

Strengths of evidence using the Hill criteria from 1965.

Lennart Hardell* and Michael Carlberg

Using the Hill viewpoints from 1965 for evaluating strengths of evidence of the risk for brain tumors associated with use of mobile and cordless phones¹⁾

Abstract

Background: Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. An increased risk of brain tumors is a major concern. The International Agency for Research on Cancer (IARC) at the World Health Organization (WHO) evaluated the carcinogenic effect to humans from RF-EMF in May 2011. It was concluded that RF-EMF is a group 2B, i.e., a “possible”, human carcinogen. Bradford Hill gave a presidential address at the British Royal Society of Medicine in 1965 on the association or causation that provides a helpful framework for evaluation of the brain tumor risk from RF-EMF.

Methods: All nine issues on causation according to Hill were evaluated. Regarding wireless phones, only studies with long-term use were included. In addition, laboratory studies and data on the incidence of brain tumors were considered.

Results: The criteria on strength, consistency, specificity, temporality, and biologic gradient for evidence of increased risk for glioma and acoustic neuroma were fulfilled. Additional evidence came from plausibility and analogy based on laboratory studies. Regarding coherence, several studies show increasing incidence of brain tumors, especially in the most exposed area. Support for the experiment came from antioxidants that can alleviate the generation of reactive oxygen species involved in biologic effects, although a direct mechanism for brain tumor carcinogenesis has not been shown. In addition, the finding of no increased risk for brain tumors in subjects using the mobile phone only in a car with an external antenna is supportive evidence. Hill did not consider all the needed nine viewpoints to be essential requirements.

Conclusion: Based on the Hill criteria, glioma and acoustic neuroma should be considered to be caused by RF-EMF emissions from wireless phones and regarded as carcinogenic to humans, classifying it as group 1 according to the IARC classification. Current guidelines for exposure need to be urgently revised.

Keywords: acoustic neuroma; causation; glioma; Hill criteria; wireless phones.

¹⁾Based on a presentation at the Corporate Interference with Science and Health: Fracking, Food and Wireless, Scandinavia House, New York City, March 13 and 14, 2013.

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Background

Mobile phones have been used since the early 1980s, and the Scandinavian countries were among the first in the world to adopt this technology. At first, analog phones [Nordic Mobile Telephone System (NMT)] were used, but in the early 1990s, the digital system [Global System for Mobile Communication (GSM)] was introduced. The analog system was definitely closed down in Sweden on December 31, 2007. Nowadays, mobile phones are used more than landline phones in Sweden (1). Worldwide, estimates of 5.9 billion mobile phone subscriptions were reported at the end of 2011 by the International Telecommunication Union (2).

Desktop cordless telephones have been used in Sweden since the end of the 1980s, first using the analog system, but since the 1990s, the digital variant was used. They are very common both in homes and at workplaces, overtaking telephones connected to landlines.

Wireless phones, i.e., mobile phones and cordless phones, emit radiofrequency electromagnetic fields (RF-EMF) when used. Cordless phones should be given an equal consideration as mobile phones when this type of exposure is assessed. In fact, this has not been the case except for the Hardell group studies in Sweden (3–8). When used, the handheld mobile phones gives exposure

Conclusion according to Hill criteria:

Glioma and acoustic neuroma are caused by RF-EMF emissions from wireless phones

IARC Preamble:

Group 1: The agent is *carcinogenic to humans*.

This category is used when there is *sufficient evidence of carcinogenicity* in humans. Exceptionally, an agent may be placed in this category when evidence of carcinogenicity in humans is less than *sufficient* but there is *sufficient evidence of carcinogenicity* in experimental animals and strong evidence in exposed humans that the agent acts through a relevant mechanism of carcinogenicity.

2013-12-17

Exposure from mobile phones, base stations and wireless networks

A statement by the Nordic radiation safety authorities
Introduction

The overall data on brain tumour and mobile phone use do not show an effect on tumour risk.

Commentary

Mobile Phones and Cancer

Next Steps After the 2011 IARC Review

Jonathan M. Samet, Kurt Straif, Joachim Schüz, and Rodolfo Saracci

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COMMENTARY

Mobile Phones and Cancer

Next Steps After the 2011 IARC Review

Jonathan M. Samet,^{a,b} Kurt Straif,^c Joachim Schüz,^d and Rodolfo Saracci^e

Do mobile phones cause cancer? If the answer were to prove to be "yes," then more than half of the world's population is already at risk.¹ Mobile phone use increasingly begins in childhood and will likely extend across the full life span, if this technology is not surpassed by another mode of communication. From the public health viewpoint, the introduction of mobile phones, now used by some 5.5 billion people, represents a massive new exposure for which safety information is needed.

