Summary, conclusions and recommendations

Ulf Bergqvist, Evi Vogel, *et. al.* Possible health implications of subjective symptoms and electromagnetic fields. *Arbete och* Hälsa 1997;19.
The aim of the project was to investigate the occurrence of "electromagnetic hypersensitivity" across Europe. The relevant scientific literature was to be reviewed and the publications and case reports concerning symptoms or adverse health effects were to be analysed in view of a better health protection and prevention. Data on risk perception and communication as well as available public information in connection with this phenomenon and electromagnetic fields were to be evaluated, and specific advice on handling and further recommendations were to be deduced.

The term "electromagnetic hypersensitivity" is used here to designate a phenomenon where individuals experience adverse health effects while using or being in the vicinity of electric, magnetic or electromagnetic field sources and devices (EMF devices). The use of the term "electromagnetic hypersensitivity" does not - by itself - presuppose or indicate any causes of these adverse reactions.

The project was made possible by a grant from DG V of the European Commission.

Description

Certain individuals experience adverse health reactions while using or being in the vicinity of EMF devices. Symptoms vary substantially among different individuals, but in the majority of cases they present mild non-specific symptoms, with objective signs normally absent - unless another disease is present. There are, however, some cases experiencing severe problems with major consequences for work and everyday life. There are no known long-term diseases related to this phenomenon. In the absence of diagnostic criteria, the observed symptoms are attributed to "electromagnetic hypersensitivity".

Both symptoms and attributions do vary substantially between different afflicted individuals. The occurrence and appearance of this phenomenon also vary considerably throughout Europe. It is possible that the varying use of a term like "electromagnetic hypersensitivity" for many different types of claimed adverse health effects could be one source of this diversity.

Literature review

The scientific literature was evaluated for information on relationships between relevant symptoms and exposure to electromagnetic fields (EMFs), and for

information on possible causal factors for "electromagnetic hypersensitivity". There is a need to differentiate clearly between biological/physiological effects and adverse health reactions. In terms of relationships with EMFs, it should be noted that the report deals with situations where field levels are below accepted international limits. Extrapolation between frequencies is not justified. Some investigations are difficult to interpret because of inadequacies in exposure assessments, absence of clear definitions of medical terms etc.

This review was unable to establish a relationship between low or high frequency fields and "electromagnetic hypersensitivity" or with symptoms typically occurring among such afflicted individuals. The results are often inconsistent and conflicting. Furthermore, the absence of credible mechanisms (both physical and physiological) should be noted. In addition, other possible causal factors were suggested, such as low humidity or flickering light. Among such other factors, the possibility that the risk perception/worry could be a causal factor for certain symptoms must be considered. Like most disorders and illnesses, there were indications of a multifactorial causation of "electromagnetic hypersensitivity".

Two large groups of afflicted individuals have been identified; individuals with mostly neurasthenic symptoms with a general or varied attribution to various sources of electromagnetic fields, and individuals working with visual display units having primarily skin problems. These different groups may require separate descriptions and approaches, as their individual traits, symptoms, attributions and prognoses appear to differ.

Risk perception and risk communication

The concepts of risk perception may be used to describe the reactions of people when using or being in the vicinity of EMF devices. As is the case with any risk, perception varies depending on social background, country and education. Risk perception appear to influence what symptoms are reported by people claiming "electromagnetic hypersensitivity", and would therefore contribute to the heterogeneity of the picture.

Very different perceptions are found among different stakeholders, in particular between experts and the general public. This also has to be taken into account when risk perception is analysed in order to deduce communication concepts. It has to be kept in mind that inadequate communication, such as bias among the communicating parties, selecting wrong target groups or using ill prepared information invariably lead to misunderstandings and problems. In the worst case there is an increased concern, a loss of credibility of the experts and/or an increase of symptoms.

It is acknowledged that public media information is of a transient nature and can change long-term habits only very slowly. However, as public media play an important role, journalists as opinion leaders are an important target group. It is

also necessary that officials or scientists communicating with journalists are capable of presenting their knowledge and the results of studies and research.

Available information

In order to get a better understanding of the information people have about EMFs, information brochures available within different EU states were collected and reviewed. The main finding is that the availability of such leaflets is very non-homogeneous across the EU and the various groups. The leaflets obtained were prepared by different stake holders, such as authorities, industry, scientists, self-aid groups and other organisations. In the reviewed material, information on EMFs was fairly good and comprehensive. However, only a few different target groups were addressed, and "electromagnetic hypersensitivity" was mentioned very rarely or only marginally. For the layout and the preparation of such brochures, it appears that often no professional help, e.g. by communication specialists, was used.

