



# Interphone Brain Tumors Studies To Date

An Examination of Poor Study Design  
Resulting in an UNDER-ESTIMATION  
of the Risk of Brain Tumors

*L. Lloyd Morgan*  
*BEMS, San Diego, 12 June 2008*

# Methodology

## What If There Is No Risk of Brain Tumors?

- ORs  $<1.0$  would be ~equal ORs  $>1.0$ 
  - Think coin tossing
    - OR=1.0 are excluded
  - OR $<1.0$  implies protection
  - OR $>1.0$  implies risk
- 13 Interphone brain tumor studies to date
  - 10 Interphone brain tumor studies analyzed
  - 3 excluded: 2 overlapping studies, 1 recent study
- Calculate Protection/Risk ratio (OR $<1.0$ /OR $>1.0$ )
- Calculate binomial p-values

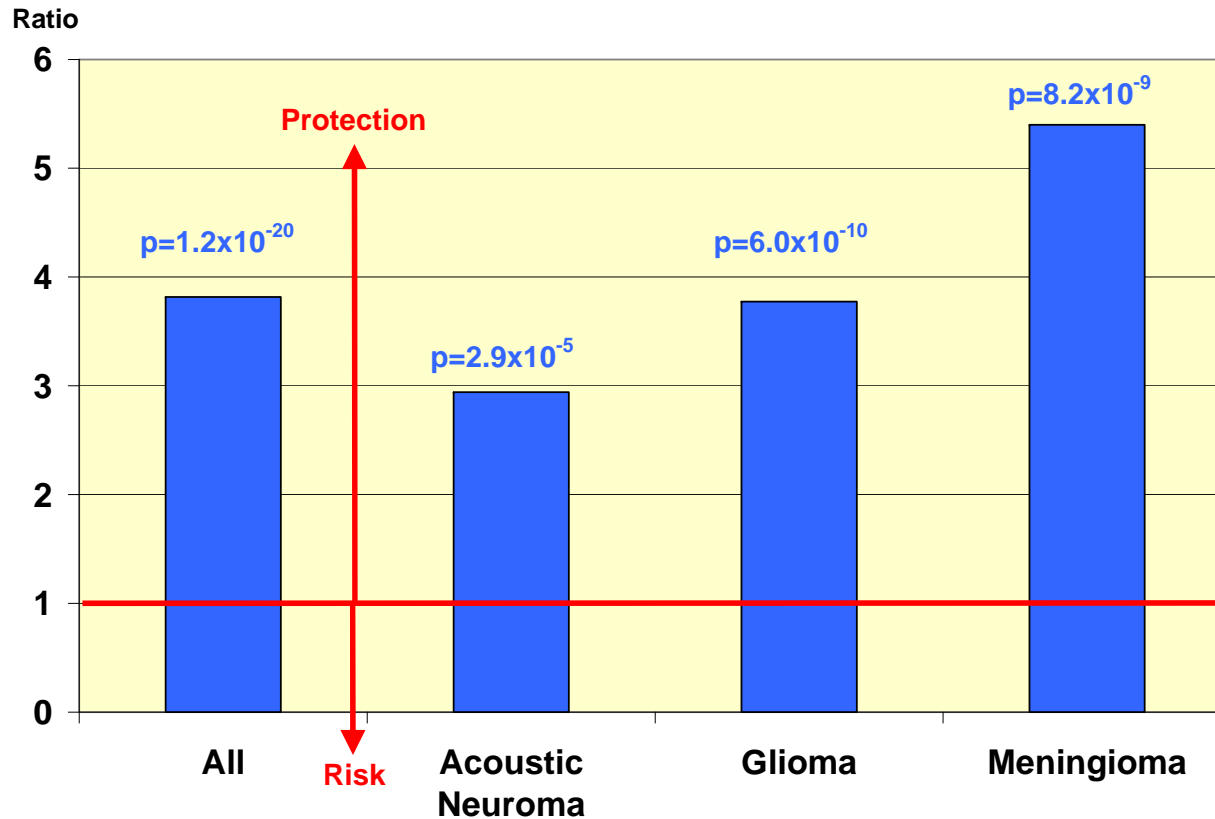
# Methodology

## Statistical Independence

- Compare between studies, not within studies
  - Comparison categories
    - Brain Tumors
      - All
      - Acoustic Neuroma
      - Glioma
      - Meningioma
    - Years of use (Years)
    - Cumulative hours of use (Hours)
    - Cumulative number of calls (Call #)
    - “Regular” cellphone use (“Regular”)
    - Years of ipsilateral cellphone use (Years Ipsi)
    - Years of contralateral cellphone use (Yrs Contra)
    - Minutes of cellphone use per day (Min/Day)

# Results

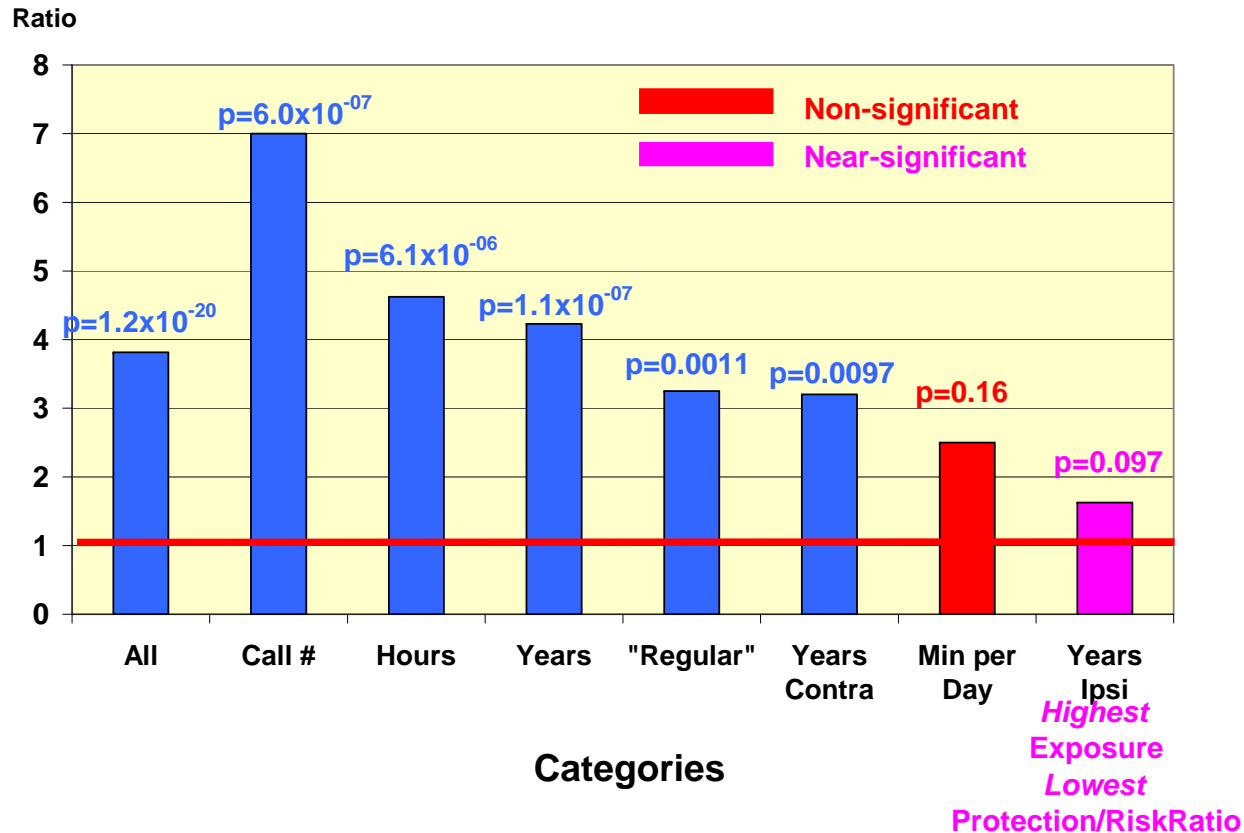
## Protection/Risk Ratio by Brain Tumor Type



