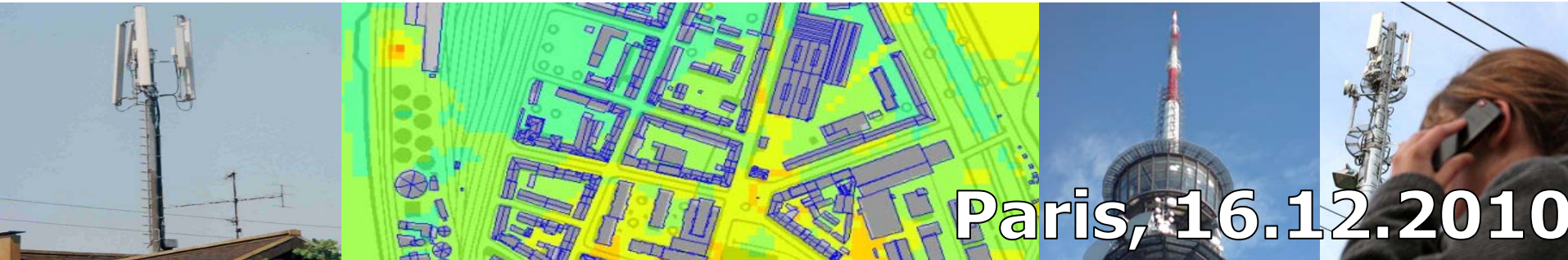




# Radiofrequency electromagnetic field exposure and non-specific symptoms of ill health



Martin Rösli



# Outline

- Type of studies
- Results from human laboratory trials
- Results from observational studies on symptoms
- Electromagnetic hypersensitivity (EHS)



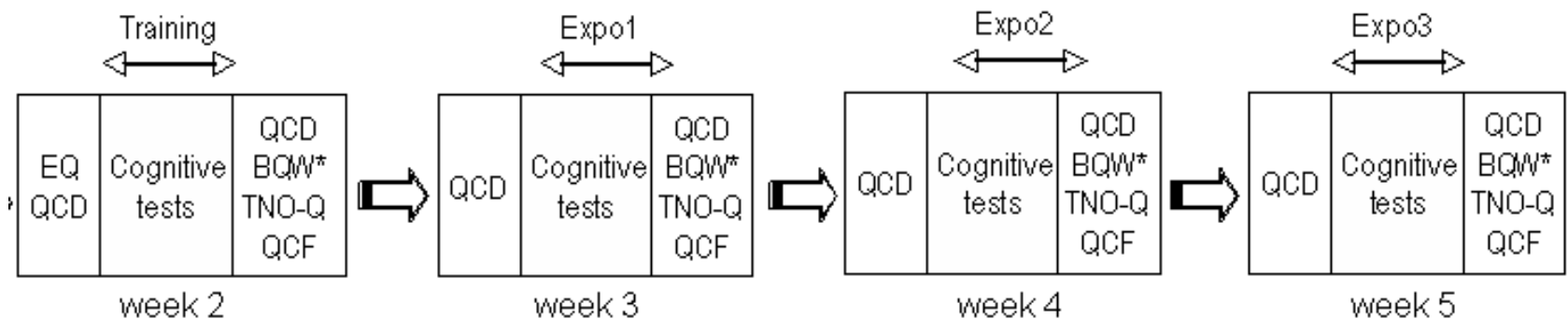
## Type of research

- Provocation studies / randomized trials / human laboratory study:
  1. Perception of low-level fields: sensibility (Leitgeb and Schröttner, 2003)
  2. short term effects on symptoms
  
- Epidemiological/observational studies
  1. long term effect on symptoms

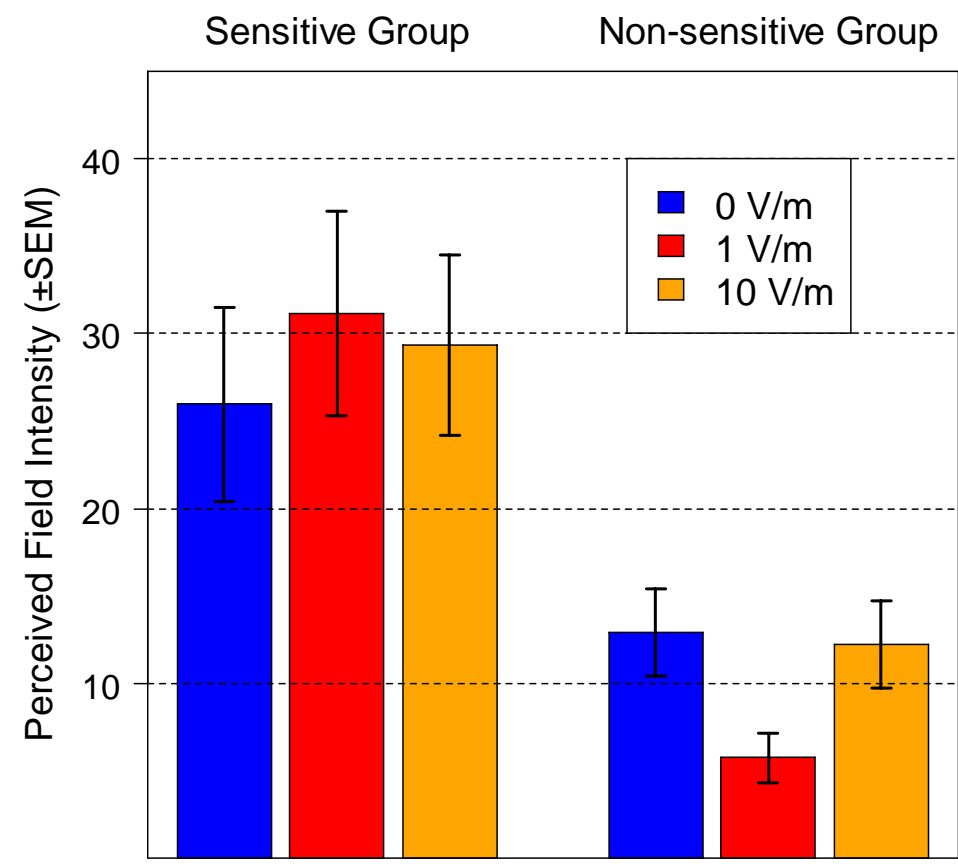


# Provocation study

- Repeated tests with different exposure conditions (incl. sham): **randomised**
- Neither the study participants nor the study assistant know the exposure condition: **double blind**.
- Study participants state whether they perceive exposure or not (or symptoms).