Handling

In some countries and within some organisations, schemes to handle "electromagnetic hypersensitivity" center around:

1. Prevention, mainly concerned with information and mitigation of factors known to give rise to adverse health effects such as indoor air quality or stress conditions.
2. Intervention or early handling of afflicted cases, including medical examination to detect if the individual suffers from a known disease, and investigations of the relevant situations for other factors besides EMF.
3. Treatment, primarily directed towards reducing symptoms and functional handicaps.

Practical experience strongly suggests that early intervention greatly reduces the likelihood of more serious problems.

To reduce the exposure to electromagnetic fields in the relevant situation(s) is a commonly asked for action by individuals claiming "electromagnetic hypersensitivity". There are, however, both advantages and disadvantages of such actions, such as measuring and reducing field emissions or avoiding field exposures. These must be carefully considered, case by case.

Recommendations

This project led to the following recommendations:

The phenomenon known as "electromagnetic hypersensitivity" requires various actions. The extent to which such activities are needed may differ considerably between different European nations and between different organisations.

It is strongly advocated that further information on "electromagnetic hypersensitivity" should be made available. Such information, however, must be based on currently available scientific information, and be carefully tailored to specified target groups. The limited number of seriously afflicted individuals, and the absence of evidence for EMFs as causal factors, do not justify alarmist reports. Well designed information plays a major role in prevention and early handling.

The existence of individuals with severe health problems who claim to be "electromagnetic hypersensitive" is a clear motivation for adequate handling. Such handling would emphasise the need to reach afflicted individuals at an early stage, and to avoid concentrating on single factor explanations. A case-by-case approach within broad recommendations may prove to be effective.

Because of the inability to clearly describe the syndrome and causation of "electromagnetic hypersensitivity", further scientific research is warranted. Research should be centred on the causation of specified symptoms or syndromes, and verification of specific hypotheses. The phenomenon also gives rise to other areas of investigations, such as the role of risk perception and risk communications.

Introduction

General background

In many countries there is increasing concern about reports of cases of various suspected environmental illnesses. One such is that of individuals claiming that the reason for their adverse health symptoms could be exposure to electric, magnetic and electromagnetic fields (EMFs) from nearby electric appliances. This is a major concern in a few countries, where also practical health related work is directed towards this problem. The concern appears to increase in some countries, but it is little noticed in other nations. The fact that the majority of people under similar exposure conditions does not exhibit any reactions - even in countries with major concerns - is assumed to be due to affected persons having an increased sensitivity to such environmental factors. This explanation has been adopted by public media and coined in various terms like "electrosensitivity", "electric allergy", "electromagnetic hypersensitivity" or "sensitivity to electricity". These terms and their applications are based on the conviction and self classification of individual subjects.

Within this project, the term "electromagnetic hypersensitivity" is used to describe a phenomenon where individuals experience adverse effects while using or being in the vicinity of devices emitting electric, magnetic or electromagnetic fields (EMF devices). The use of this term does not imply an already established relationship between EMFs and the health reactions. For this reason, the term is - in this document - always within quotation marks ("...").

Presently the issue of "electromagnetic hypersensitivity" has gained considerable public attention and led to the formation of self aid groups (SAGs) of afflicted persons in different countries in Europe as well as overseas. Although the role of the electromagnetic environment is still unclear, it has to be acknowledged that there are people with health problems of unknown origin that might become so severe that they quit their workplace and even change their entire life and move from their home in cities to rural areas.

It is also recognised that this topic has received different awareness in various European countries: In Sweden, a substantial part of the EMF research and health related efforts is directed towards "electromagnetic hypersensitivity" primarily in relation to office work situations and visual display units (VDUs). In other countries like Austria and Germany, concerns of people appear to be more concentrated on the exposure at home and focused on power lines and transmitter stations.

In recognition of this problem, DG V of the European Union has supported this project. It was the aim of this project to collect and evaluate the scientific knowledge and practical experience on possible health implications of subjective

symptoms allegedly related to EMFs. The prevalence of the phenomenon within the various member states of the European Union was also to be assessed.

Based on the assumption that information plays a major role, the presentation and dissemination of information material within different European countries was investigated, taking into account risk perception and risk communication. Originally it was also planned to prepare a compendium of information material for use throughout the EU. However, one of the main results of our investigation was that effective information has to be tailored exactly to the situation (target group, country, subject) and therefore ready-made and general information appear to be of limited value.

Organisation of the project work

The project was managed by the National Institute for Working Life (Sweden) and was co-ordinated by U. Bergqvist (Sweden) and E. Vogel (Germany).