# Results

## Protection/Risk Ratio by Category

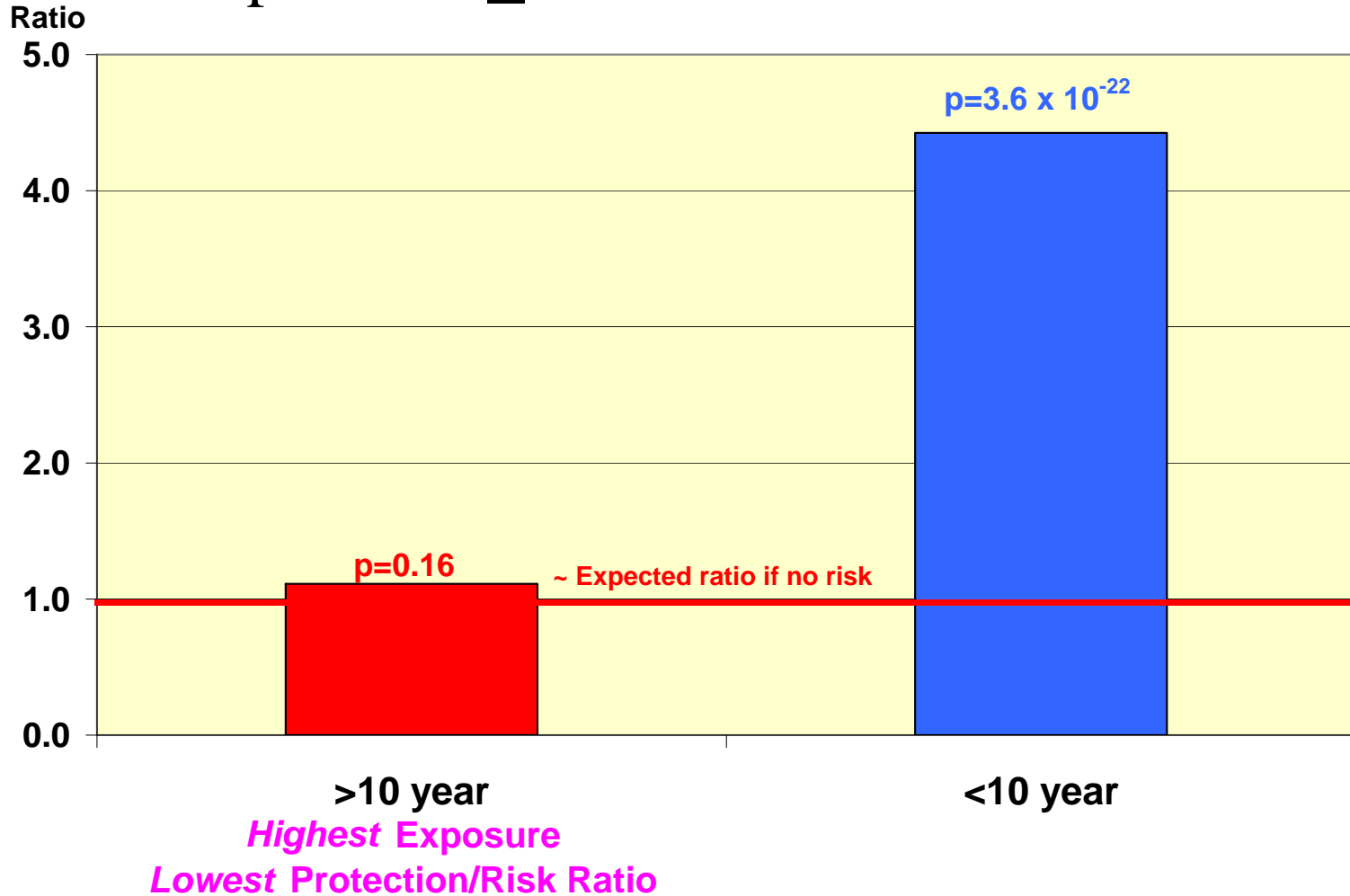
(exclusive of brain tumor types)



