

Seminario
Salute e campi elettromagnetici
Pontecchio Marconi
31 marzo 2009

Effetti sulla salute dei campi a radiofrequenza



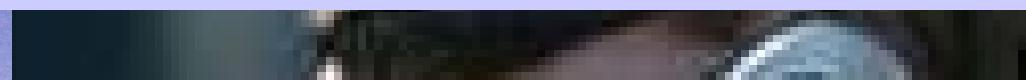
Susanna Lagorio

Centro Nazionale di Epidemiologia

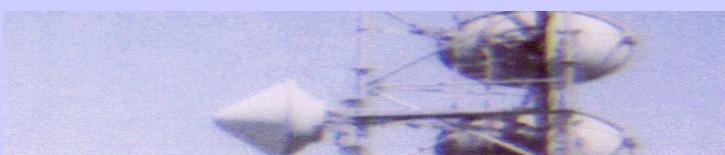
Argomenti



✓ Antenne radio-TV e leucemia infantile



✓ Telefoni cellulari e tumori intracranici



✓ Aggiornamento opinione SCENHIR (Jan 09)



Impianti di trasmissione radio-TV e leucemia infantile

Frequenze e modulazioni impiegate

	Frequenza	Modulazione
Radio	Bassa - "onde corte" (LW)	Ampiezza (AM)
	Media - "onde medie" (MW)	
	Molto alta (VHF)	
TV	Molto alta (VHF)	Frequenza (FM)
	Ultra alta (UHF)	





Studi ecologici 1992-2004

Study	Place	Comparison	Cases	Results
Selvin 1992	San Francisco	Cluster An	52	Random pattern
Maskarinec 1994	Hawaii	<2.6 miles	12	2.0 (0.1-8.3)
Hocking 1996	Sydney^	Inner/outer	33/101	1.6 (1.1-2.3)
Dolk 1997a	Sutton Coldfield*	<2 km	2	1 case exp
Dolk 1997b	All Great Britain	<2 km	10	1.1 (0.6-2.1)
McKenzie 1998	Sydney ^	High/low exp ($\mu\text{W}/\text{cm}^2$)	A B	1.5 (1.1-2.2) 1.0 (0.7-1.5)
Cooper 2001	Sutton Coldfield [§]	<2 km	1	1.1 (0.03-6.3)
Michelozzi 2002	Rome (Vatican R)	<6 km	8	2.2 (1.0-4.1)
Park 2004	Korea	AM+ / AM-	11	2.3 (1.1-6.0)

*1974-86; [§]1987-94; ^independent analyses of the same data;

A=same districts as in Hocking 1996; B= excluding 1 out of 3 inner districts

Inadequate evidence

Strong need for analytic studies with better exposure assessment (very weak relation distance-exposure)

ICNIRP Stand Comm Epidemiol (Ahlbom A, Green A, Kheifets L, Savitz D, Swerdlow A)

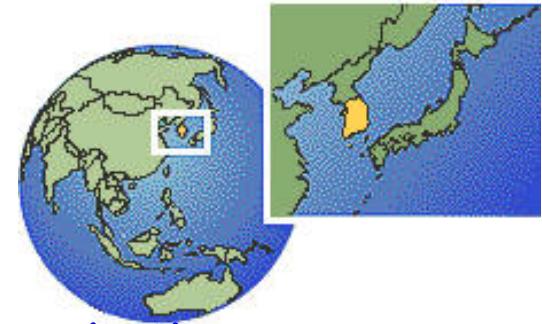
Environ Health Perspect 2004; 112: 1741-1754



Studi caso-controllo COREA DEL SUD

Campione

- 1,928 casi di leucemia infantile (diagnosi 1993-99)
- residenti in località con antenne radio AM (31)
- 1,928 controlli ospedalieri



Valutazione esposizione a RF

- distanza
- intensità di campo da programma di predizione

Risultati

- Distanza → OR = 2.15 (1.00-4.67) a ≤ 2 km
- Intensità del campo → OR = 0.83 (0.63-1.08) per quartile superiore vs quartile inferiore

Ha et al, Am J Epidemiol 2007; 166:270-279

Schüz et al, Am J Epidemiol 2008; 167:883-4 (Letter + Authors' replay)

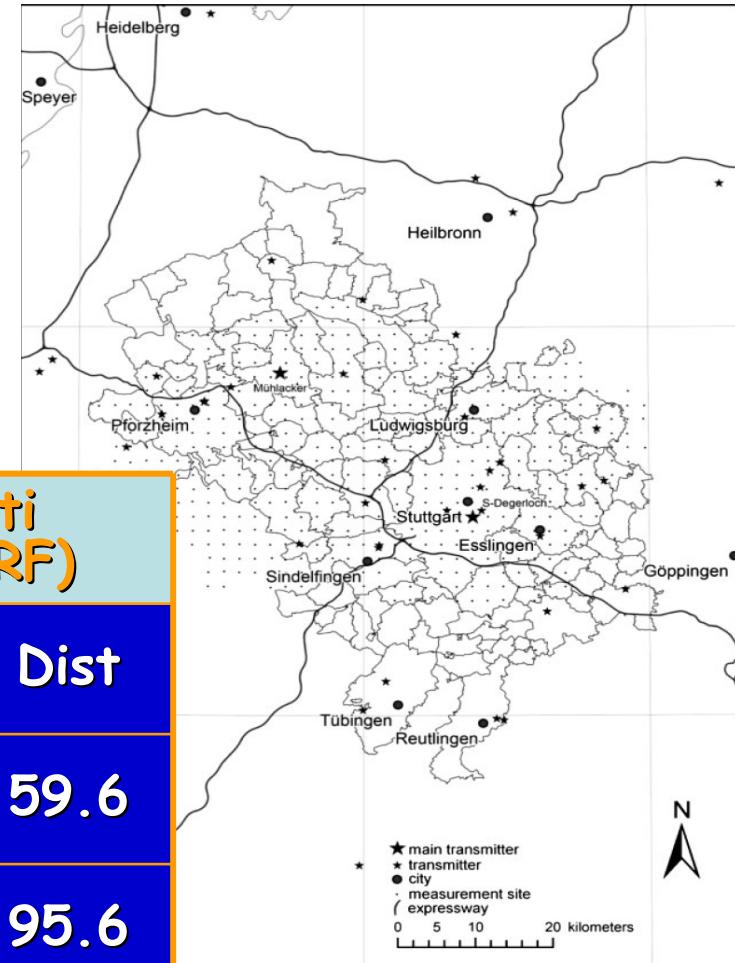


Studi caso-controllo Germania

Studio validazione preliminare

I livelli di campo predetti da modello sono un indicatore più accurato della distanza?

	Unico AM		Unico FM		Molti (tot RF)	
	Mod	Dist	Mod	Dist	Mod	Dist
SE%	77.8	65.1	57.7	36.5	77.6	59.6
SP%	97.5	96.1	95.5	92.9	97.4	95.6
p	0.91	0.69	0.86	0.70	0.80	0.54



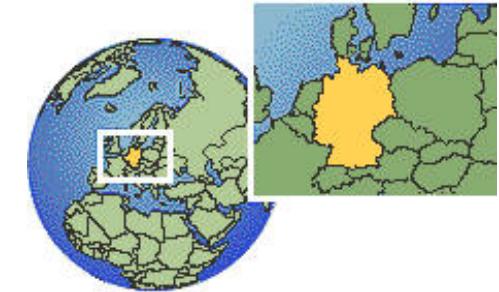
Area = Stuttgart e Mühlacker
Puntini = Siti misure (#850)
Asterischi = Trasmettitori
Punti grandi = Città



Studi caso-controllo Germania

Campione

- comuni con trasmettitori (16 AM e 8 FM)
- 1,959 casi di leucemia infantile (diagnosi 1984-2003)
- 5,848 controlli di popolazione



Valutazione esposizione a RF

In base a validazione preliminare

- Intensità campo da programma predizione

Risultati

- Intensità del campo → OR = 0.86 (0.67-1.11) per quantile superiore ($\geq 95\%$) vs quantile inferiore ($< 90\%$)
[Distanza → OR = 1.04 (0.65-1.67) a ≤ 2 km]

Merzenich et al, Am J Epidemiol 2008; 168:1169-1178



Studi caso-controllo 2007-08

Campi RF da trasmettitori AM e rischio di LLA infantile: RRs da studi caso-controllo in Corea e Germania e RR pooled per esposizioni $\geq 0.917 \text{ V/m}$ vs $< 0.518 \text{ V/m}$