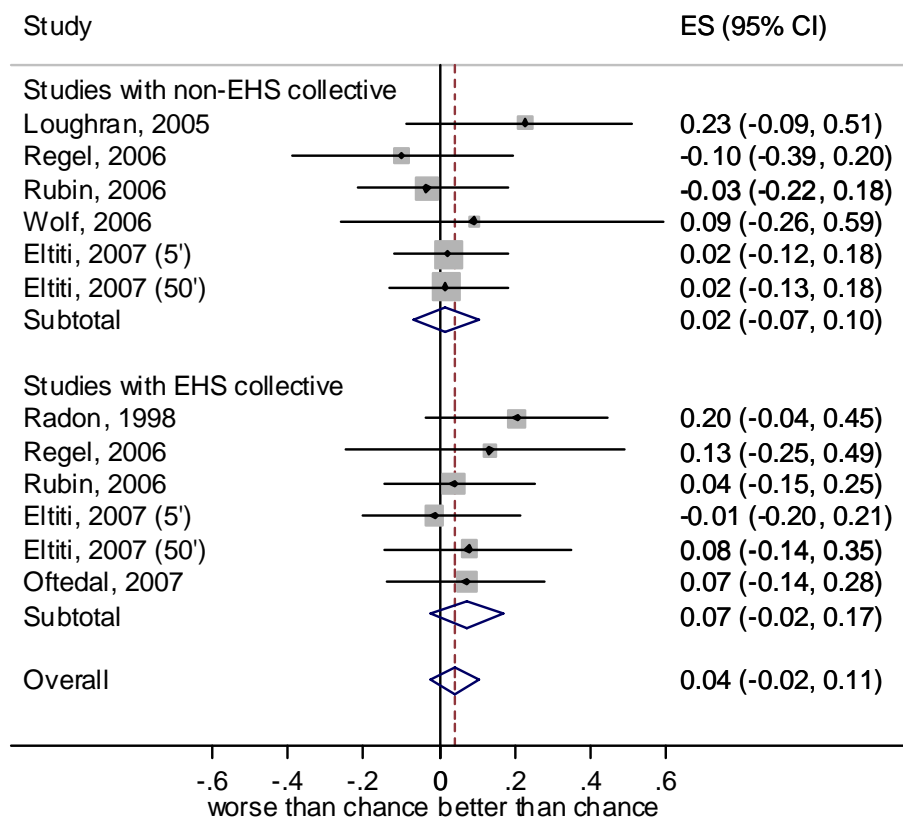


# Perceived field intensity



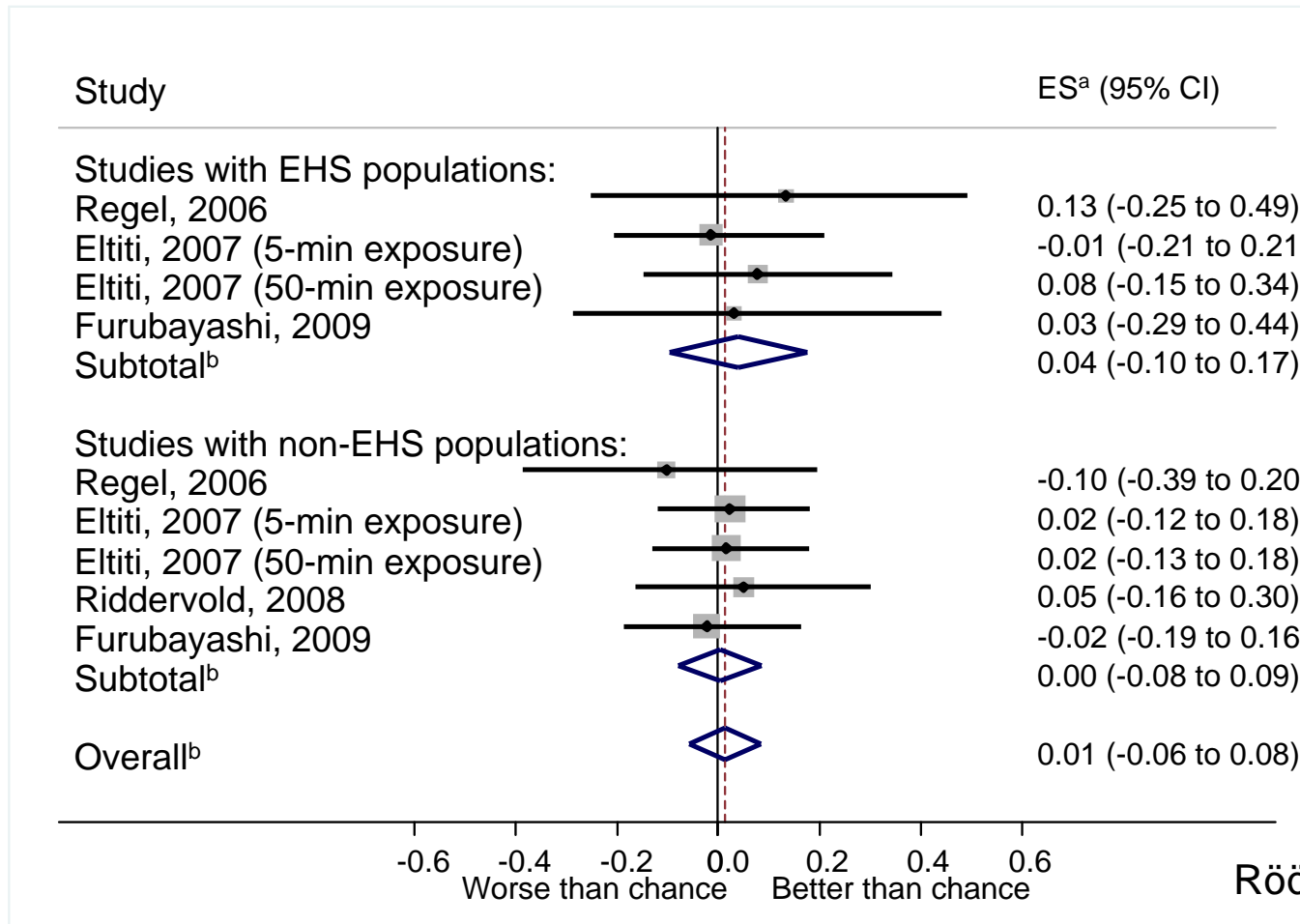
Regel et al, EHP, 2006

# Meta-analysis of provocation studies (correct field detection rate)



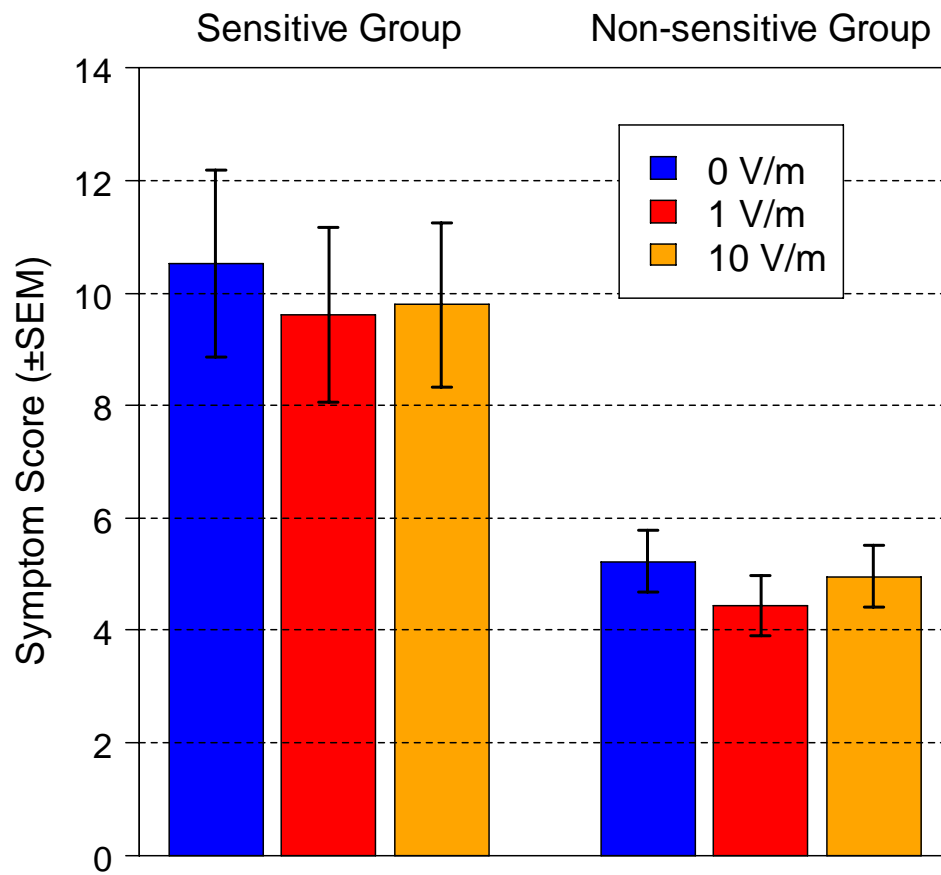