# Results

## Protection/Risk Ratio

Exposures:  $\geq 10$  Years and  $< 10$  Years



# Interphone Protocol Design Flaws

- **Flaw 1: Selection Bias**
  - Participating controls use cellphones more than non-participating controls
    - Weighted average control participation rate: 59%
      - Controls and cellphone use (Löon 2004)
        - » Participating: 59% used a cellphone
        - » Non-participating: 34% used a cellphone
  - Underestimates risk
- **Flaw 2: Tumors outside the radiation plume are treated as “exposed”**
  - Underestimates risk

## Flaw 2

### Tumors Outside Radiation Plume Are “Exposed”

- **Ipsilateral: exposed**    **Contralateral: unexposed**
- **Percentage of absorbed cellphone radiation by anatomical structure**
  - **Ipsilateral temporal lobe: 50-60% ~15% of brain's volume**
  - **“Ipsilateral” cerebellum: 12-25% ~5% of brain's volume**
- **62-85% of absorbed radiation is in ~20% of the brain's volume**

# Interphone Protocol Design Flaws

- **Flaw 3: Short latency times**
  - Ionizing radiation & brain tumor: 20-40 years
  - Smoking & lung cancer: ~30 years
  - Asbestos & mesothelioma: 20-40 years
  - Short latency times underestimates risk
- **Flaw 4: Definition of “regular” user**
  - At least once a week for 6 months or more
  - Definition of “regular” user underestimates risk

# Flaws 3 & 4: Latency Time & “Regular” Use

- UK cellphone subscriber data
  - 85% of “regular” use
    - <5 years
  - 98% of “regular” use
    - <10 years
- Years of use (latency time) too short for Dx
- Reporting “regular” use
  - Suppresses finding a risk

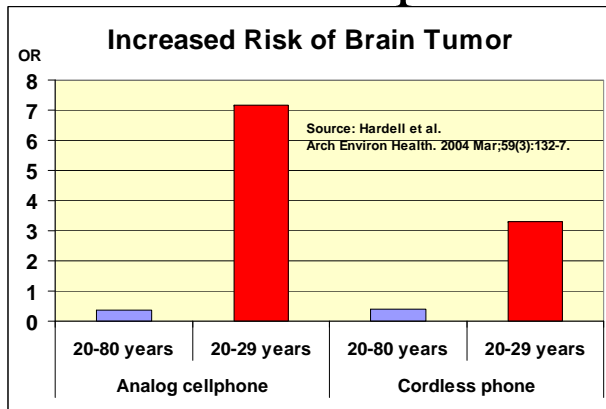
# Interphone Protocol Design Flaws

- **Flaw 5:** Young adults and children are excluded
  - Young adults and children
    - Highest risk group
  - Underestimates risk