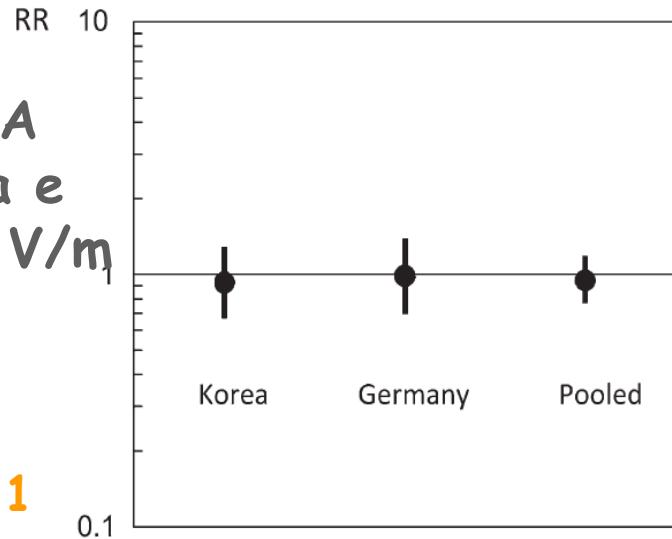


Figure 5 in
Schüz & Ahlbom Rad Prot Dosim 2008; 132:202-11

Evidenza negativa

- I recenti studi caso-controllo su larga scala, basati su livelli di campo da modello di predizione per ciascun partecipante, NON mostrano alcuna associazione tra livelli di RF da antenne radio-TV e leucemia infantile, indebolendo molto precedenti osservazioni di clusters a breve distanza dai trasmettitori
- Le esposizioni a nuove sorgenti fisse di RF (es. stazioni radio-base, telefoni cordless o reti WiFi) sono generalmente molto al di sotto dei livelli misurabili in prossimità di potenti antenne radio-TV, suggerendo così che non c'è necessità impellente di altri studi dello stesso tipo



Cellulari → priorità di ricerca

- Intensità esposizione locale relativamente alta
- Diffusione (~2.5 miliardi di utilizzatori)



Rassegna studi - criteri

- Periodo 1996-2008
- Tumori cerebrali e neurinomi nervo acustico
- Studi originali 28
 - Descrittivi (trend temporali) 5
 - Analitici { Coorte 2
 { Caso-controllo 17 + 4 analisi pooled
- Gruppi omogenei di risultati
 - tipo istologico (gliomi, meningiomi, neurinomi)
 - analisi confrontabili (users/non users, durata, intensità)

Studi ecologici - trend temporali

Group	Design	Controls	Exposure Assessment	Country
1 Early studies	Case	Population	Self-report from mail questionnaire	Sweden
		Hospital	Self-report from interview PC	USA
		Population	Subscriber lists	USA
Swedish series	I	Population	Self-report from mail questionnaire	Finland
Quattro gruppi di studi analitici Interphone study	Control	Population	Self-report from mail questionnaire + validation	Sweden
		Population	Self-report from interview PC	UK north + UK south
		Population	Self-report from interview PC	Germany
		Population	Self-report from interview PC	Norway
		Population	Self-report from interview PC	France
		Population	Self-report from interview PC	Japan
		Population	Self-report from interview PC	Nordic + UK south
		General population	Subscriber lists	USA
		Non-subscriber adult Danes	Subscriber lists + validation	Denmark

Case-control studies

Early studies

Swedish series

Interphone

Study	Nº of Cases		
	Glioma	Meningioma	Ac Neuroma
Hardell, 1999	53	16	13
Muscat, 2000; 2002	469	-	90
Inskip, 2001	489	197	96
Auvinen, 2002	198	129	-
Hardell, 2002*§	588	611	159
Hardell, 2005 _a *; 2006 _a §	317	305	84
Lönn, 2004*; 2005#♦	371	273	148
Christensen, 2004•2005#♦	371	273	106
Hepworth, 2006 #(UK south only)	966	-	-
Schüz, 2006 _b ; Schlehofer, 2007	366	381	97
Takebayashi, 2006; 2008	83	128	101
Klaeboe, 2007•#♦	289	207	45
Hours, 2007	96	145	109
Hardell, 2006 _b (*)	905	-	-
Hardell, 2006 _c (§)	-	916	243
Schoemaker, 2005 (•)	-	-	678
Lahkola, 2007 (#)	1521	-	-
Lahkola, 2008 (♦)	-	1209	-

Pooled analyses

Interphone study

Centre

Australia (Sydney & Melbourne)

Canada (Montreal)

Canada (Ottawa)

Canada (Vancouver)

Denmark (nationwide)

Finland (almost nationwide)

France (Lyon)

France (Paris)

Germany (Bielefeld, Heidelberg, Mainz, Mannheim)

Israel (nationwide)

Italy (Rome)

Japan (Tokio)

New Zealand (Wellington, Greater Auckland)

Norway (Southern and middle regions)

Sweden (Umeå, Stockholm, Göteborg, Lund)

UK-North (Trent, Midlands, Yorkshire, Scotland)

UK-South (Thames regions)

Target population = 46,231,000

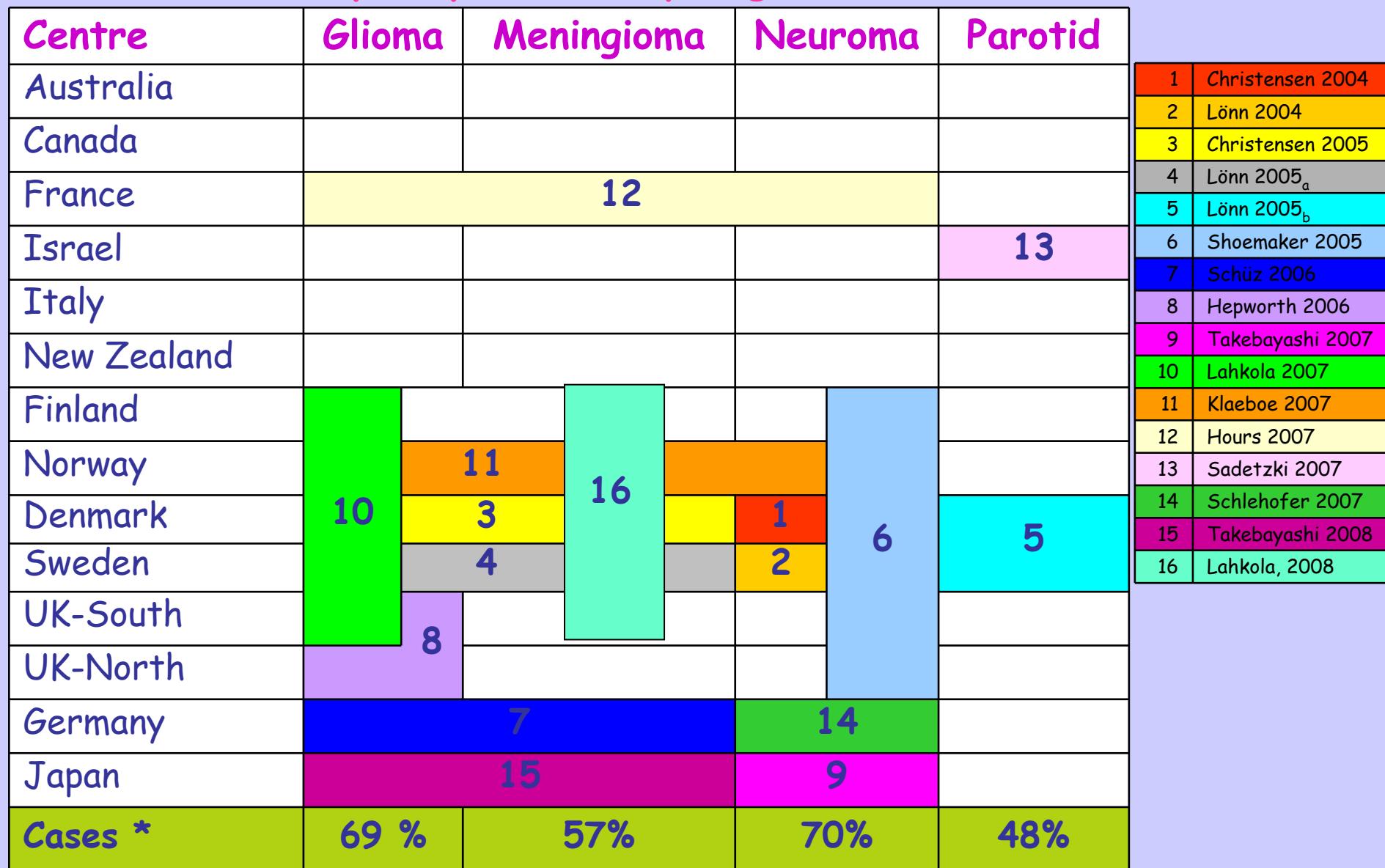
Age = 30-59 years

Subjects	Interviewed
Glioma	2,765 (65%)
Meningioma	2,425 (78%)
Acoustic neuroma	1,121 (82%)
Malignant Parotid	109 (75%)
Controls	7658 (53%)