Röösli, Env Res, 2008

# Meta-analysis of provocation studies with base station exposure (correct field detection rate)



Röösli, WHO Bull, 2010

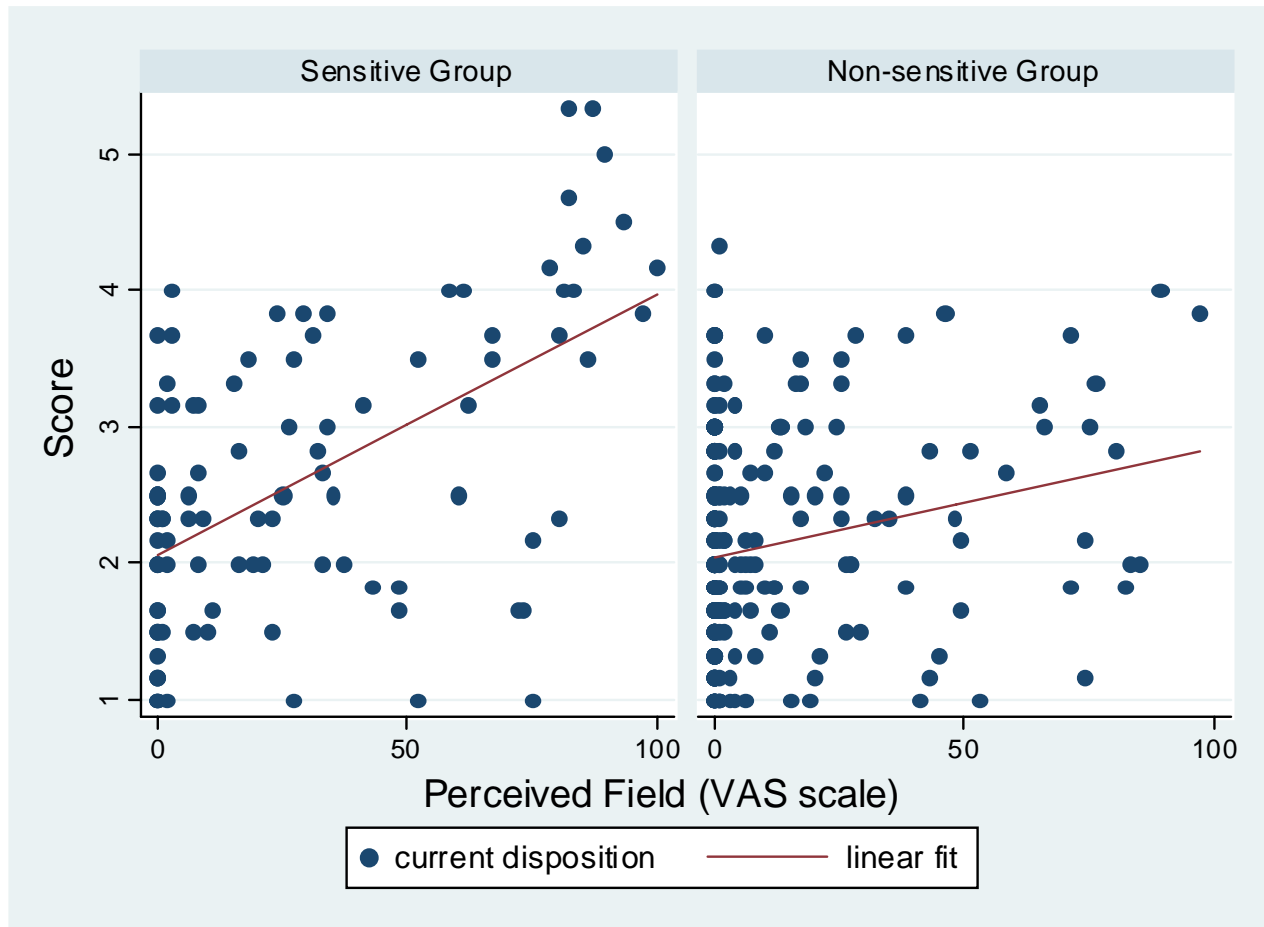
# Short term effects: Symptom score after exposure