The following researchers have participated (in alphabetic order):
Dr Leif ARINGER
National Board of Occupational Safety and Health, Sweden,
Dr Ulf BERGQVIST
National Institute for Working Life, Sweden,
Dr Joe CUNNINGHAM
Electrical Supply Board, Ireland,
Dr Fabriziomaria GOBBA
Department of Biomedical Sciences, University of Modena, Italy,
Prof Norbert LEITGEB
Institute for Biomedical Engineering, Austria,
Prof Luis MIRO
Centre Hospitalier Universitaire de Nimes, France,
Dipl.-Ing Georg NEUBAUER
Austrian Research Center Seibersdorf, Austria,
Dr Ingeburg RUPPE
Federal Institute for Occupational Safety and Health, Germany,
Dr Paolo VECCHIA
National Institute of Health, Italy,
Dr Evi VOGEL
Federal Institute of Radiation Protection, Germany, and
Ms Cecilia WADMAN, scientific project secretary
National Institute for Working Life, Sweden.

The project was based on:
- three meetings of the participating scientists,
- the elaboration and evaluation of a questionnaire which was sent to official institutions as well as self aid groups,

- the evaluation of information brochures about EMFs, available in different EU countries and
- contributions and talks of invited experts at the second meeting in München, November 1996 and the third meeting in Stockholm, March 1997 (see below).

Invited experts and acknowledgements

The following experts were invited to some project meetings (the titles of their respective talks are also indicated):
Prof Eduard David, Germany
Universität Witten Herdecke, Institut für Physiologie, Witten
"Electrosensitivity and magnetosensitivity - psychosocial aspects",
Mr Lars Grönqvist, Sweden
National Institute for Working Life, Solna (currently at the National Board of Technical Development)
"Electrosensitivity in Sweden - the role of the media",
Ms Renate Harrington, Haltenbek, Germany
"The role of media in the communication of negative and positive news",
Dr Lena Hillert, Sweden
Environmental Illness Research Centre, Huddinge
"Medical approaches to electrosensitivity",
Prof Oswald Jahn, Austria
Abteilung Arbeitmedizin, Universität Wien, AKH, Wien
"Handling of electrosensitive people",
Dr Mike Repacholi, Switzerland
WHO Office of Global and Integrated Environmental Health, Geneva
"The international EMF project",
Dr Turid Vendshol, Norway
Norwegian Board of Health, Oslo
"Project on sensitivity to electric and magnetic fields",
Prof Arne Wennberg, Sweden
Department of Occupational Medicine,
National Institute for Working Life, S-171 84 Solna, and
Dr Peter Wiedemann, Germany
Forschungzentrum Jülich, Gruppe MUT, Jülich
"Risk perception".

We would like to express our gratitude to these invited experts for their valuable contributions to the project. It is also appreciated that due to the additional support by the National Institute for Working Life, Stockholm, Sweden and the Federal Institute of Radiation Protection, Munich, Germany (beyond that included in the project), as well as by their respective affiliations, it was possible to profit from the expertise of all these experts.

Description of "electromagnetic hypersensitivity"

Preamble

According to the plans laid out for this project, the following information of a descriptive nature was to be obtained:

- A description of cases of "electromagnetic hypersensitivity" in the different participating EU member nations - including symptoms, situations where symptoms appear, and allegations as to causes.
- Formal definition(s) of cases (if possible), and a discussion of the extent of the problem - with data (when available) from different countries.

It was quickly apparent that the data basis for responding to several of these questions does not exist. For this reason, a questionnaire was sent out across Europe to overcome this lack of information, and enabling some comparisons between different countries. The information gained by this questionnaire is described below, augmented by some information from other sources.

Two further comments based on the information described here and elsewhere in the report are appropriate. Firstly, no formal definition or diagnosis of "electromagnetic hypersensitivity" is possible, because of a/ the nonspecificity of the symptoms, b/ the apparent heterogeneity of the afflicted individuals and c/ the lack of an established aetiology. (A working definition for the purpose of the study was given in the introduction, see above). Secondly, and for similar reasons, no "typical" cases of "electromagnetic hypersensitivity" could be identified, therefore the case descriptions given below should be seen as examples only, and not as an attempt to establish any typicality.

Questionnaires

In order to assess the appearance of "electromagnetic hypersensitivity", a questionnaire was designed to solicit responses from certain organisations to questions concerning the awareness of the problem, estimates of the extent, situations where problems appear, symptoms and consequences for the afflicted individuals.