A review carried out at the end of May 2011 by the World Health Organization's International Agency for Research on Cancer (IARC) and published as an IARC Monograph¹ gave a first answer to the question. This review classified radiofrequency electromagnetic fields—the type emitted by mobile phones—as "possibly carcinogenic to humans." Corresponding to Group 2B in the agency's four-level system, this expresses an inherent uncertainty based on evidence in humans of a positive association between exposure to an agent and cancer "for which a causal interpretation is considered by the Working Group as credible, but bias and confounding could not be ruled out with reasonable confidence." This classification signals a warning, but without enough evidence to move radiofrequency electromagnetic fields to a higher level of concern (Group 2A-Probable or Group 1-Carcinogenic to Humans).

The 2B classification was driven largely by the epidemiologic findings, particularly a set of case-control studies carried out in Sweden by Hardell and colleagues² and the multicountry INTERPHONE study.³ Difficult methodological problems cloud interpretation of these observational studies,⁴ and the IARC Working Group concluded that the human studies provided "limited evidence" for carcinogenicity.

The 2B classification for radiofrequency electromagnetic fields by IARC continues to receive worldwide media attention, and it remains of great interest to the public, reflecting the increasing use of mobile phones in our lives. There are diverse opinions about this classification, with deep skepticism from those who see no possibility of carcinogenesis by radiofrequency electromagnetic fields based on biophysical principles or from those who find the epidemiologic findings less convincing. For instance, an article by a panel of the International Commission on Non-Ionizing Radiation Protection (submitted in March 2011) had concluded that the evidence weighed against causation.⁵ An editorial accompanying a case-control study of childhood brain cancer published after the meeting of the IARC Working Group and interpreted as "negative" offered a similar view.⁶ At variance with this interpretation, another group of scientists regarded the available data as simply "insufficient to make any determinations" about use longer than 10 years.⁷

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....an analysis of data from the cancer registries of the Nordic countries, supports a similar null conclusion. This finding is noteworthy because it includes incidence data from populations of some INTERPHONE study centers and the Hardell studies. Overall these newer results do not remove the uncertainty inherent in the “possibly carcinogenic” (2B) IARC classification.



**Scientific Committee on Emerging and Newly Identified Health Risks
SCENIHR**

**Preliminary opinion on
Potential health effects of exposure
to electromagnetic fields
(EMF)**

SCENIHR approved this opinion at the 4th plenary of 12 December 2013

SCENIHR 2013

Health effects from Radiofrequency (RF) fields

Based on the most recent cohort and incidence time trend studies, it appears that the evidence for an increased risk of glioma became weaker while the possibility of an association of RF EMF exposure with acoustic neuroma remains open.

24 April 2014

**Comments on the RF fields epidemiology
section pages 57-68 in SCENIHR approved
at the 4th plenary of 12 December 2013**

Dear Mr Ryan,

**...Joachim Schüz, who did the evaluation of
the epidemiological studies on mobile phone
use and brain tumour risk, intentionally
disregarded key epidemiological studies that
provide evidence of risk for glioma and
acoustic neuroma from mobile and cordless
phone use. He was not interested in taking
relevant studies, see below, into the text. He
clearly stated that the epidemiological part
was solely his responsibility to write and
furthermore he himself was to decide what
to include....**

