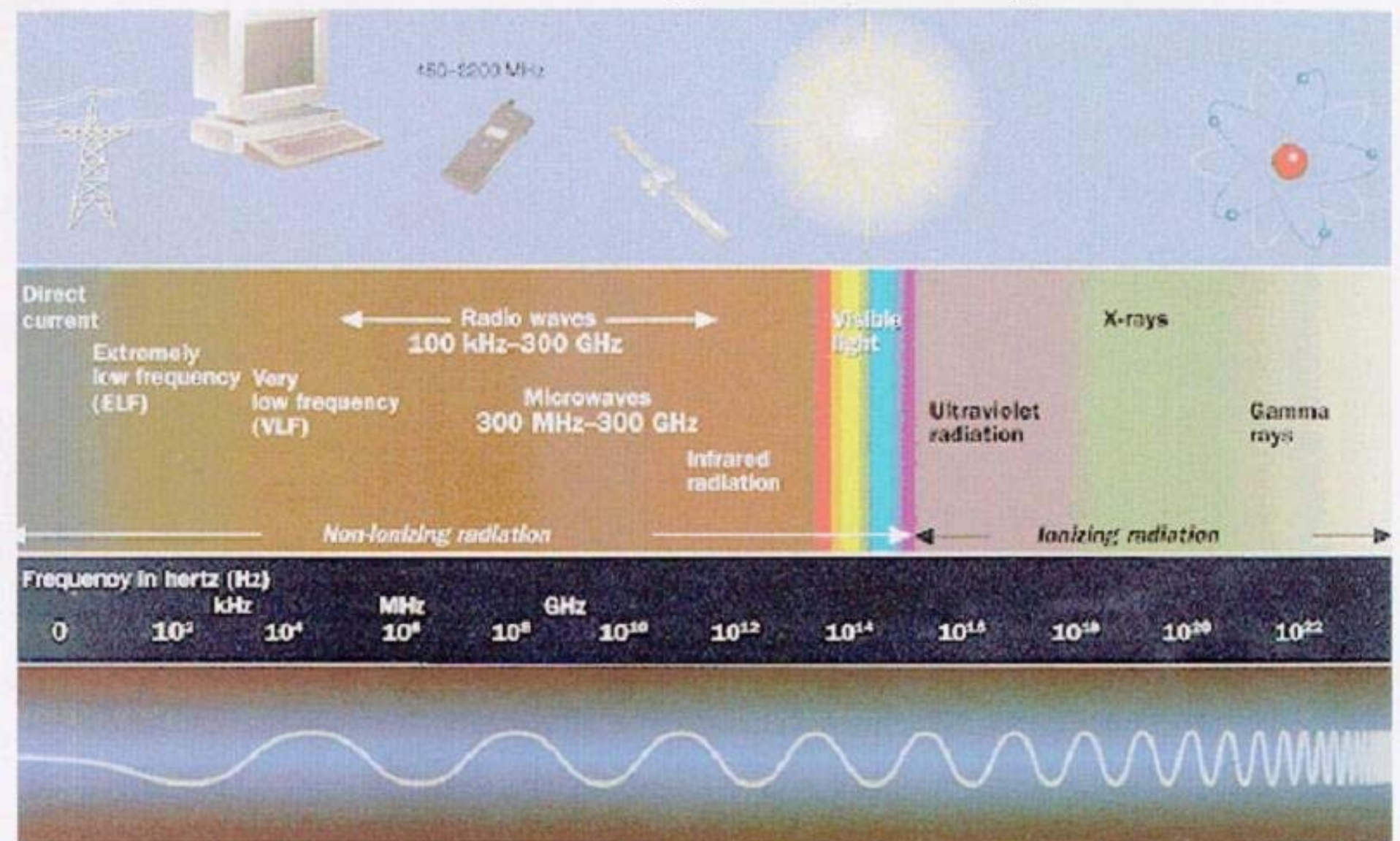


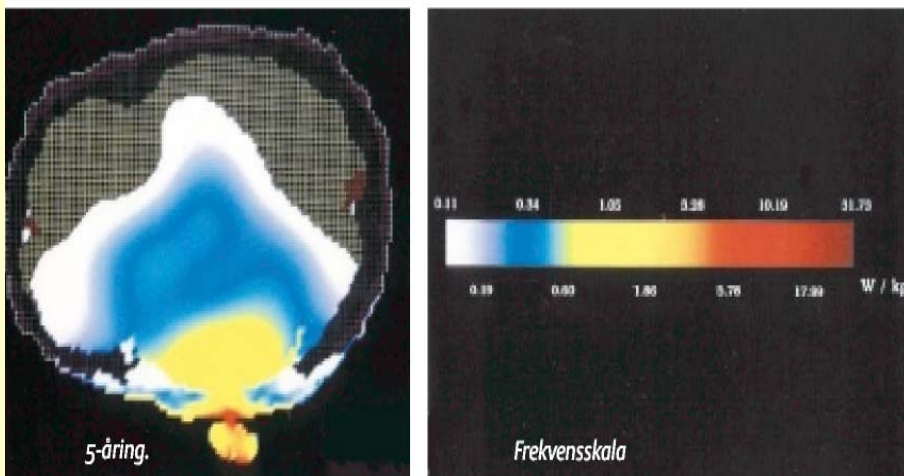
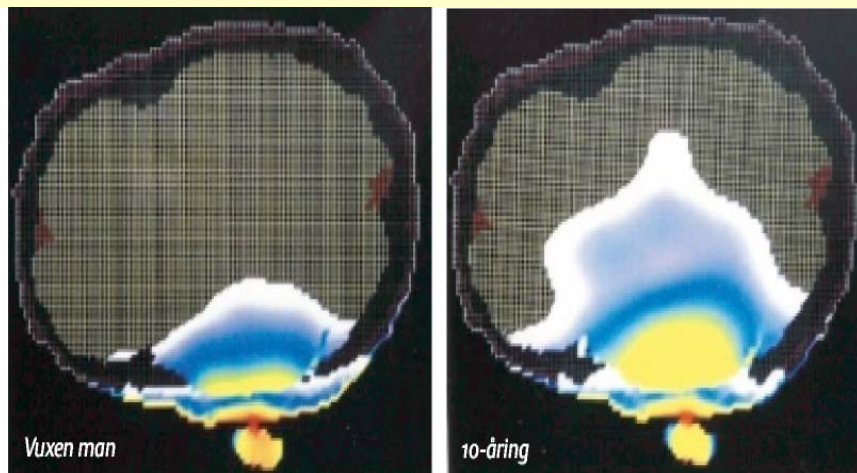
Long-term use of cellular and cordless phones and the risk of brain tumours

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The electromagnetic spectrum





Adult man, 10 years child, 5 years child, frequency scale.
 GSM phone 835 MHz with SAR in Watt/Kg.
 Professor Om Gandhi with courtesy.

Cellular telephones:

NMT 450 1981- (portable 1984)

NMT 900 1986-2000

(analogue)

GSM 900/(1800) 1991-

(digital)

3G (UMTS) 2003-

Desktop cordless phones:

Analogue (800-900 MHz) 1988-1990's

Digital (DECT 1900 MHz) 1991-

Cellular telephones and brain tumours

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CNS 1997-2003 (answered the questionnaire)

Cases, study 1997-June 30, 2000 = 1429

Controls, study 1997-June 30, 2000 = 1470

Cases, study July 1, 2000-2003 = 729

Controls, study July 1, 2000-2003 = 692

Total number of cases = 2158 (89 %)

Total number of controls = 2162 (89 %)

Assessment of exposure

Mailed 20 pages questionnaire

Additional phone interviews

Whole working life assessed etc

Different exposures such as pesticides, solvents, smoking habits

Cellular telephones:

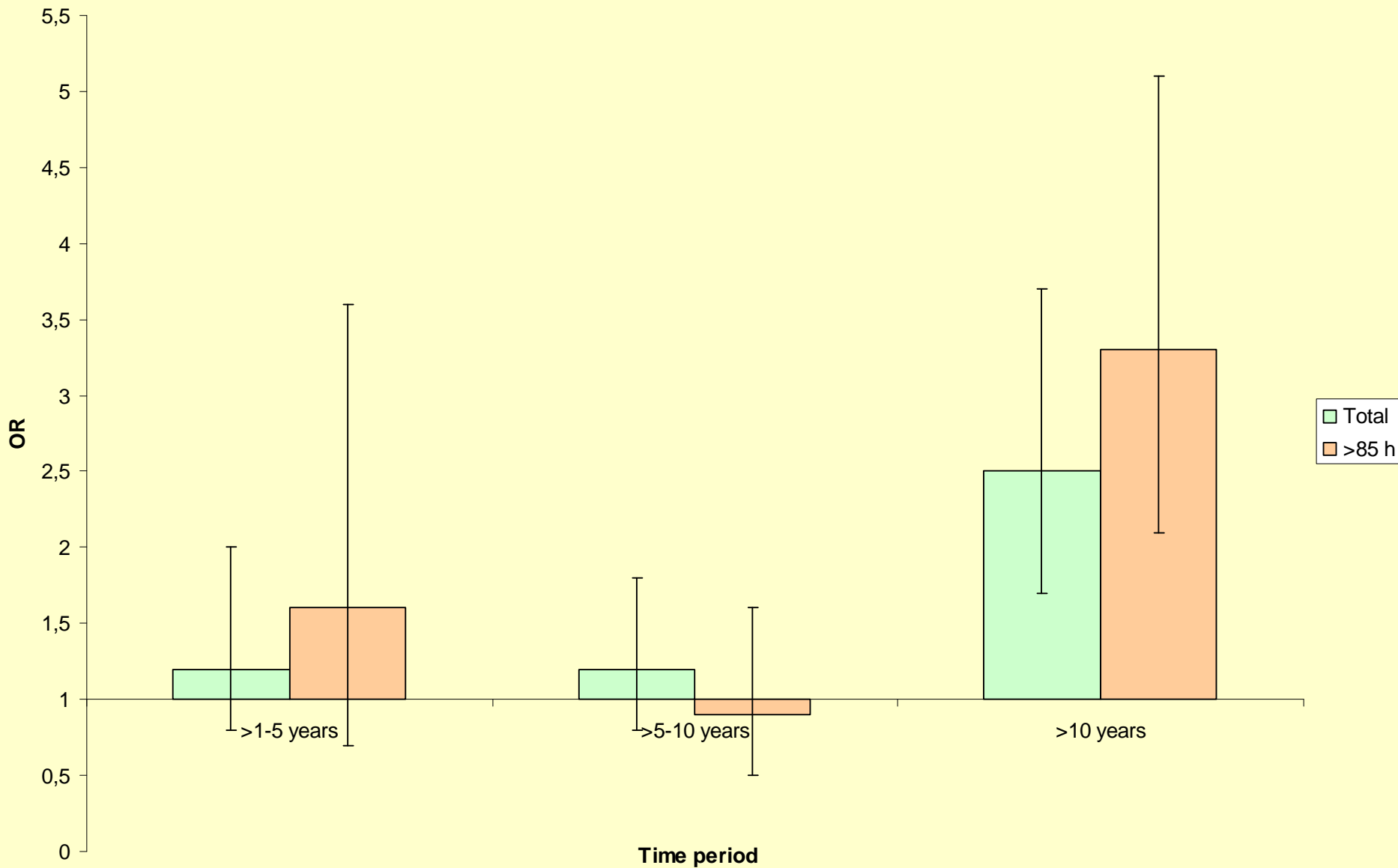
- first year of use or time period
- type of telephone (prefix 010 = analogue, prefix 07 = digital)
- average number of calls per day
- average number of minutes per day
- use of external antenna in a car
- use of handsfree
- ear most frequently used or equally both