Questionnaires were sent to centres for occupational medicine and other similar organisations (COMs) and self-aid groups (SAGs) in different European nations. The questionnaires were written in English, German, Italian, French and Swedish (see Appendix 2 for the English versions). The numbers of questionnaires sent out and received were as follows (see also Table 1):

- 138 questionnaires to centres of occupational medicine (COM) in the following 18 European countries: Austria, Belgium, Denmark, Faroe Island, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Norway, Portugal, Spain, Sweden, The Netherlands and United Kingdom. The reply rate was 45 %. Non-responding countries were Belgium, Greece, Luxembourg, Portugal and Spain.
- 15 questionnaires to self aid groups (SAG) of "electromagnetic hypersensitive" individuals in the following countries: Denmark, France, Germany, Norway, Sweden and Switzerland. In all we received 10 answers from all of these countries except Switzerland, including answers from 2 SAGs in Ireland.

It should be emphasised that the selection of addresses, the response rates as well as the type of questions asked do not permit detailed and absolute quantitative assessment of the situation across Europe. The intention behind this questionnaire was rather to have a descriptive and - to some degree - a comparative assessment between different countries. Nevertheless, a rough estimate of the extent of the problem could - in our opinion - be obtained.

A detailed description of the responses is given in Appendix 1, and summarised below.

Symptoms

The respondents, both the COMs and the SAGs, were asked to list the five most common symptoms reported in connection with the use of electrical appliances or proximity to EMF sources. The answers may be classified into the following groups - the first two are further specified:

- Skin symptoms; objective, subjective or undefined.
- Nervous system symptoms; sleep disturbances, decreased arousal, neurasthenia, stress, irritation, anxiety and headache.
- Hormonal and metabolic disorders, general body symptoms, cardiovascular symptoms, eye symptoms, ear/nose/throat problems and digestive problems
- Other responses concerned different types of cancer, allergy, reproductive and pregnancy problems and various symptoms attributed to the sick building syndrome.

Overall, the most common symptoms for "electromagnetic hypersensitivity" encountered among the responses were various neurasthenic symptoms, headache and skin symptoms. Other more specific symptoms such as sleep disturbances or anxiety occurred less consistently among these descriptions.

The answers differed considerably between different European nations, however, especially considering the relative importance of nervous system and skin symptoms. In the Nordic countries - with the exception of Denmark - skin symptoms occurred fairly often among the COM responses, while skin symptoms were not so reported from France, Ireland, Italy and United Kingdom. In COM

responses from Austria, Denmark and Germany, some mention of skin symptoms was made, but appeared to be of minor importance compared to nervous system symptoms.

Essentially, all replies from the different countries did suggest a number of various nervous system symptoms in connection with "electromagnetic hypersensitivity". Neurasthenia was the most common among the six different symptom types (except for the COM reply from Ireland) followed by headache, but otherwise no obvious pattern of nervous system symptoms could be found that was consistent among the different European nations. Likewise, it was difficult to discern general patterns among other types of symptoms.

Comparisons of symptom prevalences between individuals with "electromagnetic hypersensitivity" and other individuals that has been made in some Swedish investigations (19, 20) deserve some further comments. It was noted that the symptoms occurring among "electromagnetic hypersensitive" individuals also occurred in other groups of individuals - thus no specificity of symptoms could be discerned. The differences were more directed towards the number of symptoms reported by an individual - "electromagnetic hypersensitive" individuals appeared to report a larger number of symptoms (20). Based on symptoms, it was also indicated that individuals with "electromagnetic hypersensitivity" could be separated into several subgroups (see further below).

Finally, it should be noted that most descriptions were aimed at the identity of different symptoms - not at the severity. The majority of individuals do appear to report mild symptoms, however, there are a smaller number of cases with severe health problems (see further below).

Attribution to sources

"Electromagnetic hypersensitivity" reactions were seen in different situations and have been attributed to different sources - and these appear (again) to differ between different European nations.

In most countries, according to the COMs, problems arose most frequently at the workplace, with the exception of Germany and possibly also Austria, where primarily situations at home were associated with "electromagnetic hypersensitivity". In contrast, outdoor situations in general seem to play a minor role (this was indicated by only a few COMs). The same pattern was reported by the SAGs, except for France and Ireland, where the SAGs emphasised home situations, whereas the COMs pointed towards work situations (note, however, that we do not have SAG replies from all countries).

More pronounced differences between countries were found when the COMs and the SAGs were asked for specific EMF sources being reported in connection with "electromagnetic hypersensitivity". Basically, sources of radiofrequency (RF) fields such as telecommunication masts, broadcasting or TV towers and radar stations were strongly reported by several COMs and SAGs in Denmark, Germany, France, Ireland and Italy, while more localised sources such as

induction heaters, plastic welding or microwave ovens were mentioned in the answers from Denmark, France, Germany, Italy and United Kingdom. Mobile phones were reported by Germany, Ireland, Italy and Sweden. With this last exception, no mention of RF sources as being a common source of problem was made from Sweden, Norway or Finland.

