Electromagnetic fields: perception of risk, exposure and health

Master thesis [#229]

Johan Timmerman, BSc

Toxicology & Environmental Health

May 21st 2010

1. Contents

2. Preface

This thesis was written as final part of the Life Sciences master Toxicology and Environmental Health. The subject was chosen because of its great social significance and since the topic is very hot in science at the moment.
To give the thesis a more social approach, I chose not just to review the known health effects, but to focus on the way people perceive the risks of electromagnetic fields, their exposure to EMFs, their health in relation to EMFs and the interplay of all these factors. As a University of Utrecht student, I was skillfully supervised by Pauline Slottje, PhD at the IRAS Environmental Epidemiology department.

3. Introduction

As the possible health effects of electromagnetic fields (EMFs) are a hot topic in recent environmental health research, this thesis is written not just to give an overview of possible health effects of EMF exposure, but to search for the link of people's perception of EMF risk and exposure with their health state. Therefore, the focus will be more on subjective health complaints than on objective health effects.

Electromagnetic fields are fields caused by electrically charged objects, such as electric equipment but also thunderstorms in the atmosphere. EMFs therefore are not only generated by man-made sources, they are naturally occurring everywhere in our environment, and make a compass needle orienting to the North, for example.
Electromagnetic fields consist of radiation at a certain wavelength. Some types of electromagnetic radiation at very high frequencies are energy-rich enough to break bonds between molecules. An example of this so called ionizing radiation is gamma radiation produces by radioactive sources. This ionizing radiation is harmful for the human body as it can break molecular bonds of amongst others DNA molecules. The frequencies of the electromagnetic radiation in the EMFs discussed in this thesis are much lower and do not carry enough energy to break bonds. EMF radiation is therefore called non-ionizing (World Health Organization, 2010). A picture of the various forms of electromagnetic radiation is shown in the EMF spectrum in figure 1.
Extremely low frequency (ELF) fields are produced for example by electrical devices and power lines. Other equipment, such as radio and TV transmitters, emit radiation at radio frequency and are consequently called radio frequency (RF) field sources (World Health Organization, 2010).

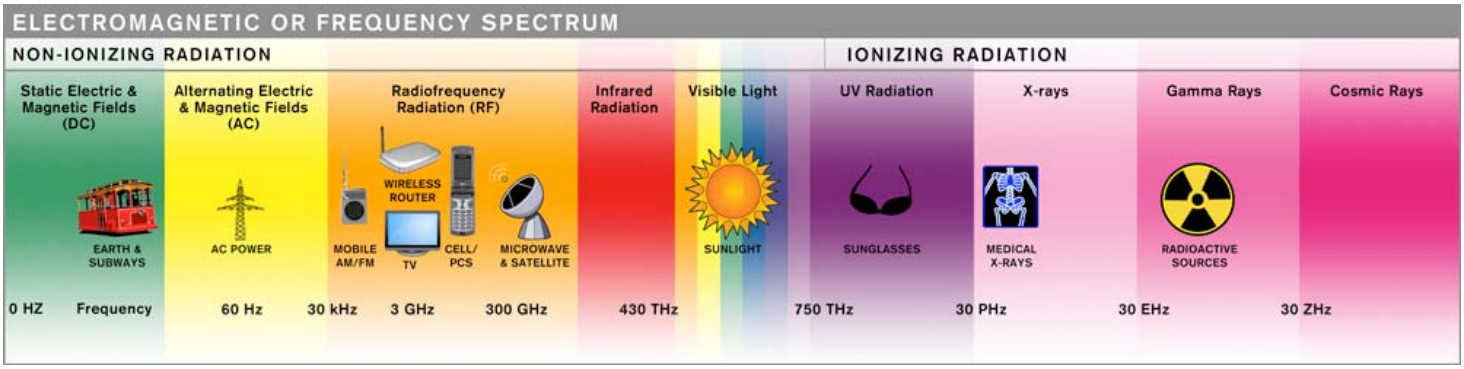


Figure 1 – The electromagnetic spectrum. Taken from http://www.etandt.com/images/spectrum.jpg, web site accessed on May 21st 2010

Mobile phone and broadband techniques use radio and microwave frequencies. With respect to health complaints, in this thesis the focus will mainly be on the radio frequency electromagnetic fields (RF-EMF). The two main sources of RF-EMF on which the focus will be in this thesis are mobile phones and their base stations. Whereas mobile phones cause a temporary, local, high exposure (usually around the ears), base stations cause a steady, whole body yet lower exposure. Both exposures are giving rise to concerns, but the base station exposure might be viewed to as the more dangerous one as this exposure is chronically abundant (Valberg et al., 2007).

The use of mobile phones has increased dramatically in the last years, nowadays in Australia for example, 94% of adolescents use mobile phones (Inyang et al., 2010). The enormous increase in mobile communication devices has led to a consequent rise in base station constructions. With new technologies coming up, more and more base stations are needed to be built (Siegrist et al., 2005b).
With increasing mobile phone use and base station placement, most countries have their national standards for maximal exposure to EMFs, the so-called reference levels. The International Commission on Non-Ionizing Radiation Protection (ICNIRP) has drawn guidelines on which the majority of the national standards have been based. ICNIRP evaluates worldwide scientific results and draws guidelines based on these scientific results. Guidelines are periodically reviewed and updated when necessary (World Health Organization, 2010). ICNIRP guidelines are based on maintaining body temperature rise below 1º Celsius (Bakker et al., 2010).
Although to date, no direct causal link has been established between sub-reference EMF exposure levels and self-reported health effects (Roosli et al., 2004), parallel to the increase in use of communication devices, public concerns have grown that exposure to high frequency EMF could cause health effects, even below the permitted reference levels (Thomas et al., 2008). Indeed, some people attribute health complaints to exposure to EMF. The most reported symptoms are sleeping disorders and headache and have been ascribed to mobile phones and their base stations (Roosli et al., 2004). Indeed, around one third of German general practitioners currently believe that people can get symptoms from EMF exposure below reference levels (Kowall et al., 2009). However, this so called electromagnetic hypersensitivity (EHS) is not very well characterized. In fact, it is characterized by an array of non-specific symptoms which as a collection are not part of any recognized syndrome. Therefore, it resembles other hypersensitivities to environmental factors and can thus be categorized as Idiopathic Environmental Intolerance (IEI) with attribution to EMF (IEI-EMF) (World Health Organization, 2005). In this thesis, the term EHS will be preferred to use.

4. Research question

What is the interplay between EMF exposure (perception), EMF risk perception and health complaints?

To answer this overall research question the following questions will be addressed:

- To what extent is the general public exposed to EMF and do they perceive EMF exposure?
- What is risk perception in general and in the context of EMF?
- Do people perceive symptoms and attribute these to EMF exposure?
- Is (objective) EMF exposure associated with perceived EMF exposure, EMF risk perception, and symptoms?
- Is EMF risk perception associated with (objective) EMF exposure, perceived EMF exposure and symptoms?
- Are symptoms associated with objective EMF exposure, perceived EMF exposure, and/or EMF risk perception?

5. Methods

To address the research questions a literature study and a series of exploratory, structured interviews were performed.

Literature study

Literature was searched in April and May 2010, using the NCBI PubMed and the APA PsycINFO databases. Only human studies were considered. Searching the PubMed database for "percept* AND EMF" revealed a number of theoretical studies about risk and exposure perception as well as some reviews about the possible health effects of EMF. Using these reviews, experimental studies were screened and outcomes were reported. These experimental studies were not searched for in the databases using general search terms but were searched for by authors and publication date (e.g. "Leitgeb N [auth] AND 2003"). In the PsycINFO database, some more theoretical, psychological information was gathered. Whenever possible, epidemiological data were coupled to these theories to support them.
Key words which were searched for were 'EMF', 'electromagnetic', 'risk perception', 'EHS', 'perceived exposure', 'electromagnetic hypersensitivity' and related search terms.

During writing the thesis, distinction was made between RF-EMF and other types of EMF: with respect to EHS-related health complaints only exposure to RF-EMF was considered. In the more general concepts of risk or exposure perception, other types of EMF and also other environmental hazards were taken into account. Within RF-EMF, mobile phones and base stations were distinguished as these cause different exposure patterns.
Another distinction was made between experimental and epidemiological studies when searching for EMF-related health symptoms. Epidemiological studies are useful for searching for effects of long term exposure, whereas experimental studies mostly focus on short term exposure.
Experimental studies were only selected when they were published after January 2000.

Search activities were logged to optimize searching strategies. Review articles were printed and read, than summarized to save the key points of each article. Experimental papers were selected from the reviews, and searched for by author and publication date as described above. Experimental papers were not always read from the beginning till the end but the main outcomes and methods were checked. When the paper was not printed, the search terms were not logged and no summary was made.

Exploratory interviews

In addition to literature study, a series of exploratory, structured interview was performed. 8 subjects were asked to fill in a questionnaire in which they had to rate their exposure to various environmental factors, rate the risk these factors poses to health and report any health effects they ever attributed to these factors. After filling in the questionnaire, subjects were asked to explain some answers. In general, they were asked to elucidate their ratings of their exposure to and risk of EMF. Additionally, they were asked several questions about how they looked upon EMF or related affairs e.g. the role of the government in preventing EMF exposure. The questionnaire is included in supplement 1; a summary of the talks with the subjects is included in supplement 2.

6. EMF exposure

RF-EMF exposure in the population

It is quite complicated to assess people's personal exposure for the different types of EMF. The most used proxy of exposure to RF-EMF due to mobile phone use in epidemiological studies is self-reported usage. Subjects have to remember and report the number of phone calls over a certain time period and in most of the cases also the duration of these calls. The amount of recall bias can be big in this method and several studies have been done to determine the recall bias (Samkange-Zeeb et al., 2004;Vrijheid et al., 2009;Inyang et al., 2009). In most cases, recall bias was moderate; bias was stronger for the total duration of calls than for the number of calls (Samkange-Zeeb et al., 2004;Vrijheid et al., 2009). The number of calls was underestimated, whereas the call duration was overestimated. The longer the time period between the actual calls and the interview was, the stronger was the bias (Vrijheid et al., 2009). In adolescents, the correlation between validated and self reported mobile phone use was modest yet significant. Results of epidemiological studies using self-reported phone use therefore should be interpreted cautiously, especially when adolescents are the investigated age group (Inyang et al., 2009). A long time period between mobile phone use and the interview can lead to increased recall bias, leading to exposure overestimation. This will result in a positive bias in estimating the risk of possible outcomes associated with mobile phone use (Vrijheid et al., 2009).
In Australia, a study was performed to investigate possible predictors of adolescent phone use (Inyang et al., 2010). It was found that males use mobile phones on earlier ages than females and study participants with no siblings used mobile phones earlier than other participants. In addition, participants with higher psychoticism scores were more likely to use their mobile phones often.

