



Electromagnetic hypersensitivity

Prof. Dr. Martin Röösli

*Institute of Social and Preventive Medicine
at Swiss Tropical Institute, Basel
associated Institute of the University of Basel*



Content



- > Definitions/prevalence
- > Perception of low level RF-EMF
- > Symptoms and RF-EMF: short term
- > Symptoms and RF-EMF: long term
- > Therapeutic options
- > Conclusions



Definitions

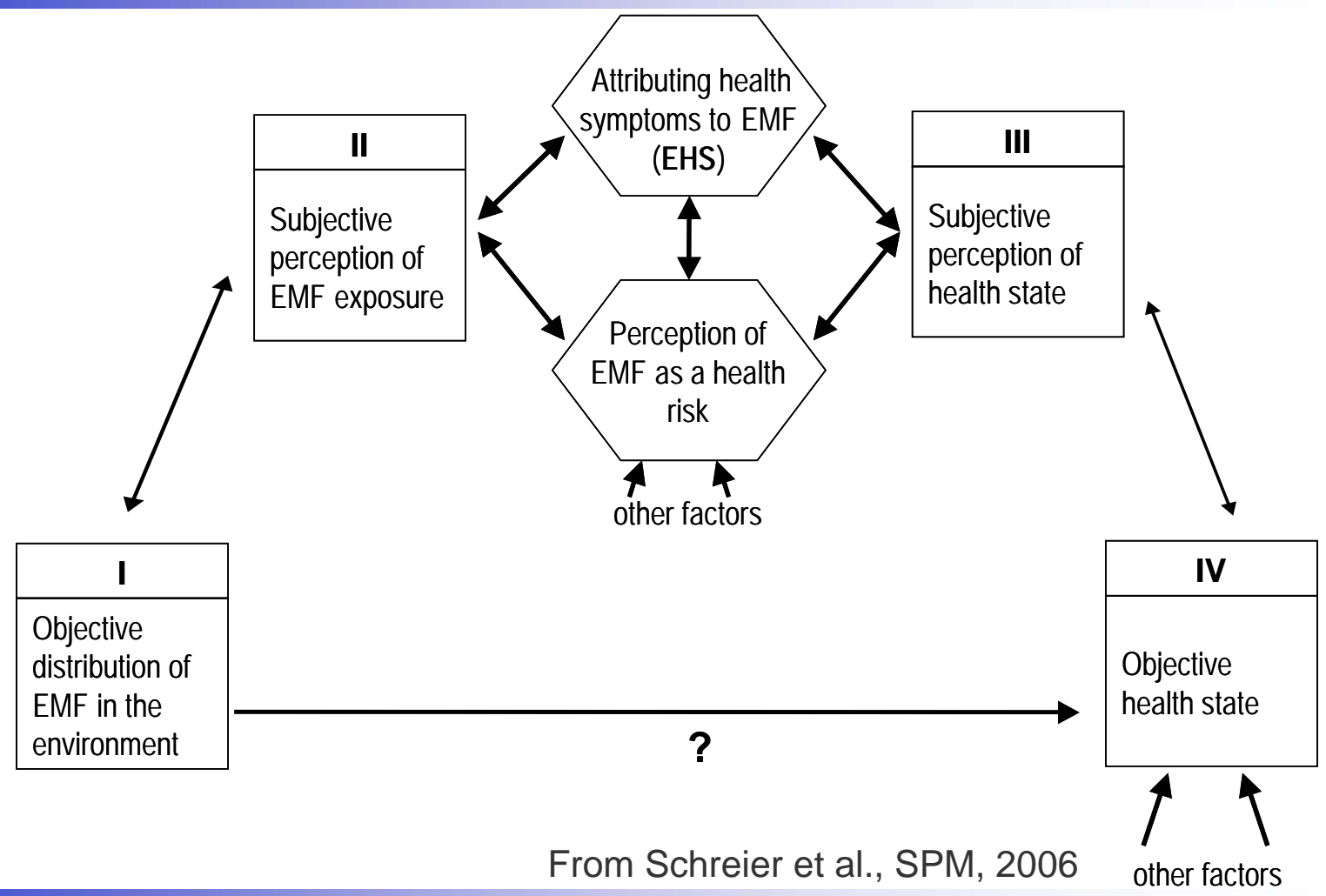


- > Terms:
 - Electromagnetic Hypersensitivity (EHS)
 - Electrosensitivity
 - Idiopathic environmental Intolerances (IEI-EMF)
- > EHS is characterized by a variety of non-specific symptoms, which afflicted individuals attribute to exposure to EMF (WHO, fact sheet N° 296).
- > No established biological mechanism

EHS model

subjective pathway

biological mechanism



- > Prevalence:
 - Stockholm: 1.5% (Hillert, SJWEH, 2002)
 - California: 3.2% (Levallois, EHP, 2002)
 - United Kingdom: 4% (Elititi, 2007)
 - Germany: 8-10% (Infas 2002-2006)
 - Switzerland: 5.0% (Schreier, SPM, 2006)
 - Austria: women: 4.2%, men: 1.7% (Leitgeb & Schröttner, BioEM, 2003)
- > A substantial part of EHS individuals claims to immediately perceive low level EMF when they are exposed (56%) and to develop symptoms within a few minutes (53%) (Röösli, 2004).

