The Precautionary Principle should be Invoked for RF-EMF

Christopher J. Portier, Ph.D.

BIOEM 2015

Asilomar Conference Center

June 15, 2015

Precautionary Idioms

- Better safe than sorry
- An ounce of prevention is worth a pound of cure
- It is best to have your umbrella before you get wet (ぬれぬさきのかさ)
- Let the buyer beware
- Prevention is better than the cure
- Vorbeugen ist besser als heilen

Precautionary Principle in Environmental Public Policy

- Vorsorgeprinzip – 1980s German principle of “forecaution”
  - Raffensperger and Tickner (1999)
- Rio Conference (1992)
  - Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

Precautionary Principle

- Wingspread Statement (1998)
  - When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.
  - In this context the proponent of an activity, rather than the public, should bear the burden of proof.
  - The process of applying the Precautionary Principle must be open, informed and democratic and must include potentially affected parties. It must also involve an examination of the full range of alternatives, including no action.

Precautionary Principle

- EU Communication of the Commission (2000)
  - "Recourse to the precautionary principle presupposes that potentially dangerous effects deriving from a phenomenon, product or process have been identified, and that scientific evaluation does not allow the risk to be determined with sufficient certainty."
- California Proposition 65 (1986)
  - Put on annual list any chemical that "has been clearly shown through scientifically valid testing according to generally accepted principles to cause cancer or reproductive toxicity, or if a **body considered to be authoritative** by such experts has formally identified it as causing cancer or reproductive toxicity, or if an agency of the state or federal government has formally required it to be labeled or identified as causing cancer or reproductive toxicity."
    - IARC "is designated as authoritative for the identification of chemicals as causing cancer (Section 25306(m))."

Basic concepts of the PP

- Don’t wait for “causation” to act
- Shift from having to prove harm to having to prove safety
  - Toxic Substances Control Act (1976)
- Inform the public early and often

RF-EMF Epidemiology - Glioma

- Case-Control Studies
  - 5 negative studies before 2005
  - Interphone (2010)
    - Positive for highest exposure decile (glioma)
    - Ipsalateral consistency
    - Specular analysis (Larjavaara,2011)
      - Negative
    - Remodeled exposure (Cardis, 2011)
      - Significant with dose-response
    - Subject to recall bias, weak exposure measures

RF-EMF Epidemiology - Glioma

- Case-Control Studies
  - Swedish Studies (Hardell and others, 2006-14)
    - Multiples studies over multiple years
    - All positive in high exposure groups
    - Ipsalateral consistency
    - When adjusted to match Interphone, they are close
    - Subject to recall bias
    - Odds ratios are rather high

RF-EMF Epidemiology - Glioma

- Case-Control Studies
  - French Study (Coureau et al., 2013)
    - Positive in highest exposure group
    - Ipsalateral consistency
      - Follow-up letter to the Editor (2015)
    - Comparable to Hardell studies in response
    - Subject to recall bias
- Meta-analysis (Lagorio and Roosli, 2014)
  - Highest exposure group elevated but marginal significance
  - Only studies to 2012

RF-EMF Epidemiology - Glioma

- Cohort Studies
  - Danish Cohort (Frei et al., 2011)
    - No significant positive effects
    - No increased risk for longest exposures
      - Few cases
    - Objective exposure measure
    - Serious problem with exposure miss-classification
  - Million Women Study (Benson et al., 2013)
    - No significant positive effects
    - No increased risk for longest exposures
    - Small follow-up time (based on 1998-2005 questionnaire)
    - Positive for acoustic neuromas

RF-EMF Ecological Studies - Glioma

- China (Ding and Wang, 2011)
  - 1983-2007
  - Join-point analysis
  - Increasing incidence, but no change over period
  - Concluded either longer induction period, smaller risks, or absence of association
- Australia (Dobes et al, 2011)
  - 1982-2004
  - No change (visual analysis only)

RF-EMF Demography - Glioma

- United Kingdom (de Vocht et al, 2011)
  - 1998-2007
  - No increase in brain cancers
  - Slight increase in temporal lobe
  - No adjustment for trend prior to 1998 (ecological falacy)
- United States (Little et al, 2012)
  - 1998-2007
  - Hardell not consistent, Interphone is
  - No adjustment for trend prior to 1998

RF-EMF Demography - Glioma

- Nordic Countries (Deltour et al., 2012)
  - 1979-2008
  - Adjusted for trends (breakpoint analysis)
  - “risk increases seen in Case-Control studies seem to be incompatible” with data
  - Concluded either longer induction period, smaller risks, or absence of association
  - Only show analysis with 40-59 groups
    - Small positive trend in 20-39 and 60-79

RF-EMF Demography - Glioma

- Sweden (Hardell and Carlberg, 2015)
  - 1998-2013
  - Adjusted for trends (breakpoint analysis)
  - Compared Cancer Registry data with hospital registry and death register
  - Positive increase in hospital registry data – compatible with Case-Control studies
  - No increase in Cancer Registry for glioma, but an increase in brain tumor of unknown type
  - Change in autopsy rates in Sweden makes cancer registry not reliable for glioma

Other Data (Used by IARC)

- 33 animal studies
  - 2 mouse and 5 rat 2-year cancer studies
    - All negative
  - 6 co-carcinogenesis studies
    - 4 positive
- Mechanistic data
  - Uniformly weak

Sufficient to “trigger” the PP?