For base stations, it is also difficult to assess one's exposure. Distance to base stations is not always a good proxy, as there are numerous disturbing factors. For example, directly below the antenna, the exposure is very low. Moreover, the signal is reflected and scattered in urban area's due to buildings and other objects in its way and inside houses field strength can vary from just as high as outside to 100 times lower than outside (Viel et al., 2009). Therefore, Hutter *et al.* measured field strengths in the bedrooms of 365 subjects (Hutter et al., 2006). People, however, do not spend their whole day in the bedroom, so this approach does not solve the problem either, although valuable information was acquired in this study.
The first study to use a personal dosimeter measured personal exposure of 329 adults in Bavaria. This way, subjects wear a device on their body which measures EMF field strengths throughout the day. Overall exposure was compared to International Commission on Non-Ionizing Radiation Protection (ICNIRP) reference level, which was not exceeded (Thomas et al., 2008). Also in other studies where personal exposure was measured, levels below ICNIRP reference levels were found (Alanko and Hietanen, 2007;Habash et al., 2009;Thomas et al., 2010). More recently, personal dosimetry was used to investigate where EMF strength is highest compared to location of the antenna. It appeared that in urban areas EMFs were strongest around 280m distance from the antenna, whereas in rural areas EMFs were strongest around 1000m distance from the antenna (Viel et al., 2009).

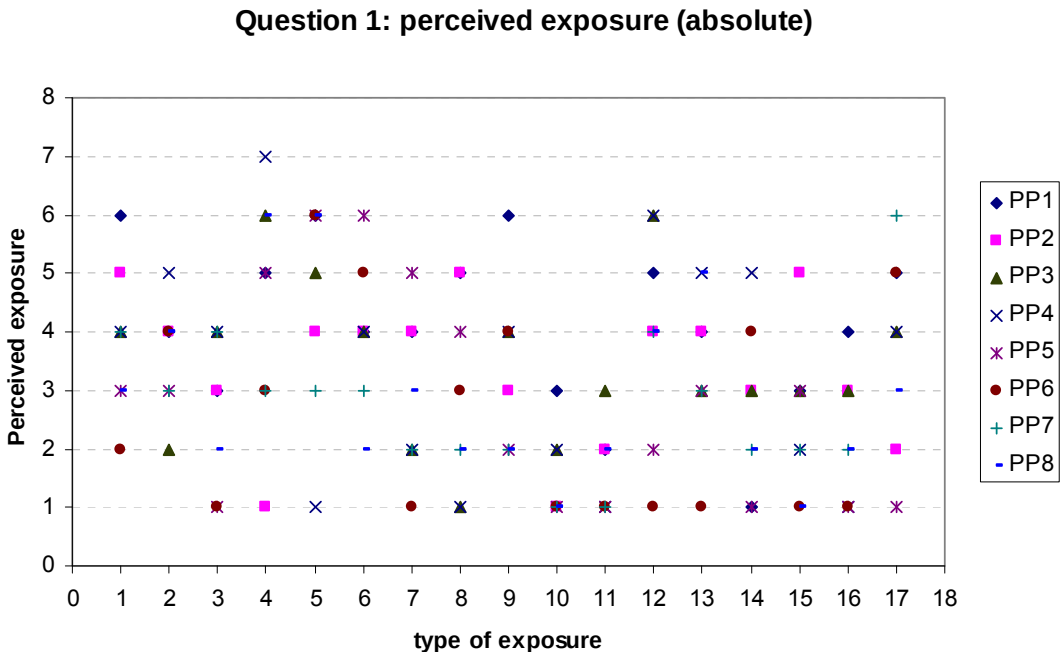
RF-EMF exposure perception

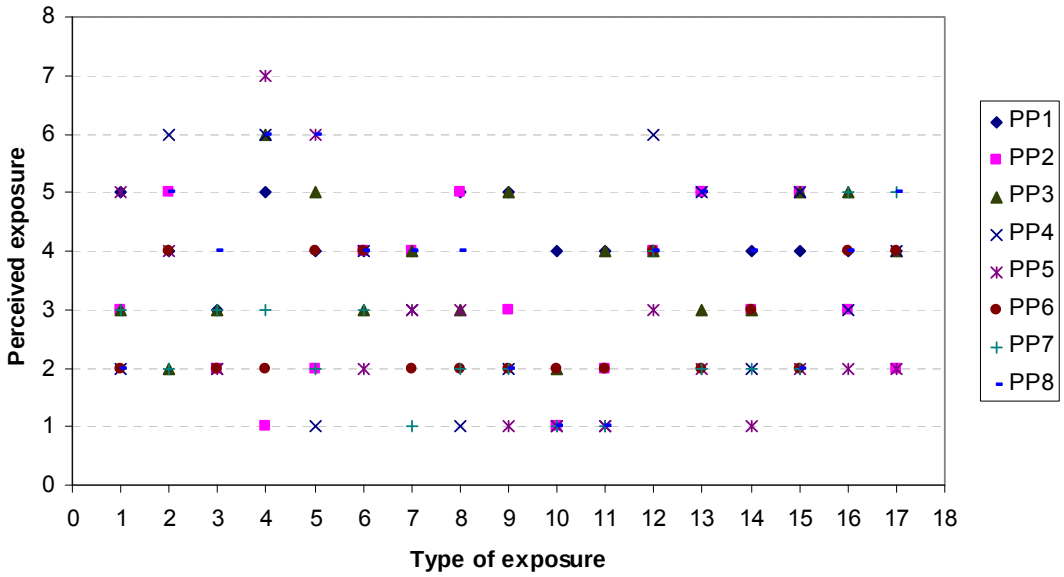
In the introduction section, EHS was introduced as the tendency of afflicted individuals to attribute health complaints to EMF exposure. Basically, two aspects in EHS have to be discriminated: electromagnetic sensibility and electromagnetic

hypersensitivity itself. Electromagnetic sensibility is the ability to sense electromagnetic exposure without necessarily developing symptoms and is a compulsory condition for EHS. Electromagnetic sensibility alone however is not sufficient for developing EHS (Leitgeb and Schrottner, 2003).
Leitgeb and Schröttner tested 708 adult subjects on their ability to sense electromagnetic exposure. It appeared that there are indeed people who have an increased ability to perceive electric currents without developing symptoms, however, as said, this is not sufficient for EHS. Variability within the sample was larger than estimated thus far, again pointing to the probability that some subjects have greater abilities to perceive electromagnetic currents than others. One more interesting finding was that women have lower perception threshold than men (Leitgeb and Schrottner, 2003). This, however, only shows the variability between subjects with respect to sensing electric currents. Subjects were not exposed to electromagnetic fields such as mobile phone or base station radiation, so no real conclusion can be drawn from this experiment with respect to EMF sensibility.
In other experimental settings, subject were blindly exposed to RF-EMF. EHS subjects were found to have a substantially higher false alarm rate (i.e. they reported presence of RF-EMF exposure) during sham conditions compared to general population in majority of the studies (Regel et al., 2006;Eltiti et al., 2007a;Roosli, 2008), In general, under double-blind conditions, EHS subjects were not better in marking presence of RF-EMF exposure than expected by chance (2000;Kwon et al., 2008), (reviewed by refs (Roosli, 2008) and (Rubin et al., 2005)).
In a provocation study by Kwon and colleagues, two participants showed extraordinary performance. Out of 100 trials (“Is the GSM-field on?”) they managed to achieve a correct response rate of 97%. However, one month later they were tested again and did not score higher than expected by chance. This shows the need for replication, as highly unexpected scores can be achieved sometimes. In the same study, 6 subjects reported themselves to be sensible to EMF but they did not score better than the other participants on average (Kwon et al., 2008).
To summarize, EMF-sensible individuals may indeed exist but self-reported EHS individuals are not consistently better in sensing EMF exposure than non-EHS individuals.

Interviews

In the interviews, all subjects perceived their exposure to mobile phone base stations as low, and also lower than mean exposure in The Netherlands. For perceived exposure to mobile and cordless phones there was more variation. Correlation between perceived absolute exposure and perceived relative exposure, i.e. compared to mean exposure in The Netherlands, was good; people perceiving low exposure rated their exposure as relatively low and people perceiving high exposure rated their exposure as relatively high. Two subjects rated their exposure to cordless phones as high, but not higher than mean exposure in The Netherlands. See also figure 2 (next page).





	Perceived exposure to mobile phone base stations		Perceived exposure to mobile phone use		Perceived exposure to cordless phone use	
	Absolute	Relative	Absolute	Relative	Absolute	Relative
PP#1	-	-	+	+	++	+/-
PP#2	-	--	-	---	+/-	--
PP#3	+/-	-	++	++	+	+
PP#4	+/-	--	+++	++	---	---
PP#5	---	--	+	+++	++	++
PP#6	---	--	-	--	++	+/-
PP#7	+/-	-	-	-	-	--
PP#8	--	+/-	++	++	++	++

Figure 2 – answers on the first two questions in the questionnaire. Subjects had to rate their exposure to several environmental factors (question 1) and compare that exposure to mean exposure in The Netherlands (question 2). For a complete overview of the questions, see the questionnaire list in supplement 1. RF-EMF questions were questions 3 (mobile phone base stations), 4 (mobile phone use) and 5 (cordless phone use).
Absolute exposure ratings: 1 and --- = not at all, 7 and +++ = very high. Relative exposure ratings: 1 and --- = much lower than mean, 7 and +++ = much higher than mean. PP# stands for subject number.

7. Risk perception

Risk perception, the subjective judgment people make about a risk, is a very complex issue, which differs for each individual and is being influenced by many factors (Siegrist et al., 2005c).
One of the very important factors that influence people's perception of risk is voluntariness. As early as in 1969, it was found that people are willing to take a thousand times bigger risks on voluntary base compared to involuntary risks (Starr, 1969;MacGregor and Fleming, 1996). An example of this is that many people take the risk to go skiing, which might be seen as a risk factor for physical trauma, whereas many people do not want to take the risk of food additives (MacGregor and Fleming, 1996).

In addition, people accept higher risk levels when the risk is seen as catastrophic, dreaded, uncontrollable, unknown to those exposed or unknown to science (Fischhoff et al., 1978). The way lay people perceive risks therefore is determined by two main factors: the first factor is an emotional or affective factor: a catastrophic, dreaded and/or uncontrolled risk is perceived as a high risk. The other factor deals with uncertainty: when the exposed subject does not know anything about the potential risk and no scientific data is available, subjects tend to perceive the risk as high. This means that a risk containing a high degree of both the affective and the uncertainty factor, will be perceived as high and draw relatively much attention, also in the media (MacGregor and Fleming, 1996).

Affect was defined by Slovic and colleagues as 'the specific quality of "goodness" or "badness" experienced as a feeling state (with or without consciousness) and demarcating a positive or a negative quality of a stimulus' (Slovic et al., 2002). This means that people base their judgments partly on how they feel about a potential hazard. As most people that go skiing will like that activity, they are moved to perceive the risk as low and the benefit as high. However, when one does not like the activity, the opposite is true (Alhakami and Slovic, 1994;Slovic et al., 2002).
One other complicating factor is trust, which enhances the perceived benefit, thus affecting the correlation between perceived risks and perceived benefit (Siegrist et al., 2005b).

EMF risk perception

For EMF, many of the factors that give rise to a highly perceived risk are present: though EMF exposure is becoming more and more common, most people will see it as unknown to themselves and to science and probably also as involuntary. It should be noted however that RF-EMF exposure can be both voluntary and involuntary: mobile phones in most cases are used on a voluntary base, whereas exposure to base stations generally will be involuntary. The same accounts for LF-EMF: using electrical equipment is much more voluntary than living near to power lines.