For sources of low frequency EMFs, power lines or transformer stations were emphasised in the replies from a number of countries except Sweden and Finland, while electrical appliances at home were emphasised by Danish, German, Swedish and French COMs or SAGs. Visual display units (VDUs) or fluorescent tubes (thus also sources of light) were reported primarily from the Nordic countries (Denmark, Finland, Norway, Sweden) but also by a few German and Italian COMs.

Thus, these data do suggest some fairly distinct geographical variation, with a "Nordic" scene where use of VDUs (and possible vicinity to fluorescent tubes) predominate, while other countries exhibit a more diverse attribution to various sources of both low and higher frequency fields.

The questions whether individuals who reported "electromagnetic hypersensitivity" also tended to report allergic problems, problems with dental alloys or multiple chemical sensitivity were indicated rather differently by different organisations. The SAGs generally affirmed this, whereas the COMs by and large restricted such correlations to dental alloy attributions or failed to suggest such correlations.

The extent of "electromagnetic hypersensitivity"

In Table 1, the answers to some questions related to the estimated extent of this phenomenon in different European countries are shown (for further details, see Appendix 1).

The results show that the estimates of the total number of cases differ substantially between these countries as well as between the answering groups: SAGs usually give numbers about one order of magnitude higher than COMs.

The countries with the highest estimated occurrence of "electromagnetic hypersensitivity", as estimated by SAGs as well as by COMs appear to be Sweden and Germany, followed by the other Nordic countries. SAGs in Ireland and France also estimate a high number of cases, in contrast to the respective COMs who give very low numbers. From Austria, Italy and the Netherlands, we only received answers from COMs, indicating low numbers of "electromagnetic hypersensitivity". COM replies from United Kingdom do not really suggest the presence of the phenomenon (we had no SAG reply from United Kingdom). No replies were obtained from Belgium, Faroe Island, Greece, Iceland, Luxembourg, Portugal and Spain - which might suggest that in these countries, there is limited occurrence or at least awareness of this phenomenon.

With a few exceptions, the proportion of severe cases to the total number of estimated cases is in the order of 10% throughout the European nations that have provided any estimates; this ratio is the same for both SAGs and COMs.

Table 1. Estimated extent of "electromagnetic hypersensitivity" in some European nations

Country	No of replies	Phone calls/ week a/	Number of members b/	Median no cases c/	Median no severe cases d/
Austria /COM	4	<1/week	-	10-100	<10
Denmark/COM	13	<1/week	-	100-1 000	10-1 000
-"- /SAG	1	-	75	1 000-10 000	100-1 000
Finland/COM	2	<1-4/week	-	10-100 and 100-1 000	10-100
France/COM	6	<1/week	-	10-100	<10
-"- /SAG	2	-	4 + ? e/	1 000-10 000	100-1 000
Germany/COM	8	≥5/week	-	1 000-10 000	1 000-10 000
-"- /SAG	3	-	300	>10 000	>10 000
Ireland/COM	1	no reply	-	10-100	<10
-"- /SAG	2	-	350 f/	>10 000	1000 - 10 000 and >10 000
Italy/COM	4	<1/week	-	10-100	<10
Norway/COM	6	<1/week	-	100-1 000	10-100
-"- /SAG	1	-	90	100-1 000	100-1 000
Sweden/COM	8	<1/week	-	1 000-10 000	100-1 000
-"- /SAG	1	-	1800	>10 000	1 000-10 000
The Netherlands/ COM	1	<1/week	-	10-100	<10
United Kingdom/ COM	7	<1/week	-	<10	<10

Notes for table 1

a/ The "average" number of phone calls received - the question was only asked to COMs. Median of all COM replies indicated.

b/ The number of members in all SAGs who replied (combined).

c/ The estimated number of cases in the country. The median of all COM or SAG replies indicated (unless otherwise indicated).

d/ The estimated number of severely afflicted cases in the country. The median of all COM or SAG replies indicated (unless otherwise indicated).

e/ Not specified by one of the two SAG replies.

f/ Number of "contacts" by one of the SAG. The other reported 3 members.

It should be commented on, that media have often quoted estimates of the prevalence of "electromagnetic hypersensitivity" from a few percent up to 30%, and have argued that "if a third of the general population belonged to the

"electromagnetic hypersensitivity" group, then existing exposure limits appear to be far too high". From Table 1, it can be derived that the prevalence of these estimates - when compared to the total populations of these countries - are far below these figures; ranging from less than a few per million (COM estimates from United Kingdom, Italy and France) to a few tenth of a percent (SAG in Denmark, Ireland and Sweden), and with severe cases - generally - with one order of magnitude lower occurrence. (An obvious uncertainty in this evaluation is due to the fact that some SAGs reported >10 000 cases with no upper limit specified.)