Cardis et al. Eur J Epidemiol 2007; 22: 647-664

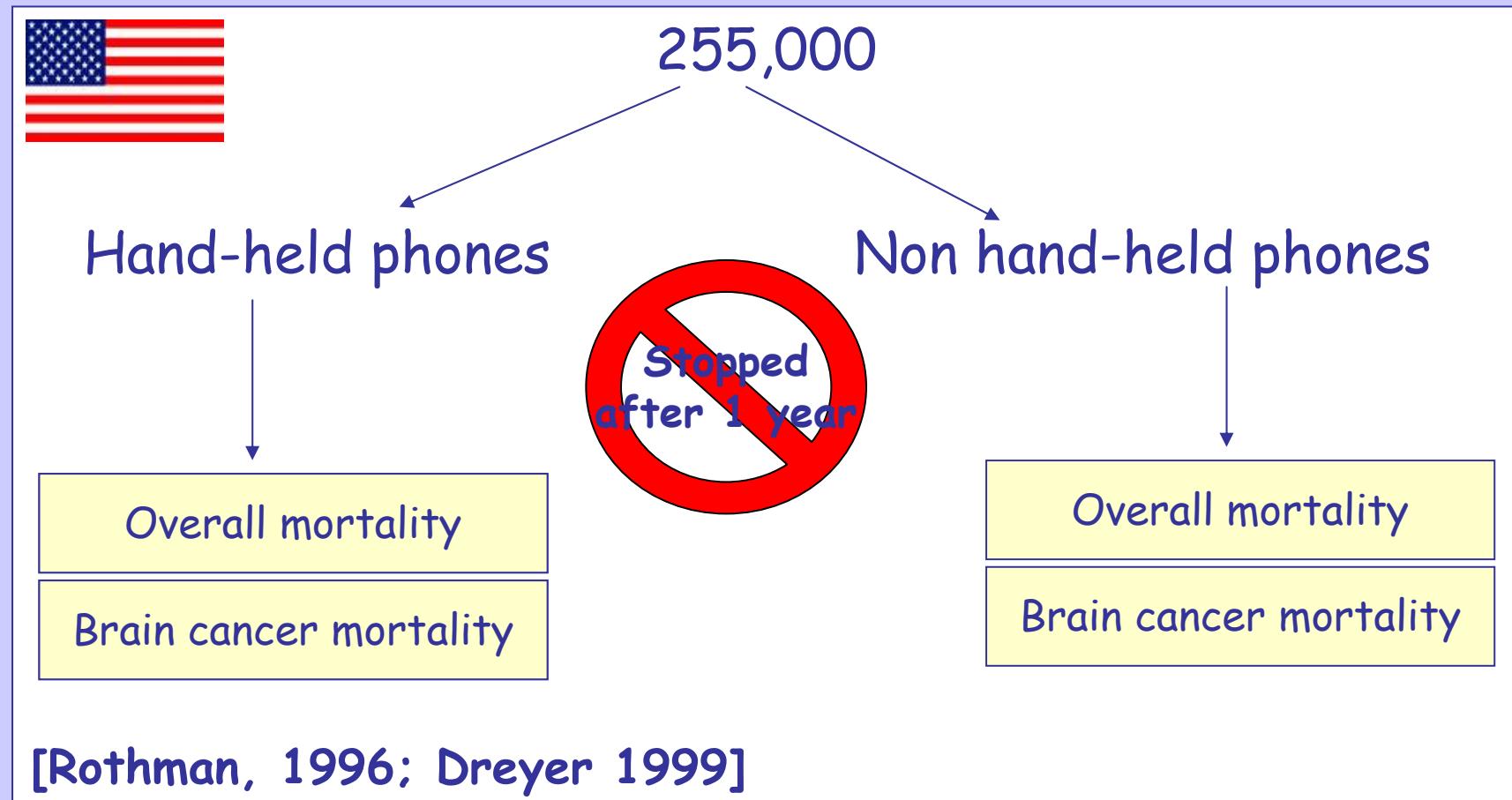
INTERPHONE - Risk related to mobile phone use

Papers published by August 2008

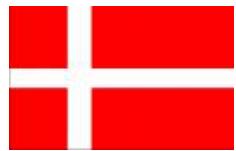


* Proportion of total Interphone cases

Cohorts of mobile phone users -1



Cohorts of mobile phone users -2



420,095

(all private* Danish subscribers in 1982-1995)

- Cancer incidence up to 2002
- Follow up: max 21 years, average 8.5 years
- Compared with remaining ~4 millions adult Danes
- Exposure validation with Danish Interphone data

[Johansen, 2001; Schüz, 2006_b]

* ~200,000 corporate subscriptions not attributable to individuals



Selezione degli articoli

- **Coorte Danese** → solo follow-up aggiornato (Schüz, 2006_b)
- **Serie Svedese** → 1° studio (Hardell, 1999) e analisi pooled del 2° and 3° (Hardell, 2006_{b,c})
- **Interphone** → analisi pooled dei 5 paesi nord Europei e risultati di altri centri locali non inclusi in queste analisi combinate. Parziale eccezione UK (Hepworth, 2006)

Hepworth 2006



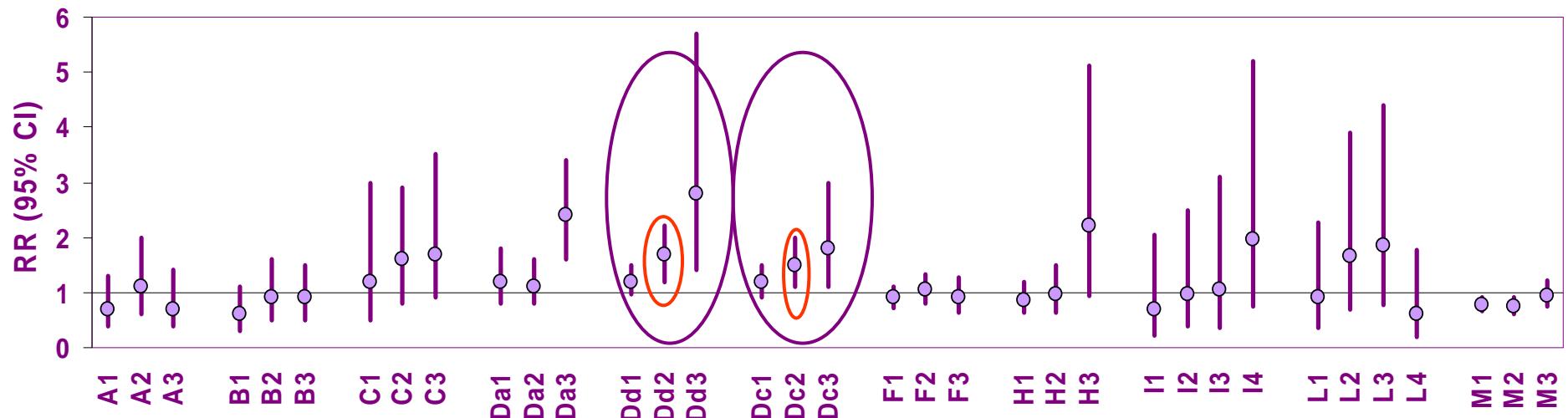
Lahkola 2007

Glioma Users vs non users



Study	Phone	RR	95% CI
Muscat, 2000		0.85	0.6-1.2
Inskip, 2001		0.8	0.6-1.2
Auvinen, 2002		1.5	1.0-2.4
Hardell, 2006 _b	analogue	1.5	1.1-1.9
	digital	1.3	1.1-1.6
Hepworth, 2006		0.94	0.8-1.1
Schüz, 2006 _a		0.98	0.7-1.3
Hours, 2007		1.15	0.6-2.1
Takebayashi, 2008		1.22	0.6-2.4
Lahkola, 2007		0.78	0.7-0.9
Schüz, 2006 _b (Danish cohort)		1.01	0.9-1.1

Glioma by time since start *



#	Study	Notes
A	Muscat, 2000	
B	Inskip, 2001	
C	Auvinen, 2002	
D	Hardell, 2006 _b (pooled)	a=analogue; d=digital; c=cordless
F	Hepworth, 2006	
H	Schüz, 2006 _b	
I	Hours, 2007	* non homogeneous categories
L	Takebayashi, 2008	
M	Lahkola, 2007 (pooled)	