Cordless telephones: Same method for assessment of use

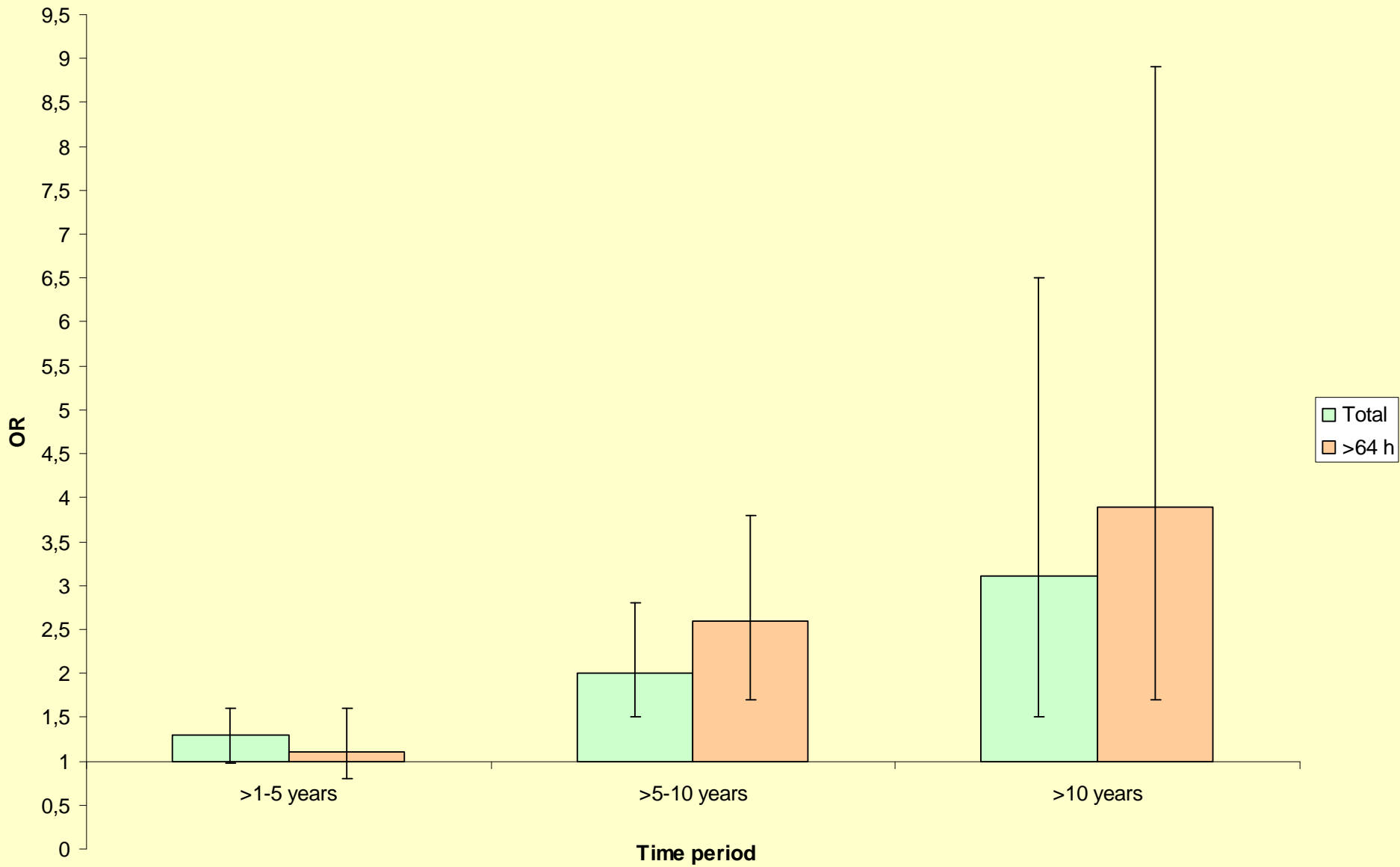
Anatomical tumour localisation

Histopathology

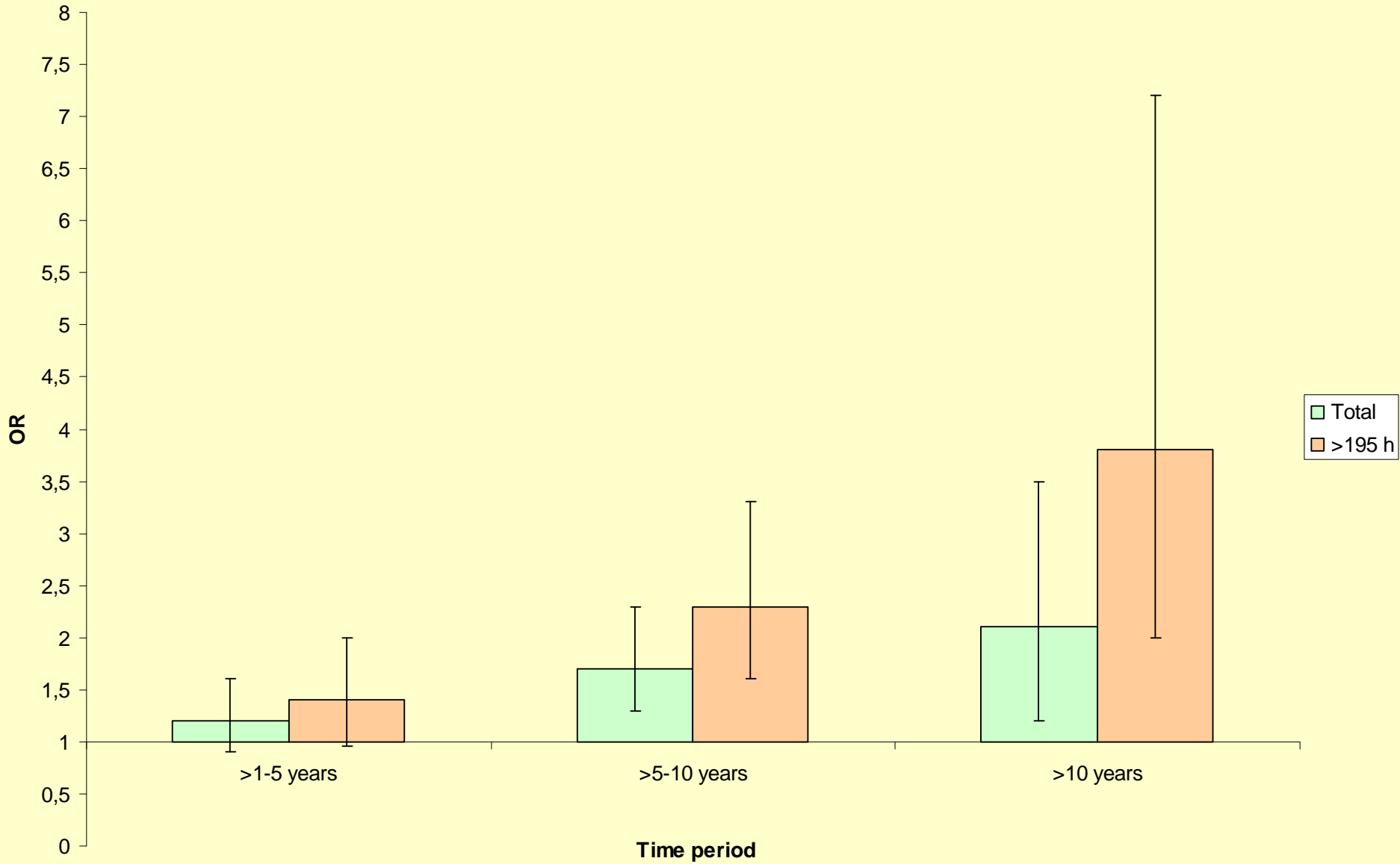
Astrocytoma, all: Analogue, latency periods, total and >85 hours.



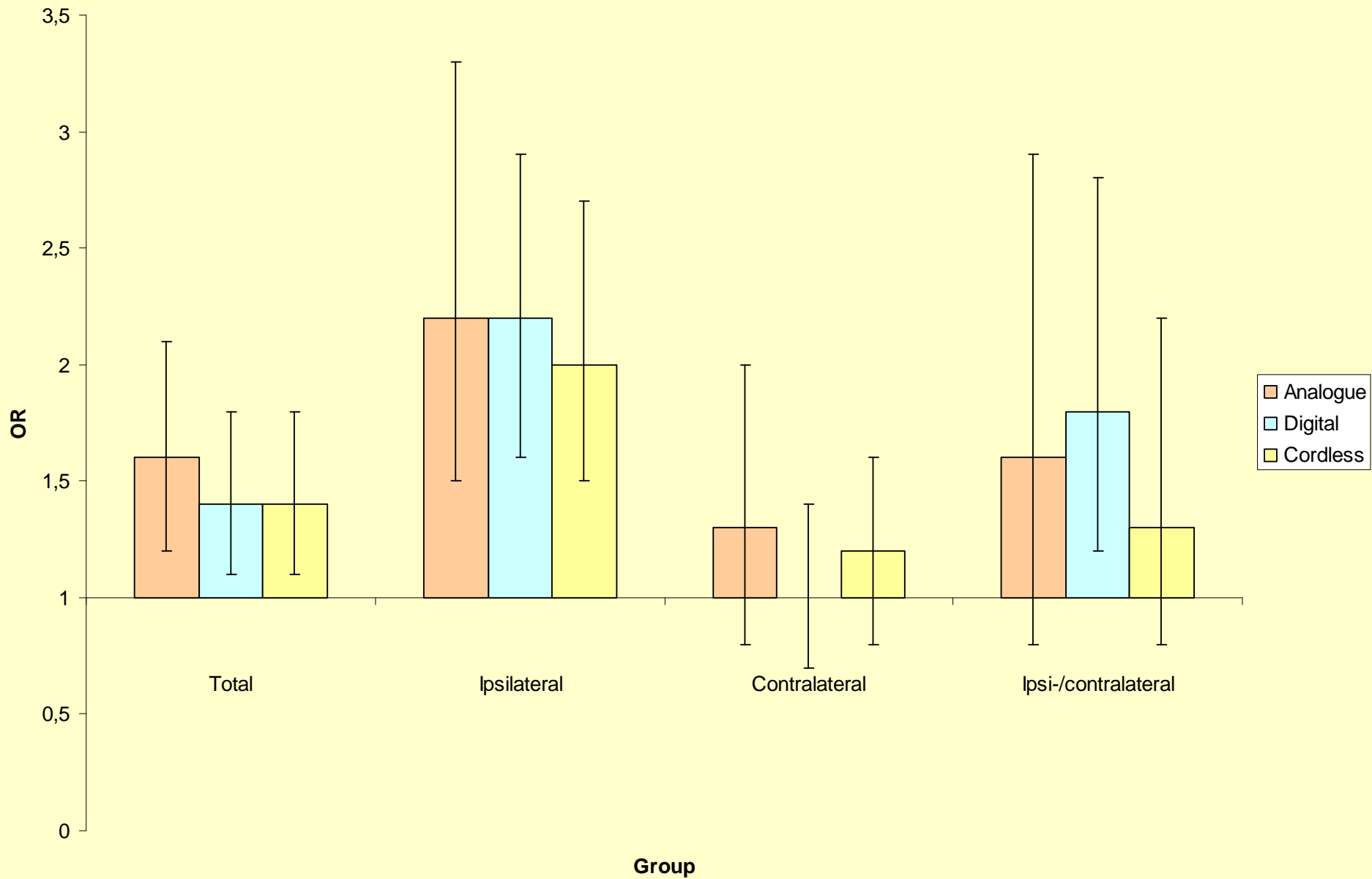
Astrocytoma, all: Digital, latency periods, total and >64 hours.



Astrocytoma, all: Cordless telephone, latency periods, total and >195 hours.



Astrocytoma, all: Laterality.