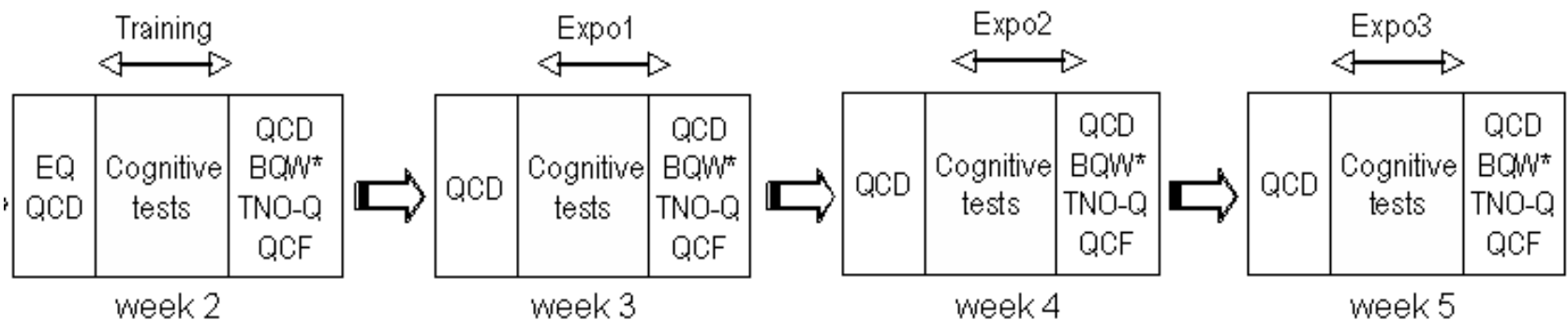
3 different aspects of EHS

- > Perception of low-level fields: sensibility (Leitgeb and Schröttner, 2003)
provocation studies
- > Symptoms and RF-EMF: short term
provocation studies / randomized trials / human laboratory study
- > Symptoms and RF-EMF: long term
epidemiological/observational studies



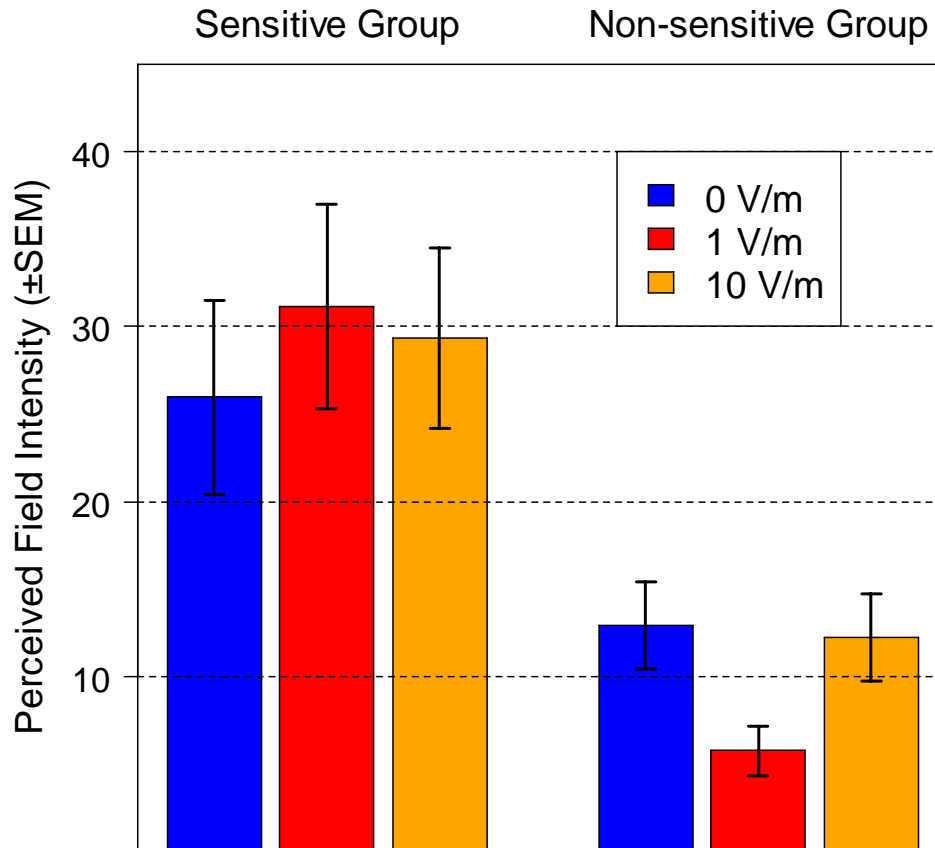
Provocation study

- > 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



EHS individuals show more false alarms



- > see Nam et al, BioEM, 2009
- > Similar observation in Frick et al, BioEM, 2005 in a study on perception of singular transcranial magnetic stimuli.