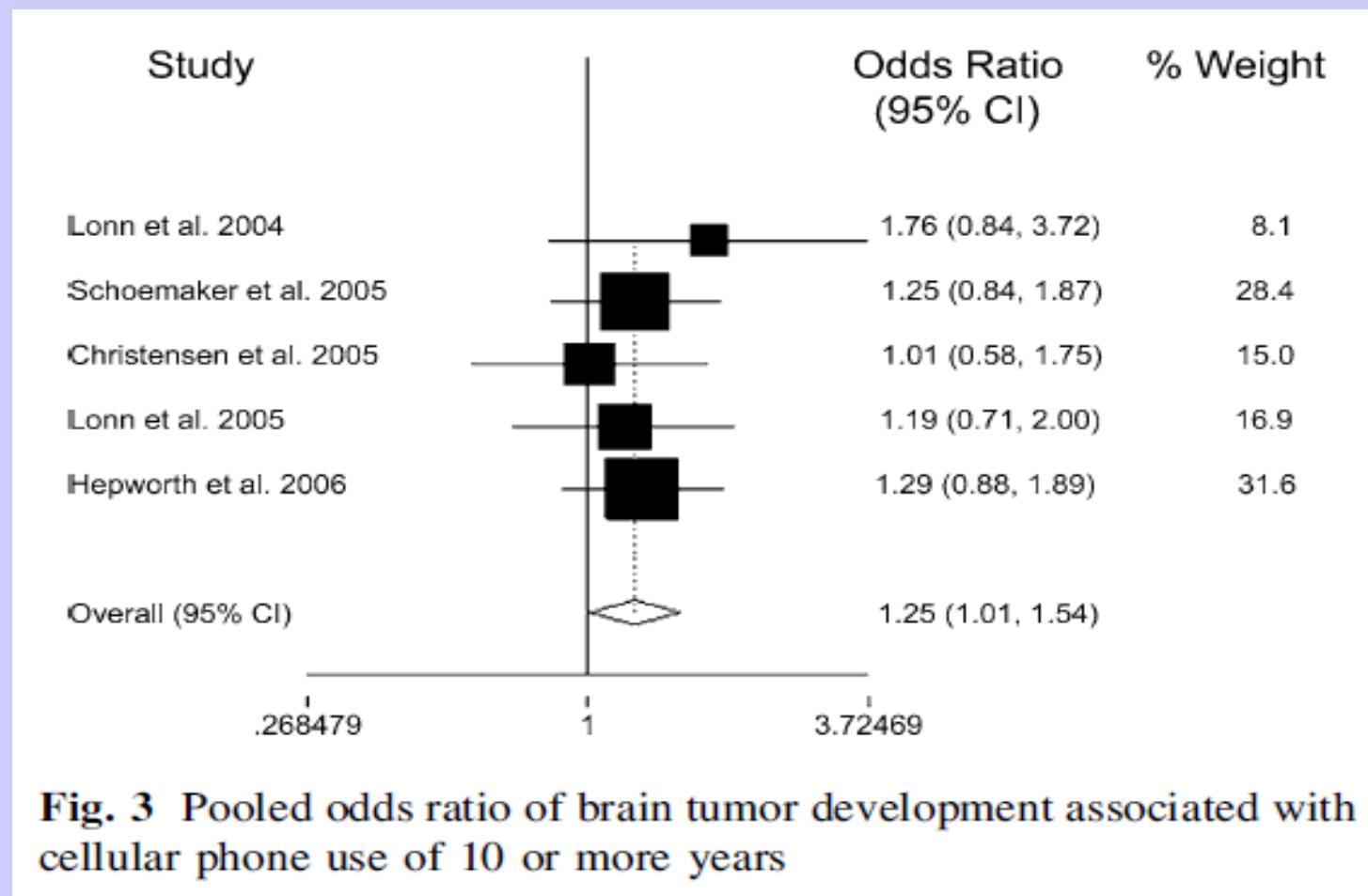
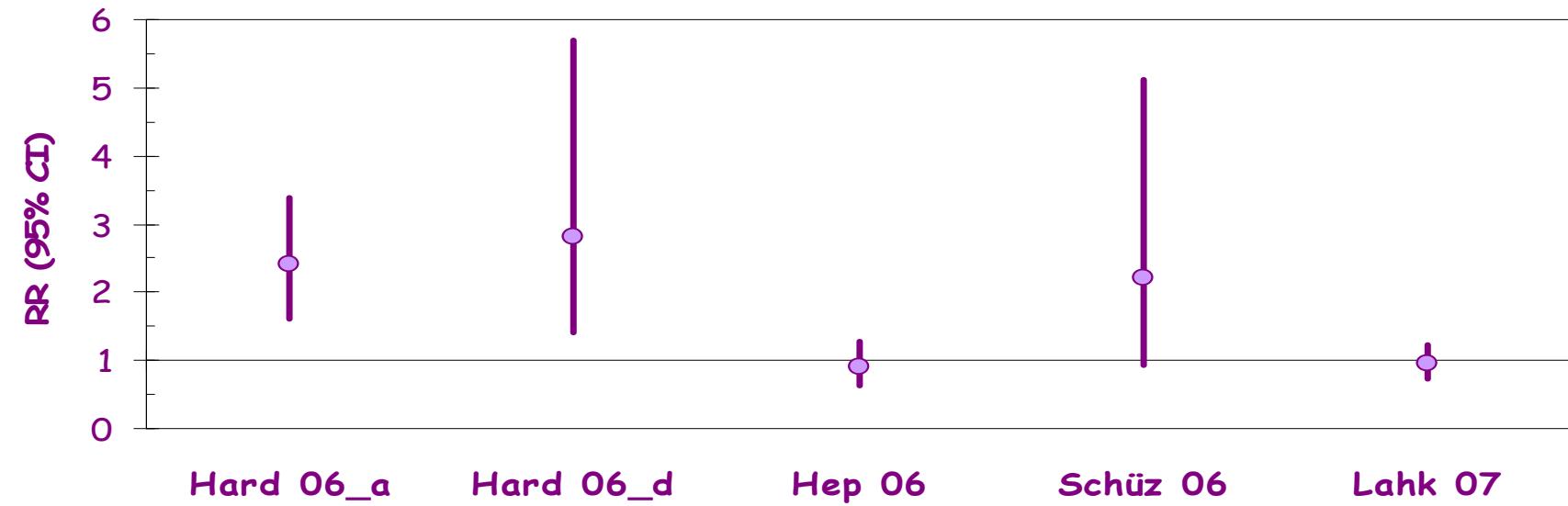


Fig. 3 Pooled odds ratio of brain tumor development associated with cellular phone use of 10 or more years

Study	Glioma (≥ 10 year latency)	Total
Author, year of publication, country, latency, reference number	No. of cases/controls	OR 95% CI
Meta-analysis	233/330	1.3 1.1–1.6

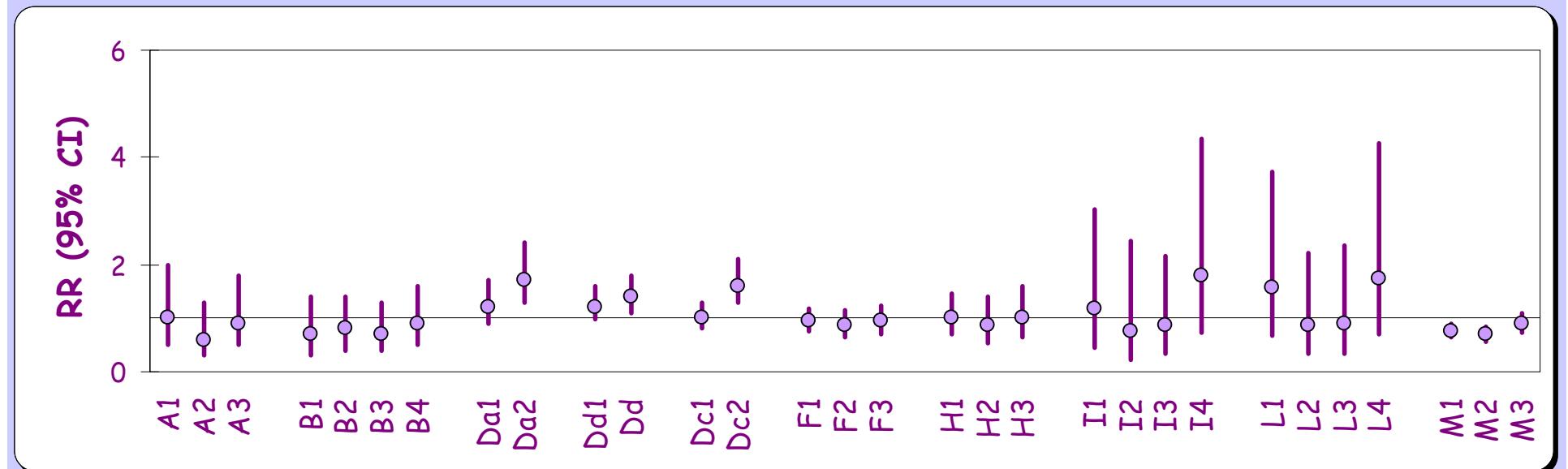
Glioma Long-term users (≥ 10 yrs)



Meta-analysis	Exp Cases	OR	95% CI	p homog	Model
All studies (Hard_anal)	293	1.4	0.8-2.4	<0.001	random
All studies (Hard_dig)	230	1.3	0.8-2.1	0.009	random
Sensitivity to exclusions					
Excl Hepworth (Hard_anal)	-56	1.7	0.8-3.4	<0.001	random
Excl Schüz (Hard_anal)	-12	1.3	0.7-2.3	<0.001	random
Excl Lakhola (Hard_anal)	-143	1.6	0.8-3.4	<0.001	random
Excl Hardell	-82	1.0	0.8-1.4	0.148	fixed



Glioma by cumulative call time *



#	Study	Notes
A	Muscat, 2000	
B	Inskip, 2001	
D	Hardell, 2006 _b	A=analogue; d=digital; c=cordless
F	Hepworth, 2006	
H	Schüz, 2006 _b	
I	Hours, 2007	
L	Takebayashi, 2008	
M	Lakhola, 2007	

* non homogeneous categories

Risk of brain tumour in relation to estimated maximal SAR in the tumour

	Glioma		
	Case no.	Control no.	OR (95% CI)
<i>Mean maxSAR^a</i>			
Non-exposed ^b	34	71	1.0
<0.001	17	37	0.94 (0.40–2.24)
0.001–0.01	17	27	2.30 (0.86–6.19)
≥0.01	9	16	0.87 (0.28–2.75)
			P for trend = 0.492
<i>Cumulative maxSAR-year^c</i>			
Non-exposed ^b	34	71	1.0
<0.001	7	19	0.66 (0.21–2.09)
0.001–0.01	14	26	1.53 (0.61–3.85)
0.01–0.1	18	28	2.09 (0.75–5.83)
≥0.1	4	7	0.63 (0.14–2.93)
			P for trend = 0.332