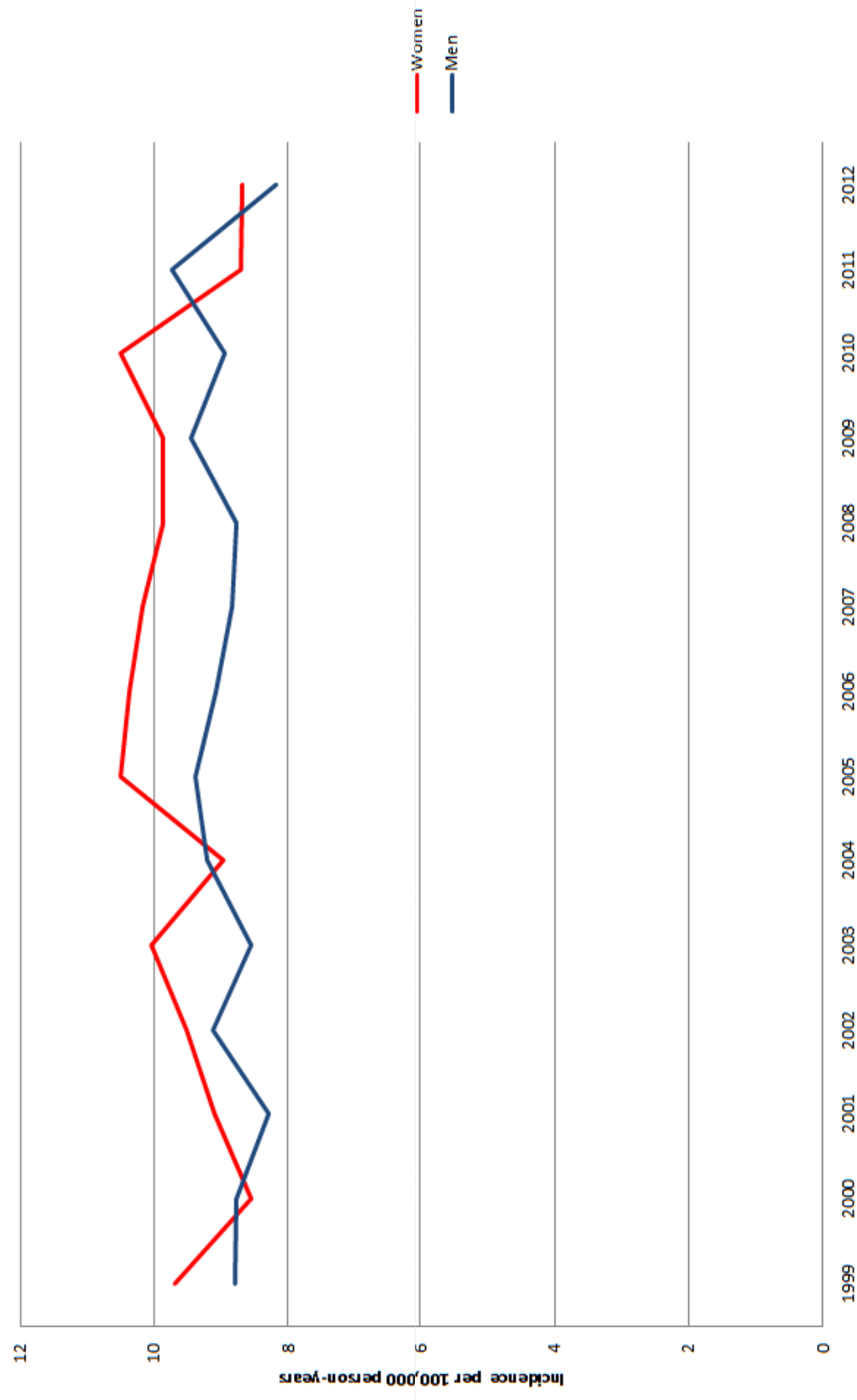
Kjell Hansson Mild, PhD

Department of Radiation Sciences,

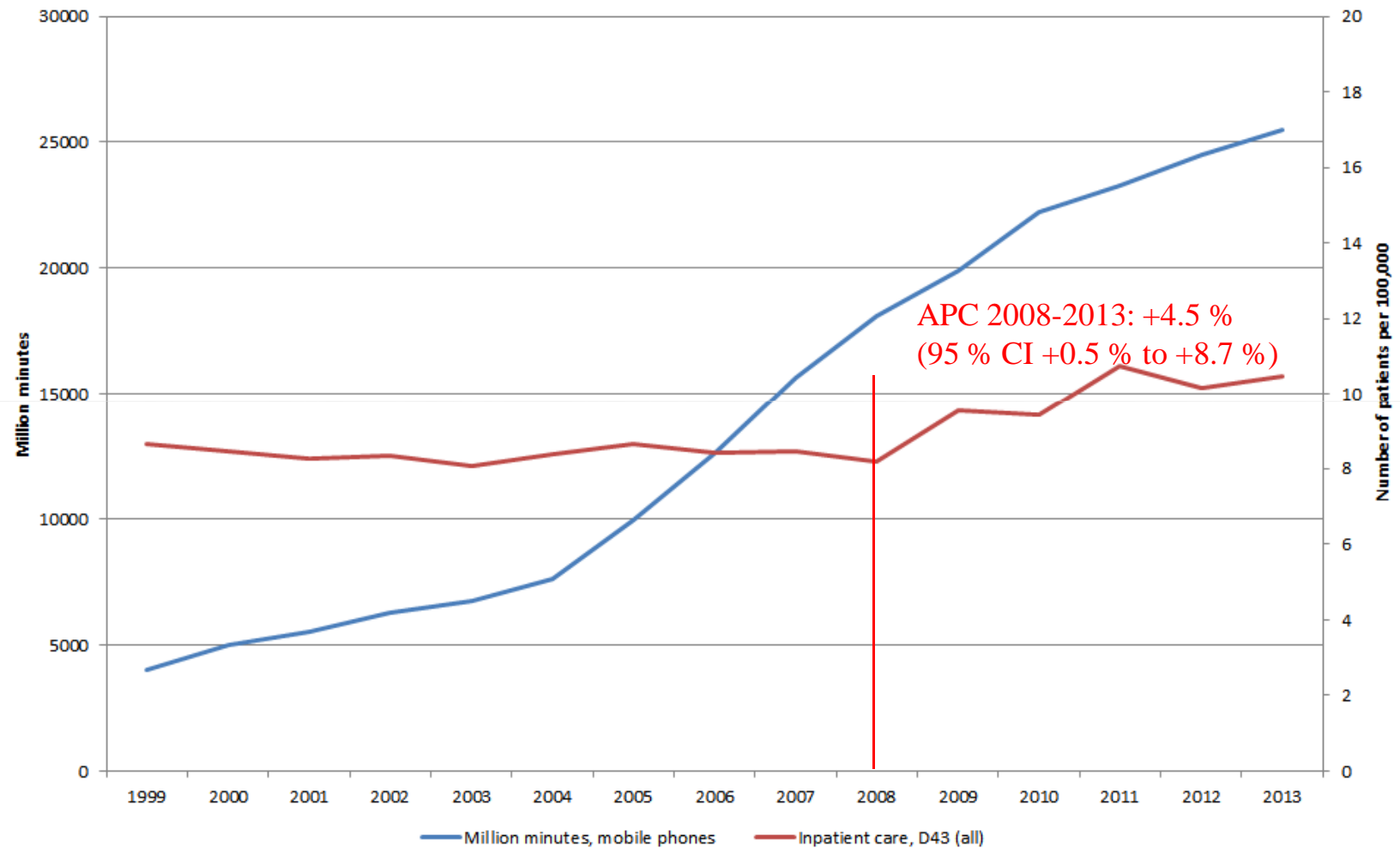