Regel et al, EHP, 2006



# Symptom score after exposure vs. **perceived** field intensity



Regel et al, EHP, 2006



## Example: Scandinavian Headache study

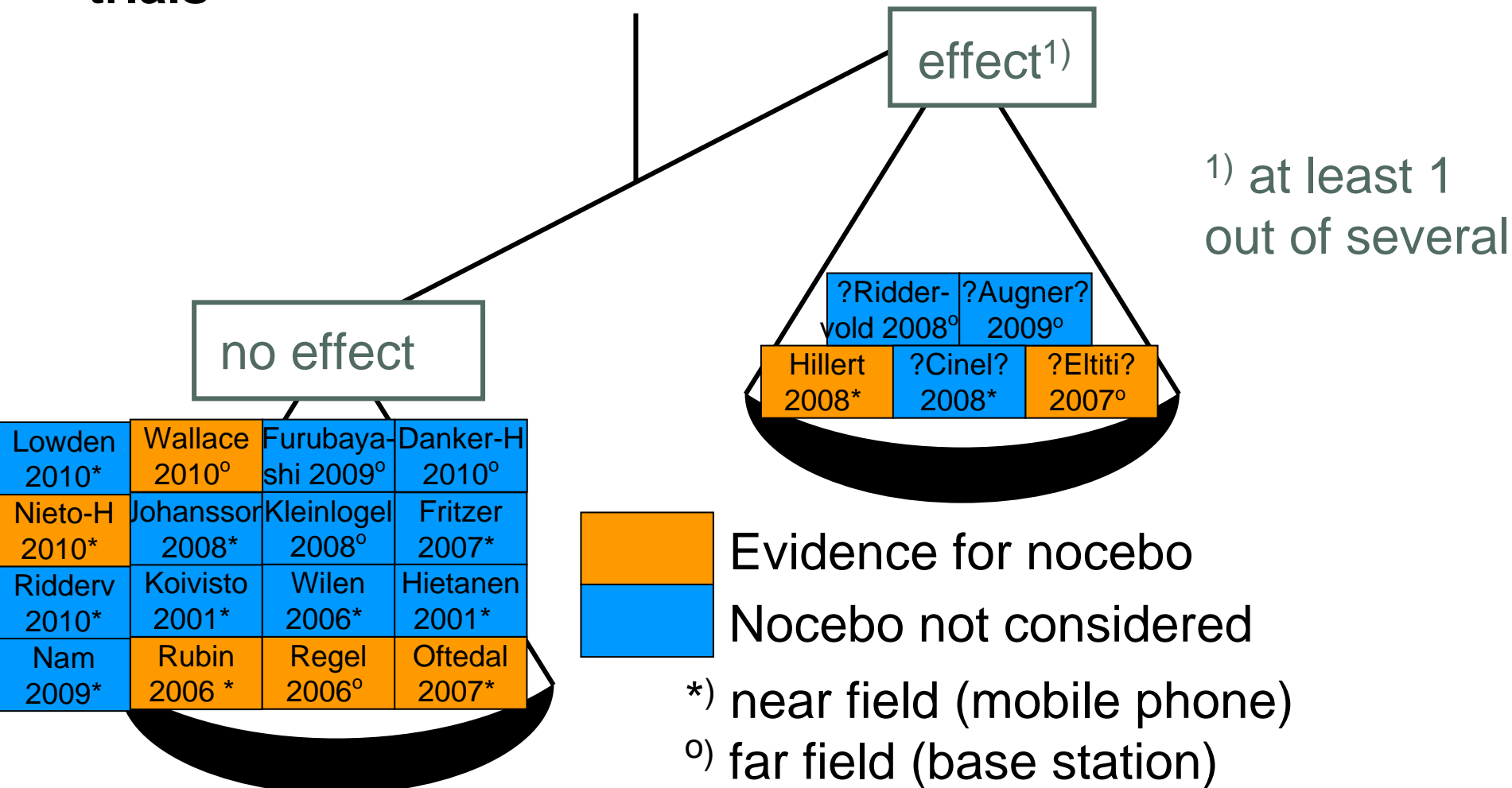
(Oftedal et al, 2007)

- Open provocation with 38 persons, who report headache when using a mobile phone.
- 24 persons reacted with headache during the open provocation.
- 17 persons agreed to participate at a double blind experiment.
- Under double blind condition: no association between headache and exposure.
- Evidence for nocebo effect.

# Nocebo

- contrary to placebo
- development of symptoms due to expectation (e.g. concern)

# In line with short term effects from randomised blinded trials

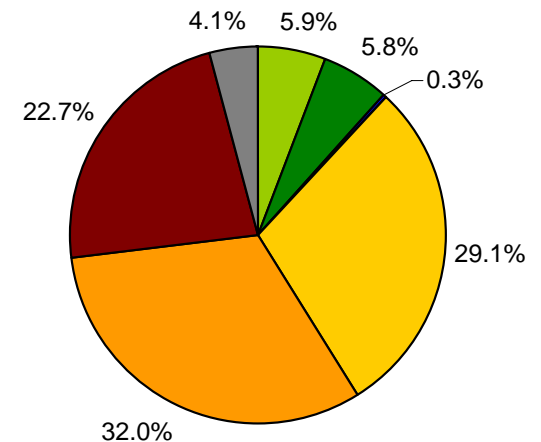
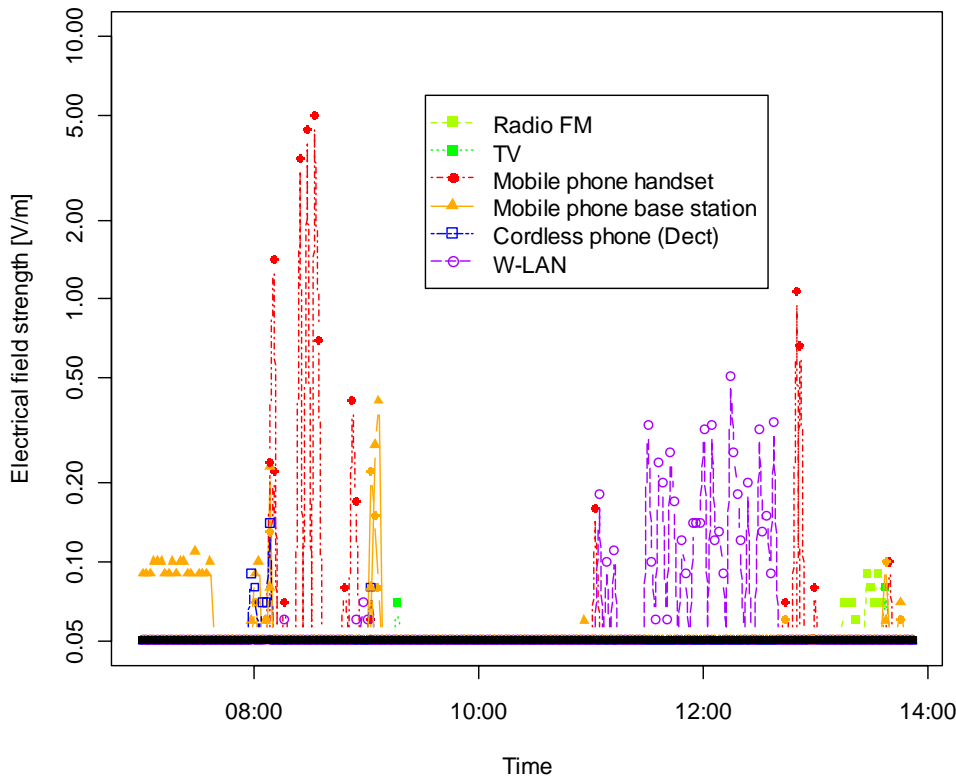


# Why observational studies?

- Effect of prolonged exposure
- Real life situation:
  1. Exposure
  2. Symptoms
- Large study population

# Major Challenge I: Exposure assessment

Average EMF distribution in a Swiss sample (mean=0.22 V/m):

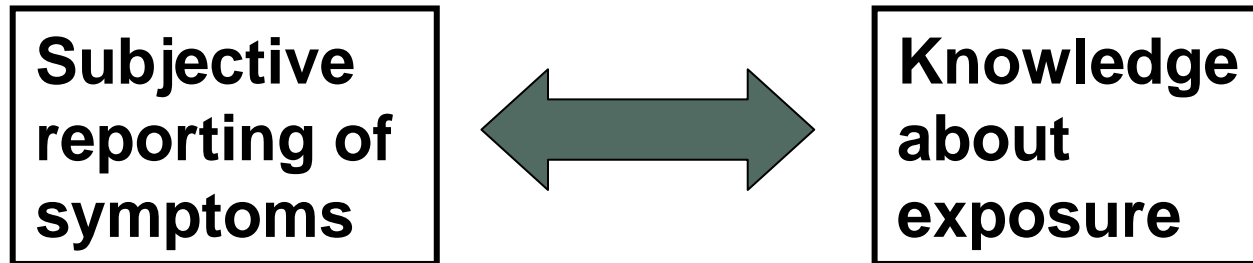


-  FM radio broadcast
-  TV broadcast
-  Tetrapol
-  Mobile phone handset
-  Mobile phone base station
-  Cordless phone (DECT)
-  Wireless LAN