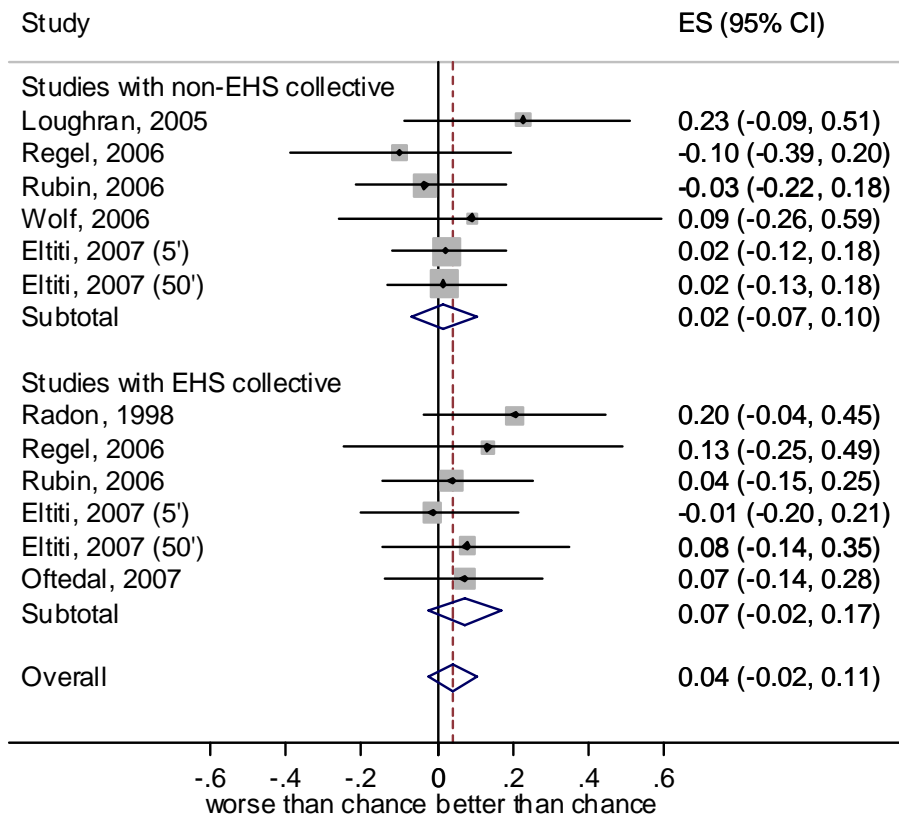
Provocation studies



- > Systematic literature search: 7 double-blind, peer-reviewed papers on RF-EMF published before August 2007
- > Exposure:
 - Mobile phone: 5 GSM 900
 - base station: 1 GSM, 2 UMTS
- > Exposure duration: 2-50 minutes
- > Number of sessions per individual: 3-12
- > Collectives: 182 hypersensitive (EHS) individuals and 332 healthy volunteers.



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



Röösli, Env Res, 2008



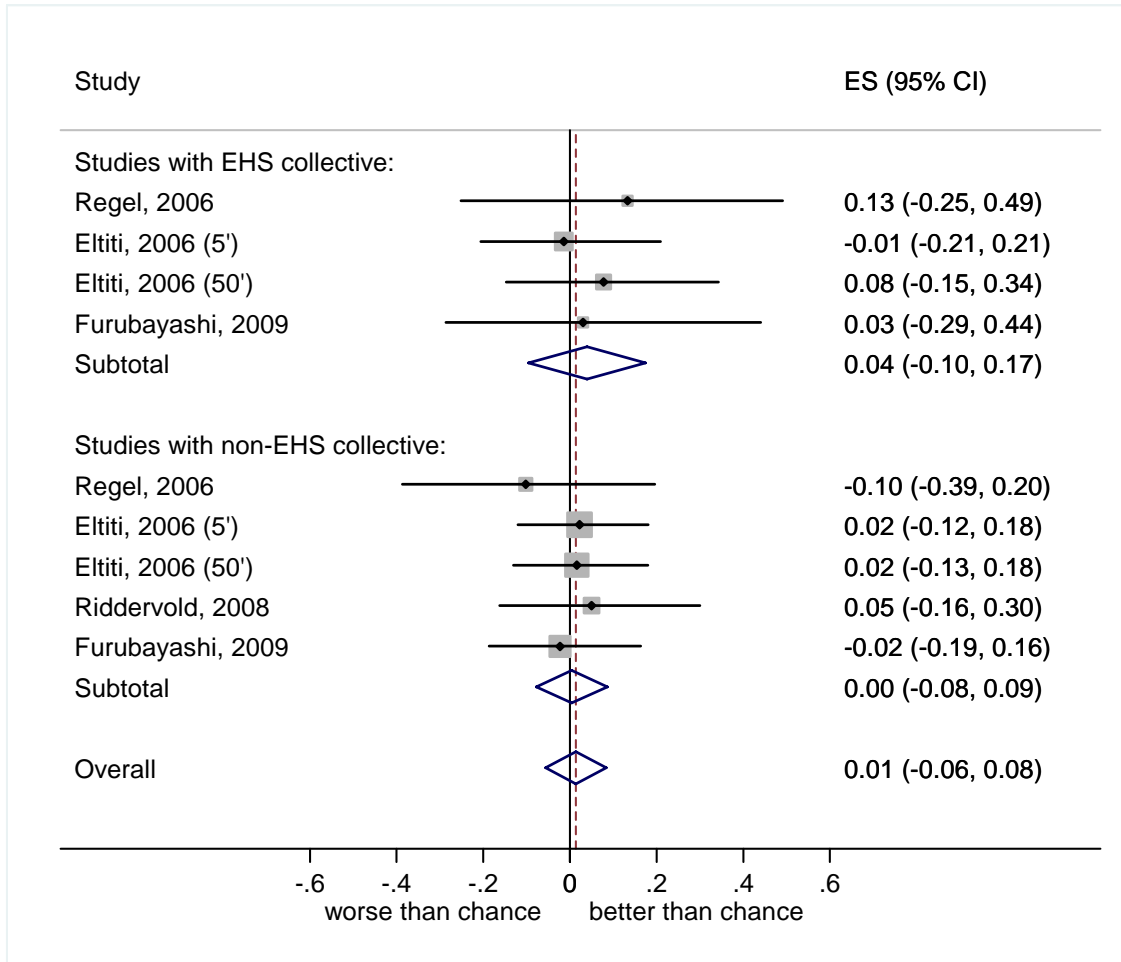
New studies on perception



- > Kwon et al, BioEM, 2008 [mobile phone]:
on average correct response rate not better than chance; 2 participants with extraordinary performance failed when retesting.
- > Hillert et al, BioEM, 2008 [mobile phone]:
OR for correct detection: 1.4 (95% CI: 0.61-3.10). There were significantly more subjects who reported RF exposure at the second session.
- > Bamiou et al, BioEM 2008 [mobile phone]:
on average 2.5 correct guesses (out of 6): consistent with guessing.
- > Furubayashi et al, BioEM, 2009 [base station]:
Correct-response: 52%(±8%) [EHS] and 49%(± 5%) [controls].
- > Riddervold et al., BioEM 2008 [base station]:
after true exposure: 35/80 yes; after sham: 31/80 yes.