Umeå University,

SE-90187 Umeå, Sweden

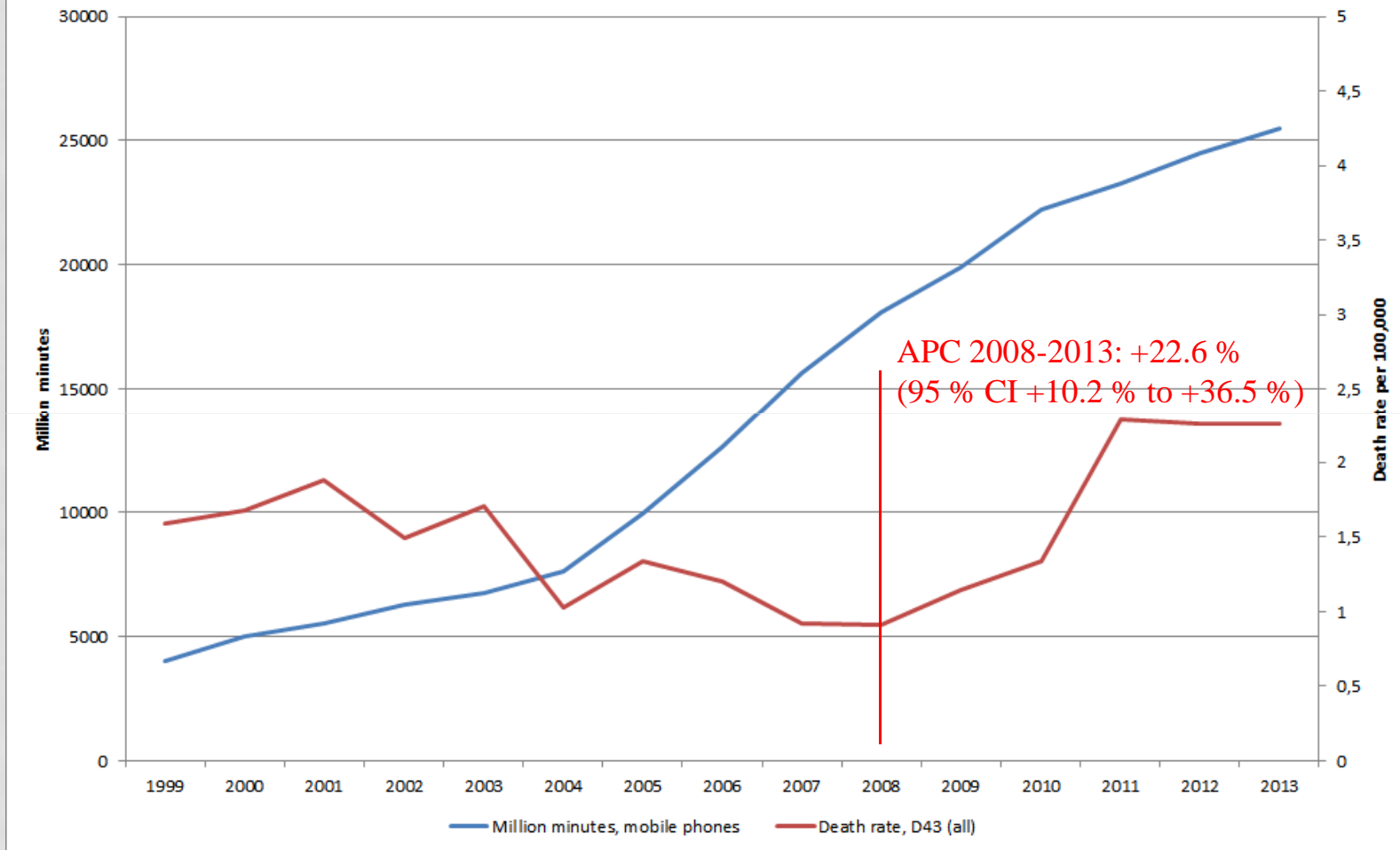
Incidence of brain tumours (ICD-7 193-0) in Sweden 1999-2012