Frei et al. EnvRes, 2009



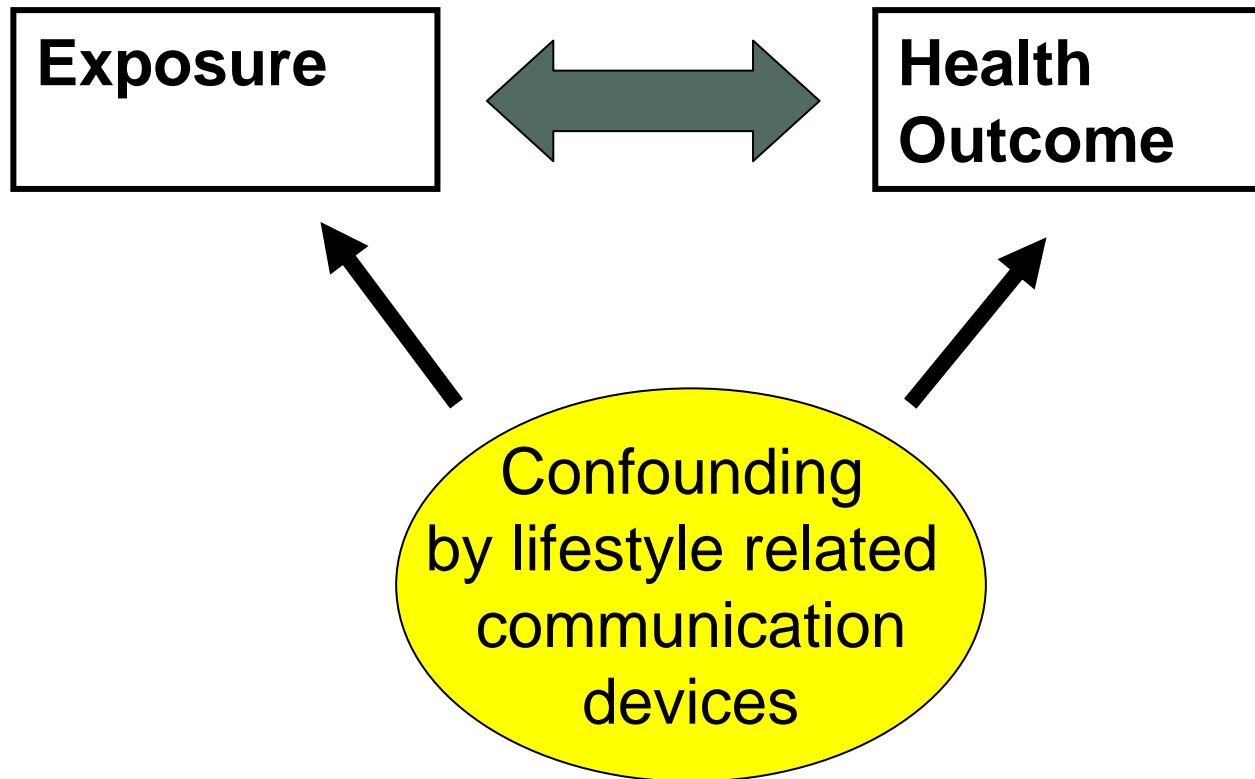
## Major Challenge II



**Consequences:** self-estimated exposure measures are particularly vulnerable to bias.



## Major Challenge III





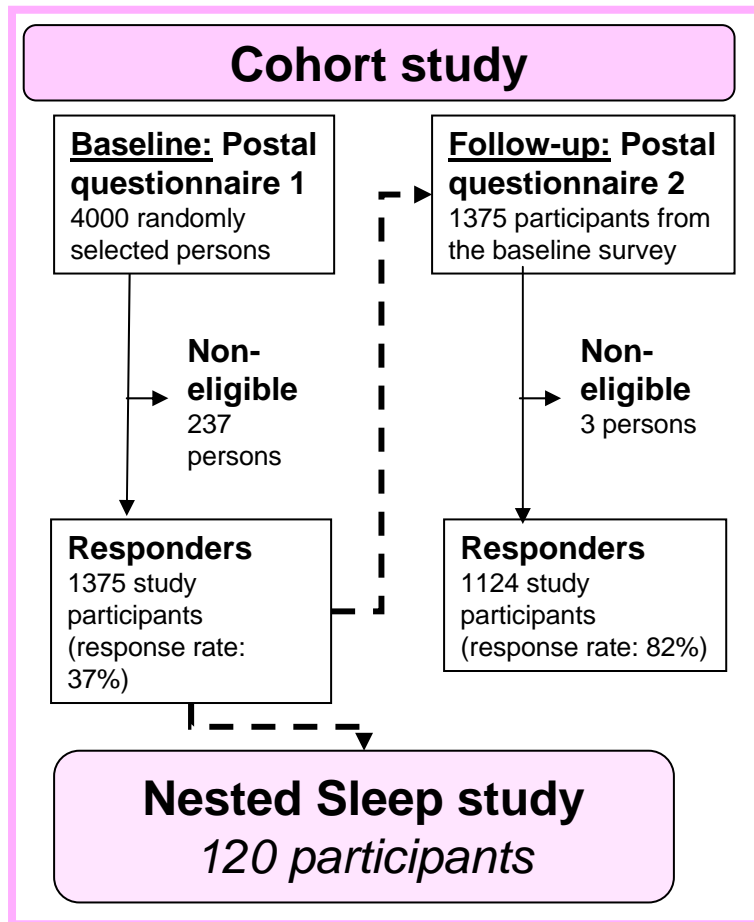


## Cross-sectional studies

- 3 out of 17 Zerssen symptoms associated with exposure in 365 residents of mobile phone base stations (Hutter et al. OEM, 2006):
- No effect among 329 adults (Thomas et al. BioEM, 2008)
- No effect on symptoms among 3022 children and adolescents (Heinrich et al. EnvInt, 2010)
- Among adolescents (but not among children) behavioural problems were more common in the highest quartile of exposure (OR 2.2; 95% CI 1.1–4.5) (Thomas et al. Eur J Epidem, 2010)
- Symptom score was not associated with RF-EMF measurement in the bedroom among 1500 adults (Berg-Beckhoff et al. OEM, 2009)



# Longitudinal study: Qualifex (Mohler et al. RadRes, 2010)

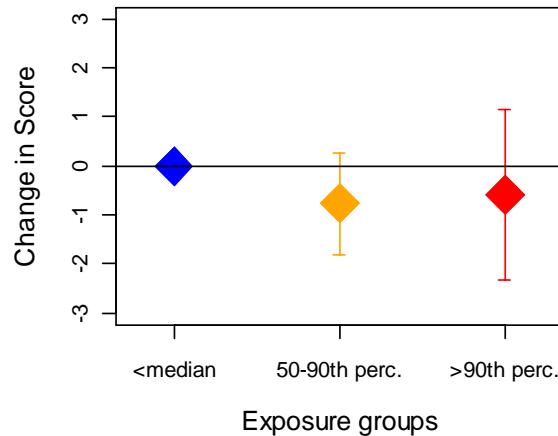


- Far field exposure:
  1. Residential exposure to fixed site transmitters (Bürgi et al., 2010)
  2. Total personal exposure (prediction model) (Frei et al., 2009)
- Close to body sources:
  1. Use of mobile phones (self-reported & operator data)
  2. Use of cordless phones