As shown in an Austrian investigation, the number of individuals who believe they are "electromagnetic hypersensitive" but who do not have any actual problems related to EMF sources may be higher (11, 12). In accordance with the working definition (see above), these individuals would then not be considered as cases, as they present no symptoms.

Some case descriptions

In order to further illustrate the findings of the questionnaire and also in order to input experiences of different organisations dealing with this problem, the following descriptions of cases in different stages are given. Cases have occurred in different age and gender groups, as well as in relation to different situations (see above).

In general, health complaints of unclear origin are at the beginning of the problem. In this situation people might look for possible explanations, especially environmental factors. Whether or not "electromagnetic hypersensitivity" develops appears to depend on different circumstances - as is suggested in the variations between different European nations.

In many cases, even mild symptoms may be interpreted by the afflicted persons as warning signals of serious diseases which may lead to avoidance behaviour that may cause inability to work and social isolation. Some patients, however, report intolerable symptoms, most commonly pain or severe paralysing fatigue if they do not avoid the vicinity of EMF sources. As a result, these patients may move from modern society to isolated cottages without any electricity. If the symptoms persist in spite of these measures, as is frequently the case, the patients interpret this by having been exposed for too long a time before or by residual fields which exist even in their new environment.

It should also be noted that the same or similar symptoms occur also in individuals who do not claim to be "electromagnetic hypersensitive", and they can thus presumably be caused by various factors, also those not necessarily occurring in the vicinity of electrical appliances. Of some possible interest in these circumstances are a high working load, poor psychosocial situation, flickering light or low indoor humidity etc. In addition, the observation that - in a given situation - only some individuals develop "electromagnetic hypersensitivity" clearly points to the involvement also of internal factors relating to the individual. For these and other related reasons, the symptoms occurring among

"electromagnetic hypersensitive" individuals should be considered to have a multifactorial aetiology.

In principle, the following different stages can be discerned among reported cases. Some individuals may - during the progression of the problem - undergo all these different stages. The examples given illustrate these stage descriptions and are taken from case series in COMs. It should be emphasised that the symptoms, situations and age information given here are not typical, as there is no typical case of "electromagnetic hypersensitivity", the examples are only used to describe the stages.

Stage 1

At this stage the patients experience temporary symptoms. Usually, they have heard of the existence of "electromagnetic hypersensitivity" and may consider a possible relationship between the occurrence of these symptoms and exposure to electromagnetic fields. According to some Swedish experiences, cases of "electromagnetic hypersensitivity" start in more than 90% with VDU-related skin problems with generally very good prognosis (9, 20) About 60-70% of the cases show a recovery within 2 to 5 years (5). In this early stage, by providing information and alternative explanations for their problems, in most cases the development of "electromagnetic hypersensitivity" can be avoided or can be treated with a fairly good prognosis and the chance of complete rehabilitation. (As already pointed out above, this predominance on VDU work origin and on skin problems may not, however, be relevant for situations in other countries, though.)

For example, C.N., 32, lived in a newly built house. When the utility built a new power line 50 m away from the house, C.N. began to suffer from headache and sleeplessness. In reaction to C.N.'s complaints, C.N. was informed about the current scientific knowledge concerning interactions between the fields and the body, and the field contribution from the power line was measured. It could be demonstrated that this contribution was much less than the fields from the daily used electric appliances. After some time, C.N. phoned back and told that the symptoms had disappeared.

In another example, an employee, A.K., 42, was told by a colleague that A.K.'s adverse health symptoms like headache, fatigue, anxiety were caused by electromagnetic fields, in particular from a VDU. When having contacted an institute for occupational health, A.K. was informed about the scientific knowledge concerning electromagnetic fields. Furthermore, in a blind experiment, A.K. was exposed to various electromagnetic fields without any reactions. As a result, A.K. accepted that the causes for the symptoms had to be due to other reasons than electromagnetic field exposure.

Stage 2

If the symptoms persist and increase either in intensity, duration and/or number of symptoms, the assumption of a connection between electromagnetic fields exposure and symptoms develops toward certainty and patients may start to look for further confirmation of their "electromagnetic hypersensitivity" hypothesis.