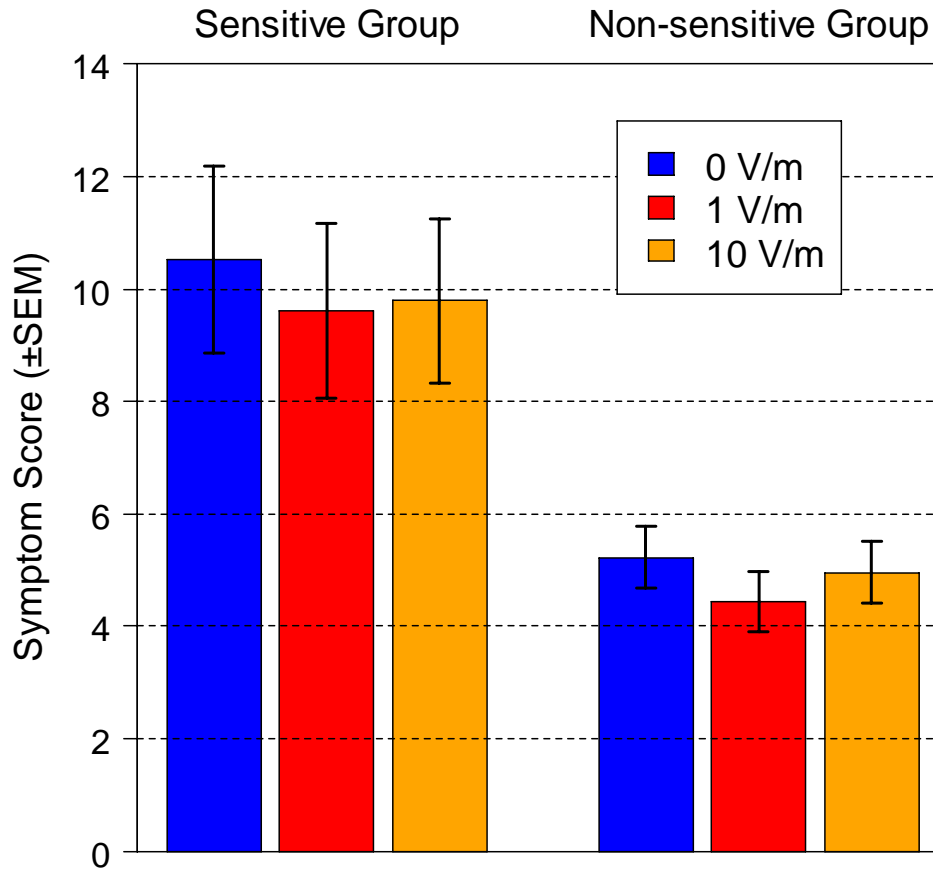


Base station exposure (correct field detection rate)





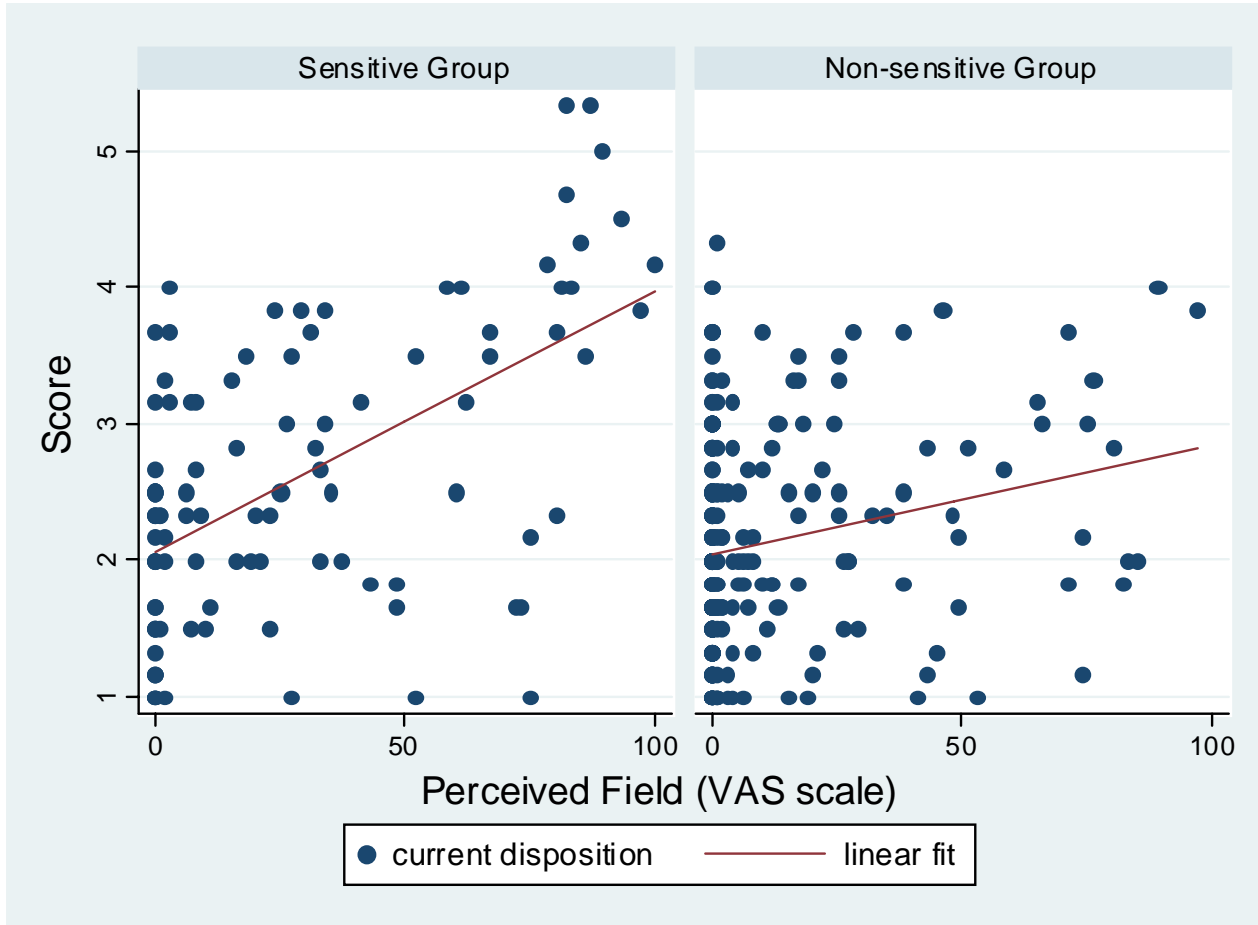
Short term effects: Symptom score after exposure



Regel et al, EHP, 2006



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



Regel et al, EHP, 2006



Example: Scandinavian Headache study (Ofstedal 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.