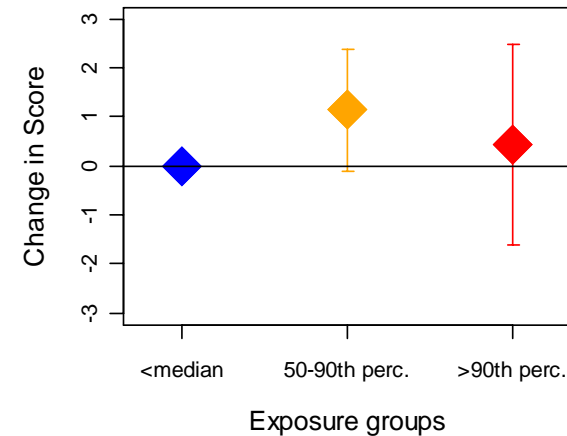
# Symptom score (Zerssen) vs. total personal exposure

Cross-sectional analyses

Baseline survey (n=1375)

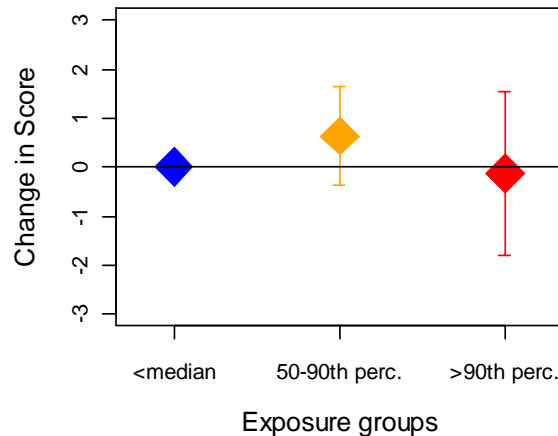


Follow-up survey (n=1124)

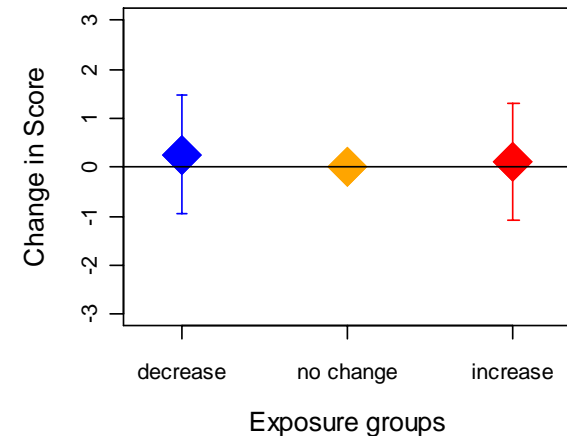


Longitudinal analyses

Cohort analysis (n=1124)



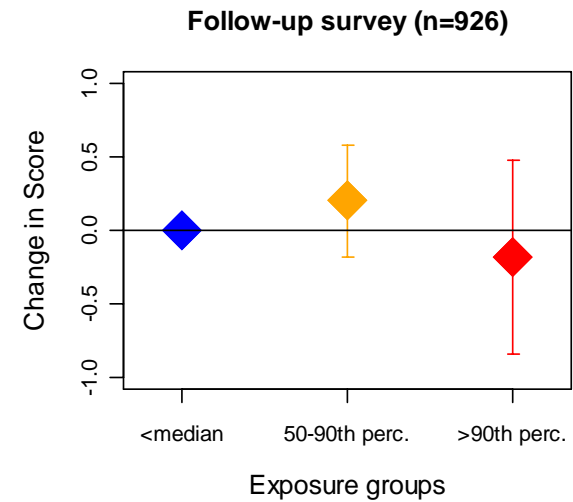
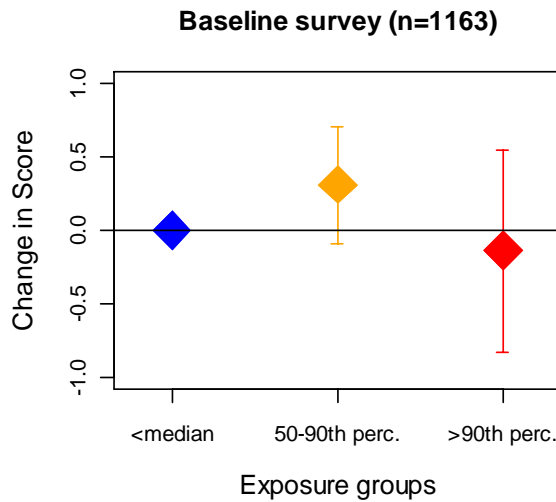
Change analysis (n=1124)



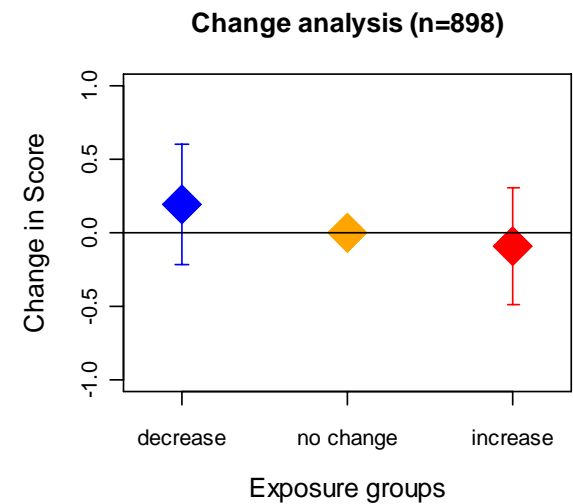
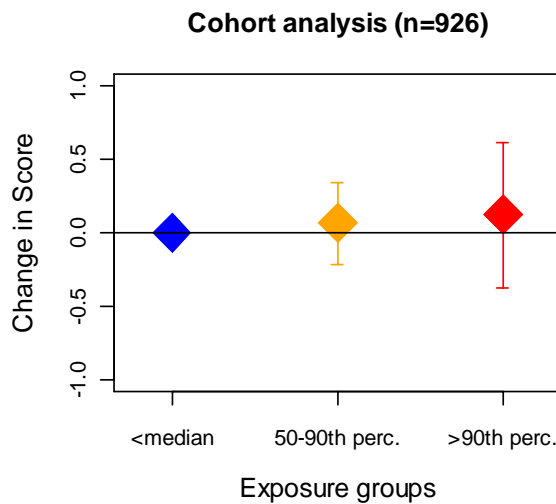