For example, R.G., 44, in a situation when personal conflicts at the workplace coincided with the reorganisation of the work and the introduction of computers, developed adverse symptoms like reduction of concentration ability, nervousness, low blood pressure, tingling sensations and metallic taste in the mouth. These symptoms occurred in particular when working at the visual display unit (VDU). R.G. started to collect publications on the impact of EMFs on health. Gradually the conviction grew that EMFs were responsible for the health problems. This opinion was supported by contacts with other persons claiming to be "electromagnetic hypersensitive". When R.G. contacted a center for occupational health, R.G. was not able to detect electromagnetic fields in a blind exposure situation, but insisted, however, to be affected by electromagnetic fields due to a distant visible VDU even at unmeasurable low intensities. Staying convinced to suffer from "electromagnetic hypersensitivity", R.G. changed the lifestyle and avoided the use and proximity of electrical appliances as far as possible.

Stage 3

This stage is reached by a few people only. At this stage frequently neuro-vegetative symptoms are reported to be triggered by vicinity to most electromagnetic field sources, and the patients are already convinced of a causal relationship between their symptoms and EMF sources. In this stage, the prognosis of a successful treatment is poor, supportive therapy usually only results in some improvement of daily life.

One example that might illustrate this stage is the technician P.S., 37, who experienced the first stinging and burning sensations in the face after several hour's work at the VDU. Within one year, P.S. discovered a reaction also to fluorescent light tubes and other kinds of EMF sources, including the electromagnetic fields of the car. After one more year, P.S. reacted strongly to various electrical environments, and went on sick leaves - but problems appeared also at P.S.'s own house. Therefore P.S. decided first to sleep in the car (with the ignition off) and then to live in an aluminium caravan. P.S. would have had to quit the employment if the company would not have enabled P.S. to work in a ironsheeted (shielded) room.

Possible causal factors for subjective symptoms related to "electromagnetic hypersensitivity"

As described in the introduction, "electromagnetic hypersensitivity" is used to describe a phenomenon where individuals experience adverse health effects while using or being in the vicinity of devices emanating electric, magnetic or electromagnetic fields (EMFs). Often, these attributions are specifically directed to EMFs from these devices, even if other factors - both physical and others - have also been suggested. This attribution to specific factors must not be confused with a statement of an established causality, however.

In the text below, we describe the results of scientific investigations which have tried to establish or indicate whether there is a link between certain factors (especially exposure to various EMFs) and symptoms typical of those claiming to be "electromagnetic hypersensitive". Studies have been performed both on the general population and on individuals reporting "electromagnetic hypersensitivity".

A full review based on details in a large number of studies, supplemented by several reviews, is found in Appendix 3 - where also the specific references are listed.

General population-based studies

Studies were reviewed that aim to detect whether the occurrence of certain adverse health reactions are associated with exposure to EMFs. Several adverse health reactions were considered, with main emphasis on neurasthenic symptoms in the general populations, and skin reactions among individuals using visual display units. While considerable concerns are attached to various diseases (notably cancer and possibly also some neurological disorders) and EMFs, scientific investigations of such diseases are not considered in this review as they cannot be included in the given definition of "electromagnetic hypersensitivity". It should be noted, however, that the worry and concern about such health outcomes may be of relevance for "electromagnetic hypersensitive" persons.

Low frequency fields and neurasthenic or similar endpoints

The most consistent human experimental results appear to come from investigations of EEG activity changes caused by EMFs. While these indications do motivate further investigations, it is worth pointing out that the interpretation of these changes is unclear - they do indicate a biological effect, but not necessarily an adverse effect. EMFs have been shown to reduce pineal melatonin synthesis or

increase the melatonin degradation in four studies on rodents, but failure to find such effects have also been reported in one study. Data on non-rodent mammals are very scarce, and - in the two studies performed - essentially non-positive. A few groups have investigated this possibility in humans, and generally failed to indicate any relationships.

A limited number of epidemiological studies on headaches, depressive or similar symptoms and suicide were also found and reviewed. For depressive symptoms, an association with powerline proximity was suggested in some, but not in other studies. Based on available data, it is, however, difficult to separate (presumed) effects due to the physical presence of the fields from those dependent on psychosomatic mechanisms. For headaches (migraine or non-migraine) and for suicide, no affirmative conclusions or strong indications about associations with electric or magnetic fields could be made. The absence of direct measurements of field levels in most studies, the lack of a well formulated hypothesis of interaction and the varying and in some studies limited scientific quality, all contribute to the inability to make any firm conclusions.

In conclusion, while some results exist that do motivate further research into the possibility of adverse neurasthenic reactions to low frequency fields, current scientific knowledge is unable to prove this possibility.

Radiofrequency fields and neurasthenic or similar endpoints

It is not possible to extrapolate results between different frequencies, so results obtained in subjects exposed to extremely low frequency fields cannot be directly applied to radiofrequency field (RF) situations and vice versa.

For individuals regularly exposed to high levels of RF fields capable of causing substantial thermal effects, or accidentally exposed to very high levels, various neurological and other adverse effects have been demonstrated. The main concern here, however, is with low level RF field exposures - i.e. below those causing thermal interactions with the body, and below the exposure limits set by various national and international guidelines or standards.