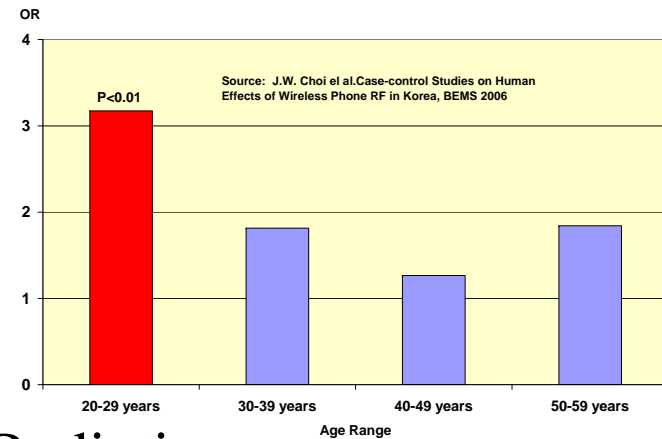
# Flaw 5

## Young Adults and Children Excluded

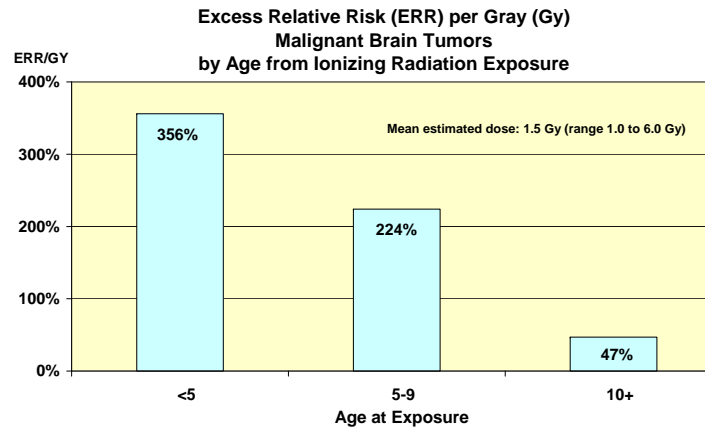
### Swedish: Cellphone.



### Korean: Cellphone



### Israeli: Ionizing Radiation



Source: Sadezki et al., RADIATION RESEARCH 163, 424-432 (2005)

# Interphone Protocol Design Flaws

- **Flaw 6:** Cellphones radiating higher power levels are not examined (few exceptions)
  - Analog Vs Digital cellphone use
  - Rural Vs Urban cellphone use
  - Without inclusion of cellphones radiating the most power there is an underestimation of risk
    - Requires sufficient number of cases for statistical power
- **Flaw 7:** Other RF exposures treated as unexposed
  - Cordless phones, walkie-talkies, etc.
  - Underestimation of risk

# Interphone Protocol Design Flaws

- **Flaw 8:** Exclusion of brain tumor types
  - Includes acoustic neuroma, glioma & meningioma
  - Excludes other brain tumor types
  - Underestimates risk
- **Flaw 9:** Exclusion of brain tumor cases because of death
  - Underestimates risk of the most deadly brain tumors

# Flaw Mitigation

- Increase the diagnosis eligibility time
  - Ten Interphone studies: weighted-average 2.6 years
  - Hardell et al. eligibility time: 6 years
- Lower age range to  $\leq 10$  years
- Pay controls (and cases?) for participation in study
  - Do not tell controls what is the purpose of the study
- Interview proxies in case of death
- Treat unexposed tumors as unexposed
- Etc., Etc., Etc., ...
  - **It could have been done**

# Conflicts-of-Interest

- Cellphone Industry
  - If risk is found: major revenue loss
  - Interphone's funding is inadequate to mitigate flaws
    - Substantial funding from cellphone industry
- Researchers' conflict-of-interest (unconscious?)
  - Source of funds: known in spite of "Firewall"
  - Honest, but "Don't bite the hand that feeds you"
    - **90 significant *protective* results**
      - Ignored by authors (no commentary in the text)

# Conclusions

- **Either cellphone use is protective, or the study has major flaws**
- The Interphone Protocol substantially, underestimates the risk of brain tumors
  - Protection/Risk Ratio is *lowest* for *highest* exposure
    - Increased exposure counteracts design flaws
  - Significant risk found in the Interphone studies
    - $\geq 10$  years and ipsilateral use
- Without design flaws, risk would increase substantially
- Cellphone industry's conflict-of-interest is obvious
- **Potential public health impact is enormous**
- Studies independent of industry are required