# Sleep disturbances vs. fixed site transmitter radiation

**Cross-sectional analyses**



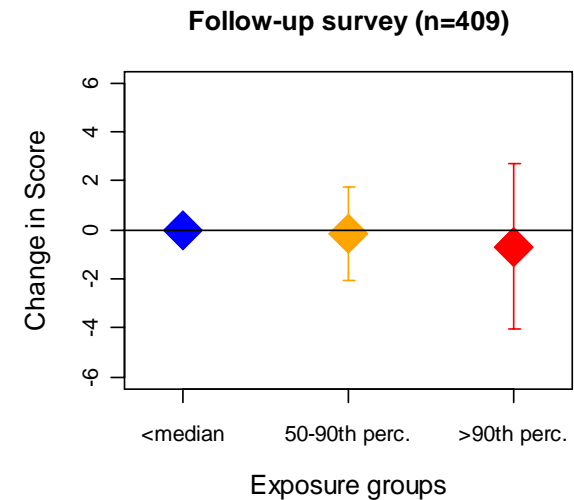
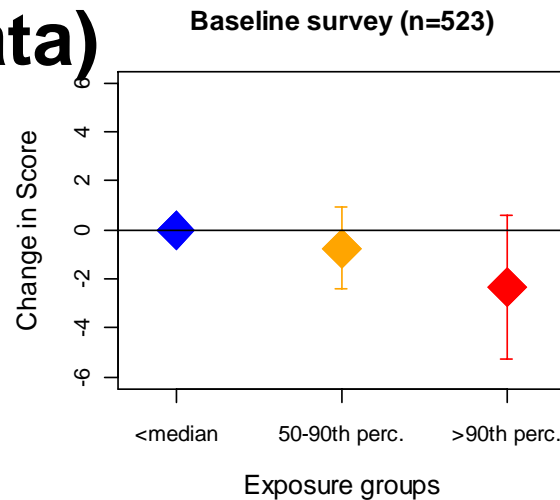
**Longitudinal analyses**



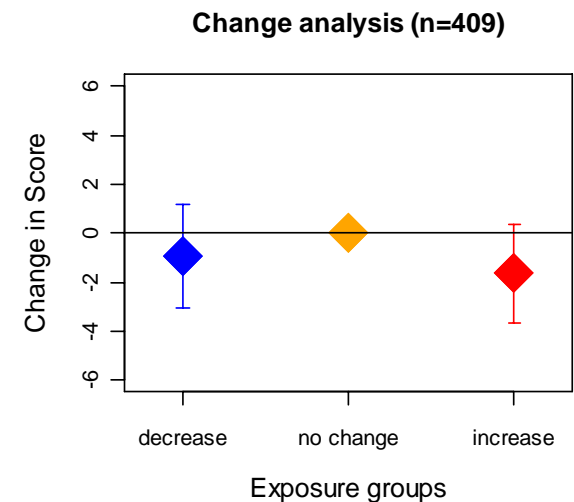
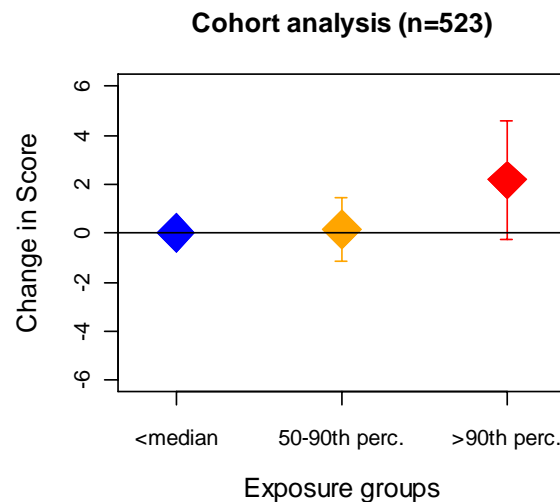
# Mobile phone exposure

# Headache (HIT-6) vs. mobile phone use (operator data)

**Cross-sectional  
analyses**



**Longitudinal  
analyses**



## Danish subscriber cohort (Schüz, PlosOne, 2009)

- Danish mobile phone subscriber Cohort: Comparison of hospital contacts in 420,000 early mobile phone subscribers (1982-1995) with the rest of the Danish population.
- Outcomes: first hospitalizations due to any central nervous system diseases.
- Follow-up: since subscription until end of 2003 (at the latest)
- Increased risk for migraine (RR=1.2; 95% CI 1.1-1.3) and for vertigo (1.1; 95% CI 1.1-1.2)

# Conclusions

- The vast majority who claims to be able to perceive low level EMF is not able to perceive fields in a laboratory double blind setting.
- Nocebo effects occur.
- Strong evidence for absence of short term effects on symptoms
- Investigating long term effect is a challenge and less firm conclusions can be drawn from the available studies:
  1. Objective exposure measures are a must
  2. In most studies no effect was observed
  3. Confounding by lifestyle is crucial
  4. Low exposure contrasts
  5. Few longitudinal studies





# References

Research |

WHO Bulletin, Dec. 2010, 88(12): 887-896

## Systematic review on the health effects of exposure to radiofrequency electromagnetic fields from mobile phone base stations

Martin Röösli,<sup>a</sup> Patrizia Frei,<sup>a</sup> Evelyn Mohler<sup>a</sup> & Kerstin Hug<sup>a</sup>



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Interactions between radiofrequencies signals and living organisms

Sense and sensibility in the context of radiofrequency electromagnetic field exposure

*Mesure et perception des champs électromagnétiques radiofréquences : une étude de cohorte sur l'hypersensibilité électromagnétique*

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<sup>b</sup> University of Basel, Petersplatz 1, CH-4003 Basel, Switzerland



# EHS status

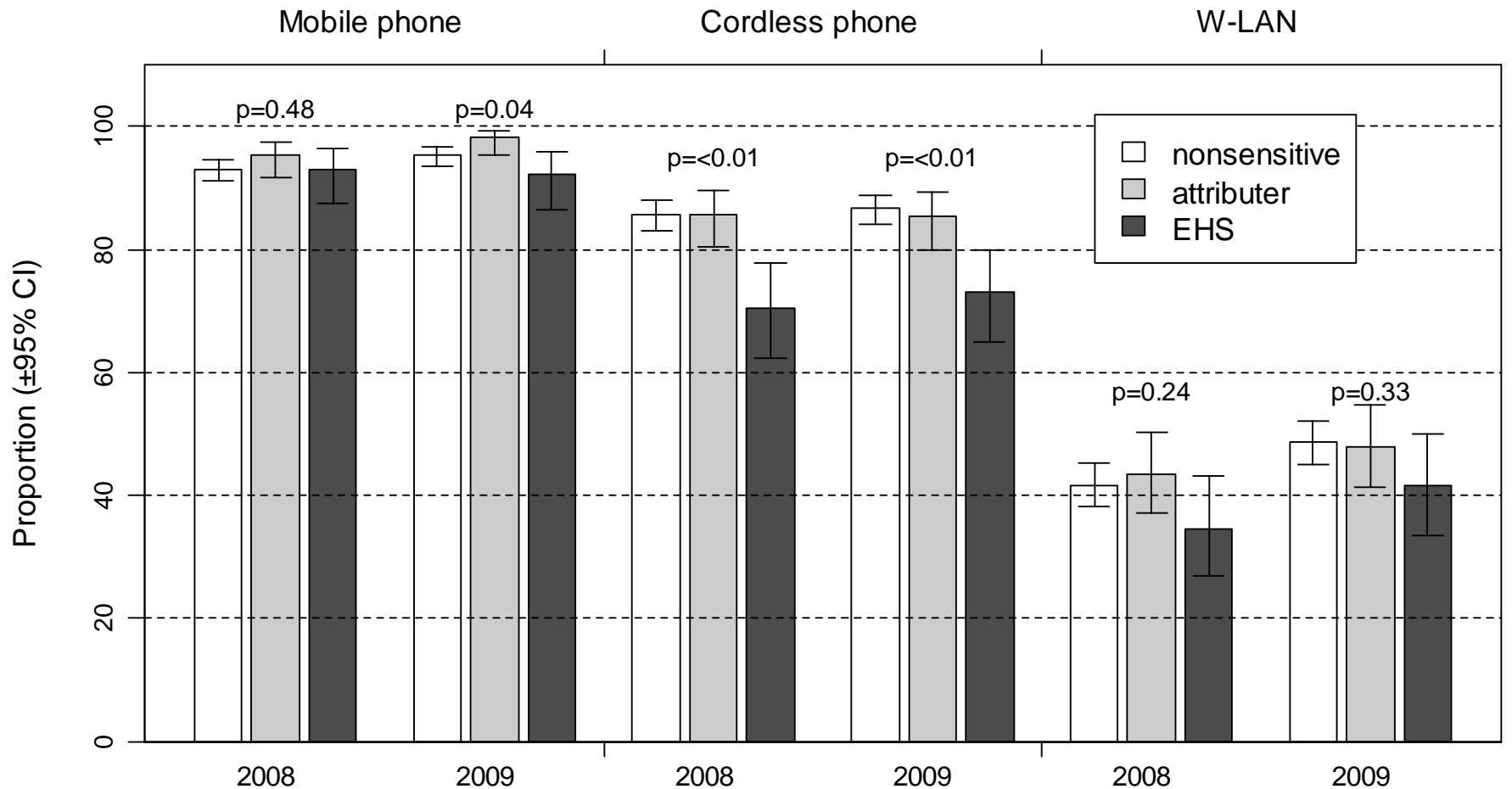
			EHS status 2009			
			nonsensitive	attributer	EHS	Total
<b>EHS status 2008</b>	non-sensitive	n	773 (68.9%)	85 (7.6%)	23 (2.1%)	881 (78.5%)
	attributer	n	74 (6.6%)	60 (5.4%)	11 (1.0%)	145 (12.9%)
	EHS	n	28 (2.5%)	16 (1.4%)	52 (4.6%)	96 (8.6%)
Total			875 (78.0%)	161 (14.4%)	86 (7.7%)	1,122 (100%)