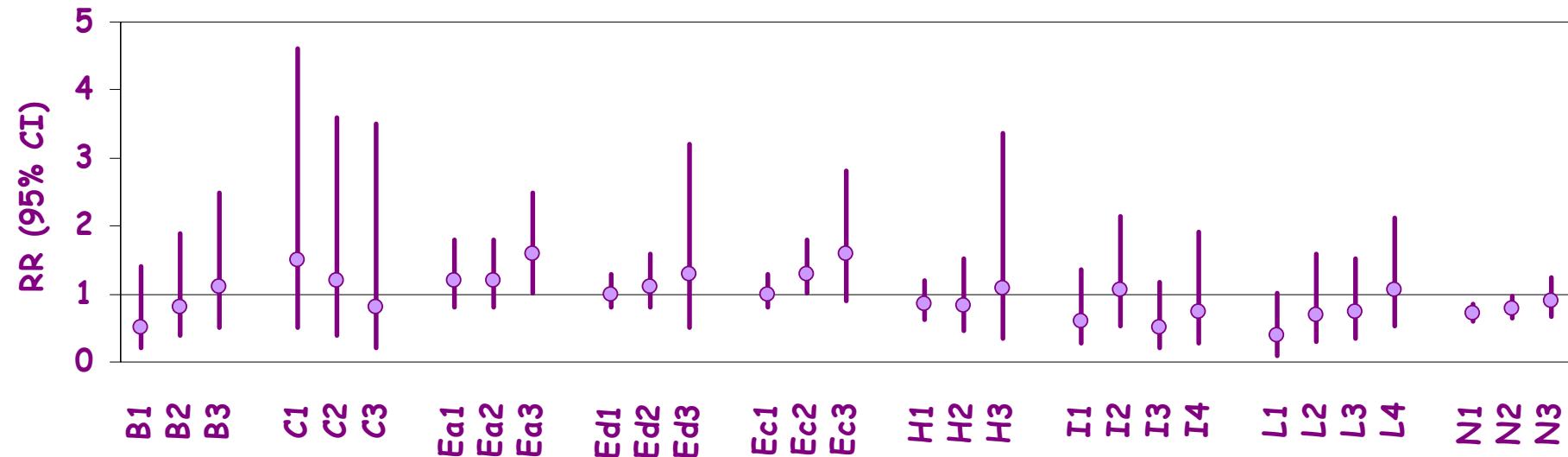
T Takebayashi et al. Br J Cancer 2008; 98: 652 - 659



Meningioma Users vs non users

Study		RR	95% CI
Inskip, 2001		0.8	0.4-1.3
Auvinen, 2002		1.1	0.5-2.4
Hardell 2006 _c	analogue	1.3	1.0-1.7
	digital	1.1	0.9-1.3
Schüz, 2006 _a (Danish cohort)		0.9	0.7-1.1
Schüz, 2006 _b		0.8	0.6-1.1
Hours, 2007		0.7	0.4-1.3
Takebayashi, 2008		0.7	0.4-1.2
Lahkola, 2008		0.8	0.7-0.9

Meningioma by time since start



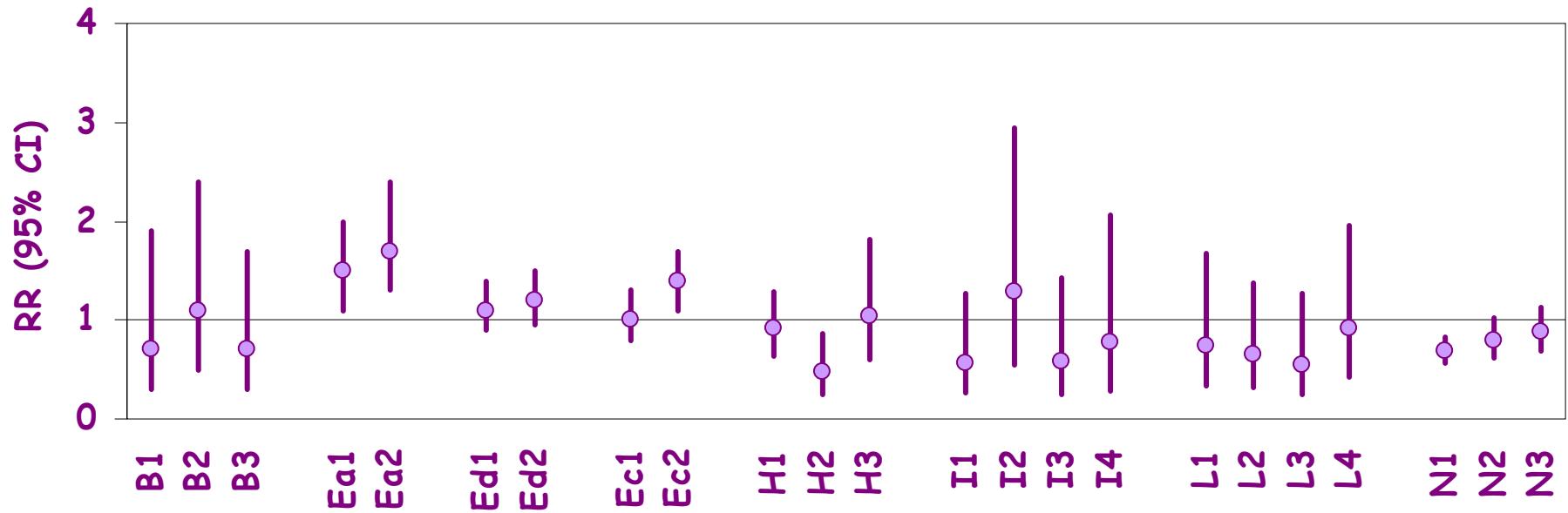
#	Study	Notes
B	Inskip, 2001	
C	Auvinen, 2002	
E	Hardell 2006 _c	a = analogue; d = digital; c = cordless
H	Schüz, 2006 _b	
I	Hours, 2007	
L	Takebayashi, 2008	
N	Lakhola, 2008	

Meningioma Long-term users (≥ 10 yrs)



Study	Phone	Exp Cases	RR	95% CI
Hardell 2006 _c	Analogue	57	2.1	1.1-4.3
	Digital	13	1.5	0.6-3.9
Schüz, 2006 _b	Any	5	1.1	0.4-3.4
Lahkola, 2008	Any	73	0.9	0.7-1.3

Meningioma by cumulative call time



#	Study	Notes
B	Inskip, 2001	
C	Auvinen, 2002	
E	Hardell 2006 _c	a = analogue; d = digital; c = cordless
H	Schüz, 2006 _b	
I	Hours, 2007	
L	Takebayashi, 2008	
N	Lahkola, 2008	



Acoustic neuroma Users vs non users

Study	RR (95% CI)	Phone
Inskip, 2001	1.0 (0.5-1.9)	Any
Muscat, 2002	0.8 (0.4-1.7)	Any
Hardell, 2006 _c (pooled)	2.9 (2.0-4.3)	Analogue
	1.5 (1.1-2.1)	Digital
	1.5 (1.0-2.0)	Cordless
Schoemaker, 2005 (pooled)	0.9 (0.7-1.1)	Any
Takebayashi, 2006	0.7 (0.4-1.2)	Any
Schüz, 2006a (Danish cohort)	1.0 (0.5-1.6)	Any
Schlehofer, 2007	0.7 (0.4-1.2)	Any
Hours, 2007	0.9 (0.5-1.6)	Any

Acoustic neuroma long-term users



Study	Exp cases	OR (95% CI)	Time since start (yrs)
Inskip, 2001	5	1.9 (0.6-5.9)	≥ 5
Muscat, 2002	11	1.7 (0.5-5.1)	3-6
Hardell, 2006 _c (anal)	19	3.1 (1.7-5.7)	>10
Schoemaker, 2005	47	1.0 (0.7-1.5)	>10
Takebayashi, 2006	4	0.8 (0.2-2.7)	≥8
Schlehofer, 2007	0	0 ca, 3 co	≥10
Hours, 2007	14	0.7 (0.3-1.6)	≥3.8