Hours of use (1-1000, 1001-2000, > 2000 h), malignant

	Analogue			Digital		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	147/281	1.3	1.0002-1.7	355/731	1.3	1.03-1.6
1001-2000 h	10/8	3.0	1.1-7.7	26/33	1.8	1.02-3.1
>2000 h	21/8	5.9	2.5-14	21/12	3.7	1.7-7.7

	Cordless			Total, any combination		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	265/599	1.2	0.9-1.4	433/983	1.2	0.98-1.4
1001-2000 h	42/52	2.3	1.5-3.5	65/104	1.6	1.1-2.2
>2000 h	43/50	2.3	1.5-3.6	85/85	2.4	1.7-3.4

p, trend: Analogue: 0.0007

Digital: 0.01

Cordless: 0.0002

Total: <0.0001

Hours of use (1-1000, 1001-2000, > 2000 h), astrocytoma, all

	Analogue			Digital		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	109/281	1.4	1.04 -1.9	262/731	1.4	1.1 -1.8
1001-2000 h	10/8	4.1	1.6- 11	21/33	2.1	1.1 -3.7
>2000 h	15/8	5.8	2.3-14	17/12	4.3	2.0-9.5

	Cordless			Total, any combination		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	194/599	1.2	0.97-1.6	307/983	1.2	0.98-1.5
1001-2000 h	34/52	2.7	1.7-4.4	54/104	1.8	1.3-2.7
>2000 h	33/50	2.6	1.6-4.2	68/85	2.8	1.9-4.1

p, trend: Analogue: 0.001

Digital: 0.008

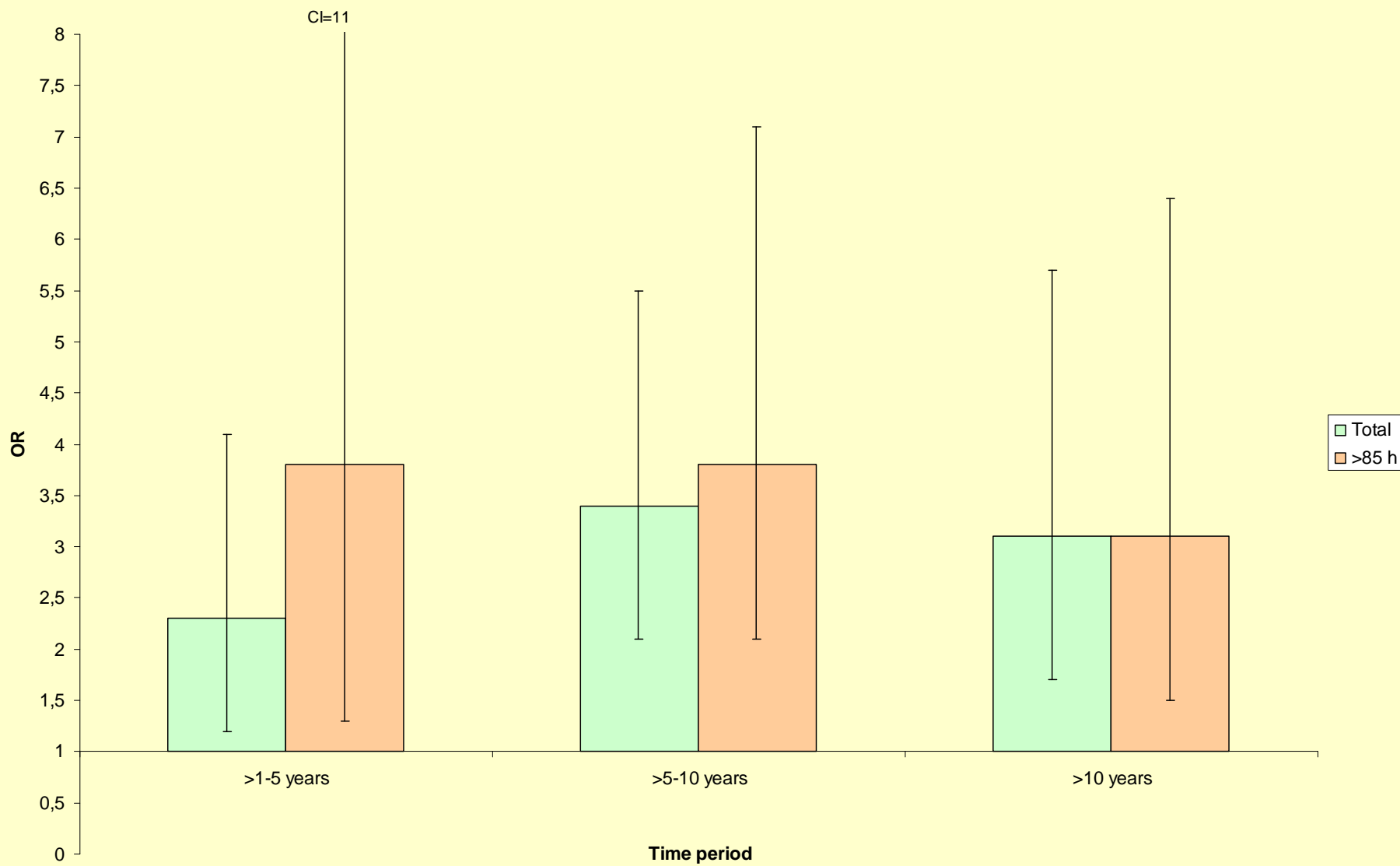
Cordless: 0.0001

Total: <0.0001

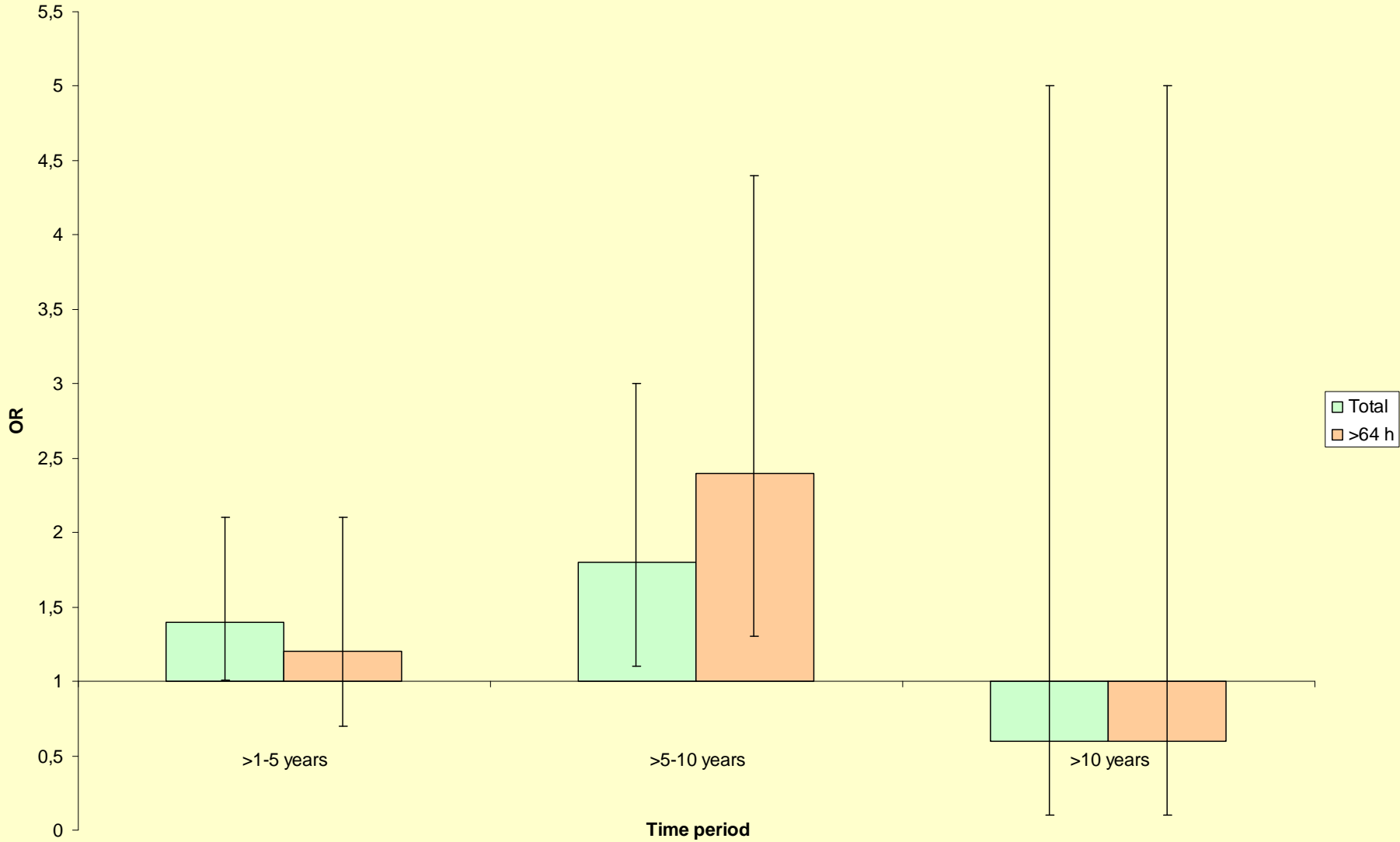
Age groups (age at first exposure), malignant

	> 1 year latency		
	Ca/Co	OR	CI
Analogue phone			
All ages	178/297	1.5	1.1-1.9
<20	4/6	1.3	0.3-4.9
-20-49	131/214	1.4	1.1-1.9
-50-80	43/77	1.6	1.02-2.4
Digital phone			
All ages	402/776	1.3	1.1-1.6
<20	16/9	3.7	1.5-9.1
-20-49	229/445	1.3	0.99-1.6
-50-80	157/322	1.3	1.02-1.7
Cordless phone			
All ages	350/701	1.3	1.1-1.6
<20	17/16	2.1	0.97-4.6
-20-49	200/416	1.2	0.9-1.5
-50-80	133/269	1.5	1.1-1.9