The importance of uncertainty in the risk perception of lay people was shown by MacGregor and colleagues. As said above, an uncertain risk is perceived as a high risk. MacGregor and co-workers provided subjects with a brochure which discussed the 'possible, but not proved' health effects of ELF exposure. After reading the brochure, subjects perceived the health risks of ELF exposure as higher than before reading the brochure (Siegrist et al., 2005a). In the interviews I performed, three subjects were asked for the role of uncertainty in their risk perception, only one agreed that the uncertainty of exposure increased the perceived risk. Six subjects stated that they were not worried about health

effects, as long as certainty can not be given about the health risks. Four subjects, when asked what they wanted to know before giving a good judgment on the risk of EMF exposure, explicitly stated that they wanted certainty about the health risks.
In 2005, Siegrist and colleagues conducted a study in Switzerland to evaluate general publics risk perception of mobile phones and base stations. The term 'base station' was in general associated with negative feelings, people who did not have negative associations perceived lower risks from base stations than subjects who did have negative associations. Base stations were seen as a bigger threat than mobile phones, whereas high-voltage transmission lines were seen as the most risky type of EMF sources (Siegrist et al., 2005b).

Mobile phones have benefits over fixed telephones; in the study by Siegrist and colleagues it was shown that there is a negative correlation between the perceived benefits and the perceived risk. People who perceive high benefits from mobile phone use, tend to perceive a lower risk. The same accounts for trust in the way governments handle with the possible threat. For example, when people have trust in the way the government handles with base station placement, the perceived risk of base stations is lower (Luhmann, 1988;Siegrist et al., 2005b).
In a study performed by a Norse consumer's organization, 1000 subject were asked about EMF uncertainty concerns. It appeared that in reaction to EMF uncertainties, less than half of the subjects trusted other agencies (such as the government and the communication industries). Slightly less than half of these confident subjects reported to take own measures, the others did not. Of the subjects not trusting other agencies, two third reported to take own measures. Overall, 25% of the subjects were comfortably confident whereas 35% of the subjects were skeptically cautious, taking own private measures (Berg et al., 2010).
In my interviews, seven people were asked if they trust the governments. Six of them answered negatively. Four subjects were explicitly asked for the reason why they did not trust governments, all of them answered that governments are too much focused on economic issues than citizen's health. Three interviewed subjects stated to take own measures, if the risk of EMF exposure would be clear to them. Only one subject reported to take own precautionary measures.

Perceived benefits also play a role in the EMF risk perception. Owners of mobile phones perceive the risks of mobile phones and base stations lower than persons not owning a mobile phone. The risk of base stations is generally perceived higher than the risk of mobile phones, which was also the case in an Austrian study (Hutter et al., 2004). Frequent mobile phone users perceived lower risk of mobile phone use than less frequent users. This however may be caused by a tendency of persons who perceive high risk to use their phones less or not at all (Siegrist et al., 2005b).
Other factors that appeared to influence the way people look at possible risks of EMF are female gender, belief in paranormal phenomena and certain reluctance towards any technological advance. All three variables were positively correlated to the perceived risk. The results of this study support the statement that both voluntariness as emotions play a role in risk perception (Fischhoff et al., 1978;MacGregor and Fleming, 1996;Siegrist et al., 2005b).

The role of affect in EMF risk perception was shown by a 2006 study using the implicit association test (IAT). This test is based on the fact that making a decision requires two modes of thinking: the experiential way and the analytical way. Lay people only use the experiential system, which is the emotional or affective way, whereas experts can use the analytical way of logical reasoning and evidence-based decision making. During the IAT, however, subjects have very little time to answer questions, as a result of which subjects only use their

experiential system. It appeared that in the IAT, lay people and experts judged mobile phone base stations and power lines similarly risky. These results support the idea that the affect is an important factor in risk perception which can be used parallel to the more delicate analytical system, which is used when one has more time for decision making (Slovic et al., 2002;Siegrist et al., 2006).

In the study by Siegrist and colleagues, trust in the government decreased the perceived risk: the authors state that public awareness of strong limiting values was stated to possibly decrease levels of risk perception of base stations (Siegrist et al., 2005b).
In another study, is was recommended to provide lay people with information to take away exaggerated fears, thus lowering perceived risks (Hutter et al., 2004).
A sure difficulty with the mobile phone communication is the rapid development, which makes it hard for researchers to conduct studies fast enough to make sure their results are relevant for the most recent exposure situations (Berg et al., 2010).
As EMF is a hot topic and it still can not be excluded that sub-reference levels RF-EMF exposure can cause aspecific health complaints, in many countries there is discussion whether precautionary measures should be taken or not (Wiedemann and Schutz, 2005). Theoretically, precautionary measures can have two effects: they can increase trust in risk management and thus lower risk perception, as stated above. On the other hand, precautionary measures might give lay people a hint that EMF might be something really risky, thus raising concerns and subsequently perceived risk. Wiedemann and Schütz tested both hypotheses and concluded that precautionary measures increase perceived risk but not trust in risk management (Wiedemann and Schutz, 2005), which is in contrast with the study by Siegrist an co-workers.

As discussed in the section above the way persons perceive risks can be split up into two ways: the experiential and the analytical way. Risk communication can alter the analytical way, giving people knowledge and a base to make decisions on. The experiential way in contrary, seems to be unlikely to be altered trough risk communication. The first judgments people make, therefore can probably not be influenced by risk communication strategies (Siegrist et al., 2006). Risk communication strategies can thus influence the more delayed judgment people make with respect to a risk, but the feeling they have by a certain risk most probably can not be altered by risk communication strategies.

Interviews

In my interviews, 3 subjects stated to be unsure about the risk of RF-EMF exposure and filled in ‘don’t know’ for all three RF-EMF exposure types. One more subject did not know the risk of base stations. Of the other subjects, 1 subject rated all three RF-EMF exposure risks as ‘sure’; all other subjects rated them as ‘possible’ or ‘probable’, one subject excepted who rated the risk of base stations as ‘sure.’ The risk of base stations was rated higher than the risk of mobile or cordless phone use. See figure 3 on the next page.

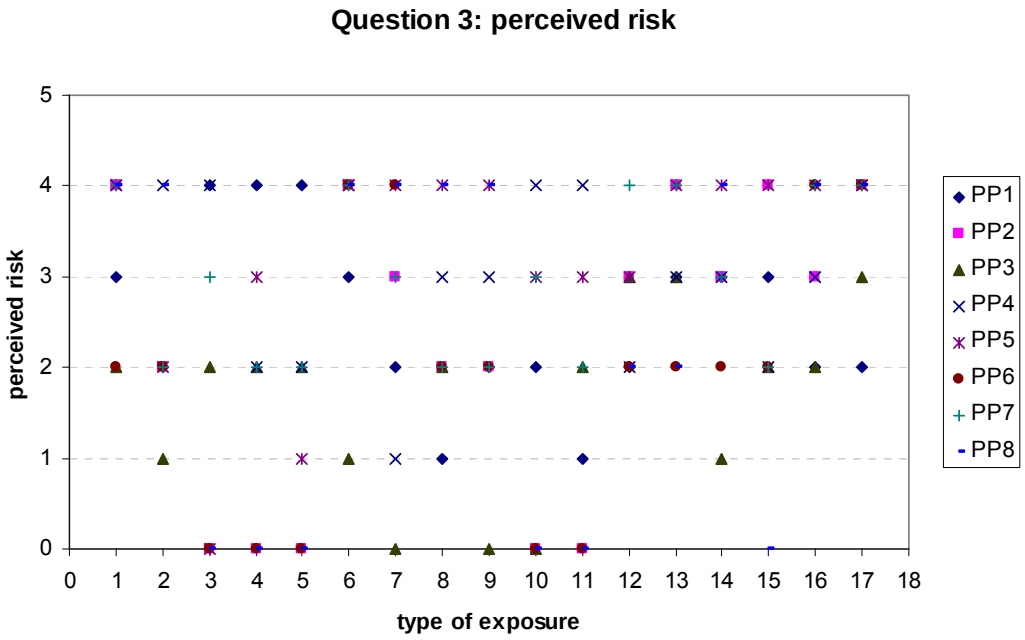


Figure 3 - answers on the third question in the questionnaire. Subjects had to rate the risk of exposure to several environmental factors. For a complete overview of the questions, see the questionnaire list in supplement 1. RF-EMF questions were questions 3 (mobile phone base stations), 4 (mobile phone use) and 5 (cordless phone use).
Risk ratings: 0= don't know, 1= surely no risk, 2= possible risk, 3= probable risk, 4= sure risk. PP# stands for subject number.

8. Perceived health

How do people perceive their health?

Health is a very complex issue and was defined by the WHO as ‘a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity’ (World Health Organization, 1948). So, not only the actual health status, but also the way people perceive their health determines their health for a great part as the perceived health is strongly correlated to wellbeing. Many factors influence the way people perceive and interpret their health. Somatic changes play the main role in illness perception. Somatic changes can be symptoms such as headache or ‘other perceived bodily conditions that signal a departure from a personalized norm of physical functioning’ (MacGregor and Fleming, 1996). Such a somatic change is not necessarily the result of an illness such as flu or a physical state such as fatigue. It can also be caused by stress or sensory clues such as taste or olfaction (e.g. the gag reflex after smelling someone’s vomit or after seeing someone eat nasal mucus). These complex relations are pictured in figure 4.

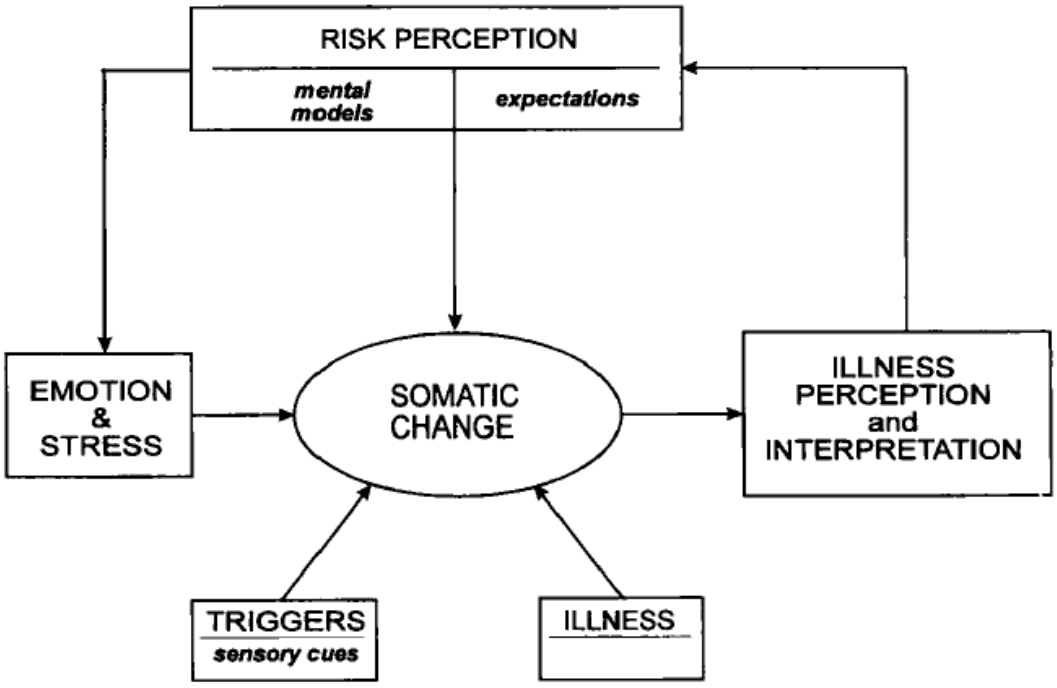


Figure 4 – Relations between perceived risk, stress, somatic changes and illness perception (from MacGregor and Fleming 1996; figure 1)

Based on perceived symptoms, many people believe they are able to determine the presence of asymptomatic conditions, such as hypertension, even when they are told that the conditions are asymptomatic. People thus stick to their own perception of symptoms, which they consider to be real. In addition, somatic changes can occur purely because the subjects expects to experience them (McFarland et al., 1989;MacGregor and Fleming, 1996). This means that in response to a high perceived risk or exposure, people may expect symptoms and hence instinctively amplify and interpret commonplace sensations to be symptoms (MacGregor and Fleming, 1996).