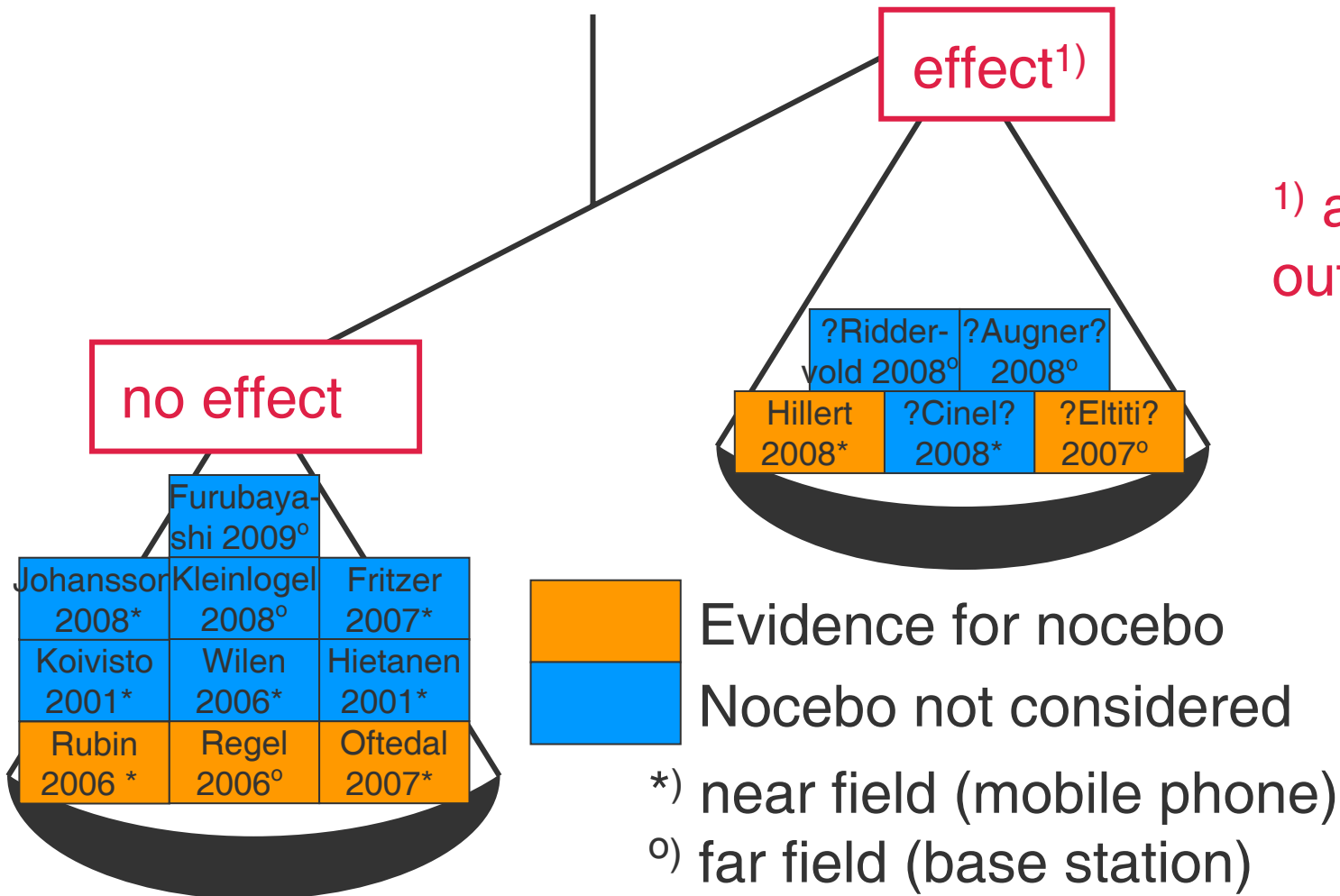
Nocebo



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



Short term effects: randomised double blind trials



1) at least 1
out of several



Other EMF exposures?

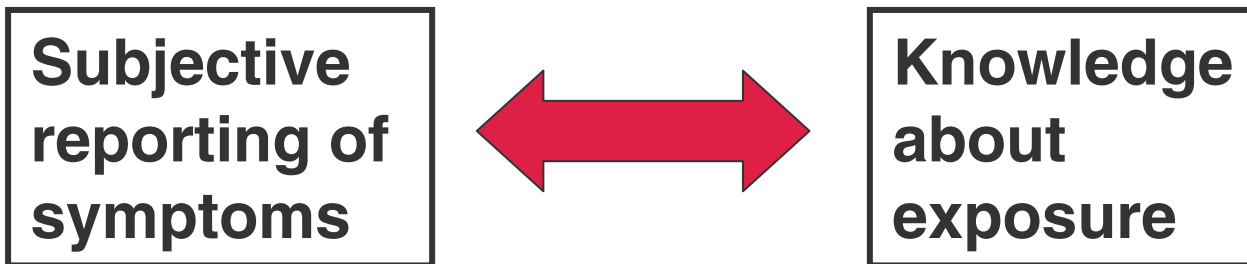
- > Systematic review from Rubin et al, BioEM, 2009:
 - All type of EMF exposure
 - 46 blind or double blind provocation studies including 1175 EHS volunteers
 - No evidence for correct field detection in other frequency ranges
 - No robust evidence for an association between exposure and symptoms
 - Role of nocebo is important