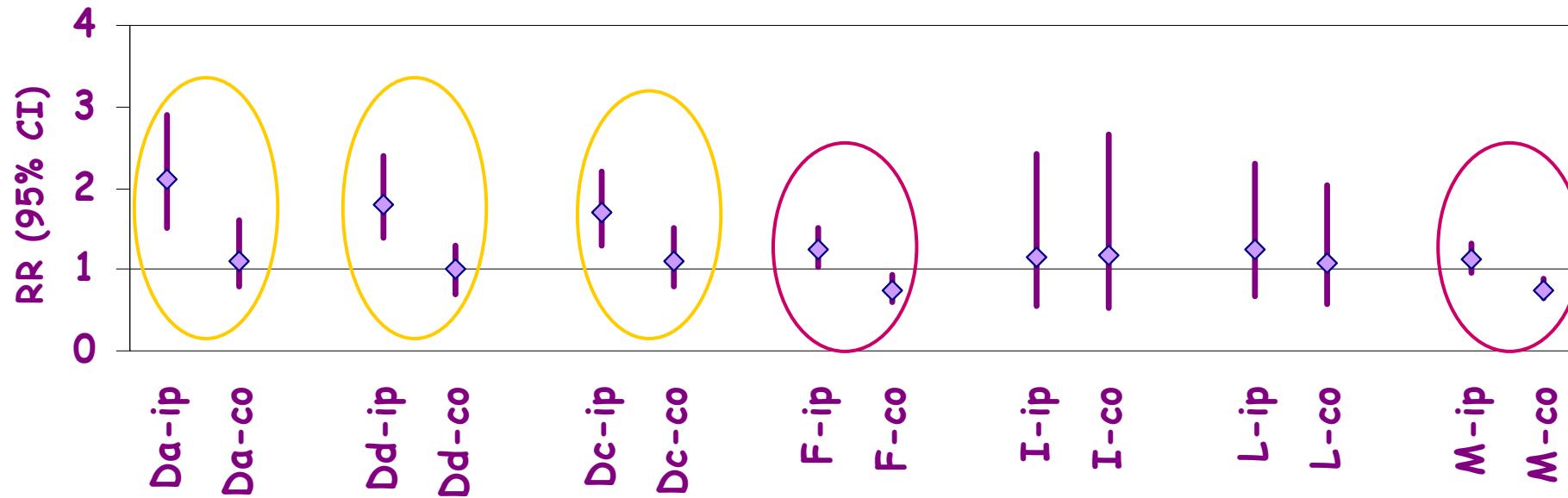
Le analisi di lateralità



Study	Regular Use	Ipsilateral	Contralateral	Ratio
Exposure	RR (95% CI) ^c	RR (95% CI) ^c	RR (95% CI) ^c	i/c ^d
Lahkola et al. (2007): Glioma				
Not exposed ^e	1.00	1.00	1.00	
1.5 – 4 years	0.77 (0.65, 0.92)	1.08 (0.88, 1.31)	0.70 (0.57, 0.87)	1.54
5 – 9 years	0.75 (0.62, 0.90)	1.10 (0.89, 1.35)	0.74 (0.59, 0.92)	1.49
10+ years	0.95 (0.74, 1.23)	1.39 (1.01, 1.92)	0.98 (0.71, 1.37)	1.42
Lahkola et al. (2008): Meningioma				
Not exposed ^e	1.00	1.00	1.00	
1.5 – 4 years	0.72 (0.60, 0.86)	0.77 (0.60, 0.99)	0.62 (0.47, 0.80)	1.24
5 – 9 years	0.78 (0.64, 0.96)	0.78 (0.56, 1.04)	0.78 (0.58, 1.05)	1.00
10+ years	0.91 (0.67, 1.25)	1.05 (0.67, 1.65)	0.62 (0.38, 1.03)	1.69

SCENHIR, 2009

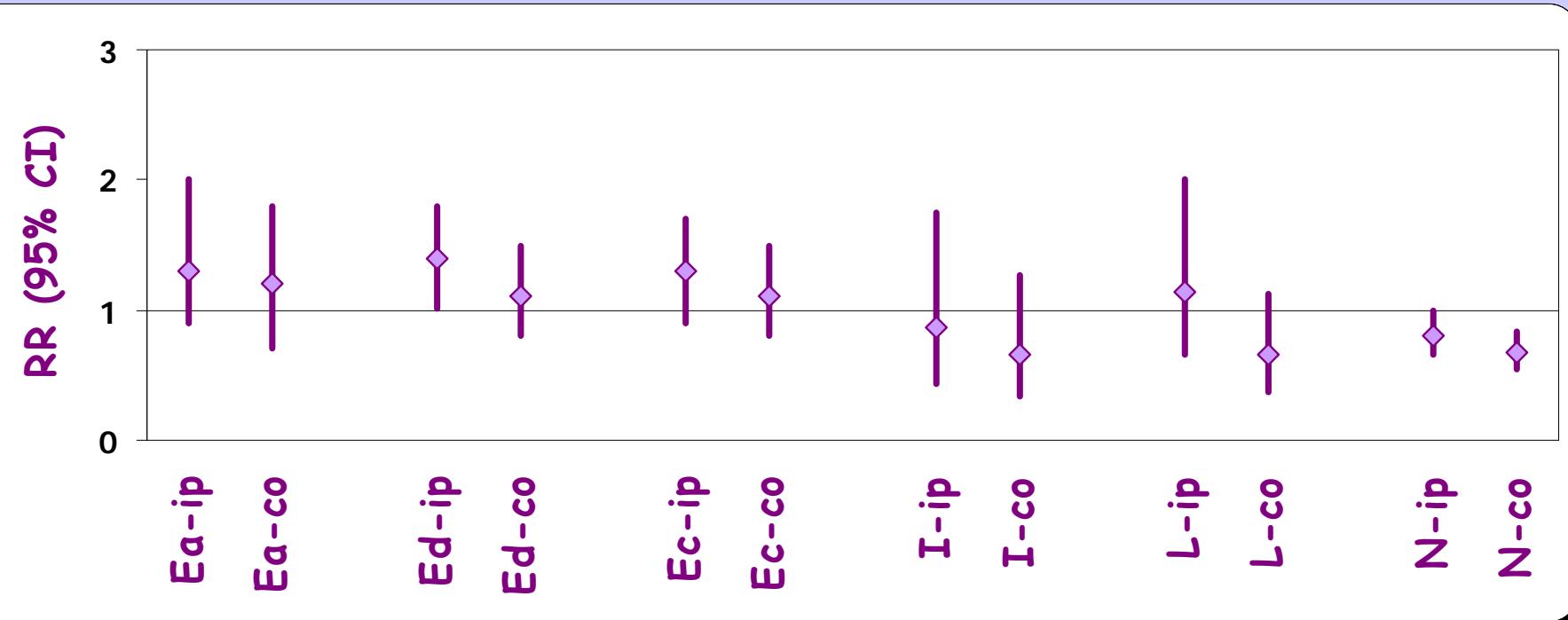
Glioma Laterality analyses



#	Study	Notes
D	Hardell, 2006 _b	a=analogue; d= digital; c=cordless; ip=ipsilateral; co=contralateral
F	Hepworth, 2006	ip=ipsilateral; co=contralateral
I	Hours, 2007	ip=ipsilateral; co=contralateral
L	Takebayashi, 2008	ip=ipsilateral; co=contralateral
M	Lahkola, 2007	ip=ipsilateral; co=contralateral



Meningioma Laterality analyses



#	Study	Notes
E	Hardell, 2006 _c	a=analogue; d= digital; c=cordless; ip=ipsilateral; co=contralateral
I	Hours, 2007	ip=ipsilateral; co=contralateral
L	Takebayashi, 2008	ip=ipsilateral; co=contralateral
N	Lahkola, 2008	ip=ipsilateral; co=contralateral



Acoustic neuroma Laterality analyses

Study	Laterality	OR (95% CI)	Category (years)
Schoemaker, 2005	Ipsi	1.3 (0.8-2.0)	≥ 10 (tss)
	Contra	1.0 (0.6-1.7)	
	Ipsi	1.8 (1.1-3.1)	≥ 10 (dur)
	Contra	0.9 (0.5-1.8)	
Hardell, 2006 _c (analogue)	Ipsi	3.0 (1.9-5.0)	> 1 (tss)
	Contra	2.4 (1.4-4.2)	

Mobile Phone Use and Location of Glioma

Hartikka H et al. *Bioelectromagnetics* 2009 [DOI 10.1002/bem.20471]

TABLE 3. Odds Ratios (OR) With 95% Confidence Interval (CI) for Distance ≤ 4.6 cm by Indicators of Mobile Phone Use

Exposure indicator	Crude OR (95% CI)	Adjusted OR (95% CI)
Cumulative call time (h)		
2–539 vs. never/non-regular	3.31 (0.84–12.98)	→ 3.36 (0.84–13.42)
>540 vs. never/non-regular	1.33 (0.29–6.03)	2.52 (0.45–13.93)
Laterality of use		
Ipsilateral vs. never/non-regular	1.45 (0.34–6.18)	1.34 (0.29–6.20)
Contralateral vs. never/non-regular	4.50 (1.07–18.86)	→ 4.93 (1.13–21.46)
Duration of use		
5–5 years vs. never/non-regular use	2.91 (0.75–11.34)	→ 3.39 (0.83–13.76)
>5 years vs. never/non-regular use	1.57 (0.34–7.13)	1.96 (0.38–10.17)

- Case-case analysis
- Slightly higher proportion of gliomas ≤ 4.6 cm from presumed location of phone among users than non-users (**28%** vs. **14%**)
- Modestly elevated ORs for various indicators of use, but **without exposure gradient** → highest ORs for contralateral and short-term use.