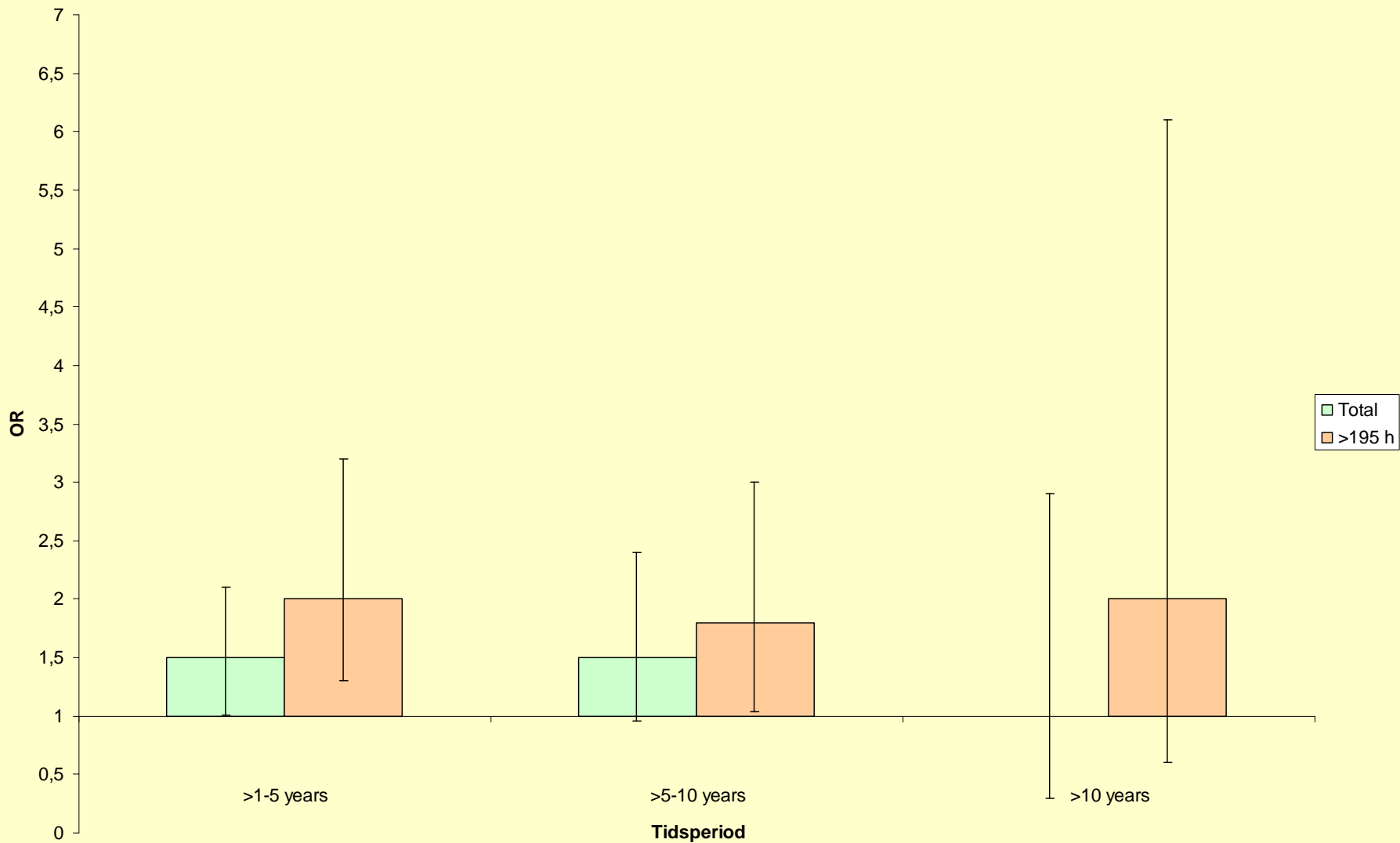
Acoustic neuroma: Analogue, latency periods, total and >85 hours.



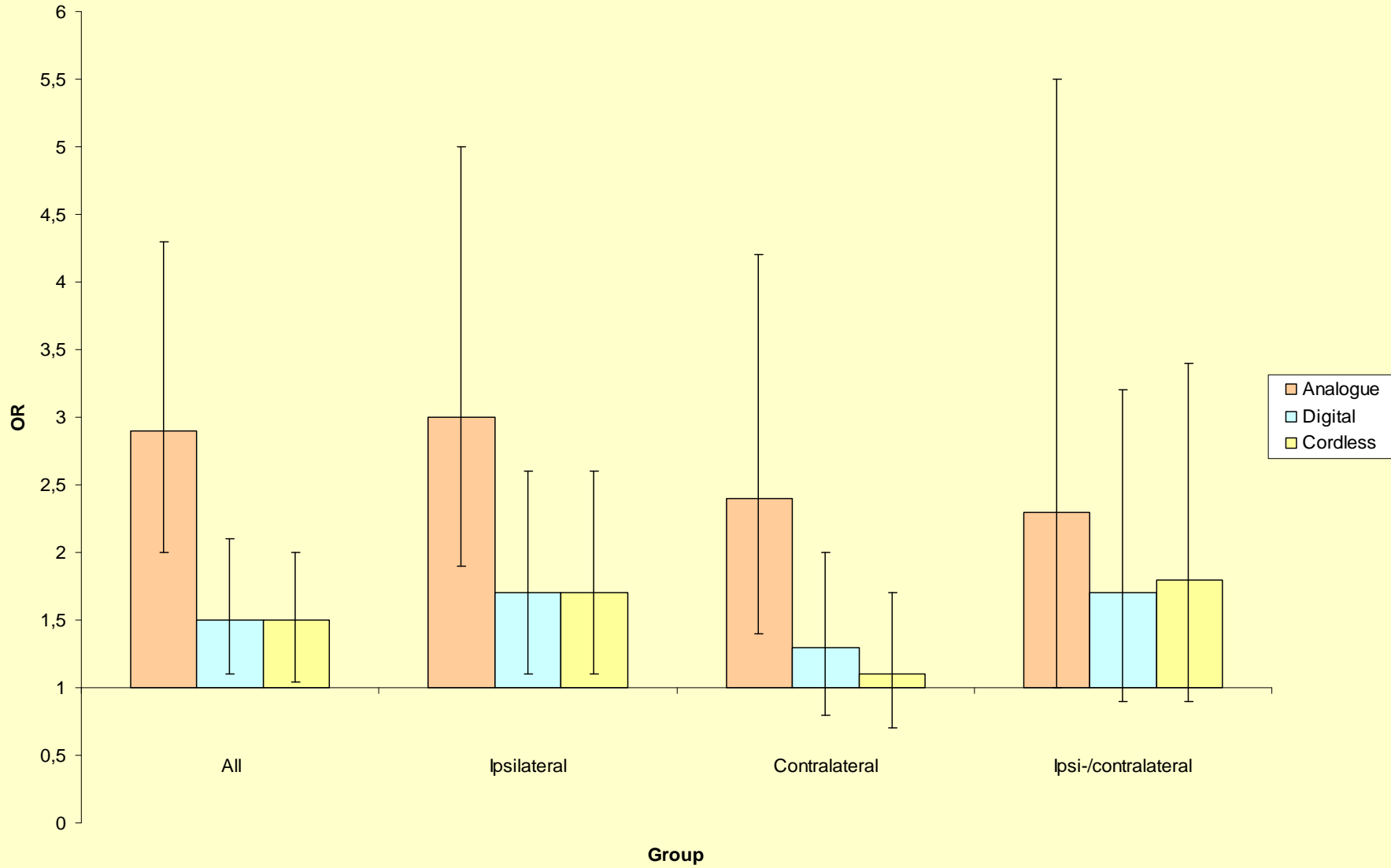
Acoustic neuroma: Digital, latency periods, total and >64 hours.



Acoustic neuroma: Cordless telephone, latency periods, total and >195 hours.



Acoustic neuroma: Laterality.



Hours of use (1-1000, 1001-2000, > 2000 h), benign

	Analogue			Digital		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	186/281	1.6	1.2-2.0	414/731	1.2	0.96-1.4
1001-2000 h	7/8	2.6	0.9-7.4	15/33	1.1	0.6-2.0
>2000 h	6/8	1.8	0.6-5.4	8/12	1.7	0.7-4.3

	Cordless			Total, any combination		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	339/599	1.1	0.95-1.4	548/983	1.1	0.9-1.3
1001-2000 h	45/52	1.7	1.1-2.5	65/104	1.3	0.9-1.8
>2000 h	39/50	1.6	1.02-2.5	64/85	1.6	1.1-2.3

p, trend: Analogue: 0.64

Digital: 0.68

Cordless: 0.11

Total: 0.06

Hours of use (1-1000, 1001-2000, > 2000 h), acoustic neuroma

	Analogue			Digital		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	62/281	2.8	1.9-4.2	93/731	1.4	1.01-2.0
1001-2000 h	3/8	5.3	1.3- 21	9/33	3.1	1.4-7.0
>2000 h	3/8	4.9	1.2- 19	3/12	2.8	0.7- 11

	Cordless			Total, any combination		
	Ca/Co	OR	CI	Ca/Co	OR	CI
1-1000 h	75/599	1.3	0.9 -1.9	119/983	1.4	1.0003 -1.9
1001-2000 h	11/52	2.1	1.1-4.3	14/104	1.5	0.8-2.8
>2000 h	10/50	2.1	1.03-4.4	22/85	3.0	1.7-5.1

p, trend: Analogue: 0.51

Digital: 0.10

Cordless: 0.23

Total: 0.01

No association between the use of cellular or cordless telephones and salivary gland tumours

L Hardell, A Hallquist, K Hansson Mild, M Carlberg, H Gertzén, E-B Schildt, Å Dahlqvist

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14 February 2004

Aim: To investigate the association between the use of cellular or cordless telephones and the risk for salivary gland tumours.

Methods: Cases were assessed from the six regional cancer registries in Sweden. Four controls matched for sex and age in five year age groups were selected for each case. A total of 293 living cases and 1172 controls were included.

Results: There were 267 (91%) participating cases and 1053 (90%) controls. Overall no significantly increased risk was found. Odds ratios were 0.92 (95% CI 0.58 to 1.44) for use of analogue phones, 1.01 (95% CI 0.68 to 1.50) for use of digital phones, and 0.99 (95% CI 0.68 to 1.43) for use of cordless phones. Similar results were found for different salivary gland localisations. No effect of tumour induction period or latency was seen, although few subjects reported use for more than 10 years.

Conclusions: No association between the use of cellular or cordless phones and salivary gland tumours was found, although this study does not permit conclusions for long term heavy use.

Salivary gland tumours

- 293 patients (267 participated)
- 1172 controls (1053 participated)
- Analogue: OR=0.9 (95% CI; 0.6-1.4)
- Digital: OR=1.0 (95% CI; 0.7-1.5)
- Cordless: OR=1.0 (95% CI; 0.7-1.4)
- Squamous cell cancer OR=4.4 (95% CI; 0.8-25)

Use of cellular or cordless telephones and the risk for non-Hodgkin's lymphoma

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Abstract Objectives: To evaluate the use of cellular and cordless telephones as the risk factor for non-Hodgkin's lymphoma (NHL). **Methods:** Male and female subjects aged 18–74 years living in Sweden were included during a period from 1 December 1999 to 30 April 2002. Controls were selected from the national population registry. Exposure to different agents was assessed by questionnaire. **Results:** In total, 910 (91%) cases and 1016 (92%) controls participated. NHL of the B-cell type was not associated with the use of cellular or cordless telephones. Regarding T-cell NHL and > 5 year latency period, the use of analogue cellular phones yielded: odds ratio (OR) = 1.46, 95%; confidence interval (CI) = 0.58–3.70, digital: OR = 1.92, 95%; CI = 0.77–4.80 and cordless phones: OR = 2.47; CI = 1.09–5.60. The corresponding results for certain, e.g. cutaneous and leukaemia, T-cell lymphoma for analogue phones were: OR = 3.41, 95%; CI = 0.78–15.0, digital: OR = 6.12, 95%; CI = 1.26–29.7

and cordless phones: OR = 5.48, 95%; CI = 1.26–23.9. **Conclusions:** The results indicate an association between T-cell NHL and the use of cellular and cordless telephones, however based on low numbers and must be interpreted with caution. Regarding B-cell NHL no association was found.

Keywords T-cell · B-cell lymphoma · Microwaves · Risk factors · Cellular · Cordless phones

Introduction

Non-Hodgkin's lymphoma (NHL) is a heterogeneous group of lymphoid malignancies, where new classification systems based on immunohistochemistry, cytogenetics and evolving knowledge in clinical presentation and course has lead to modern classification systems

Non-Hodgkin's lymphoma

901 patients och 1016 controls.

Indication of an association with T-cell NHL, located in the skin. No association with other types of lymphoma.

Use of cellular and cordless telephones and risk of testicular cancer

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Summary

A case-control study on testicular cancer included use of cellular and cordless telephones. The results were based on answers from 542 (92%) cases with seminoma, 346 (89%) with non-seminoma, and 870 (89%) controls. Regarding seminoma the use of analog cellular phones gave odds ratio (OR) = 1.2, 95% confidence interval (CI) = 0.9–1.6, digital phones OR = 1.3, CI = 0.9–1.8, and cordless phones OR = 1.1, CI = 0.8–1.5. The corresponding results for non-seminoma were OR = 0.7, CI = 0.5–1.1, OR = 0.9, CI = 0.6–1.4, and OR = 1.0, CI = 0.7–1.4, respectively. There was no dose-response effect and OR did not increase with latency time. No association was found with place of keeping the mobile phone during standby, such as trousers pocket. Cryptorchidism was associated both with seminoma (OR = 4.2, CI = 2.7–6.5) and non-seminoma (OR = 3.3, CI = 2.0–5.6), but no interaction was found with the use of cellular or cordless telephones.