So, even when there is no scientific evidence of symptoms caused by a hazard, people still tend to attribute vague and common symptoms to this hazard. In fact, this suspicion of illness heightens symptom perception and distress and these in turn reinforce the judgment that one is ill. This process is called symptom amplification, and operates in all so called somatizers: people who tend to experience and communicate somatic distress in response to psychosocial stress and to seek medical help for it (Lipowski, 1988;Barsky and Borus, 1999). Somatization was stated to be the ground for the so-called functional somatic syndrome (SFD). One of the main variants of SFD might be IEI (Bailer et al., 2005).

Idiopathic Environmental Intolerance (IEI)

The IEI syndrome is characterized by a range of aspecific complaints which get attributed to environmental factors (Bailer et al., 2005). IEI is also called 'multiple chemical sensitivity' (MCS), although subjects suffering from it can be sensitive for more environmental factors than chemicals only (Andersson et al., 2009). One of the environmental factors individuals report to be hypersensitive to is the presence of EMF. Nowadays, electromagnetic hypersensitivity is more and more described as Idiopathic Environmental Intolerance attributed to electromagnetic fields (IEI-EMF) (Rubin et al., 2010).

Electromagnetic hypersensitivity (EHS)

There is an growing number of people that report being hypersensitive to EMF, these generally report unspecific symptoms such as headaches, sleep disorders, dizziness etc (Roosli et al., 2004). Electromagnetic hypersensitive (EHS) subjects attribute these health symptoms to electromagnetic fields (Roosli, 2008). Prevalence of EHS was estimated to be 1.5% in Sweden (Hillert et al., 2002), 3% in California (Levallois et al., 2002), 4% in the UK (Eltiti et al., 2007b), 5% in Switzerland (Schreier et al., 2006) and 8-10% in Germany (Roosli, 2008), so there are some reported differences between populations, but the absolute number of people affected can considered to be quite big.
In a study by Röösli and colleagues in 2004, people who reported EMF-related health problems were questioned about their experiences. It appeared that 56% of them declared to be able to sense electromagnetic fields (Roosli et al., 2004). In contrast to experimental studies, in observational studies, an association between EMF exposure and symptoms was reported several times.

As discussed in chapter 6, it is doubted if people can detect low level RF-EMF in everyday life. Demonstrating person's inability to detect EMF was suggested to be a helpful therapeutic option as it might take away the perception of getting ill from EMF (Roosli, 2008), thus reducing illness.
Most experimental studies that have been done to determine if electromagnetic sensibility indeed exists are double blinded provocation studies: subjects as well as researchers do not know if the subjects are exposed to an electromagnetic field. Subjects have to report their symptoms and afterwards the number and severity of symptoms can be determined in exposed conditions compared to shame conditions.
In another setting, subjects can also be divided in two groups: self-declared EHS subjects and control subjects. In that case, the ability of EHS subjects to distinguish the exposed conditions from the shame conditions can be compared to the control subject's abilities to do so (Rubin et al., 2005). As was discussed above, EHS subjects were not able to sense electromagnetic fields better than control subjects. However, when EHS subjects experience symptoms during exposure, their health state may guide them in judging whether they are exposed or not.

In some experimental studies, there were some indications of nocebo effect. The nocebo effect basically is the inverse of the placebo effect. Whereas in the placebo effect health improvement occur due to expectations, in the nocebo effect adverse symptoms occur due to expectation (Roosli, 2008). In one study, some subjects experienced severe headache during sham conditions (Rubin et al., 2006).
In some other studies, EHS subjects experienced increased symptoms when they thought they were exposed (Lonne-Rahm et al., 2000) or after they were told they were exposed but not when they were not told whether they were exposed or not (Oftedal et al., 2007;Eltiti et al., 2007a). In a 2008 study with self-reported EHS subjects and control subjects, controls felt no sensation during sham conditions in 60% of all series, whereas EHS subject only felt no sensation during 40% of sham conditions. Hence, EHS subject do not have higher abilities to discriminate real EMF exposure from shame exposure, even when they can navigate on their self-reported EMF-related symptoms (Landgrebe et al., 2008).

Sleeping problems is one of the main symptoms EHS individuals report (Roosli et al., 2004). Several cross-sectional and experimental studies however have not been able to show a negative effect of exposure to RF-EMF from mobile phones on reported sleep quality or daytime fatigue (Huber et al., 2000;Koivisto et al., 2001;Hutter et al., 2006).
Another main symptom which is reported by EHS subjects is headache (Roosli et al., 2004). In two experimental studies, no association between exposure to RF-EMF from mobile phones or base stations and headache was found (Koivisto et al., 2001;Zwamborn et al., 2003). In two observational studies, an increase in headache was reported with increasing use of mobile phones (Chia et al., 2000;Sandstrom et al., 2001), in another study with a smaller sample size, this effect was not found (Santini et al., 2001;Seitz et al., 2005). In the study by Hutter and colleagues, who measured base station exposure in subject's sleeping rooms, measured power density was significantly related to headaches (Hutter et al., 2006).
Concentration difficulties is another much reported symptom in EHS subjects (Roosli et al., 2004;Eltiti et al., 2007b). After some contradicting results in the past (Eltiti et al., 2009), more recently larger studies found no effect of mobile phone emissions on attention or memory (Russo et al., 2006;Unterlechner et al., 2008;Cinel et al., 2008) in non-EHS subjects.

Although there is uncertainty about the relation between EMF and health, more than half of EHS individuals in the 2004 Röösli study declared that impairments due to their symptoms was 'severe' or 'very severe (Roosli et al., 2004).' So, despite the fact that a correlation between EMF and impaired health was never proved, the social and health care problem is real.

Interviews

In the interviews, no subjects reported any health complaints caused by EMF exposure either at present or in the past. Four people where asked for their opinion about EHS. Three of them were very skeptical. One other subject assumed that if there would be more publicity about EMF, he/she probably would start attributing symptoms to it, since he/she stated to be easily influenced.

9. Associations between RF-EMF exposure perception, RF-EMF risk perception and perceived symptoms/health complaints

Linkage of perceived risk and perceived exposure

Using questionnaires about various environmental exposures, it was shown by MacGregor and co-workers that lay people tend to increase their perceived exposure when they perceive the risk that is caused by the exposure as high (MacGregor et al., 1999). With other words: a perceived high risk of health effects, leads to a high exposure perception. This implies that perceived exposure and perceived health consequences are related to each other (MacGregor et al., 1999).

Linkage of perceived risk and perceived health

As was discussed in section 7, female gender is positively correlated with perceived EMF risk (Siegrist et al., 2005b). In a randomized survey, Frick *et al.* tried to estimate the effect of personality and cognitive characteristics on EMF-related complaints (Frick et al., 2002). They expected females and subject with high somatization rates to report more EMF-related complaints. Subjects were interviewed for health complaints and analyzed for personality traits. In the middle of the interview, they had to evaluate the risk of various scenarios. Females and subjects with high tendency for somatization indeed reported more complaints. Females were shown to be more likely to show high somatization tendencies, which difference was corrected for in the other outcomes. Subjects with high somatization tendencies reported markedly more symptoms when the threat of the scenario presented to them was low. So, high somatization tendencies have an effect on the perception of low threats mainly (Frick et al., 2002).
In section 8, it was stated that somatic changes can occur due to expectations (McFarland et al., 1989;MacGregor and Fleming, 1996). When people perceive a high risk, they might expect symptoms and thus amplify and attribute commonplace sensations to be symptoms, caused by the risk they fear (MacGregor and Fleming, 1996).

When people experience health problems and attribute these problems to an exposure to an environmental factor, than either the exposure, the risk or both must be perceived as big. So, depending on the perceived exposure, the worse the health is perceived, the bigger the perceived risk is.

Linkage of perceived exposure and perceived health

As mentioned earlier, somatic changes can occur due to expectations (McFarland et al., 1989;MacGregor and Fleming, 1996). When people perceive a high exposure, and perceive this as a threat to their health, they might expect symptoms and thus amplify and attribute commonplace sensations to be symptoms (MacGregor and Fleming, 1996).
In addition, the hint that one is being exposed to something hazardous leads to a search for symptoms that could probably be caused by the hazard one is exposed to (MacGregor and Fleming, 1996).
Research by MacGregor and colleagues showed that lay people have the tendency to equate an exposure to a health effect, even if the exposure is very small (MacGregor et al., 1999).
Many commonplace symptoms can be attributed to a supposed exposure. For example, symptoms that are caused by a mild flu can be improperly attributed to

EMF exposure. As people feel illness, they are searching for a reason why they are ill. Perceived exposure to EMF might give a clue that the symptoms are caused by the EMF (MacGregor and Fleming, 1996).
In an experimental provocation study, symptoms were correlated to the perceived field strength rather than to the actual field strength, even when the perceived field strength was not correlating with the actual field strength. This was the case in both EHS as non-EHS subjects (Regel et al., 2006) and stresses the strong relationship between perceived exposure and perceived symptoms.

When people experience commonplace symptoms and start reasoning about symptom attribution, which tendency they have, as was discussed above, they can easily conclude that their health status is caused by the exposure they fear. They than perceive their exposure as big enough to cause symptoms (MacGregor and Fleming, 1996). As discussed above can the recognition of being exposed lead to symptom attributing, thus completing a self-perpetuating cycle.

Interviews

In the interviews, seven of eight subjects rated almost all risks of RF-EMF exposure as ‘possible’ or ‘probable’ or did not know have to rate the risk. None of these subjects reported any health complaints attributed to RF-EMF but the sample size was too small conclude that in these subjects there was a relation between their perceived risks and perceived health. The subject that rated the RF-EMF risks as ‘sure’ did also report no health complaints. This subject was also skeptical towards EHS. Although the risks of RF-EMF exposures was not rated higher than ‘possible’ by seven subjects, some of them rated their exposure to mobile and cordless phones as high or very high. They gave reasons like ‘I use cordless phones during my work all day’ or ‘I use my mobile phone to call my girlfriend every evening’ but did not give any hint that a perceived risk might be a reason for their high exposure perception.
As said, no subjects reported any health complaints which they attributed to RF-EMF exposure. Exposure to mobile phone base stations was perceived as low by all subjects. One subject reported that he/she was easy influencable and likely to attribute health complaints when he/she would know to be exposed to EMF. Although this subject rated his/her exposure to mobile phone base stations as low, nearest mobile phone base station was located at a distance of 400m. As the highest exposure in urban areas is around 300m distance from the antenna, exposure of this subject might be substantial. Probably, his/her perceived health state was related to his/her perceived low exposure.