Interpretazione

- **Deficit di rischio**

- Effetto protettivo
- Causalità inversa
- Bias
 - Selezione (più MPh users tra controlli non-partecipanti e/o meno MPh users tra casi partecipanti)
 - Informazione (errori random indicatori esposizione)

- **Incrementi di rischio**

- Bias
 - Informazione (errori differenziali indicatori esposizione)
 - Selezione (identificazione/intervista non contemporanee di casi e controlli)
- Associazione causale



Studi di validazione

- Permettono di stimare direzione ed entità di eventuali distorsioni nelle misure d'effetto
- Sono di fondamentale rilevanza nella interpretazione critica dei risultati

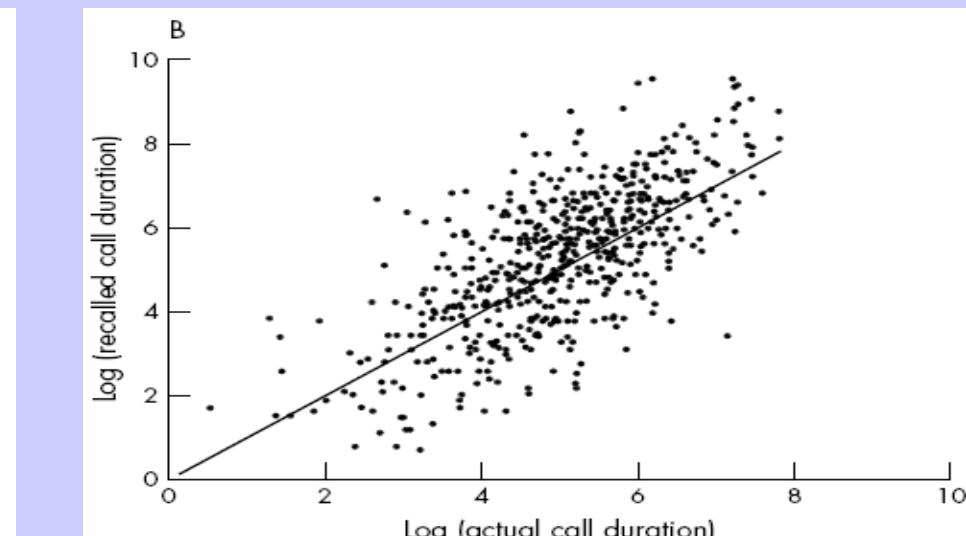
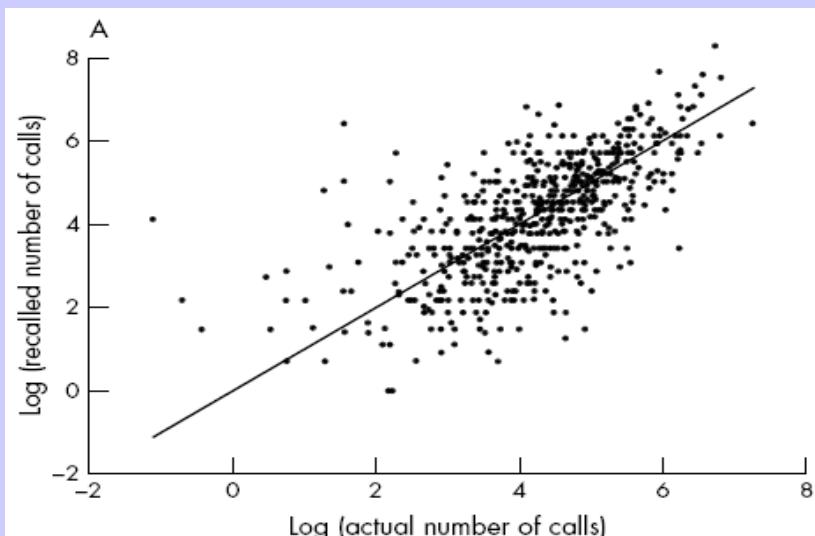
- Parte integrale di Interphone
- Assenti negli studi di Hardell

Interphone Validazione esposizione 1

Campione di convenienza (sesso/età come in studio ca-co)

Vrijheid et al. Occup Environ Med 2006; 63: 237-243

Subjects	G mean ratio (95% CI)	95% Limits agreement
Number of calls		
672	0.92 (0.85-0.99)	0.12-7.85
Duration of calls		
663	1.42 (1.29-1.56)	0.12-17.37



Interphone Validazione esposizione 2

Campione di casi e controlli

Vrijheid et al. J Exp Sci Environ Epidemiol 21 May 2008; doi:10.1038/jes.2008.272008

N°	Rapporto Uso Riferito / Uso Registrato				
		Numero chiamate		Durata chiamate	
		Ratio	IC 95%	Ratio	IC 95%
Casi	212	0.8	0.7-0.9	1.4	1.2-1.7
Controlli	296	0.8	0.7-0.9	1.4	1.2-1.6

	Durata (min/giorno)			
	Uso Riferito		Uso Registrato	
	Mediana	Min-Max	Mediana	Min-Max
Casi	6	0.1- 632	5	0.2- 78
Controlli	6	0.0- 455	4	0.2- 66

Interphone Validazione esposizione 2

Campione di casi e controlli

segue

Anni	Ratio Intervista / Dati Traffico per tempo prima dell'intervista				
	Casi		Controlli		
	Numero	Durata	Numero	Durata	
≤1	0.76	1.35	0.81	1.42	
1-2	0.86	1.47	0.81	1.41	
2-3	1.02	1.79	0.81	1.36	
3-4	1.09	2.05	0.90	1.44	
>4	1.24	2.16	1.02	1.57	
p trend	<0.001	<0.001	0.08	0.60	

Anni	Ratio Intervista / Dati traffico per tempo prima dell'intervista						
	Numero chiamate			Durata chiamate			
Casi	Controllo	p differenza casi-controllo	Casi	Controllo	p differenza casi-controllo		
≤1	1.94	0.78	0.02	4.06	0.93	<0.001	
1-2	2.15	0.87	0.03	3.88	1.05	0.003	
2-3	2.38	0.89	0.02	3.95	1.08	0.003	
3-4	2.58	0.86	0.01	4.48	1.00	<0.001	

Interphone Stima bias partecipazione

Vrijheid et al. Ann Epidemiol 2009;19:33-42

	Partecipanti	MPh Users
Casi	Si	66%
Controlli	No*	50%
Casi	Si	69%
Controlli	No*	56%

* Principalmente rifiuti

Bias factors ~ 0.9
negli scenari più
verosimili

Studi Interphone locali: ORs osservati e corretti

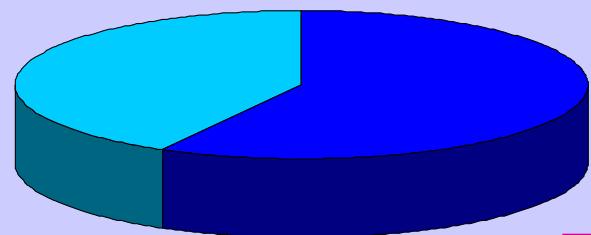
Studio	OR osservato	OR corretto (bias factor = 0.9)
Francia	1.15 (0.65-2.05)	1.28
Germania	0.98 (0.74-1.29)	1.09
UK	0.94 (0.78-1.13)	1.04
Pool nord-Europa	0.78 (0.68-0.91)	0.87

Elioma

Coorte danese: validazione dello stato di titolare di contratto con l'uso riferito all'intervista nello studio Interphone danese

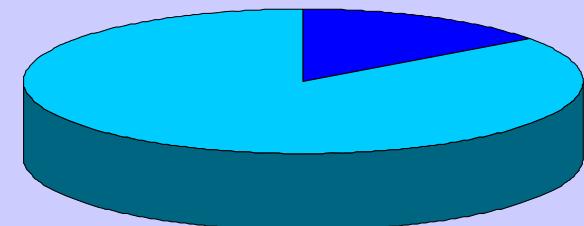
Schüz & Johansen *Bioelectromagnetics* 28:130-136 (2007)

Subscribers



User Non-User

Non-Subscribers



User Non-User

Sensibilità	30%
Specificità	94%
Valore Pr +	56%
Valore Pr -	85%

Lieve sottostima del rischio nella coorte

(es. RR osservato = 1.3 per un ipotetico RR vero = 1.5)