Long term effects: epidemiological studies

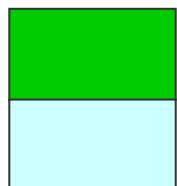
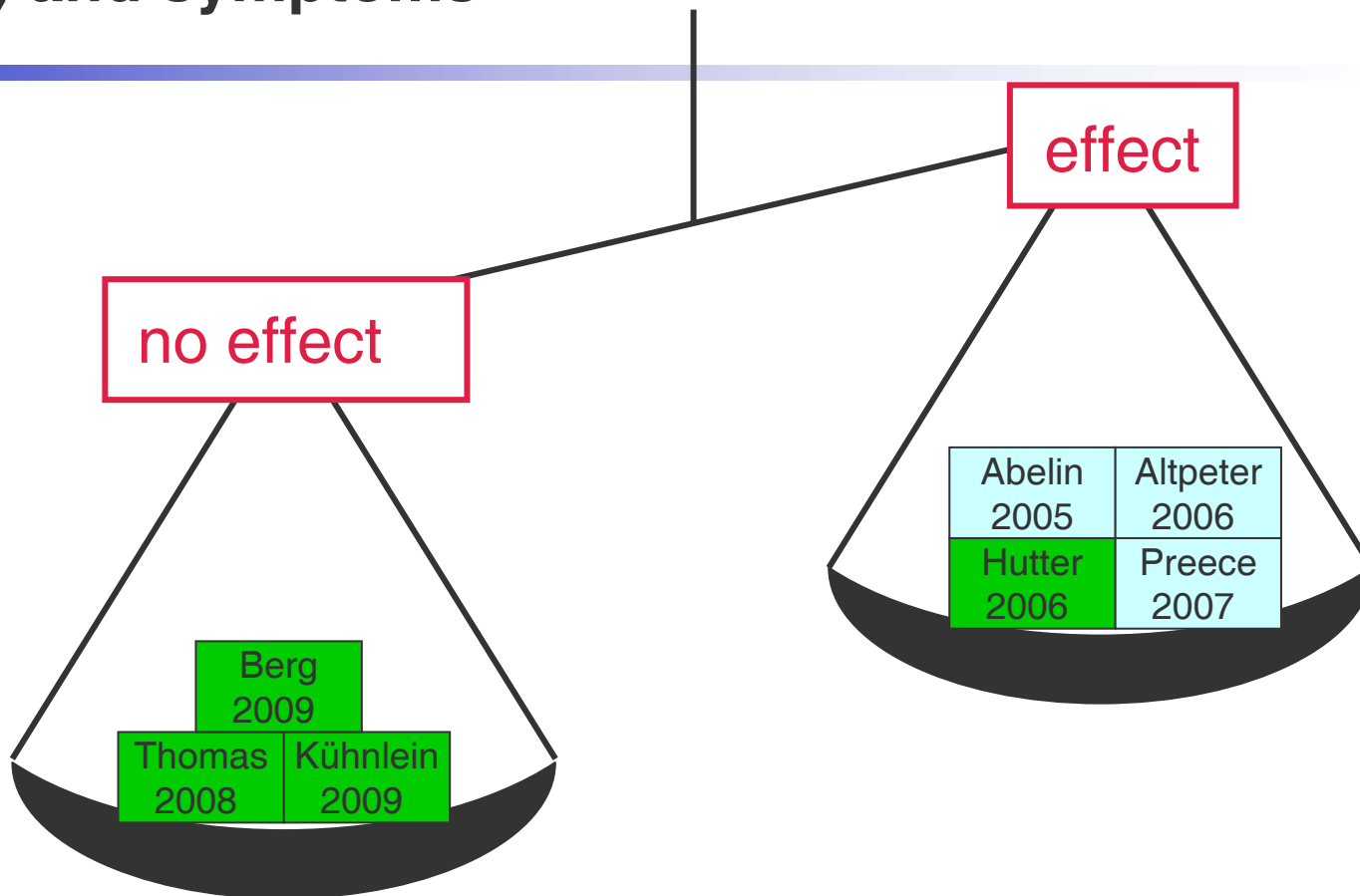


Major Challenge:





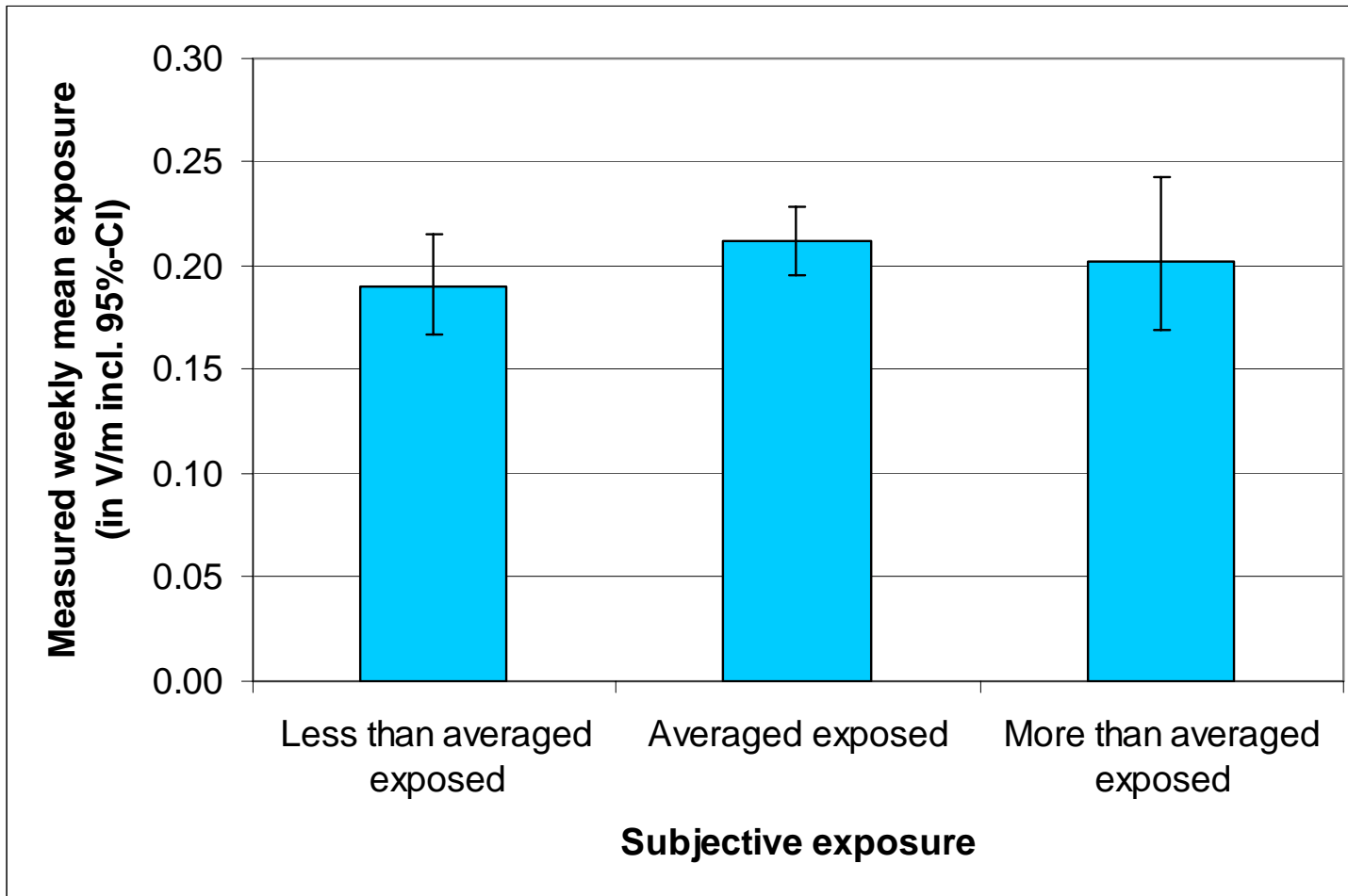
Overview: studies on long term effects (>3h) and symptoms