219 attributers; 130 EHS individuals

Röösli et al. Compt Phys, in press

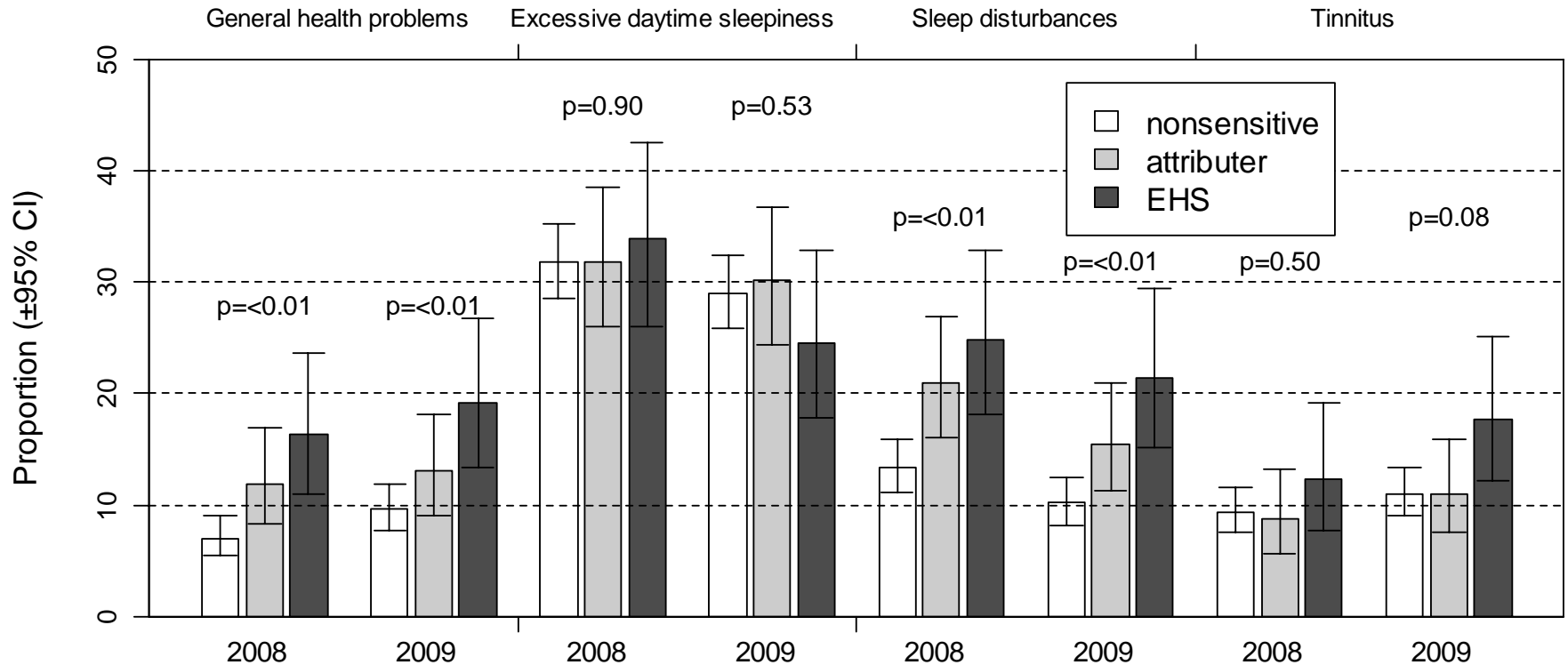


# Ownership of communication devices



Röösli et al. Compt Phys, in press

# Health status

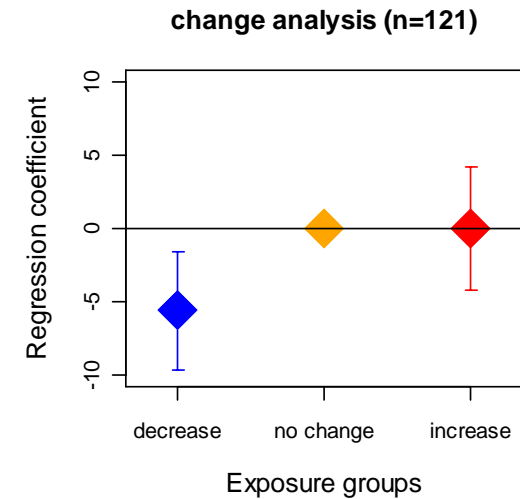
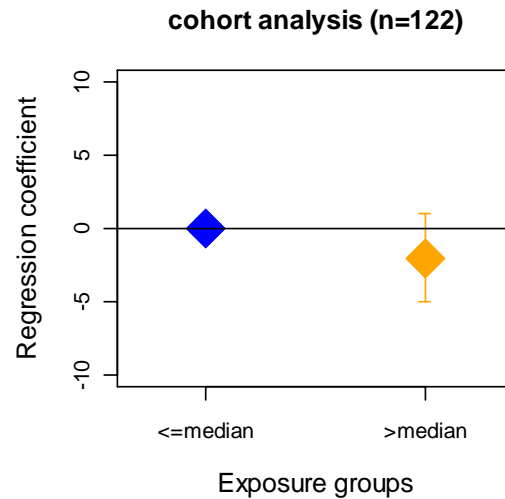


Röösli et al. Compt Phys, in press



# Results: EHS and exposure to fixed site transmitter radiation

**Zerssen symptom score and total exposure**



**Sleep disturbance score and fixed site transmitter**