Keywords:

case-control study, non-seminoma, seminoma, wireless communication

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Testicular cancer

Study of 888 young men with testicular cancer and 870 young men without testicular cancer.

No clear association with use of cellular or cordless telephones.

No association with place of telephone (trouser pockets etc).

Melanoma (head-neck area)

Study of 347 cases and 1 184 controls.

Total:

Analogue OR = 1.2 (95 % CI = 0.8-1.8; 82 cases, 263 controls)

Digital OR = 0.9 (95 % CI = 0.7-1.3; 211 cases, 694 controls)

Cordless OR = 0.8 (95 % CI = 0.6-1.1; 137 cases, 476 controls)

> 10 years latency:

Analogue OR = 0.9 (95 % CI = 0.6-1.5; 46 cases, 180 controls)

Digital OR = 1.2 (95 % CI = 0.6-2.2; 19 cases, 65 controls)

Cordless OR = 0.5 (95 % CI = 0.3-0.997; 17 cases, 89 controls)

Adjusted for age, gender, year of diagnosis, hair color, eye color, skin type, pain/blisters from sunburn, working outdoors.

Long-term use of cellular phones and brain tumours: increased risk associated with use for ≥ 10 years

Lennart Hardell, Michael Carlberg, Fredrik Söderqvist, Kjell Hansson Mild, L Lloyd Morgan

Occup Environ Med 2007;64:626–632. doi: 10.1136/oem.2006.029751

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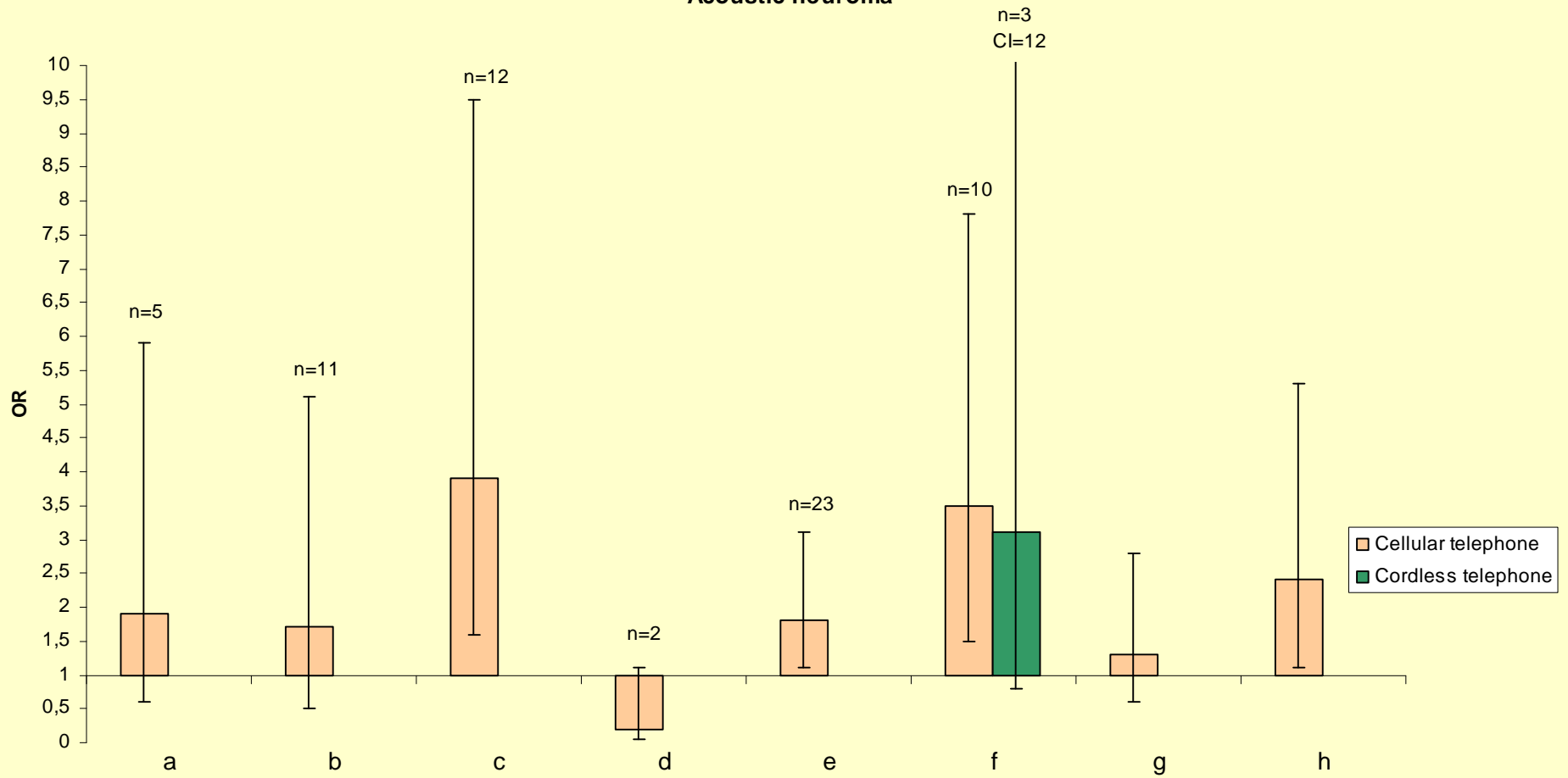
Aim: To evaluate brain tumour risk among long-term users of cellular telephones.

Methods: Two cohort studies and 16 case-control studies on this topic were identified. Data were scrutinised for use of mobile phone for ≥ 10 years and ipsilateral exposure if presented.

Results: The cohort study was of limited value due to methodological shortcomings in the study. Of the 16 case-control studies, 11 gave results for ≥ 10 years' use or latency period. Most of these results were based on low numbers. An association with acoustic neuroma was found in four studies in the group with at least 10 years' use of a mobile phone. No risk was found in one study, but the tumour size was significantly larger among users. Six studies gave results for malignant brain tumours in that latency group. All gave increased odd ratios (OR), especially for ipsilateral exposure. In a meta-analysis, ipsilateral cell phone use for acoustic neuroma was OR = 2.4 (95% CI 1.1 to 5.3) and OR = 2.0, (1.2 to 3.4) for glioma using a tumour latency period of ≥ 10 years.

Conclusions: Results from present studies on use of mobile phones for ≥ 10 years give a consistent pattern of increased risk for acoustic neuroma and glioma. The risk is highest for ipsilateral exposure.

Acoustic neuroma



a) Inskip et al 2001, USA, ≥ 5 years use

b) Muscat et al 2002, USA, 3-6 years use

c) Lönn et al 2004, Sweden, ≥ 10 years use, same side

d) Christensen et al 2004, Denmark, ≥ 10 years use, same side

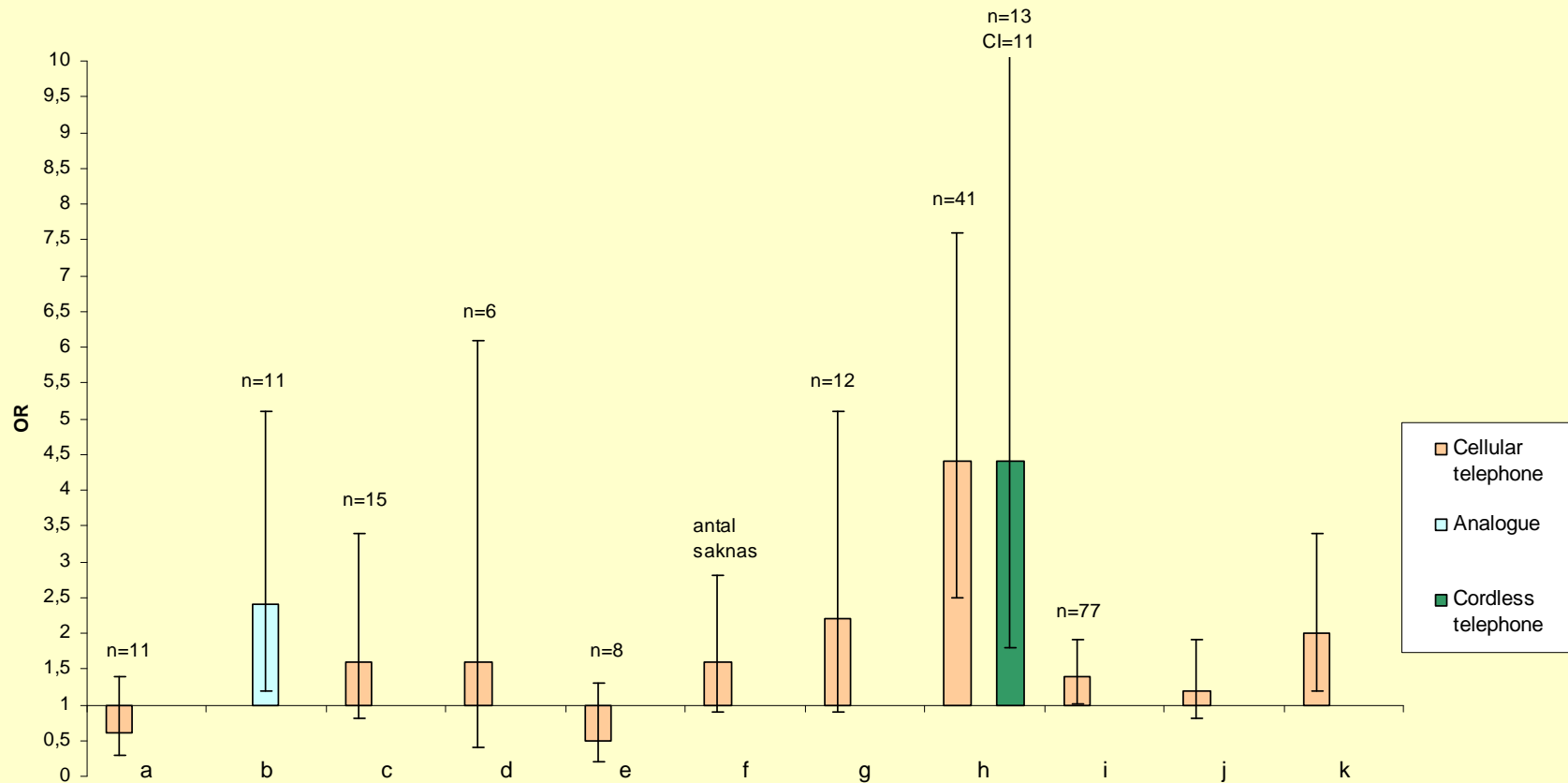
e) Schoemaker et al 2005, Denmark, Finland, Sweden, Norway, Scotland, England, ≥ 10 years use, same side

f) Hardell et al 2006, Sweden, > 10 years latency, same side

g) Lönn et al 2004, Christensen et al 2004, Schoemaker et al 2005, Hardell et al 2006, > 10 years use

h) Lönn et al 2004, Schoemaker et al 2005, Hardell et al 2006, > 10 years use, same side

Glioma



- a) Inskip et al 2001, USA, ≥ 5 years use, all gliomas
- b) Auvinen et al 2002, Finland, 1-2 years use, all gliomas
- c) Lönn et al 2005, Sweden, ≥ 10 years since first regular use, same side, all gliomas
- d) Christensen et al 2005, Denmark, ≥ 10 years since first regular use, low-grade gliomas
- e) Christensen et al 2005, Denmark, ≥ 10 years since first regular use, high-grade gliomas
- f) Hepworth et al 2006, UK, ≥ 10 years use, same side, all gliomas
- g) Schüz et al 2006, Germany, ≥ 10 years since first regular use, all gliomas
- h) Hardell et al 2006, Sweden, > 10 years latency, same side, all gliomas
- i) Lahkola et al 2007, > 10 years latency, same side
- j) Hardell et al 2007, > 10 years latency, study c-i
- k) Hardell et al 2007, > 10 years latency, same side, study c, f-i

Cellular phone use and brain tumor: a meta-analysis

Peter Kan · Sara E. Simonsen · Joseph L. Lyon ·
John R. W. Kestle

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Abstract

Background The dramatic increase in the use of cellular phones has generated concerns about potential adverse effects, especially the development of brain tumors. We conducted a meta-analysis to examine the effect of cellular phone use on the risk of brain tumor development.