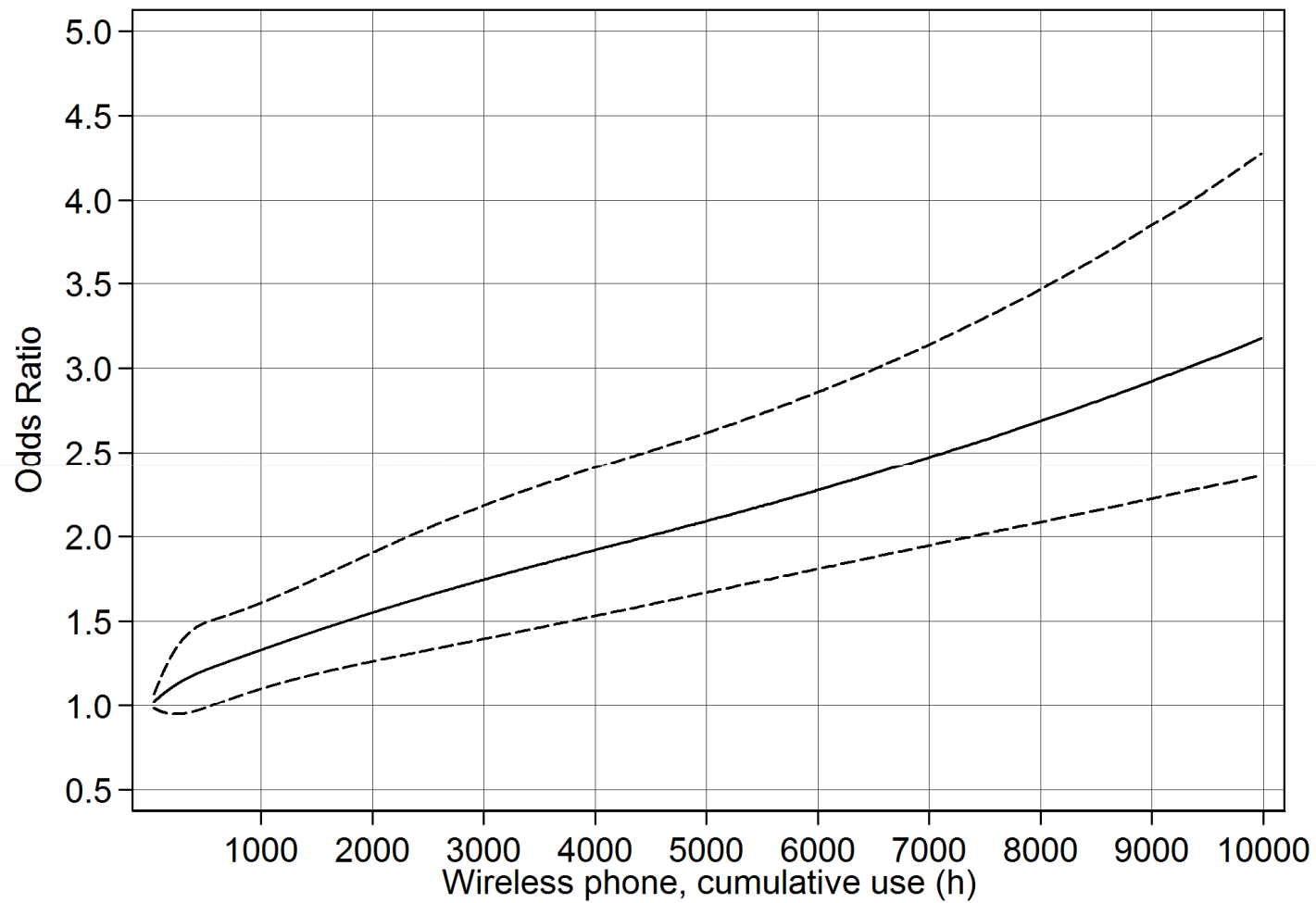


Outgoing call minutes from mobile telephones and D43, inpatient care (all)