Limiti degli studi attuali

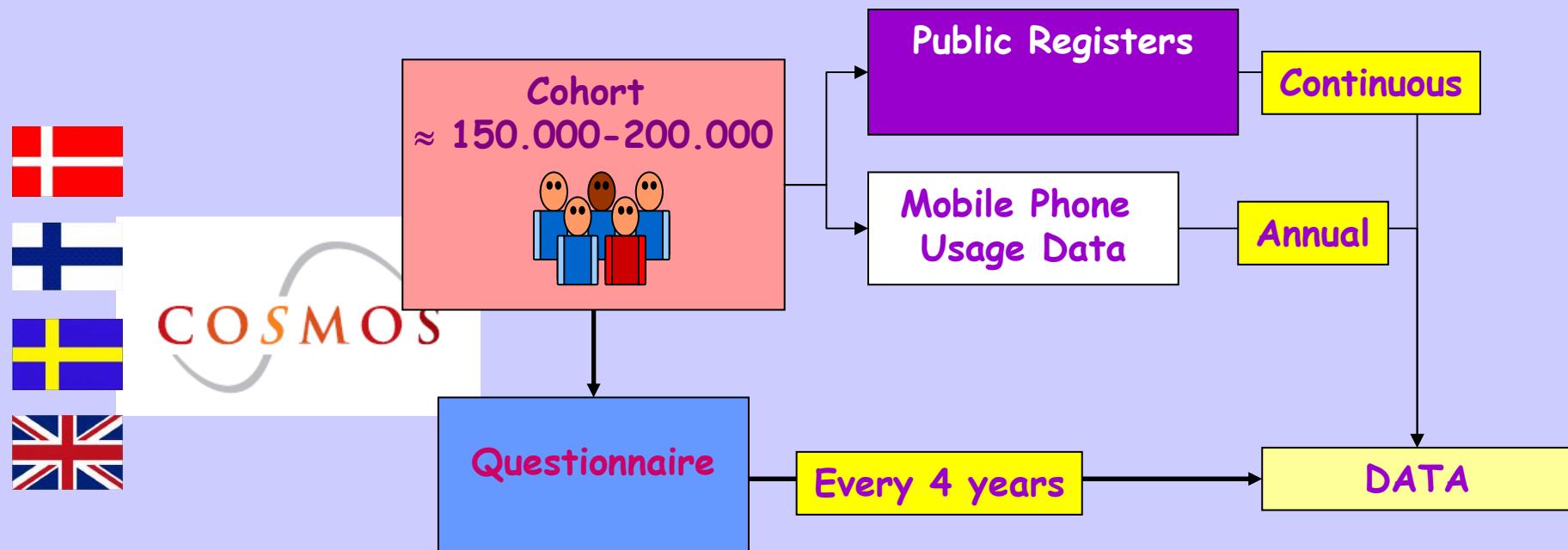
- **Misclassificazione dell'esposizione**
 - Titolarità di contratto → misclassificazione non differenziale → **sottostima del rischio**
 - **Self-report** → affetto da errori differenziali e random → **sovraprevalenza del rischio possibili**
 - Analisi di lateralità particolarmente suscettibili ad errori differenziali (sia intensità d'uso, sia lato preferito d'uso) → **sovraprevalenza del rischio**
- **Bias di selezione/partecipazione**
 - Possibili sia sotto- sia **sovraprevalenza del rischio**
- **Breve periodo di esposizione/osservazione** nella maggior parte degli studi

Neurinoma acustico - altri problemi

- L'uso del cellulare può rendere più evidenti i sintomi precoci di questa neoplasia (lievi perdite d'udito monolaterali) → **detection bias**
 - Il lato del tumore può influenzare il lato preferito d'uso
 - I casi possono dichiarare l'uso ipsilaterale anche se non è la modalità vera più frequente
 - I veri utilizzatori ipsilaterali possono aver cambiato il lato preferito d'uso a causa dei sintomi precoci del tumore
- ? interpretazione analisi lateralità

Sviluppi

- Necessari studi caratterizzati da migliore valutazione dell'esposizione
 - prima dell'insorgenza della malattia d'interesse
 - basata su combinazione di dati obiettivi e informazioni dal soggetto



Electromagnetic Fields

SCENIHR (January 2009)



- CONTESTO

L'Unione Europea ha stabilito limiti di sicurezza per la protezione dei lavoratori e della popolazione generale contro gli effetti dei telefoni cellulari e di altri campi elettromagnetici.

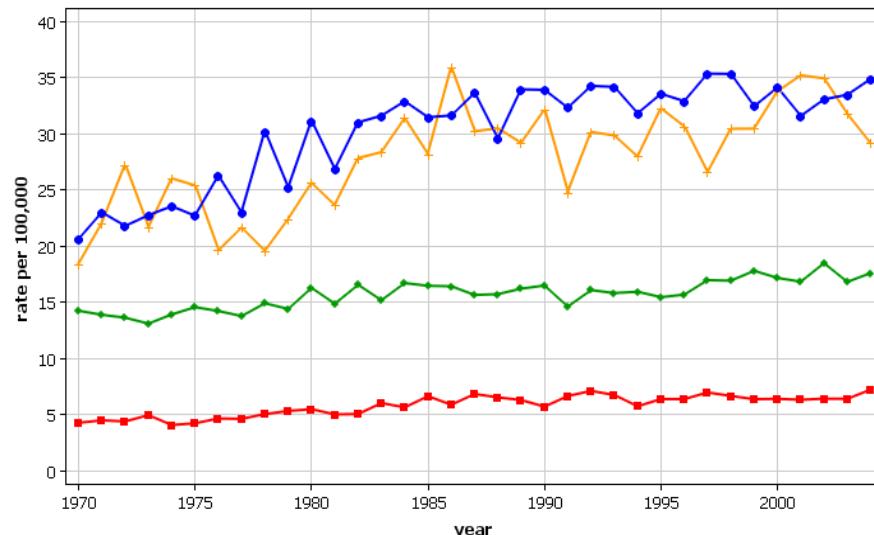
In base all'evidenza scientifica recente, questi limiti sono adeguati?



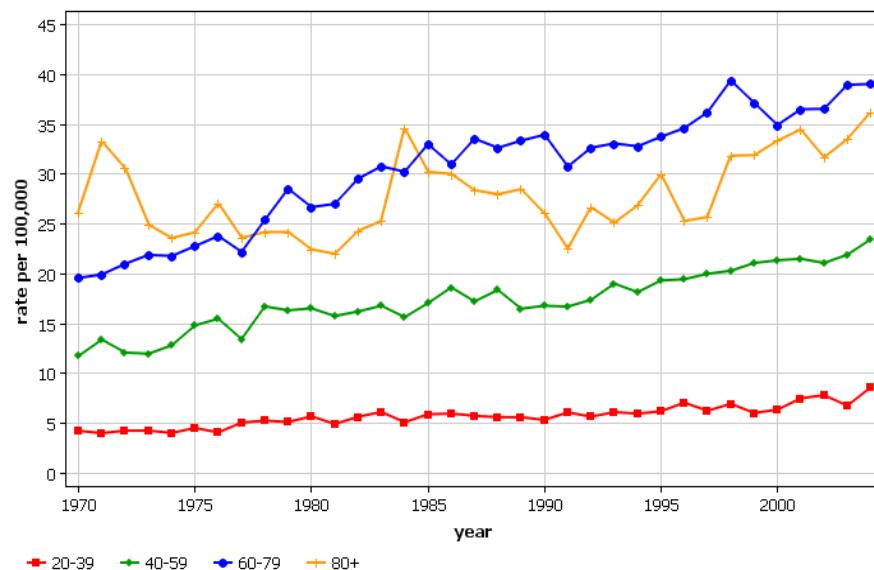
Epidemiology

- The question receiving most attention is whether RF field exposure is involved in carcinogenesis
- Previous opinion stated that mobile phone use for less than 10 years is not associated with cancer incidence; regarding longer use, it was deemed difficult to make an estimate since few persons had used mobile phones for more than 10 years
- Since then, a few additional epidemiological studies have been published; unfortunately they do not significantly extend the exposure period and do not change the assessment
- New improved studies on the association between RF fields from broadcast transmitters and childhood cancer provide evidence against such an association

Incidence: Nordic countries
Brain, central nervous system, Male



Incidence: Nordic countries
Brain, central nervous system, Female



- Lack of association between MPh use and brain tumor risk consistent with absence of increases in age-specific rates of CNS tumours in Nordic countries over last decade

- Many more men (most aged 30-60 years) than women started to use mobile phones in the early days of the technology → impact on incidence rates expected first in men

- Increase of CNS tumour incidence in older men and women from 1970 to late 1980s, long before widespread use of MPhs → effect of improved diagnosis (TAC / NMR)

- Follow-up of gender- and age-specific incidence rates remains important

Animal and in vitro studies

- Animal studies show that RF fields similar to those from mobile phones, alone or in combination with known carcinogens, are not carcinogenic in laboratory rodents
- Certain studies have also employed higher exposure levels (up to 4 W/kg), still with no apparent effects on tumor development
- The in vitro studies regarding genotoxicity fail to provide evidence for an involvement of RF field exposure in DNA-damage

Overall

- It is concluded from three independent lines of evidence that exposure to RF fields is unlikely to lead to an increase in cancer in humans
- However, as the widespread duration of exposure of humans to RF fields from mobile phones is shorter than the induction time of some cancers, further studies are required to identify whether considerably longer-term (well beyond 10 years) exposure might pose some cancer risk

Conclusions on other diseases

SCENHIR, 2009

- No effect of RF fields on self-reported symptoms
 - Associations observed but findings inconsistent
 - Possible nocebo effect (adverse non-specific effect caused by expectation or belief that something is harmful)
- Individuals (including those attributing symptoms to RF exposure) not able to detect RF fields
- Apparent influence of RF fields on EEG and sleep in humans, but relevance uncertain and mechanistic explanation lacking
- No or not consistent effects on other CNS functions
- No effects on reproduction and development
- No new data indicating any other health effects in humans

Gaps in knowledge

SCENHIR, 2009

- Important to recognise that information on possible effects in children is limited
- Lack of information on diseases other than those discussed in this report