor registry unreliable
Other potential health risks in humans from wireless phone use

- **Tumors**: acoustic neuroma, meningioma, parotid, pituitary & thyroid glands; breast
- **Sperm damage** & male infertility
- **Reproductive effects**: memory, ADHD, autism?
- **Children**: ADHD, headaches, hearing
- **Electromagnetic hypersensitivity**
  - Headaches, dizziness, fatigue, insomnia, tinnitus, skin rashes, heart palpitations
European Environment Agency: Policy recommendations

- Reduce cell phone radiation exposure, especially children & young adults
- Use phones hands-free & text
- Issue cell phone warning labels
- Adopt more stringent radiation standards
- Governments should fund research
- Manufacturers improve cell phone design

Alarmism vs. denialism—what about precaution?
“The FCC, the FDA, the National Cancer Institute, and the World Health Organization have each evaluated the scientific research on wireless phones and each has found that the weight of the scientific research has not shown that wireless phone use causes any adverse health effects.”

CTIA, May 27, 2012
U.S. government: Radio Frequency Interagency Working Group

[Logos from various government agencies]

- National Institute for Occupational Safety and Health (NIOSH)
- Food and Drug Administration (FDA)
- Occupational Safety and Health Administration (OSHA)
- Federal Communications Commission (FCC)
- United States Environmental Protection Agency (EPA)
- National Telecommunications and Information Administration (NTIA)
WHO & US federal agency positions

- **WHO**: “To date, no adverse health effects have been established as being caused by mobile phone use.”

- **FCC**: “currently no scientific evidence establishes a causal link between wireless device use and cancer or other illnesses.”

- **FDA**: “The scientific evidence does not show a danger to any users of cell phones from RF exposure, including children and teenagers.”

- **NCI**: “currently no consistent evidence that non-ionizing radiation increases cancer risk …The only known biological effect of radiofrequency energy is heating.”
Federal government position

• Need to wait for conclusive evidence yet govt. makes minimal investment in research

• “the overlap of federal agency responsibilities … leaves leadership unclear and encourages a pass-the-buck attitude.” (Cities of Boston & Philadelphia, 2013) http://bit.ly/1kAYSu7

• "the electromagnetic radiation standards used by the FCC continue to be based on thermal heating, a criterion now nearly 30 years out of date and inapplicable today." (U.S. Dept. of Interior, 2014) http://1.usa.gov/1jn3CZg
International EMF Scientist Appeal

EMFscientist.org

- Petition calls for precautionary health warnings & stronger regulation of electromagnetic fields
- Submitted to UN & WHO (May 11, 2015)
- Signed by 200+ EMF scientists
Berkeley: Cell phone “Right to Know” ordinance

- Berkeley City Council unanimously adopted cell phone consumer disclosure ordinance (May 12, 2015)
- CTIA filed lawsuit – 1st Amendment
- Harvard Law Prof. Lawrence Lessig v. Ted Olson
- See SaferEMR.com for updates & media coverage
Joel M. Moskowitz, Ph.D., Director

Center for Family and Community School of Public Health University of California, Berkeley

SaferEMR.com
References

**Tumor risk review papers**

References

Tumor risk review papers


• Morgan et al (2015) Mobile phone radiation causes brain tumors and should be classified as a probable human carcinogen (2A) (Review). http://1.usa.gov/1EqL1DF

Tumor risk case-control studies


References

Tumor risk case-control studies


Breast cancer case series

References

Brain tumor incidence trends


References

Mechanisms

References

Reproductive Health Effects


Exposure


References

Other


Supplemental Slides
Israel: Parotid gland tumors triple over time

Source: Environmental Health Trust
Israel: Increase in parotid gland tumors (PGT) over 30 years

Israel: PGT case-control study

- Elevated risks for regular cell phone users & heavy users in rural areas.
- For ipsilateral use, 49% increased risk for highest category of call time.
- Positive dose-response trend.

Young people should limit direct exposure of the head to microwave radiation from cell phones.

More than 14 nations have issued precautionary health warnings to limit cell phone use.
Brain cancer incidence: Norway

Increasing Brain Cancer Incidences in Norway 2005-2009 (NORDCAN)

Age-standardized rates (W) over time
Incidence
Male Female

Mortality
Male Female

=*

NORDCAN

NORDCAN
Brain cancer incidence: Finland

Increasing Brain Cancer Incidences in Finland 2005-2009 (NORDCAN)

Age-standardized rates (W) over time

Incidence

Male  Female

15

10

5

0


15

10

5

0


Age-standardized rates (W) over time

Mortality

Male  Female

NORDCAN

NORDCAN
Brain cancer incidence: England

Incidence in England of malignant brain tumors close to where you hold your cellphone

Note: An incidence rate of 5 per 100,000 people means about 2500 newly diagnosed malignant brain tumors a year in England (population about 50 million)

Data taken from de Vocht et al, 2011