10. Discussion

Nowadays, everyday exposure to RF-EMFs is of public concern with a substantial number of people claiming to get ill from it. Although scientific research has not led to evidence that sub-reference levels exposure to RF-EMF causes health symptoms, a causal relationship can not be ruled out (Seitz et al., 2005;Rubin et al., 2005;Feychting et al., 2005;Roosli, 2008). The same is true for the occurrence of electromagnetic hypersensitivity; EHS individuals may indeed exist but self-reported EHS individuals are not consistently better in sensing EMF exposure than non-EHS individuals (Leitgeb and Schrottner, 2003;Rubin et al., 2005).

Female gender was one of the factors that were positively correlated to the perceived risk of EMF (Siegrist et al., 2005b). Interestingly, women were found to have lower perception thresholds for electric currents than men have (Leitgeb and Schrottner, 2003), possibly predisposing them to electromagnetic sensibility. Both factors would therefore predispose women towards EHS compared to men.

An important issue is whether EMF-related symptoms occur above a high, localized threshold level or if a cumulative, whole body and probably lower exposure is more important. The latter is often suggested by EHS individuals (Seitz et al., 2005). If that is true, mobile communication base stations may be a much bigger threat than mobile phone use, and experimental studies that use short, high exposure are not valuable at all.
Objective exposure measurements are very difficult, which make it difficult to draw conclusion out of results since wrong conclusions can be drawn when exposure has been assessed incorrectly.

To date, no direct causal link has been established between sub-reference levels of EMF exposure and self-reported health effects (Roosli et al., 2004) and despite the given fact that technological progress goes very fast, more research should be done to clarify if there is a causal link between exposure to electromagnetic fields and health symptoms. When short term experimental studies are not enough, scientific research might focus on a more retrospective approach. Although self-reported exposure assessment is not perfect (Vrijheid et al., 2009;Inyang et al., 2009), this might lead to a better view on potential symptom patterns or exposure patterns. In addition, prospective studies should be initialized, eliminating the recall bias problem. Although this approach takes time, a clear correlation between EMF exposure and health effects, if present, should be shown.

In one study, EHS individuals were compared to non-EHS subjects on different points. It appeared that EHS subjects had a poorer general health condition than controls (Landgrebe et al., 2008). EHS individuals were also found to have a higher skin conductance than control subjects (Eltiti et al., 2009), indicating a higher stress level during test. It is unknown what causes these higher levels of skin conductance and what the possible effect of this is but Lyskov *et al.* have hypothesized that EHS subjects may have a general imbalanced autonomic nervous system regulation (Lyskov et al., 2001;Eltiti et al., 2009).
In addition, EHS subjects had significant cognitive and neurobiological differences compared to controls (Landgrebe et al., 2008). However, it is unclear if these alterations are a cause or result of the impaired health status of people suffering from EHS or a result of long-term EMF exposure.
Recent studies have made clear that the expectation of benefit after placebo administration indeed alters neurobiological mechanisms. Therefore, the nocebo

effect can rely on similar biological mechanisms and thus be a real cause for biological alterations in one's body (Enck et al., 2008;Zubieta and Stohler, 2009). A respectable number of epidemiological as well as experimental studies have yet not been able to reveal a direct causal between objective RF-EMF exposure and the health complaints attributed to RF-EMF by people who claim to be hypersensitive to electromagnetic fields. It was argued that electromagnetic hypersensitivity might be a complex interplay of intra-individual factors (such as behavioral traits and genetic background) and environmental factors (such as stress and RF-EMF exposure) (Landgrebe et al., 2008).

In this thesis, a brief overview was given of the role of perception in the way people react to EMF. Quite much psychological knowledge is available about risk perception and related issues but linkage to EMF-related health concerns are still rare. As limited time was available, not all details could be studied and discussed. The performed interviews were a nice chance to get some insight in how individuals think about EMF and related affairs. The number of subjects, however, was too small to draw conclusions from these results.

With no clear scientific data about the health effects of sub-reference levels RF-EMF exposure available, WHO recommends general practitioners to focus on taking away symptoms rather than on the EHS individuals perceived need for eliminating EMF in the living place (World Health Organization, 2005). Röösli suggested that showing the inability of EHS subjects to rate their EMF exposure would lead to better therapeutic opportunities as this might take away one's perception of getting in from EMF (Roosli, 2008). On the other hand, people who experience EMF-related symptoms will be in a search for recognition and might turn themselves into a victim's role when science states that they can not feel what they apparently feel.
Taken into account that in the coming years the exposure to EMFs will probably increase due to technological improvements, and that possible health effects of EMF get more and more attention in the media, the prevalence of EHS might well increase. As EHS is determined by a combination of factors, such as personality, somatizing individuals who get knowledge of the EMF issue are likely to attribute their potential health symptoms to EMF exposure. Increasing numbers of self-reported EHS patients will increase media attention, thus leading to a self-perpetuating circle.

11. Conclusions

Some studies measured personal exposure to EMF, these studies showed an exposure well below ICNIRP reference levels. Not much is known about perceived exposure in the general population, although some people claim to be able to sense EMF, this was not proven in experimental settings. In addition, some people claim to be hypersensitive to EMFs, attributing health complaints to EMF exposure. Perceived EMF exposure, however, can differ significantly from objective exposure. At present, nothing is known about the relation between sub-reference RF-EMF exposure and consequential, objective health symptoms. EMF risk perception is positively correlated with perceived EMF exposure and subjective health complaints, but not with objective EMF exposure. Health complaints, in turn, are positively correlated with the perceived EMF risk and exposure, but not with objective exposure.

12. Recommendations

I recommend more research on the topics discussed in this thesis. More attention should be focused on the possible long-term effects of sub-reference levels RF-EMF exposure.
Besides, EHS patients should be taken serious in their health complaints. On the other hand, there should be a way to show them the psychological background of their health complaints. Convincing EHS subjects from the relatively small importance of EMF exposure in their disorder might lower perception of EMF risks, exposure as well as health complaints.

13. References

References

Investigations of electrosensitivity to a GSM signal at 900 MHz for a self-reported electrosensitive target group. In: BEMS I, editor. Bioelektromagnetische Society, München, 2000, p. 269.

Alanko T, Hietanen M. Occupational exposure to radiofrequency fields in antenna towers. Radiat Prot Dosimetry 2007; 123: 537-539.

Alhakami AS, Slovic P. A psychological study of the inverse relationship between perceived risk and perceived benefit. Risk Anal 1994; 14: 1085-1096.

Andersson MJ, Andersson L, Bende M, Millqvist E, Nordin S. The idiopathic environmental intolerance symptom inventory: development, evaluation, and application. J Occup Environ Med 2009; 51: 838-847.

Bailer J, Witthoft M, Paul C, Bayerl C, Rist F. Evidence for overlap between idiopathic environmental intolerance and somatoform disorders. Psychosom Med 2005; 67: 921-929.

Bakker JF, Paulides MM, Christ A, Kuster N, van Rhoon GC. Assessment of induced SAR in children exposed to electromagnetic plane waves between 10 MHz and 5.6 GHz. Phys Med Biol 2010; 55: 3115-3130.

Barsky AJ, Borus JF. Functional somatic syndromes. Ann Intern Med 1999; 130: 910-921.

Berg, L, Slettemeaes, D, and Throne-Holst, H. The EMF uncertainty problem related to mobile phones: where do consumers place their trust? International Journal of Consumer Studies 34, 121-132. 1-2-2010. Blackwell Publishing Ltd.
Ref Type: Magazine Article

Chia SE, Chia HP, Tan JS. Prevalence of headache among handheld cellular telephone users in Singapore: a community study. Environ Health Perspect 2000; 108: 1059-1062.

Cinel C, Boldini A, Fox E, Russo R. Does the use of mobile phones affect human short-term memory or attention? Appl Cogn Psychol 2008; 22: 1113-1125.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Fox E. Short-term exposure to mobile phone base station signals does not affect cognitive functioning or physiological measures in individuals who report sensitivity to electromagnetic fields and controls. Bioelectromagnetics 2009; 30: 556-563.

Eltiti S, Wallace D, Ridgewell A, Zougkou K, Russo R, Sepulveda F, Mirshekar-Syahkal D, Rasor P, Deeble R, Fox E. Does short-term exposure to mobile phone base station signals increase symptoms in individuals who report sensitivity to electromagnetic fields? A double-blind randomized provocation study. Environ Health Perspect 2007a; 115: 1603-1608.

Eltiti S, Wallace D, Zougkou K, Russo R, Joseph S, Rasor P, Fox E. Development and evaluation of the electromagnetic hypersensitivity questionnaire. Bioelectromagnetics 2007b; 28: 137-151.

Enck P, Benedetti F, Schedlowski M. New insights into the placebo and nocebo responses. Neuron 2008; 59: 195-206.

Feychting M, Ahlbom A, Kheifets L. EMF and health. Annu Rev Public Health 2005; 26: 165-189.

Fischhoff B, Slovic P, Lichtenstein S, Read S, Combs B. How Safe Is Safe Enough - Psychometric Study of Attitudes Towards Technological Risks and Benefits. Policy Sciences 1978; 9: 127-152.

Frick U, Rehm J, Eichhammer P. Risk perception, somatization, and self report of complaints related to electromagnetic fields--a randomized survey study. Int J Hyg Environ Health 2002; 205: 353-360.

Habash RW, Elwood JM, Krewski D, Lotz WG, McNamee JP, Prato FS. Recent advances in research on radiofrequency fields and health: 2004-2007. J Toxicol Environ Health B Crit Rev 2009; 12: 250-288.

Hillert L, Berglind N, Arnetz BB, Bellander T. Prevalence of self-reported hypersensitivity to electric or magnetic fields in a population-based questionnaire survey. Scand J Work Environ Health 2002; 28: 33-41.

Huber R, Graf T, Cote KA, Wittmann L, Gallmann E, Matter D, Schuderer J, Kuster N, Borbely AA, Achermann P. Exposure to pulsed high-frequency electromagnetic field during waking affects human sleep EEG. Neuroreport 2000; 11: 3321-3325.

Hutter HP, Moshammer H, Wallner P, Kundi M. Public perception of risk concerning celltowers and mobile phones. Soz Praventivmed 2004; 49: 62-66.

Hutter HP, Moshammer H, Wallner P, Kundi M. Subjective symptoms, sleeping problems, and cognitive performance in subjects living near mobile phone base stations. Occup Environ Med 2006; 63: 307-313.

Inyang I, Benke G, Dimitriadis C, Simpson P, McKenzie R, Abramson M. Predictors of mobile telephone use and exposure analysis in Australian adolescents. J Paediatr Child Health 2010.