Methods We searched the literature using MEDLINE to locate case-control studies on cellular phone use and brain tumors. Odds ratios (ORs) for overall effect and stratified ORs associated with specific brain tumors, long-term use, and analog/digital phones were calculated for each study using its original data. A pooled estimator of each OR was then calculated using a random-effects model.

Results Nine case-control studies containing 5,259 cases of primary brain tumors and 12,074 controls were included. All studies reported ORs according to brain tumor subtypes, and five provided ORs on patients with ≥ 10 years of follow up. Pooled analysis showed an overall OR of 0.90 (95% confidence interval [CI] 0.81–0.99) for cellular phone use and brain tumor development. The pooled OR for long-term users of ≥ 10 years (5 studies) was 1.25 (95% CI 1.01–1.54). No increased risk was observed in analog or digital cellular phone users.

Conclusions We found no overall increased risk of brain tumors among cellular phone users. The potential elevated

risk of brain tumors after long-term cellular phone use awaits confirmation by future studies.

Keywords Brain tumors · Cellular phones · Radiation

Introduction

With the widespread use of cellular phones in the past decade, human exposure to low-energy radiation in the 800- to 2,000-MHz range (microwave) has increased dramatically. With more than a billion current cellular phone users worldwide [1], this exposure could pose a serious public health problem even if the radiation emitted has only a small oncogenic effect. The risk of developing intracranial tumors from cellular phone use is of particular interest because of the proximity of exposure. Although it is agreed that any carcinogenic effect would have to be through a nonthermal, nonionizing mechanism, the nature or the existence of this mechanism remains unclear [2–5]. To date, most epidemiological studies published on cellular phone use and brain tumors have not demonstrated an increased risk with overall use [6–13], but positive associations have been reported in a few small subgroup analyses, such as with long-term users (increased risk of acoustic neuroma), analog phones, and ipsilateral use [14, 15]. The purpose of the study was to provide a pooled estimate on cellular phone use and the risk of brain tumor development using a meta-analysis. In addition, by pooling available studies together, we hope to explore further how potentially important clinical variables (e.g., duration of use and phone type) can affect the risk of brain tumor development in cellular phone users.

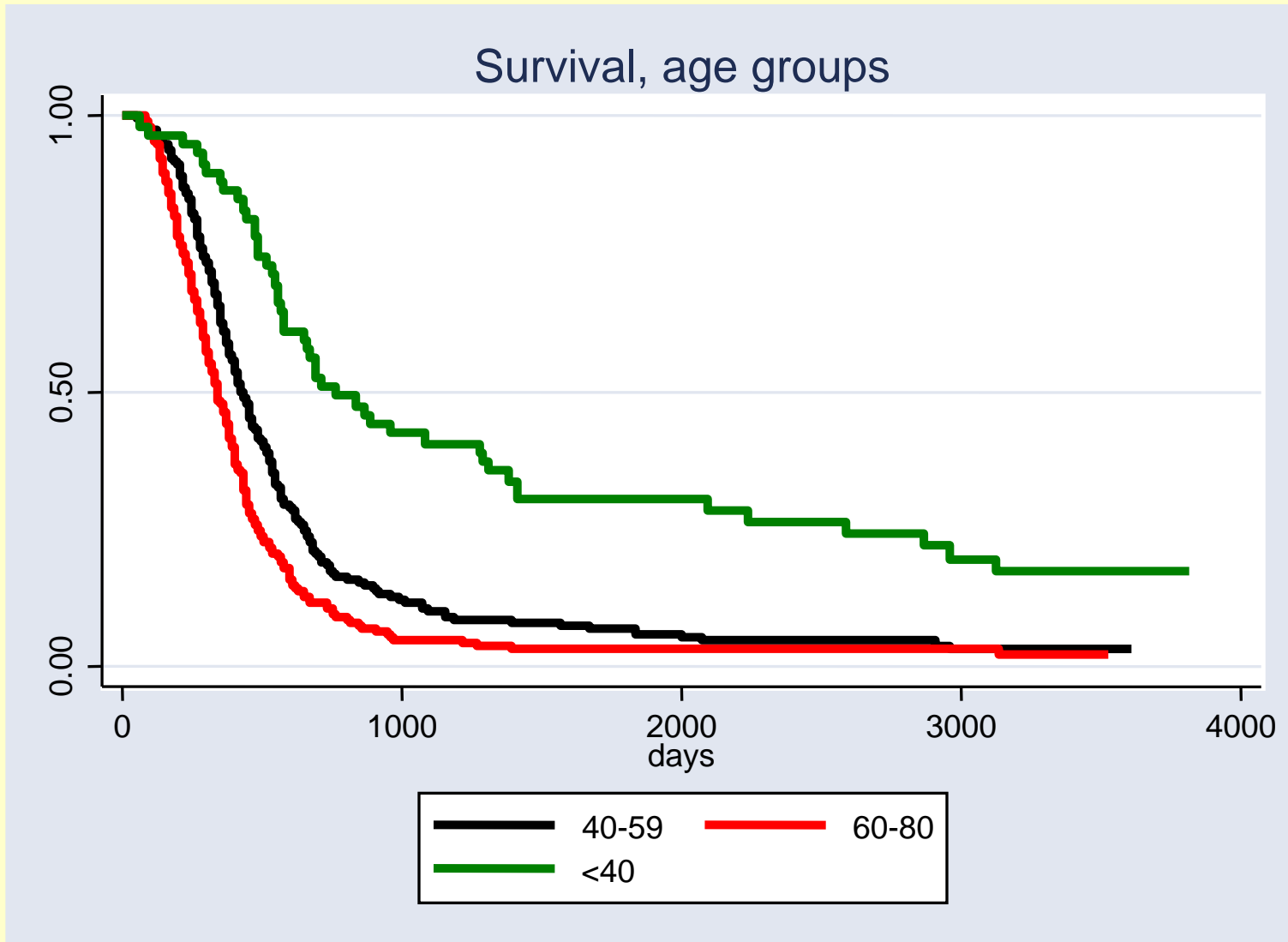
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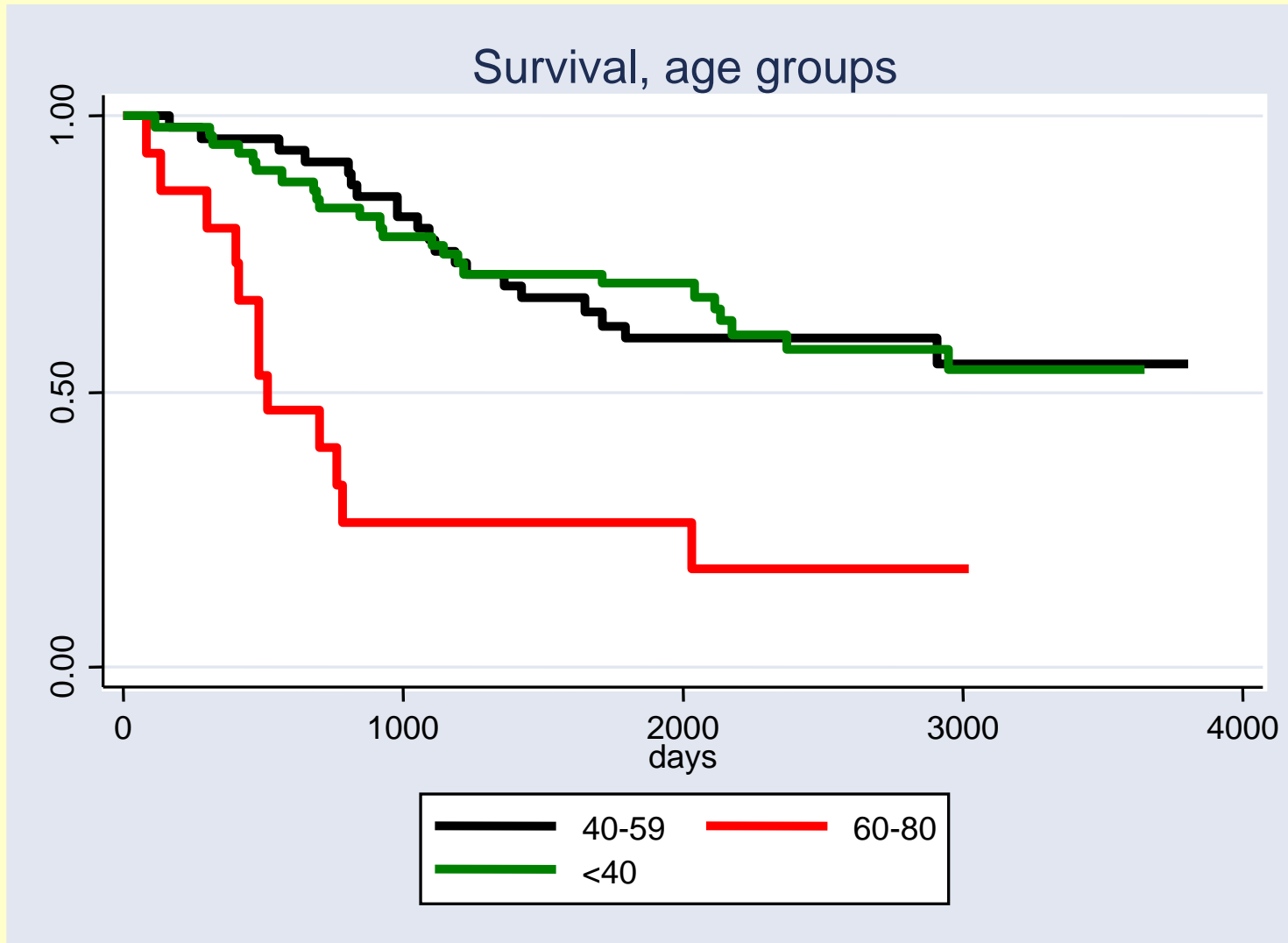
Pooled, overall: OR=0.90, 95 % CI 0.81-0.99