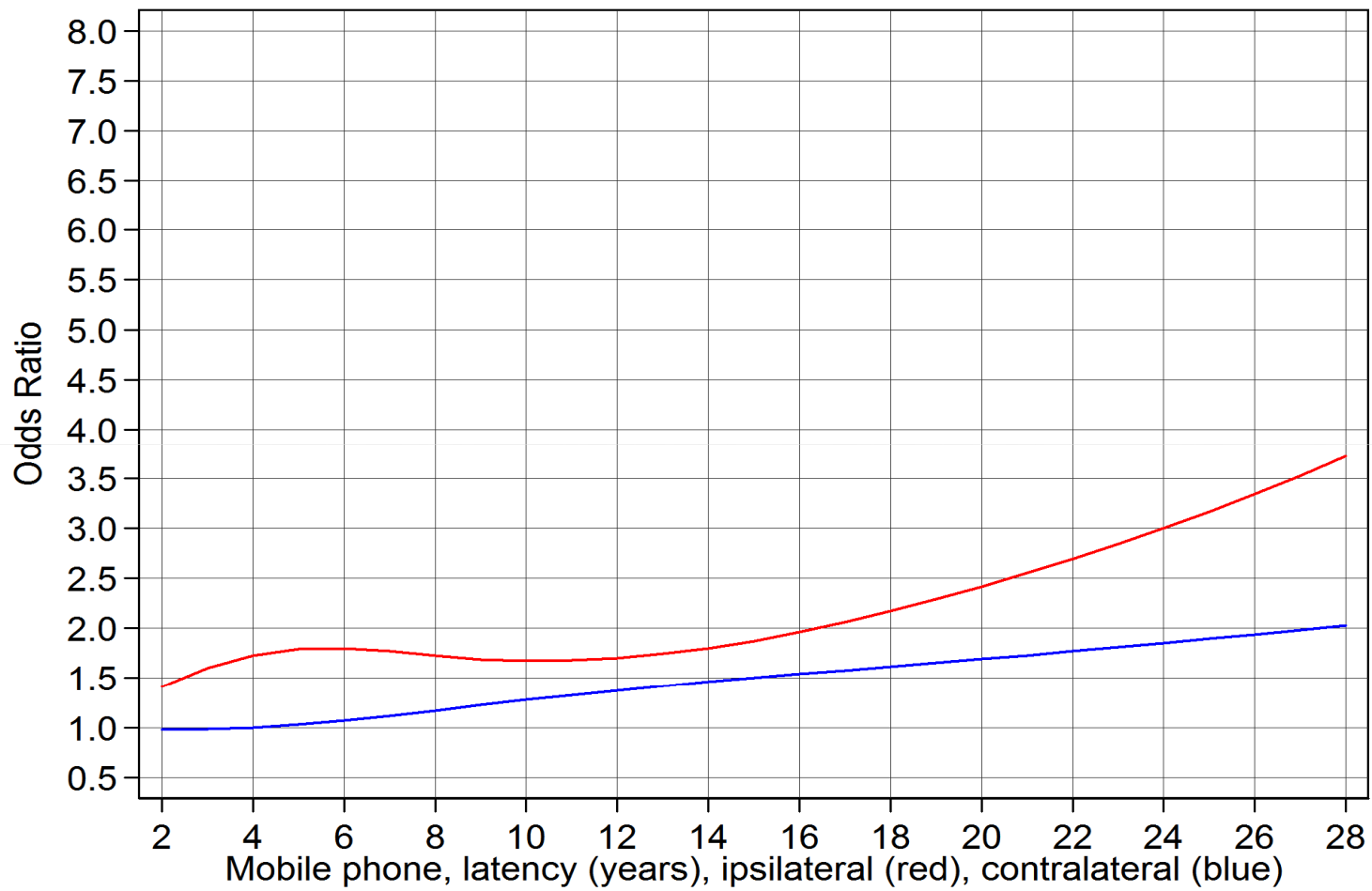
Outgoing call minutes from mobile telephones and death rate, D43 (all)