Inyang I, Benke G, Morrissey J, McKenzie R, Abramson M. How well do adolescents recall use of mobile telephones? Results of a validation study. BMC Med Res Methodol 2009; 9: 36.

Koivisto M, Haarala C, Krause CM, Revonsuo A, Laine M, Hamalainen H. GSM phone signal does not produce subjective symptoms. Bioelectromagnetics 2001; 22: 212-215.

Kowall B, Breckenkamp J, Heyer K, Berg-Beckhoff G. German wide cross sectional survey on health impacts of electromagnetic fields in the view of general practitioners. Int J Public Health 2009.

Kwon MS, Koivisto M, Laine M, Hamalainen H. Perception of the electromagnetic field emitted by a mobile phone. Bioelectromagnetics 2008; 29: 154-159.

Landgrebe M, Frick U, Hauser S, Langguth B, Rosner R, Hajak G, Eichhammer P. Cognitive and neurobiological alterations in electromagnetic hypersensitive patients: results of a case-control study. Psychol Med 2008; 38: 1781-1791.

Leitgeb N, Schrottner J. Electrosensibility and electromagnetic hypersensitivity. Bioelectromagnetics 2003; 24: 387-394.

Levallois P, Neutra R, Lee G, Hristova L. Study of self-reported hypersensitivity to electromagnetic fields in California. Environ Health Perspect 2002; 110 Suppl 4: 619-623.

Lipowski ZJ. Somatization: the concept and its clinical application. Am J Psychiatry 1988; 145: 1358-1368.

Lonne-Rahm S, Andersson B, Melin L, Schultzberg M, Arnetz B, Berg M. Provocation with stress and electricity of patients with "sensitivity to electricity". J Occup Environ Med 2000; 42: 512-516.

Luhmann N. Familiarity, confidence, trust: problems and alternatives. In: Gambetta ID, editor. Trust: Making and Breaking Cooperative Relations. Basic Blackwell, Oxford, 1988, pp. 94-107.

Lyskov E, Sandstrom M, Hansson MK. Neurophysiological study of patients with perceived 'electrical hypersensitivity'. Int J Psychophysiol 2001; 42: 233-241.

MacGregor DG, Fleming R. Risk perception and symptom reporting. Risk Anal 1996; 16: 773-783.

MacGregor DG, Slovic P, Malmfors T. "How exposed is exposed enough?" Lay inferences about chemical exposure. Risk Anal 1999; 19: 649-659.

McFarland C, Ross M, DeCourville N. Women's theories of menstruation and biases in recall of menstrual symptoms. J Pers Soc Psychol 1989; 57: 522-531.

Oftedal G, Straume A, Johnsson A, Stovner LJ. Mobile phone headache: a double blind, sham-controlled provocation study. Cephalalgia 2007; 27: 447-455.

Regel SJ, Negovetic S, Roosli M, Berdinas V, Schuderer J, Huss A, Lott U, Kuster N, Achermann P. UMTS base station-like exposure, well-being, and cognitive performance. Environ Health Perspect 2006; 114: 1270-1275.

Roosli M. Radiofrequency electromagnetic field exposure and non-specific symptoms of ill health: a systematic review. Environ Res 2008; 107: 277-287.

Roosli M, Moser M, Baldinini Y, Meier M, Braun-Fahrlander C. Symptoms of ill health ascribed to electromagnetic field exposure--a questionnaire survey. Int J Hyg Environ Health 2004; 207: 141-150.

Rubin GJ, Das MJ, Wessely S. Electromagnetic hypersensitivity: a systematic review of provocation studies. Psychosom Med 2005; 67: 224-232.

Rubin GJ, Hahn G, Everitt BS, Cleare AJ, Wessely S. Are some people sensitive to mobile phone signals? Within participants double blind randomised provocation study. BMJ 2006; 332: 886-891.

Rubin GJ, Nieto-Hernandez R, Wessely S. Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies. Bioelectromagnetics 2010; 31: 1-11.

Russo R, Fox E, Cinel C, Boldini A, Defeyter MA, Mirshekar-Syahkal D, Mehta A. Does acute exposure to mobile phones affect human attention? Bioelectromagnetics 2006; 27: 215-220.

Samkange-Zeeb F, Berg G, Blettner M. Validation of self-reported cellular phone use. J Expo Anal Environ Epidemiol 2004; 14: 245-248.

Sandstrom M, Wilen J, Oftedal G, Hansson MK. Mobile phone use and subjective symptoms. Comparison of symptoms experienced by users of analogue and digital mobile phones. Occup Med (Lond) 2001; 51: 25-35.

Santini R, Seigne M, Bonhomme-Faivre L, Bouffet S, Defrasne E, Sage M. [Symptoms reported by mobile cellular telephone users]. Pathol Biol (Paris) 2001; 49: 222-226.

Schreier N, Huss A, Roosli M. The prevalence of symptoms attributed to electromagnetic field exposure: a cross-sectional representative survey in Switzerland. Soz Praventivmed 2006; 51: 202-209.

Seitz H, Stinner D, Eikmann T, Herr C, Roosli M. Electromagnetic hypersensitivity (EHS) and subjective health complaints associated with electromagnetic fields of mobile phone communication--a literature review published between 2000 and 2004. Sci Total Environ 2005; 349: 45-55.

Siegrist M, Earle TC, Gutscher H, Keller C. Perception of mobile phone and base station risks. Risk Anal 2005a; 25: 1253-1264.

Siegrist M, Earle TC, Gutscher H, Keller C. Perception of mobile phone and base station risks. Risk Anal 2005b; 25: 1253-1264.

Siegrist M, Keller C, Cousin ME. Implicit attitudes toward nuclear power and mobile phone base stations: support for the affect heuristic. Risk Anal 2006; 26: 1021-1029.

Siegrist M, Keller C, Kiers HA. A new look at the psychometric paradigm of perception of hazards. Risk Anal 2005c; 25: 211-222.

Slovic, P., Finucane, L., Peters, E., and MacGregor, D. G. Risk as analysis and risk as feelings. http://www.decisionresearch.org/pdf/dr502.pdf . 2002. 10-5-2010.
Ref Type: Electronic Citation

Starr C. Social benefit versus technological risk. Science 1969; 165: 1232-1238.

Thomas S, Heinrich S, von KR, Radon K. Exposure to radio-frequency electromagnetic fields and behavioural problems in Bavarian children and adolescents. Eur J Epidemiol 2010; 25: 135-141.

Thomas S, Kuhnlein A, Heinrich S, Praml G, Nowak D, von KR, Radon K. Personal exposure to mobile phone frequencies and well-being in adults: a cross-sectional study based on dosimetry. Bioelectromagnetics 2008; 29: 463-470.

Unterlechner M, Sauter C, Schmid G, Zeitlhofer J. No effect of an UMTS mobile phone-like electromagnetic field of 1.97 GHz on human attention and reaction time. Bioelectromagnetics 2008; 29: 145-153.

Valberg PA, van Deventer TE, Repacholi MH. Workgroup report: base stations and wireless networks-radiofrequency (RF) exposures and health consequences. Environ Health Perspect 2007; 115: 416-424.

Viel JF, Clerc S, Barrera C, Rymzhanova R, Moissonnier M, Hours M, Cardis E. Residential exposure to radiofrequency fields from mobile phone base stations, and broadcast transmitters: a population-based survey with personal meter. Occup Environ Med 2009; 66: 550-556.

Vrijheid M, Armstrong BK, Bedard D, Brown J, Deltour I, Iavarone I, Krewski D, Lagorio S, Moore S, Richardson L, Giles GG, McBride M, Parent ME, Siemiatycki J, Cardis E. Recall bias in the assessment of exposure to mobile phones. J Expo Sci Environ Epidemiol 2009; 19: 369-381.

Wiedemann PM, Schutz H. The precautionary principle and risk perception: experimental studies in the EMF area. Environ Health Perspect 2005; 113: 402-405.

World Health Organization. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference. http://www.who.int/about/definition/en/print.html/ . 1948.
Ref Type: Electronic Citation

World Health Organization. Electromagnetic fields and public health, fact sheet No 296. www.WHO.int . 31-12-2005. 13-4-2010.
Ref Type: Electronic Citation

World Health Organization. What are electromagnetic fields? http://www.who.int/peh-emf/about/WhatisEMF/en/ . 2010. 7-5-2010.
Ref Type: Electronic Citation

Zubieta JK, Stohler CS. Neurobiological mechanisms of placebo responses. Ann N Y Acad Sci 2009; 1156: 198-210.

Zwamborn, A. P. M., Vossen, S. H. J. A., van Leersum, B. J. A. M., Ouwens, M. A., and Mäkel, W. N. Effects of Global Communication system radio-frequency fields on Well Being and Cognitive Functions of human subjects with and without subjective complaints. 2003. 7-5-2010.
Ref Type: Unpublished Work

14. Abbreviations and glossary

ELF-EMF: Extreme low frequency electromagnetic field

ICNIRP: International Commission on Non-Ionizing Radiation Protection.

IEI-EMF: Idiopathic Environmental Intolerance with attribution to electromagnetic fields

RF-EMF: Radiofrequency electromagnetic field

SFD: Somatoform disorder

Electromagnetic hypersensitivity (EHS): a variety of non-specific symptoms, which afflicted individuals attribute to exposure to EMF (defined by the WHO).

Health: a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity (defined by the WHO).

Idiopathic Environmental Intolerance (IEI): a general term for sensitivity to environmental factors (defined by the WHO).

Risk perception: the subjective judgment people make about a risk.

Somatization: a tendency to experience and communicate somatic distress in response to psychosocial stress and to seek medical help for it (defined by Lipowski, 1988).

Supplement 1: Interview script and questionnaire

PPN: └──┴──┘
WSN: └──┴──┘
Datum: 2 0 1 0
└──┴──┘ └──┴──┘ └──┴──┴──┴──┘
dag maand jaar

VRAGENLIJST

Algemene vragen

1.	**Bent u een vrouw of een man?**
	□ vrouw □ man

2.	**Wat is uw geboortedatum?**
	1 9 └──┴──┘ └──┴──┘ └──┴──┴──┴──┘ dag maand jaar

3.	**Heeft u kinderen?**
	□ ja □ nee

Alledaagse omstandigheden

Hieronder volgen een aantal alledaagse omstandigheden die in het leven en in de leefomgeving kunnen voorkomen. We willen u daarover een aantal vragen stellen.