Mobile phone base station

short wave transmitter (exposure correlated with distance)

Objective vs. subjective exposure assessment in QUALIFEX study





Epidemiological studies



- > Cross-sectional survey in 365 residents of mobile phone base stations (Hutter et al. =EM, 2006):
 - 3 of 17 Zerssen symptoms associated with exposure (headache, cold hands or feet, difficulties to concentrate)
 - sleep disturbances (Pittsburgh sleeping scale) not associated after adjusting for concerns



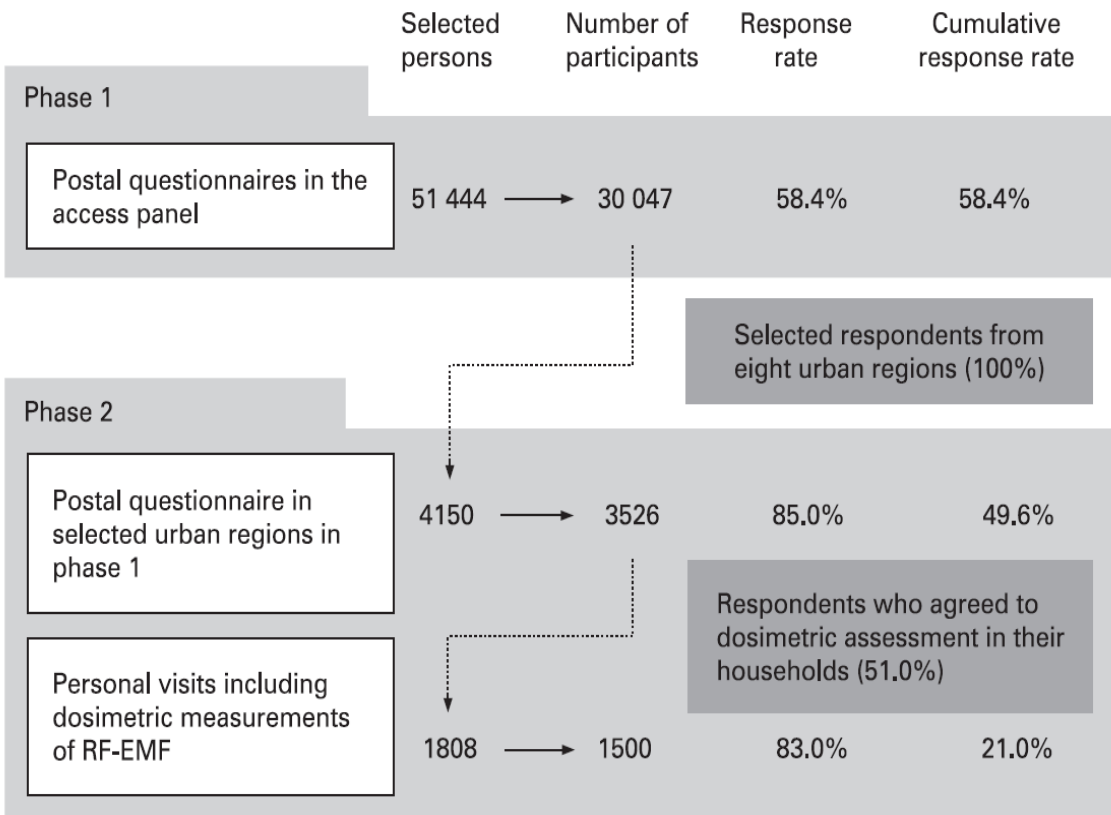
German MobilEe-study



- > Cross-sectional survey in 329 adults (Thomas et al. BioEM, 2008):
 - 24h personal measurement (mobile phone, DECT, W-LAN)
 - Highest exposed quartile: >0.21% of ICNIRP reference value
 - No indication of an association with symptoms: headache, neurological symptoms (e.g., tinnitus), cardiovascular symptoms (e.g., tachycardia), concentration problems, sleeping disorders and fatigue.
- > Cross-sectional survey in 1433 children (Kühnlein et al. BioEM, 2009)
 - No association between 24h personal RF-EMF measurement and symptoms: headache, irritation, nervousness, dizziness, fatigue, fear, and sleeping problems



QUEBEB: Symptoms and mobile phone base station



Symptom score was increased in the vicinity of mobile phone base stations (<500m) (Blettner et al. OEM, 2009)



Symptom score was not associated with RF-EMF measurement in the bedroom (Berg-Beckhoff et al. OEM, 2009)



Strengths/limitation of epidemiological studies



- + Real life exposure
- + (Personal) exposure measurements
- + Large study population

- Cross-sectional study design
- Long term exposure assessment
- Low exposure contrast



Summary health effects

- > EHS is a self declaration based on own experiences.
- > 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.
- > EHS individuals overestimate their own exposure (more false alarms).
- > Nocebo effects occur.
- > Short term effects from everyday EMF exposures on well-being are very unlikely.
- > There is no evidence that EHS individuals are more susceptible to EMF than non EHS-individuals.
- > Are there any long term exposure effects (>1h)? If yes, at what level?