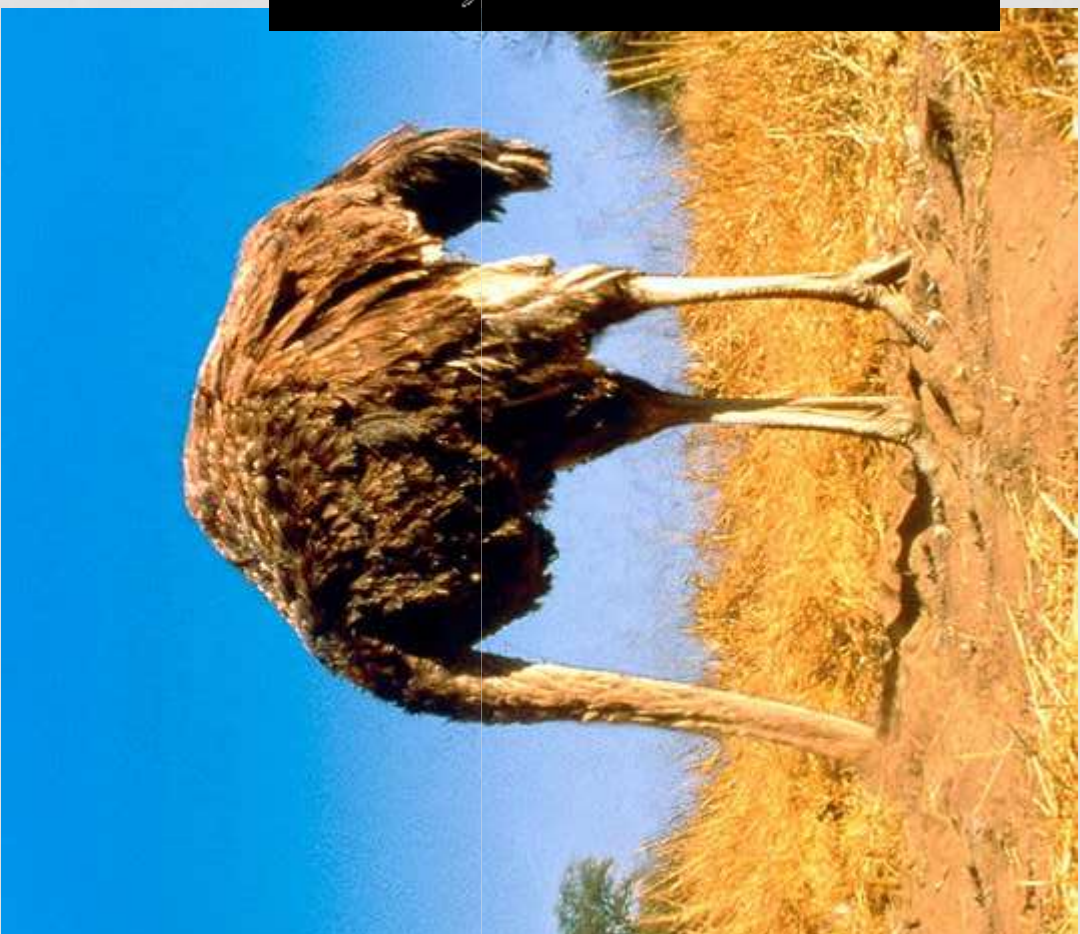
Glioma cases: n=1,380

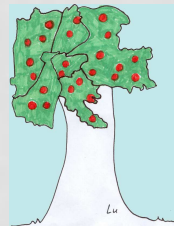
Population-based controls: n=3,530



Glioma cases: n=1,380

Population-based controls: n=3,530





MOBILE PHONES AND HEAD TUMOURS: LINK CONFIRMED BY ITALY'S SUPREME COURT

Italy's Supreme Court (employment section) (Sentence no. 17438, 3-12.10.12) has fully and definitively upheld the decision of Brescia's Court of Appeal regarding the case of a worker (I.M.) suffering from a trigeminal nerve tumor due to intense cell phone use at work (mobile and cordless). The Supreme Court judges:

- 1) confirmed the validity of the scientific references cited by the CTU (technical consultancy) of Brescia and the plaintiff's consultants: his oncologist and Prof. Levis, former professor in environmental mutagenesis at Padua University and co-founder (epidemiology) of the A.P.P.L.E. Association;
- 2) once again explained the reasons for the discrepancies between the studies and conclusions dismissive of any phone-use/health link (Interphone Project: IARC, EC, ICNIRP, WHO, but also international and national mobile telephony companies) and the alarming findings of the Hardell group;
- 3) once more acknowledged the presence of conflict of interest and thus "business bias", so nullifying the results of scientific studies carried out in this context;
- 4) noted the general principle – applicable to all pathologies and their work-place causes, including those not listed by INAIL – whereby "reasonable certainty" of the cause-effect link, giving rise to a "considerable degree of probability", can in any case be taken into consideration.

This sentence - fruitlessly hindered by researchers of the National Health Institute in Rome and even opposed by the *Procuratore Generale della Repubblica* (Italian Attorney General) in his presentation at the Supreme Court hearing – sets a precedent for other cases of tumor due to workplace exposure, whether to electric and magnetic field/extremely low frequency (EMF/ELF) HT conductors or radiofrequency (mobile and cordless phones, but also radioemitters and radar). It could also open up the way for recognition and compensation regarding a variety of acute pathologies resulting from exposure to EMF, and even pathologies attributable to other environmental agents not "listed" by INAIL.

While this sentence is certainly an important step forward in terms of recognizing the oncological harm that can result from exposure to EMF, it is still unfortunately true that a year on there is still no sign of commitment to a "*campagna di informazione indirizzata ad un uso appropriato e non smodato e indiscriminato del telefono cellulare*" (awareness-raising campaign regarding correct, not excessive, not indiscriminate, cell phone use) demanded of the Health Ministry by the National Health Council through communication no. 226 of 15.11.2011, which followed a TV broadcast (REPORT RAI **www.report.rai.it** 27.11.11) on the subject, a case taken up by various leading newspapers. This commitment was recently acknowledged again, in response to a question put to the Ministry by a lawyer afflicted by a brain tumor following intense, prolonged cell phone use (*La Gazzetta del Mezzogiorno*, 08.10.12).

The Orange network operator in Israel, Partner, will pay 400,000 shekels (110,000 USD) to a lawyer in his 50's, who sued the company, claiming he got cancer after he had been using two cell phones he had bought from the company. The court verdict was that the lawsuit was rejected. The lawyer filed the lawsuit in May 2010 to the district court. He demanded to pay him millions of shekels, after he got a rare and aggressive lymphoma near his left ear.

He claimed that he got the disease because of frequent use he had done with both cell phones he had bought from the company, one in 2003 and the other in 2007. He used the phone in the protected area in his house [this relates to a room with wide walls, that all people in Israel need to have in order to protect themselves from missiles in wars. It can be the internal room in the house which has more walls compared to external rooms, or a room with wide walls that was built especially for this purpose] and Partner is responsible for the damage that was caused to him because they did not warn him from using the phone in this room, in which the use causes higher emissions of radiation. In the medical expert opinion it was claimed that there is an association between the cancer that the plaintiff developed and cell phone use, and that the rare cancer was discovered only in one place in the body - exactly the place where he was exposed to radiation.

<http://www.ynet.co.il/articles/1,7340,L-4351091,00.html>

U.S Legal Breakthrough

**Court Allows Expert Testimony in Litigation
Alleging Cell Phone-Linked Tumors,
WASHINGTON, D.C., August 8, 2014 /**

**Judge Frederick H. Weisberg, who is
presiding over 13 consolidated lawsuits
against the telecom industry, ruled that
experts met the *Dyas/Frye* legal standards
and can offer testimony related to injury
causation and health effects. The court held
evidentiary hearings in December 2013 and
January 2014 and reviewed hundreds of
exhibits.**

**The lawsuits now move into the discovery
phase, in which each side is compelled to
produce documents and answer questions.
This is the first time that the industry has
had to turn over data. There are 46
defendants including Motorola, Nokia,
AT&T, Bell Atlantic, Cellular One, Cingular
Wireless, SBC Communications, Verizon,
Vodafone, the Telecommunications Industry
Association, the IEEE, ANSI, the CTIA, and
the FCC.**

WHO

Electromagnetic fields and public health: mobile phones

Fact sheet N°193 Reviewed October 2014

Are there any health effects?

A large number of studies have been performed over the last two decades to assess whether mobile phones pose a potential health risk. To date, no adverse health effects have been established as being caused by mobile phone use.