4.	**In welke mate wordt u blootgesteld aan of heeft u te maken met het volgende?**								
			Geheel niet **– – –**	**– –**	**–**	**+/–**	**+**	**++**	Zeer veel **+++**
	A	Luchtverontreiniging (bv. uitlaatgassen)	□	□	□	□	□	□	□
	B	Onbehaaglijke binnenlucht/klimaat	□	□	□	□	□	□	□
	C	Zendmast(en) voor mobiele telefonie	□	□	□	□	□	□	□
	D	Het gebruik van een mobiele telefoon	□	□	□	□	□	□	□
	E	Het gebruik van een draadloze telefoon	□	□	□	□	□	□	□
	F	Spanning of stress	□	□	□	□	□	□	□
	G	Problemen met bekostiging levensonderhoud	□	□	□	□	□	□	□
	H	Geuroverlast in de woonomgeving	□	□	□	□	□	□	□
	I	Geluidsoverlast in de woonomgeving	□	□	□	□	□	□	□
	J	Hoogspanningslijnen in de woonomgeving	□	□	□	□	□	□	□
	K	Transformatorhuisje(s) in de woonomgeving	□	□	□	□	□	□	□
	L	Kunstmatige toevoegingen in voedingsmiddelen	□	□	□	□	□	□	□
	M	Chemische bestrijdingsmiddelen in en om het huis (zoals middelen tegen insecten, onkruid, slakken)	□	□	□	□	□	□	□
	N	Een onveilig gevoel op straat	□	□	□	□	□	□	□
	O	Nabijheid intensieve veeteelt in de leefomgeving	□	□	□	□	□	□	□
	P	Gebrek aan goede sociale contacten	□	□	□	□	□	□	□
	Q	UV-stralen van de zon of zonnebank	□	□	□	□	□	□	□

5.	**Als u zich vergelijkt met 'de gemiddelde Nederlander', wordt u dan lager of hoger blootgesteld aan het volgende?**								
			Veel lager **– – –**	**– –**	**–**	**+/–**	**+**	**++**	Veel hoger **+++**
	A	Luchtverontreiniging (bv. uitlaatgassen)	□	□	□	□	□	□	□
	B	Onbehaaglijke binnenlucht/klimaat	□	□	□	□	□	□	□
	C	Zendmast(en) voor mobiele telefonie	□	□	□	□	□	□	□
	D	Het gebruik van een mobiele telefoon	□	□	□	□	□	□	□
	E	Het gebruik van een draadloze telefoon	□	□	□	□	□	□	□
	F	Spanning of stress	□	□	□	□	□	□	□
	G	Problemen met bekostiging levensonderhoud	□	□	□	□	□	□	□
	H	Geuroverlast in de woonomgeving	□	□	□	□	□	□	□
	I	Geluidsoverlast in de woonomgeving	□	□	□	□	□	□	□
	J	Hoogspanningslijnen in de woonomgeving	□	□	□	□	□	□	□
	K	Transformatorhuisje(s) in de woonomgeving	□	□	□	□	□	□	□
	L	Kunstmatige toevoegingen in voedingsmiddelen	□	□	□	□	□	□	□
	M	Chemische bestrijdingsmiddelen in en om het huis (zoals middelen tegen insecten, onkruid, slakken)	□	□	□	□	□	□	□
	N	Een onveilig gevoel op straat	□	□	□	□	□	□	□
	O	Nabijheid intensieve veeteelt in de leefomgeving	□	□	□	□	□	□	□
	P	Gebrek aan goede sociale contacten	□	□	□	□	□	□	□
	Q	UV-stralen van de zon of zonnebank	□	□	□	□	□	□	□

6.	**Denkt u dat blootstelling aan het volgende in alledaagse omstandigheden een risico vormt voor de gezondheid?**						
			Zeker niet	Mogelijk	Waarschijnlijk	Zeker wel	Weet ik niet
	A	Luchtverontreiniging (bv. uitlaatgassen)	□	□	□	□	□
	B	Onbehaaglijke binnenlucht/klimaat	□	□	□	□	□
	C	Zendmast(en) voor mobiele telefonie	□	□	□	□	□
	D	Het gebruik van een mobiele telefoon	□	□	□	□	□
	E	Het gebruik van een draadloze telefoon	□	□	□	□	□
	F	Spanning of stress	□	□	□	□	□
	G	Problemen met bekostiging levensonderhoud	□	□	□	□	□
	H	Geuroverlast in de woonomgeving	□	□	□	□	□
	I	Geluidsoverlast in de woonomgeving	□	□	□	□	□
	J	Hoogspanningslijnen in de woonomgeving	□	□	□	□	□
	K	Transformatorhuisje(s) in de woonomgeving	□	□	□	□	□
	L	Kunstmatige toevoegingen in voedingsmiddelen	□	□	□	□	□
	M	Chemische bestrijdingsmiddelen in en om het huis (zoals middelen tegen insecten, onkruid, slakken)	□	□	□	□	□
	N	Een onveilig gevoel op straat	□	□	□	□	□
	O	Nabijheid intensieve veeteelt in de leefomgeving	□	□	□	□	□
	P	Gebrek aan goede sociale contacten	□	□	□	□	□
	Q	UV-stralen van de zon of zonnebank	□	□	□	□	□

7.	Heeft u nu of in het verleden gezondheidsproblemen (gehad) die u in verband brengt met het volgende? Zo ja, wat is of was uw belangrijkste gezondheidsprobleem?					
			Ja: nu, namelijk…	**Ja: voorheen, namelijk….**	**Nee**	**N.v.t.**
	A	Luchtverontreiniging (bv. uitlaatgassen)			□	□
	B	Onbehaaglijke binnenlucht/klimaat			□	□
	C	Zendmast(en) voor mobiele telefonie			□	□
	D	Het gebruik van een mobiele telefoon			□	□
	E	Het gebruik van een draadloze telefoon			□	□
	F	Spanning of stress			□	□
	G	Problemen met bekostiging levensonderhoud			□	□
	H	Geuroverlast in de woonomgeving			□	□
	I	Geluidsoverlast in de woonomgeving			□	□
	J	Hoogspanningslijnen in de woonomgeving			□	□
	K	Transformatorhuisje(s) in de woonomgeving			□	□
	L	Kunstmatige toevoegingen in voedingsmiddelen			□	□
	M	Chemische bestrijdingsmiddelen in en om het huis (zoals middelen tegen insecten, onkruid, slakken)			□	□
	N	Een onveilig gevoel op straat			□	□
	O	Nabijheid intensieve veeteelt in de leefomgeving			□	□
	P	Gebrek aan goede sociale contacten			□	□
	Q	UV-stralen van de zon of zonnebank			□	□

Supplement 2: Results of interview per subject

Verslaglegging interview mei 2010 Scriptie EMV
(Thesis Supplement 2)

Johan Timmerman

6 mei 2010
PP: #1
WSN: 1
Man, 4 kinderen.
01-06-1950

Opmerkingen: *man is bekende, bekend met scriptie auteur, actief (geweest) in lokale politiek (oppositie)*

De drie EMV categorieën worden als enige aangemerkt als 'zeker wel' risico. Blootstelling hoog, op MP (mobile phone; mobiele telefoon) gebruik na niet groter dan gemiddeld. Blijkt in feite draadloze telefoongebruik te zijn. Proefpersoon heeft geen klachten aan EMV gerelateerd.
Geeft als reden voor het hoog ingeschat risico het 'Zwitsers onderzoek' waarin is aangetoond dat het risico niet hard te maken is. Hij vindt de blootstelling echter meeromvattend dan zendmasten, en vindt dat de regering dit onderzoek ten onrechte gebruikt. Bovendien is niet bewezen dat het gezond is. Geeft aan dat het voor hem een risico is tenzij het tegendeel bewezen, reden: niet natuurlijk.
Wel hoog risico en blootstelling aangegeven, niet nagedacht waarom geen klachten: geen last van.
PP heeft geen vertrouwen in regering en industrie, laten zich teveel door commercie leiden. Frequentie veilen leverde geld op. Kortzichtig, alleen op geld gericht. Overheid vertaalt onderzoek naar eigen belang; verdraait wetenschappelijke conclusie. Dit speelt mee in risicoinschatting: zolang PP niet het *werkelijke* risico weet, vindt hij dat hij moet blijven opletten.
Heeft (niet serieus) overwogen draadloze telefoon te gebruiken. Techniek is onmisbaar, niet terug te draaien, bovendien commercieel interessant maar regering moet verantwoordelijkheid nemen.
Wetenschap kan nu werkelijk risico nog niet aangeven, langer termijn effecten aanwijsbaar in mensen over 10 jaar. Wetenschap moet in de tijd alert blijven.
Wetenschap moet geld krijgen van overheid.
Wetenschappelijk bericht dat er geen risico is, zou gerust stellen: op dat moment, in die groep mensen, onder die omstandigheden niet schadelijk, maar: momentopname terwijl EMV-ontwikkelingen doorgaan.
Opmerking PP: vragen duidelijk, voor de hinderbeleving van burger is het essentieel dat de burger onbekend is met de (C2000) samenstelling van de straling: dat geeft onnodig veel hinderbeleving. Onbekendheid geeft dus hinder*beleving*. Hierdoor ook hogere risicoinschatting PP (onbekendheid).
Doorsnee burger blijft echter onwetend MP gebruiken, maar protesteert tegen basisstation (= niet vrijwillig; nut niet direct duidelijk, JT)
Economische belangen regering en onbekendheid bij burger zijn grootste problemen die risico perceptie vergroten.
PP geeft aan dat sommigen ziek worden van EMV, toont zich echter wel sceptisch: denkt dat het waarschijnlijk tussen de oren zit.
Regering zou er economisch nu juist goed aan doen om de hinderbeleving te verminderen i.v.m. zorgkosten. PP toont zich nogmaals sceptisch: 'persoon die 's nachts niet slapen kan, die zit overdag gewoon te bellen.'

7 mei 2010
PP: #2
WSN: 1
Vrouw, 4 kinderen.
10-05-1950

Opmerkingen: *proefpersoon is bekende*

Proefpersoon geeft weinig opvallende dingen aan, luchtvervuiling wordt als gevaarlijk aangemerkt, ook hoog blootgesteld maar niet hoger dan gemiddeld (reden: woon wel lang drukke weg maar niet in stad). Risico's van de drie mobiele communicatiemiddelen, hoogspanningslijnen en transformatorhuisjes worden als onbekend aangemerkt, rest wordt wel ingeschat. Geen enkel risico als 'zeker niet' aangemerkt.
Onbekende EMV risico's, PP geeft aan dat ze erop vertrouwt dat de regering nadenkt over het al dan niet plaatsen van zendmasten, en dat vindt ze een belangrijk aspect. Alleen kan ze zelf niets aan doen, ze is niet overtuigd van het gezondheidsrisico. Voor een goede inschatting wil ze graag duidelijkheid over de gezondheidseffecten. Vrijwilligheid blijkt ook zwaar te zwegen.
PP geeft aan weinig blootgesteld te zijn aan zendmasten, maar kleinere basisstations blijkt ze niet te herkennen; ze praat alleen over hoge, metalen masten. Duidelijkheid over plaatsen waar zendstations staan weegt voor haar niet zwaar, wat als ze weet als er iets staat...wat kan ze er dan meer mee? Wordt pas relevant als ze overtuigd is van de gezondheidsschade. PP geeft aan geen actie te (kunnen) ondernemen zodra niet duidelijk is dát er een gezondheidsrisico is.
M.b.t. luchtvervuiling: PP geeft aan dat als ze achter een vieze auto rijdt, de lucht dermate onprettig is dat ze zich niet kan voorstellen dat dat gezond is. Anderzijds heeft ze in de lijst aangegeven dat een onprettige lucht geen gezondheidsrisico met zich meedraagt. Binnenlucht heb je echter zelf de hand in, uitlaatgassen niet, controleerbaarheid speelt voor haar een belangrijke rol zo geeft ze desgevraagd aan.
PP uit zorgen over het feit dat veel mensen bewust gaan zonnebanken of in de zon liggen, terwijl 'algemeen bekend' is dat het slecht is. Dit kan ze niet rijmen, ook niet dat mensen tegen bv. zendmasten protesteren terwijl ze doorgaan met andere slechte dingen. Zonnebankje pikken doen mensen voor eigen welbevinden, ze zien hier dus een voordeel in. PP vraagt zich af of MP-gebruikers überhaupt nadenken over gevaren hiervan. Bovendien zijn de ontwikkelingen niet terug te draaien. Lage MP gebruik van PP heeft geen relatie met mogelijke gevaren.
PP uit bezorgdheid over intensieve veeteelt, Q-koorts etc. Overheid heeft hierin onwetend en gemakzuchtig gehandeld en achter de feiten aangelopen volgens PP.
PP legt geen verband met economische motieven maar laat tussen de regels door merken weinig vertrouwen in de regering te hebben m.b.t. omgevings-/gezondheidsrisico's.
PP geeft aan dat maar mogelijk, burgers zelf maatregelen moeten nemen. PP geeft aan dit zelf ook te doen, waar mogelijk.