- Yes!
- Wait and see actions
  - More research
  - Evaluate the literature
- Governmental Actions
  - Clarity of statement on the hazard
  - Stop saying there are no established non-thermal effects
  - Strengthen regulatory standards
  - Consider protecting children
  - Encourage/require manufacturers to develop technologies with reduced exposure

Sufficient to “trigger” the PP?

- Personal
  - Reduce exposures to the head
  - Reduce exposures to pregnant women and children
  - Use a headset with microphone
  - Avoid sleeping with the cell phone near your head
  - Etc.

Spacing Slide

Recent Reviews

- IARC (2009)
  - "Radiofrequency electromagnetic fields are **possibly carcinogenic** to humans (Group 2B)"
    - "There is **limited evidence** in humans for the carcinogenicity of radiofrequency radiation"
    - "There is **limited evidence** in experimental animals for the carcinogenicity of radiofrequency radiation"
  - Publicly available evaluation criteria
    - Developed independent of EMF
    - All roles defined
    - All terms defined
    - Criteria for evaluation defined

Recent Reviews

- SCENIHR (2015)
  - "Overall, the epidemiological studies on mobile phone RF EMF exposure **do not show** an increased risk of brain tumours"
    - Strongly influenced by cohort studies and evaluation of Nordic trends
  - "the animal studies are considered to provide **strong evidence** for the absence of an effect"
  - No publicly available evaluation criteria

Recent Reviews

- Health Canada (2015)
  - "the only **established** adverse health effects associated with RF field exposures in the frequency range from 3 kHz to 300 GHz relate to the occurrence of tissue heating and nerve stimulation (NS) from short-term (acute) exposures"
    - No evaluation of the literature is provided
  - No publicly available evaluation criteria

Recent Reviews

- Swedish Radiation Safety Authority (2013)
  - "The overall data on brain tumour and mobile telephony **do not indicate** an effect of mobile phone use on tumour risk, especially not when taken together with national cancer incidence statistics from different countries."
  - "Animal studies show that effects of RF EMF on brain function are possible and that in a number of tissues, including the brain, an increased oxidative stress may be induced by RF EMF exposure at levels around the current exposure limits."
    - No increased cancer risks were observed
  - No publicly available evaluation criteria

Recent Reviews

- EHFRAN (2012)
  - "Inclusion of recent data regarding adult brain tumours necessitates a revision to the original classification, and it is now considered to be best described as being limited"
  - Limited publicly available evaluation criteria
  - Definition provided for limited evidence
    - Linked to IARC process

Recent Reviews

- UK Health Protection Agency (2012)
  - "... the evidence considered overall **has not demonstrated** any adverse health effects of RF field exposure below internationally accepted guidance levels."
  - "... there is **no convincing evidence**..."
  - No publicly available evaluation criteria

Recent Reviews

- ICNIRP (2009)
  - "... **no evidence** of any adverse effects below the basic restrictions ..."
  - Website highlights 2011 Feytching et al. study (calls it an ICNIRP Study?)
    - "... the trend in the accumulating evidence is **increasingly against the hypothesis** that mobile phone use can cause brain tumours in adults ..."
    - Does not highlight IARC review
  - No publicly available evaluation criteria

Spacing Slide

Alcoholic Beverages

- IARC Group 1
  - Sufficient human and animal evidence
- US Alcoholic Beverage Labeling Act of 1988
  - “the American public should be informed about the health hazards that may result from the consumption or abuse of alcoholic beverages, and has determined that it would be beneficial to provide a clear, nonconfusing reminder of such hazards, and that there is a need for national uniformity in such reminders in order to avoid the promulgation of incorrect or misleading information and to minimize burdens on interstate commerce.”
- California
  - WARNING: Drinking Distilled Spirits, Beer, Coolers, Wine and Other Alcoholic Beverages May Increase Cancer Risk, and, During Pregnancy, Can Cause Birth Defects

IARC Group 1 Pharmaceuticals

- Bisulfan
- Chlorambucil
- Methyl-CCNU
- Cyclophosphamide
- Melphalan
- MOPP
- Tamoxifen
- Thiotepa
- Treosulfan
- Diethylstibesterol
- Estrogen Therapy
- Estrogen-Progestogen
- Azathioprine
- Chlornaphazine
- Ciclosporin
- Methoxsalen
- Phenacetin

Caffeic Acid

- IARC Classification 2B (1993)
  - Inadequate evidence humans, sufficient animals
  - Single dose animal studies, mice and rats
  - Dose between 678 mg/kg/day (MR) and 3126 mg/kg/day (FM)
  - Recommendation human consumption not exceed 4 mg/kg/day (based on acute toxicity) (EFSA, 2015)

Coffee

- IARC Classification – 2B
  - 1991
  - Limited evidence – human urinary bladder
  - ESLC – female breast, large bowel
  - Inadequate – animals
    - Most studies negative or poorly designed

Styrene

- IARC Classification – 2b (2002)
  - Limited human
  - Limited animal

Originally Group 2B – Now 1

- Phenacetin
- PCBs
- Salted fish