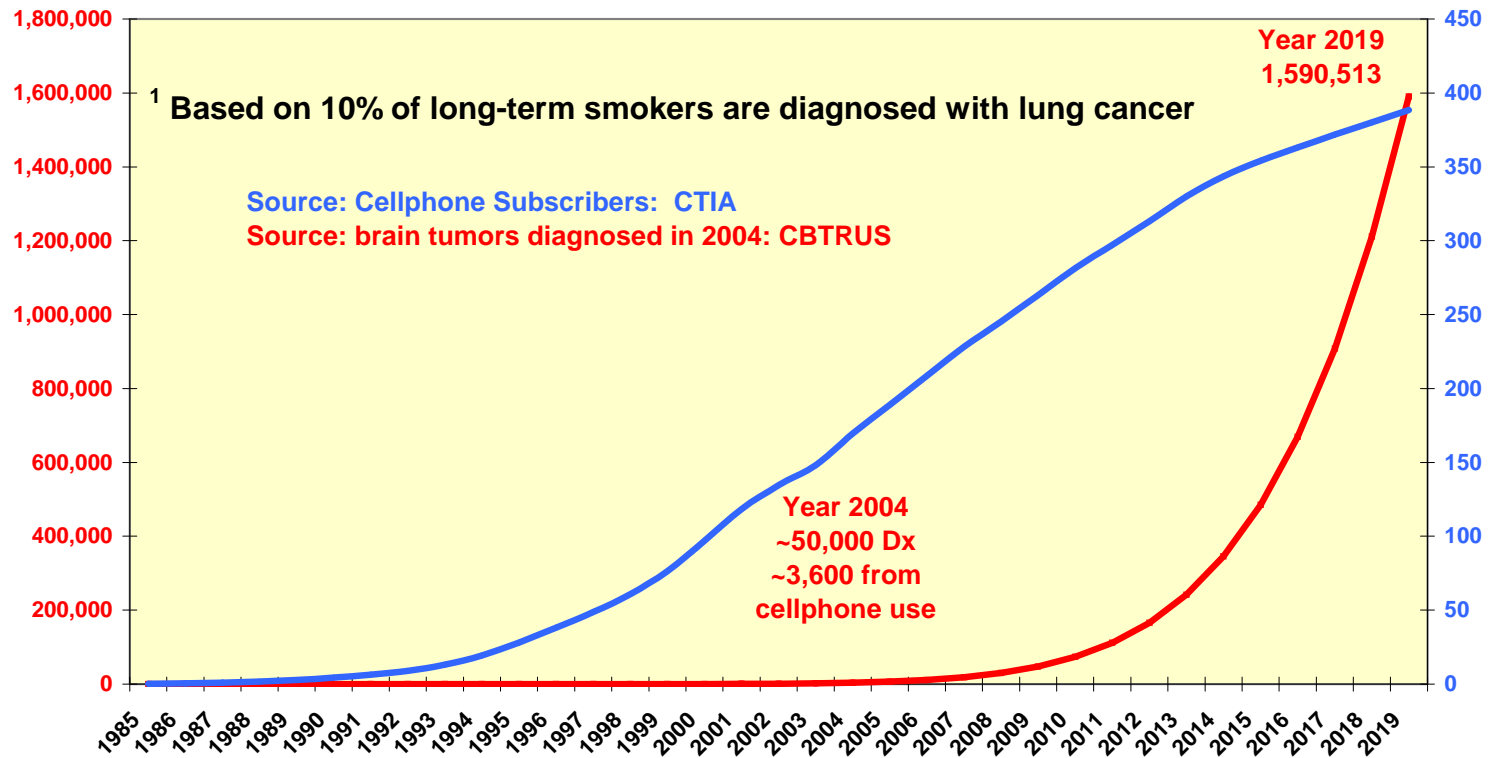
# Potential Public Health Risk

## Potential Brain Tumor Cases From Cellphone Use 30-Year Latency Time

10% of Users<sup>1</sup> Diagnosed with a Brain Tumor

Potential Cases  
of Brain Tumors  
per Year

Cellphone  
Subscribers  
millions



*I Pray I'm Wrong!*