8 mei 2010
PP: #3
WSN: 1
Man, geen kinderen.
21-04-1985

Opmerkingen: *proefpersoon is bekende*

PP geeft aan zeer veel gebruik te maken van MP, veel meer dan anderen, geeft aan 'mogelijk risico.' Nooit klachten aan MP gebruik gelinkt. Geeft aan dat de wetenschap de risico's nog niet kent, daarom maakt hij zich er ook nog niet druk over. Gebruikt veel voor werk, bellen met vriendin... minder bellen voor hem niet zo'n optie. PP stelt dat algehele blootstelling enorm is, desondanks weinig mensen die daardoor overlijden, hieruit concludeert hij dat het waarschijnlijk wel mee zal vallen. PP geeft aan geen last van straling te hebben, bv in trein geeft hoofdpijn. PP gebruikt MP soms ook lang achtereen.
PP niet overtuigd van risico's MP/straling, pas bij eenduidig antwoord van wetenschap gelooft hij dat men zich meer zorgen zal gaan maken. Zolang mensen er geen last van hebben, verwacht hij geen publieke zorgen. Hij spreekt hierbij voor zichzelf. PP weet niet zeker of regering bewust omgaat met plaatsen basisstations. Nooit nagedacht bij rol van wantrouwen in regering bij risicoinschatting. Stoppen van plaatsen basisstations zou voor PP geen alarmgevoel geven, ziet hij als verantwoordelijke actie van regering. PP heeft vertrouwen in regering.
PP vindt zich hoog blootgesteld, maar maakt zich geen zorgen zolang er geen duidelijkheid is en heeft vertrouwen in regering, techniek en wetenschap.

8 mei 2010
PP: #4
WSN: 2
Vrouw, geen kinderen.
30-01-1988

Opmerkingen: *proefpersoon is bekende*

PP geeft aan MP zeer veel te gebruiken, ook als wekker onder haar kussen. PP geeft een mogelijk risico aan. Heeft wel eens gehoord dat het slecht is om met MP onder het kussen te slapen. Wil MP tijdens slapen echter wel binnen handbereik hebben, geeft aan dat dit beetje gemakzucht is. Heeft nog nooit slechte effecten waargenomen, daarom weinig zorgen. Geeft aan dat ze bij duidelijkheid over risico's wel maatregelen zou overwegen maar verwacht dit niet de eerstkomende twee jaar. PP geeft aan bij elke risicoinschatting afweging te maken tussen mogelijk gevaar en voordelen.
PP geeft an dat basisstations 'zeker wel' een risico vormen, komt omdat zendmasten waarschijnlijk groot zijn, PP denkt dat er meer slechte straling bij de zendmast is. PP weet niet goed hoe schadelijk zendmasten zijn maar ze moeten nu eenmaal toch gebouwd worden.
PP geeft aan niet zoveel over het onderwerp te weten.
PP maakt zich weinig zorgen over MP gebruik zolang er geen schadelijke effecten van ondervind, PP staat er wel een beetje argwanend tegenover en wil meer informatie. Bij duidelijkheid overweegt ze maatregelen.
PP staat zeer sceptisch tegenover EHS: 'wat een onzin.'

8 mei 2010
PP: #5
WSN: 3
Man, 8 kinderen.
25-07-1959

Opmerkingen: *proefpersoon is bekende*

PP geeft aan MP 'waarschijnlijk' een risico vormt, draadloos 'zeker niet.' Deze inschatting heeft echter met andere dingen te maken dan met de EMV van de telefoons.
PP draagt MP bewust niet in borstzakje (hart, pacemaker) maar in broek.
Zendmast die vlakbij gebouwd zou worden: zou PP niet blij mee zijn maar vooral vanwege praktische bezwaren (uitzicht e.d.), niet zozeer vanwege EMV.
PP wil eerst bewijs van schadelijke effecten, daarna pas zorgen en maatregelen.
PP wil wel meer onderzoek, noemt als voorbeeld asbest.
PP heeft weinig vertrouwen in maatregelen door de overheid, MP-gebruik is niet meer weg te denken. Andere motieven belangrijk voor overheid dan gezondheid van burgers.
PP wil bewijs dat EMV schadelijk zijn, daarna moet overheid ingrijpen om grote gevolgen te voorkomen.

10 mei 2010
PP: #6
WSN: 4
Vrouw, geen kinderen.
13-05-1975

Opmerkingen: *proefpersoon is bekende*

PP geeft aan dat weinig mensen geen draadloze telefoon meer gebruiken. PP geeft van alle vijf de EMV-gerelateerde risico's 'weet niet' aan. Deze onwetendheid vindt ze al wat risicovol *an sich*. Dichtbij geplaatste zendmast zou PP niet direct doen verhuizen, ze zou wel het risico willen weten. Ze heeft ook wel eens van risico's van zendmasten en MP-gebruik gehoord. PP heeft nog nooit klachten aan EMV toegeschreven. Als ze meer informatie zou krijgen zou ze dat wellicht wel gaan doen want ze geeft aan dat ze op korte termijn beïnvloedbaar is. Onduidelijkheid in de wetenschap leidt tot reactie van PP dat zolang de schadelijkheid niet aangetoond is, ze zich geen zorgen maakt. PP weet niet of overheid op verantwoordelijke manier met EMV-problemen omgaat. PP weet niet wat ze zou willen weten om hier wel een antwoord op te kunnen geven., PP geeft an niks over EMV etc. te weten. PP denkt dat overheid sterk op geld gericht is, zeker zolang de gevaren niet aangetoond zijn, denkt ze niet dat de overheid maatregelen treft.
PP denkt niet dat technische ontwikkelingen op dit gebied stopgezet kunnen worden. PP denkt dat economische belangen zwaarder wegen dan **mogelijke** gezondheidsrisico's.
PP zou normaal gesproken niet over de risico's nadenken.
PP heeft twijfels over risico zendmast in vergelijking met telefoon, omdat zendmast veel evrder weg is.
PP gelooft wel dat er mensen zijn die EHS zijn, hoewel ze vermoedt dat dat niet zo aangetoond kan worden. PP suggereert placebo effect(= nocebo, JT).
PP heeft nooit over onderwerp nagedacht, maakt zich niet veel zorgen, wil eerst duidelijkheid over risico's.

10 mei 2010
PP: #7
WSN: 4
Man, geen kinderen.
22-03-1976

Opmerkingen: *proefpersoon is bekende*

PP geeft aan dat beleidsmakers soms dingen bij de bevolking 'door de strot duwen.' PP rapporteert reacties (hartslag) op momenten dat hij vlakbij een zendmast aan het werk geweest is. Hij vond het onveilig hierbij te werken. Is overtuigd van enorme blootstelling vlak onder de mast maar geeft aan dat 'het ongewisse' een verzwarende factor is. PP geeft desgevraagd aan dat op 300m afstand de blootstelling in ieder geval een stuk minder is. PP confronteren met het feit dat op 300m afstand de blootstelling groter is dan vlakbij leidt tot korte stilte, PP concludeert dan vragenderwijs dat het tussen de oren zit. De zoemtoon van de zendmast en de kabelbundel hadden een ietwat beangstigend effect. PP vindt zendmast in tuin ook 'geen gezicht.'
PP acht de onduidelijkheid over de risico's niet zo heel belangrijk.
PP geeft desgevraagd aan weinig vertrouwen in de overheid te hebben: als men maar veel geld kan verdienen, maakt het allemaal niet zo veel uit.
Economisch belang is volgens PP doorslaggevend bij onduidelijkheid.
PP geeft aan geen maatregelen te nemen zolang er geen gezondheidseffecten zijn. Geen *voorzorgs*maatregelen dus. PP suggereert mogelijk placebo-effect van stralingsabsorbers, doel hiervan is aangeven hoe belangrijk het ver-/wantrouwen is m.b.t. Gezondheidseffecten.
PP heeft nooit veel over EMV nagedacht, zolang er geen gezondheidseffecten zijn maakt hij zich geen zorgen. Heeft weinig vertrouwen in overheid.

10 mei 2010
PP: #8
WSN: 5
Vrouw, geen kinderen.
12-11-1973

Opmerkingen: *proefpersoon is bekende*

PP gebruikt 'de ganse dag' MP en draadloze telefoon. Denkt wel eens aan risico's maar vindt de voordelen hiertegen opwegen. Als PP zeker zou weten dat het een groot risico was, zou ze minder gebruik maken van draadloze en MP.
PP weet niet wat het risico van zendmasten is, ze denkt dat afstand belangrijk is. Onduidelijkheid is voor PP geen reden om zich druk te maken. Neemt ook geen voorzorgsmaatregelen.
PP denkt dat overheid nu niet kan stoppen met zendmasten bouwen, eerst onderzoek nodig. PP vindt ook dat burgers het risico niet kunnen negeren, neemt anderzijds zelf geen voorzorgsmaatregelen. Denkt ook niet dat ze, behalve MP, veel blootgesteld is en denkt daarom dat ze zich niet veel zorgen zolang zij of anderen geen gezondheidsproblemen krijgen. PP weet niet zo goed wat voor voorzorgsmaatregelen ze zelf zou kunnen nemen.
PP gelooft niet dat de overheid de 'meest betrouwbare' instantie is, heeft ook niet de 'meeste kijk' op deze zaken. Economie erg belangrijk voor overheid.
PP is niet overtuigd van risico EMV, weet er ook niet zoveel van af. Neemt geen voorzorgsmaatregelen, vindt wel dat men alert moet blijven. Geldt ook voor de regering maar PP heeft niet bijzonder veel vertrouwen in de regering.
PP wil graag meer van de risico's en de mogelijke voorzorgsmaatregelen weten.
PP weet niet zeker of er mensen zijn die echt gezondheidsproblemen kijrgen van EMV. Ze weet wel dat EM straling soms toegepast wordt bij behandeling in het ziekenhuis, blijkbaar reageert je lichaam er dus op, dan zal er ook wel een negatieve invloed kunnen zijn.