Do EHS individuals differ from the rest of the population?

- Differences observed for:
 - Self reported symptoms (Regel 2006, Frick 2005, etc.)
 - Heart rate variability (Lyskov 2001, Wilen 2006)
 - Cortical excitability (Landgrebe 2007)
 - Hyperresponsiveness to sensor stimulation, heightened arousal (Lyskov 2001)
 - Electrodermal activity (Lyskov 2001), skin conductance (Eltiti, 2007)
- No differences for cholinesterase activity (Hillert 2001) and psychiatric caseness (Rubin, 2008)
- Inconsistent results for heart rate (Lyskov 2001, Eltiti 2007)
- > Real differences or a psycho-physiological stress response when participating in EMF studies???



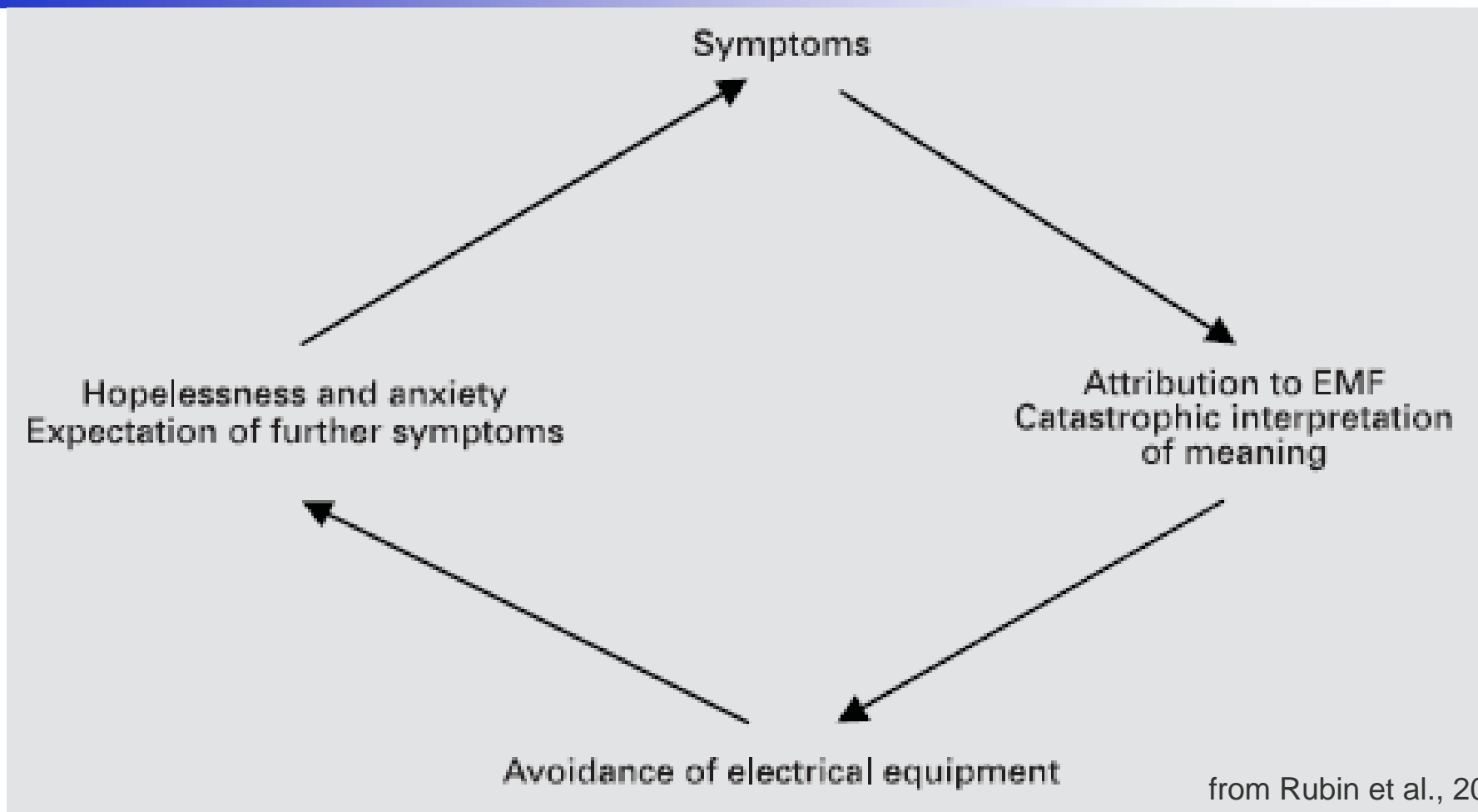
Therapeutic options

(Rubin et al. 2006)



- > Placebo works against the nocebo phenomena (e.g. "to neutralise" the exposure).
- > Shiatsu worked in one trial.
- > Affected individuals reported that reduction of exposure was helpful, however, no beneficial effect occurred in placebo-controlled studies.
- > Some success was reported from cognitive behavioural therapy, however, often not accepted.
- > But still not clear whether individual feedback is useful (Nieto-Hernandez et al. 2008).

Cognitive behavioural model of electromagnetic hypersensitivity





Handling of patients from own experience



- > Take them serious.
- > Do not focus on EMF as a cause of the illness, consider other explanations in an open way.
- > Measurements are rarely useful (-> usually taken as evidence that standard limits are not safe).
- > Measurements only beneficial if used to document wrong beliefs of the patients.