Long term use ≥ 10 years: OR=1.25, 95 % CI 1.01-1.54

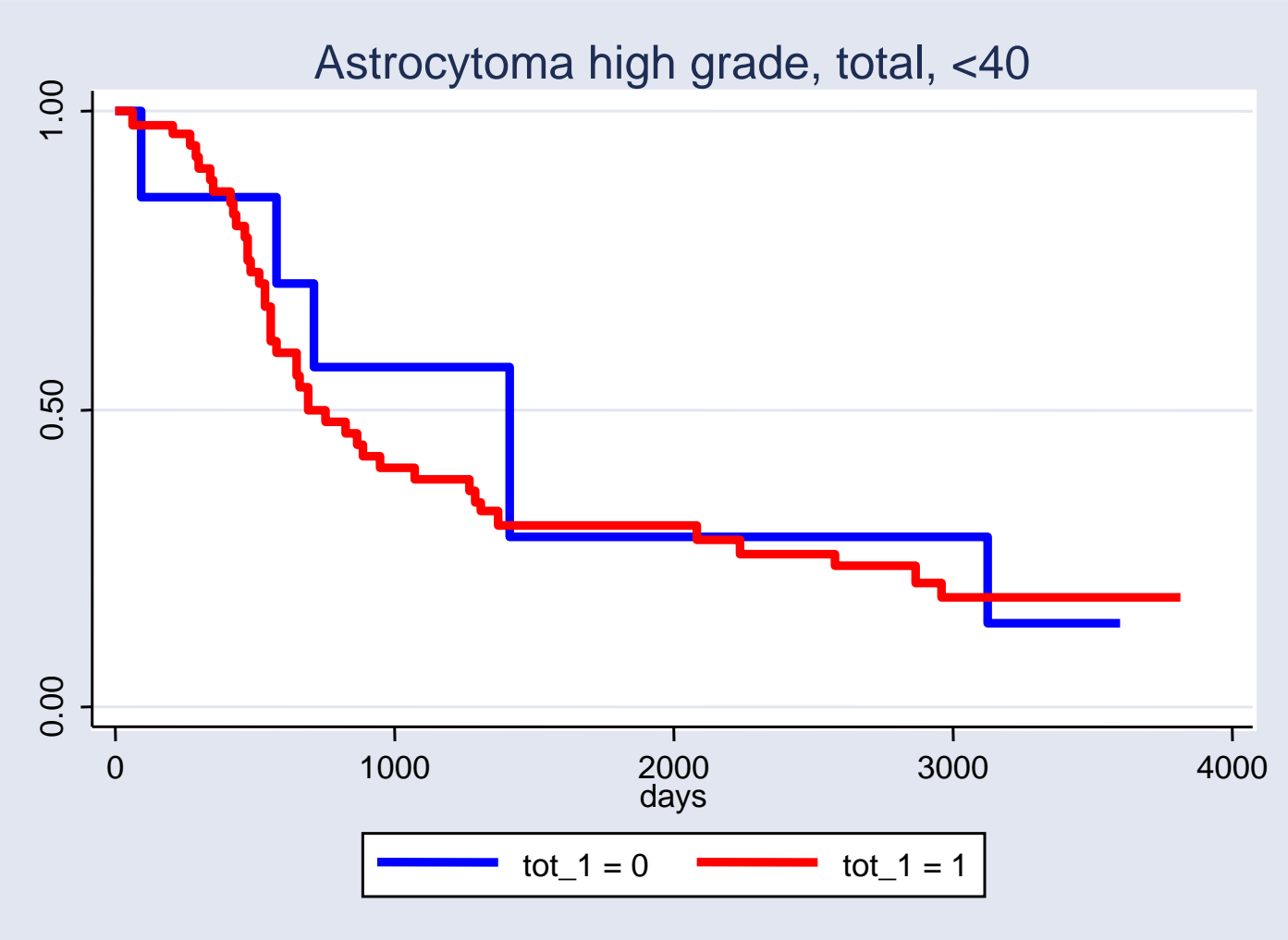
Astrocytoma high grade, age groups <40, 40-59 and 60-80 years old at diagnosis.
Significant difference between the groups ($p < 0.0001$).



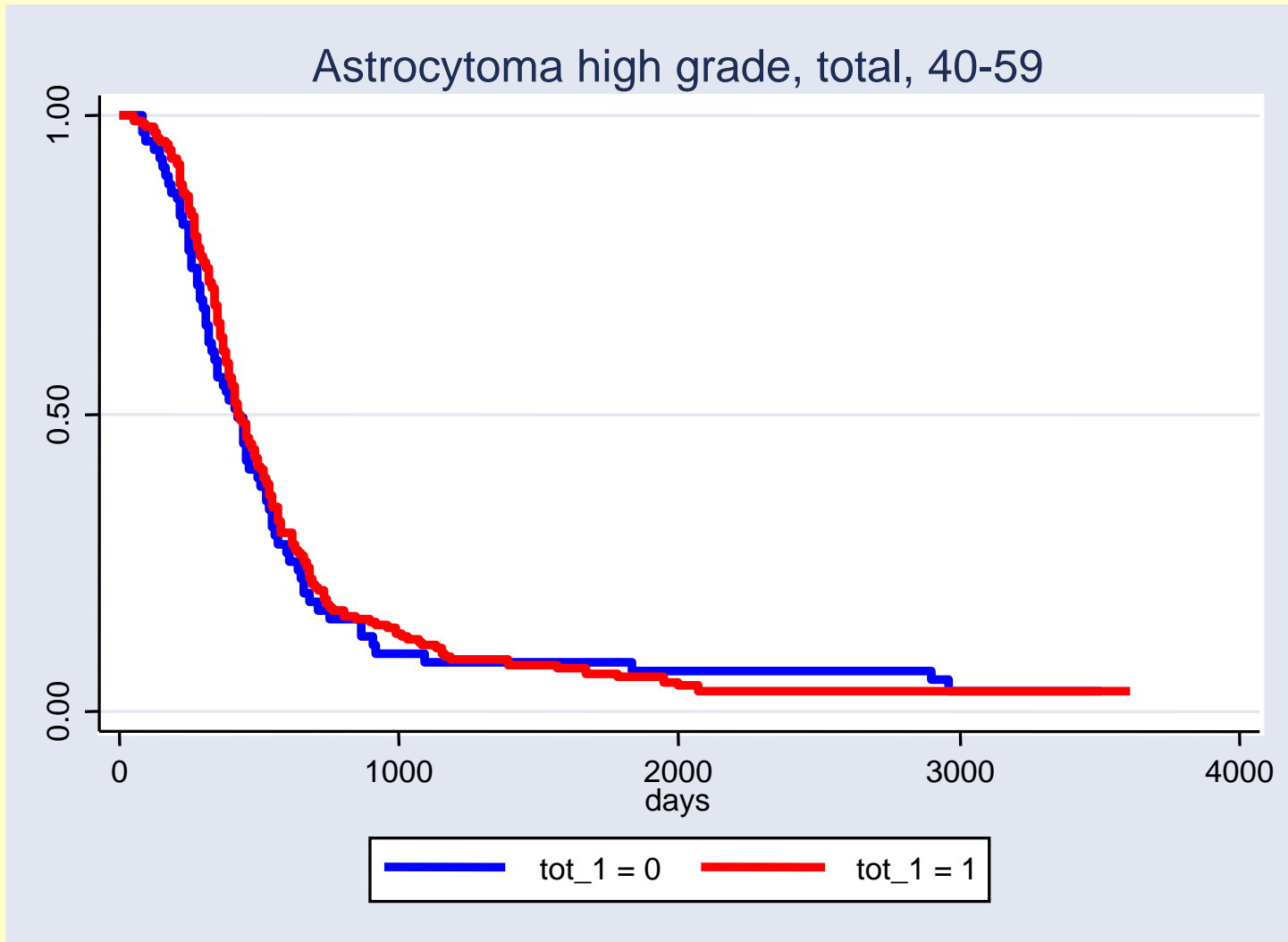
Astrocytoma low grade, age groups <40, 40-59 and 60-80 years old at diagnosis.
Significant difference between the groups ($p < 0.0001$).



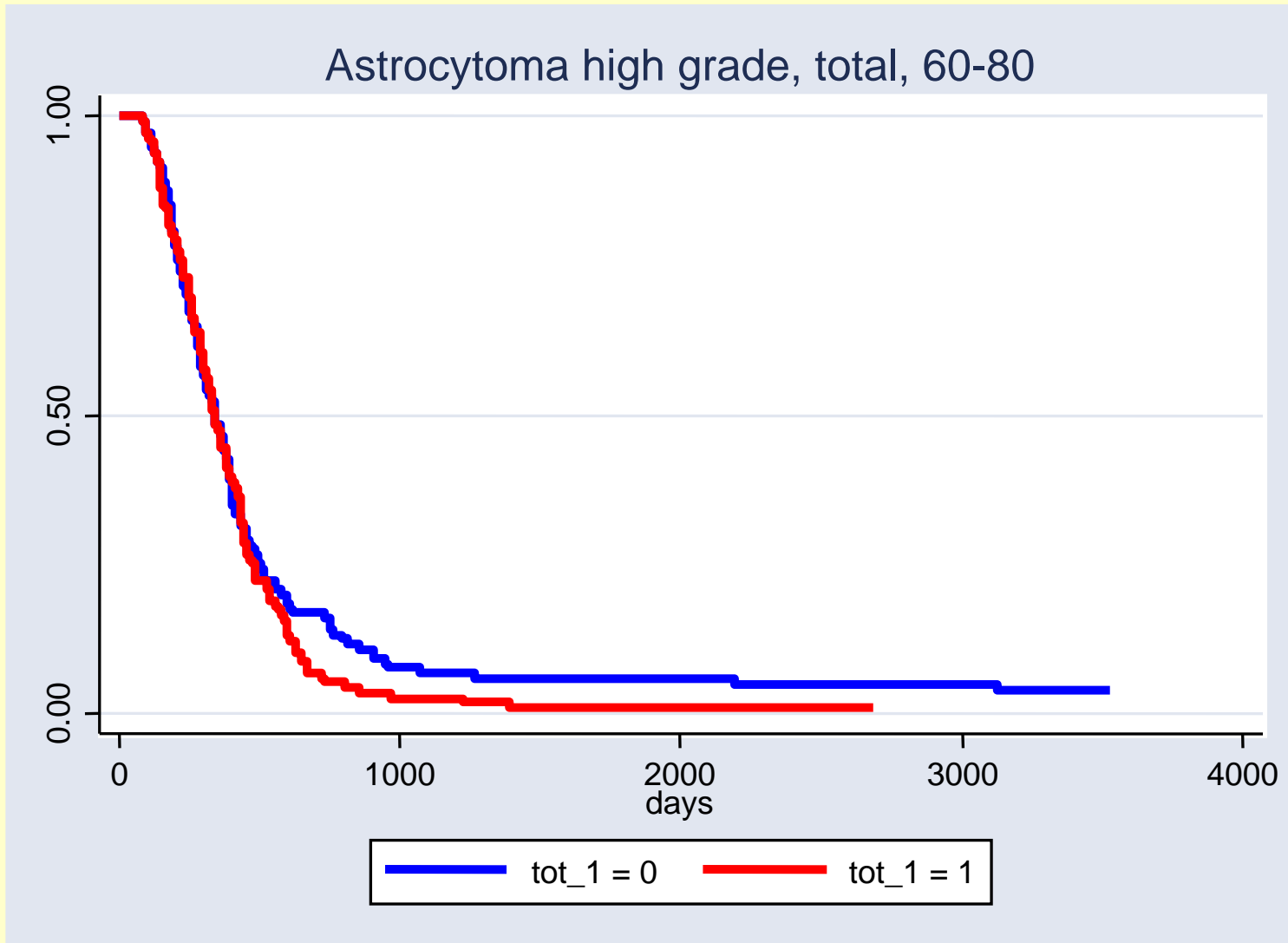
Astrocytoma high grade, total exposure for cellular-/cordless telephone (red line) vs unexposed, <40 years old at diagnosis. No significant difference between the groups (p=0.73)



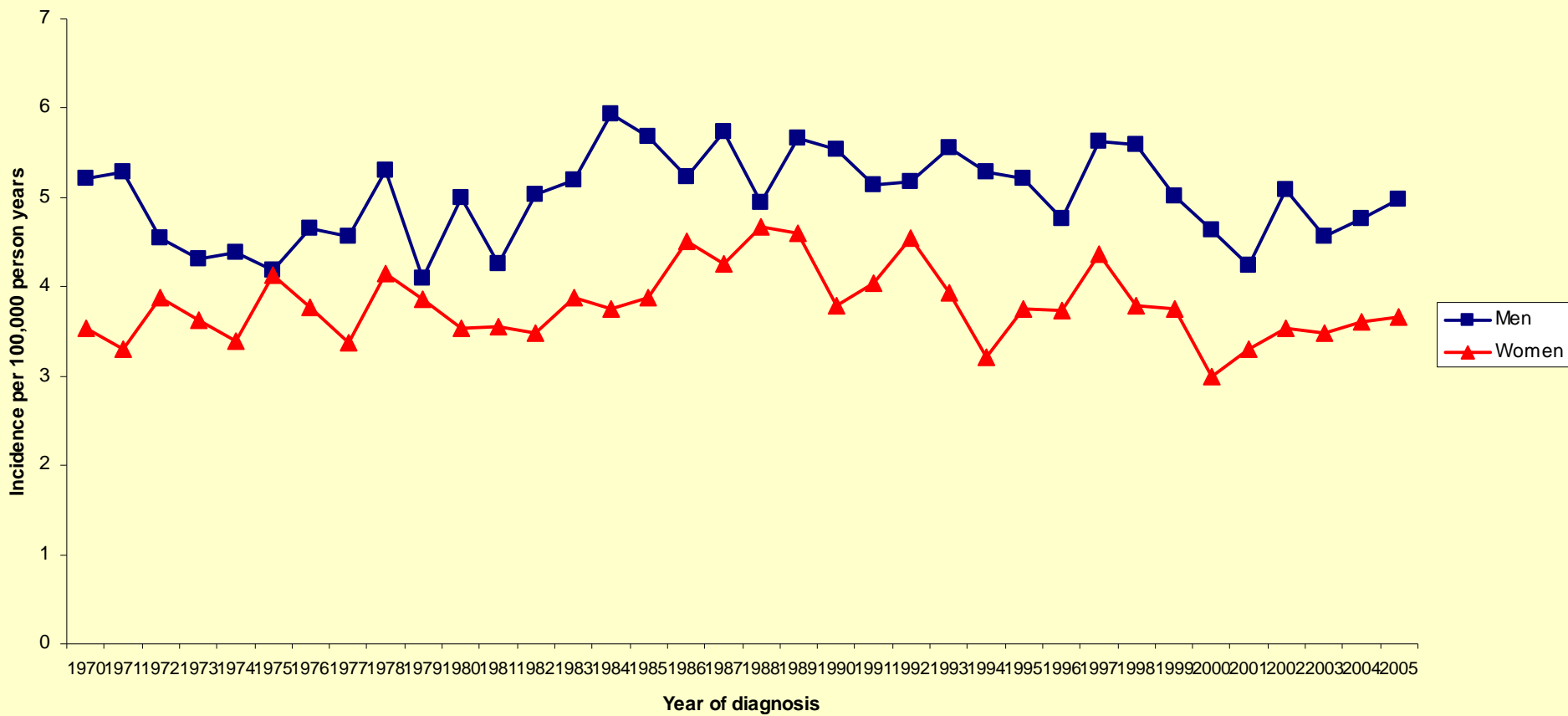
Astrocytoma high grade, total exposure for cellular-/cordless telephone (red line) vs unexposed, 40-59 years old at diagnosis. No significant difference between the groups ($p=0.63$).



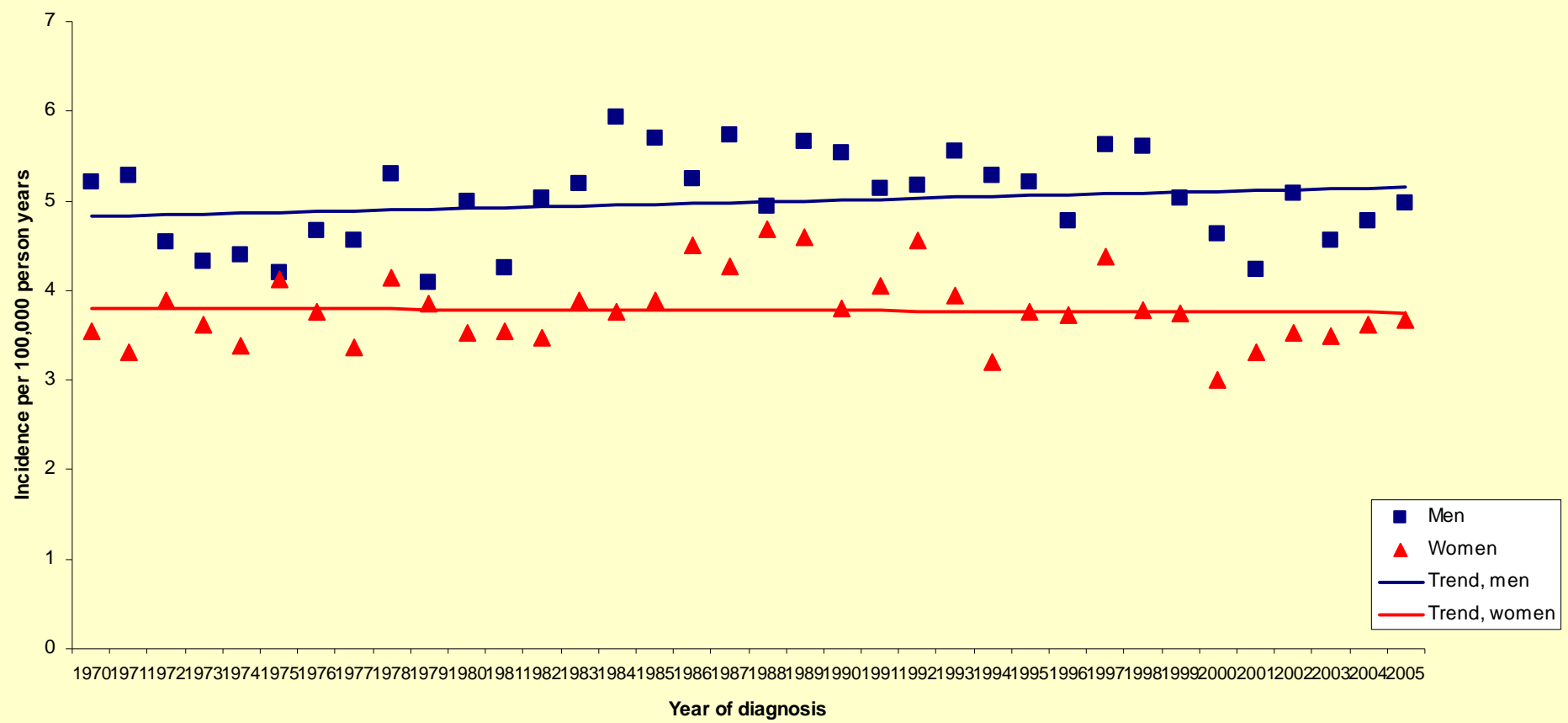
Astrocytoma high grade, total exposure for cellular-/cordless telephone (red line) vs unexposed, 60-80 years old at diagnosis. No significant difference between the groups ($p=0.22$).



Incidence of all astrocytomas in Sweden 1970-2005, age adjusted to the world standard population.



Incidence of all astrocytomas in Sweden 1970-2005, age adjusted to the world standard population. Trend for the whole time period.



Research article

Open Access

Ownership and use of wireless telephones: a population-based study of Swedish children aged 7–14 years

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Population based study of the use of cellular and cordless telephones of Swedish children aged 7-14 years

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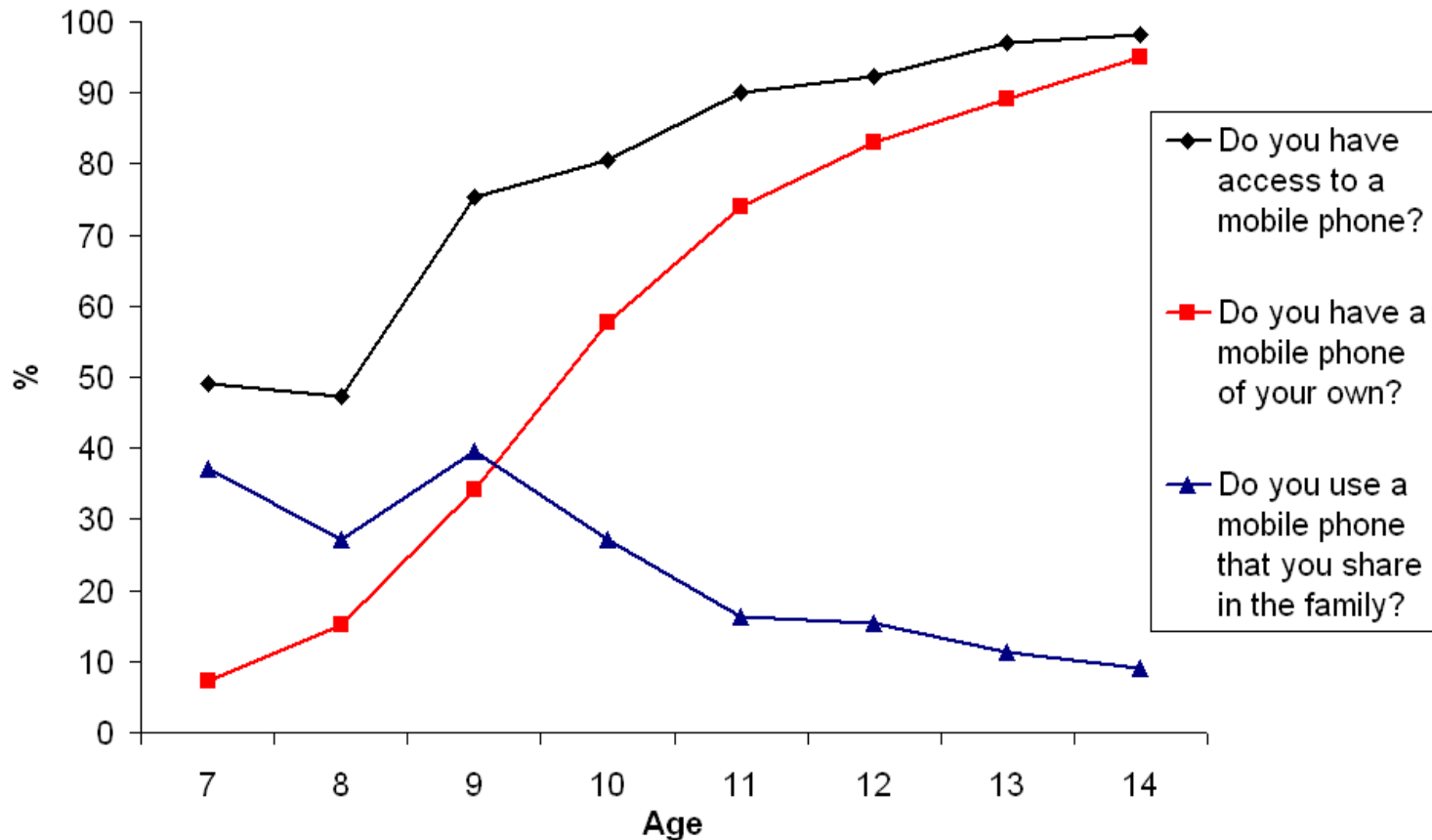
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Percentage of children aged 7–14 years with access to a mobile phone, own mobile phone or shared in the family.



Risk assessment based on epidemiological studies and non-thermal biological endpoints in laboratory studies is warranted both for mobile phones and cordless phones

Reduction of exposure:

DECT:

- * Use always a landline phone if possible
- * Short phone calls with DECT
- * Use a head set
- * The base station for DECT emits RF fields in the home

Mobile phones:

- * Children should not use mobile phones but for short calls
- * Use a phone with low SAR
- * Use hands-free
- * Use external antenna in a car
- * Short calls!

Urgent needs for research

- Long term use of mobile phones and DECT
- Passive exposure to RF fields

Release Date: August 31, 2007

SANTA BARBARA, Ca – August 31 / Serious Public Health Concerns Raised Over Exposure to Electromagnetic Fields (EMF) from Powerlines and Cell Phones.

The BioInitiative Report recommends new, biologically-based exposure standards. It is available at www.bioinitiative.org

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