Epidemiological and experimental studies that investigate the possibility of neurasthenic effects of such low level RF exposures are very few. Again, it is currently not possible to describe and verify mechanisms that could elicit a biological response of RF exposures below those relevant for known (thermal) interactions. In some contrast, it is possible to formulate a psychosomatic mechanism of interaction - but of course only for situations where the individual is aware of the exposure. In an investigation of sleep problems reported around a Swiss short-wave transmitter, efforts to exclude a psychosomatic mechanism explanation were made, but not fully successful.

A few other studies have also investigated sleep parameters and other outcomes - both biological (EEG changes) and adverse reactions. Overall, the data is at present not sufficient to establish neither the reliance of adverse neurasthenic effects of low RF exposure on mechanisms other than psychosomatic ones nor

indeed their general existence. A few observations and reports are worthy of further investigations, though.

Skin symptoms among VDU users

Skin symptoms are - in some countries - fairly common among those working with visual display units (VDUs). Overall, an excess occurrence of subjectively reported skin complaints or symptoms was found among VDU users, whereas a relationship with objective signs or diagnosed skin disorders appears less clear - a case can probably be made for seborrhoeic eczema, and possibly for non-specific erythema. Most - but perhaps not all - of the cases can be described as mild, and many often appear to improve or disappear even without any remedial action being taken. (The information available on studies from other countries than Sweden and Norway is limited and have produced varied results, even if it can be argued that three out of four available studies have at least indicated an excess of problems among VDU users vs. non-users.)

Some investigations have attempted to find possible causal factors for this phenomenon. The evidence for or indications of an involvement of various electric or magnetic fields on such VDU-related skin problems appear weak to almost non-existent. Some further attention could be given to the possibility that the body's static charges may lead to a higher facial deposition of skin irritants, though.

Generally, a fairly large body of evidence connects indoor air climate or stress factors with skin problems - evidence obtained in other than VDU work situations. Additional VDU-specific studies reviewed here are - in our opinion - sufficient to indicate that such generally accepted factors for skin complaints are operating also in VDU work situations, and to at least suggest that these may actually be major explanatory factors for the noted association between VDU work and skin ailments.

Reactions among individuals with possible special sensitivity

The evidence for the existence of groups with special sensitivity that could be of relevance to "electromagnetic hypersensitivity" was reviewed. Furthermore, investigations into possible causal or contributing factors for symptoms among such individuals with "electromagnetic hypersensitivity" were also summarised and evaluated.

There are indications that "electromagnetic hypersensitive" individuals should not be considered as a homogeneous group. A basic distinction - based primarily on Swedish data - appear to exist between individuals with skin symptoms who attribute them to VDU work situations, and individuals with (primarily) neurasthenic symptoms who attribute them to a variety of situations. Such a distinction can be supported not only on diversity of symptoms and attribution, but also - in a few investigations - on specific findings.

As already outlined before, there is a considerable diversity across different European nations when examining the appearance of "electromagnetic hypersensitivity". Even if the distinction between the skin symptoms and neurasthenic symptoms groups, described above for Sweden, seems valid, the number and the proportion of the subjects included in these groups vary a lot. One possible rationale would be that of a more general occurrence of individuals with neurasthenic symptoms attributed to a variety of sources in several European nations. In addition, observed skin problems among VDU workers would be attributed to "electromagnetic hypersensitivity" in a few countries, while in others, they would be considered as related to other factors and/or called differently.

Individual and possibly predisposing factors

It must be pointed out that further attempts to identify individuals with a special sensitivity of possible relevance to "electromagnetic hypersensitivity" is based on a limited number of investigations, with somewhat varying approaches.

One investigation indicated that individuals with VDU-related skin complaints differed from non-cases in terms of certain hormonal reactions (prolactine and thyroxine) while working with a VDU, and the authors suggested that this could be related to a "stress reactivity". Some investigations have examined relationships between e.g. prolactine levels and EMFs - both in "electromagnetic hypersensitive" and general public individuals - in most cases without finding any such relationships.

Some other results on increased reactivity and other possible predisposing factors among "electromagnetic hypersensitive" individuals consist of observations of increased facial skin temperatures, on different psychological profiles (e.g. concerning socialisation or difficulty in taking initiative), on dermatological or histopathological findings etc. It has been argued that the presence of such or other similar predisposing factors could be involved in transforming a mild and perhaps insignificant reaction (including a reaction within the "normal" physiological range) into a stronger and definitively adverse reaction. Arguments have also been forwarded for a contributing role of risk perception and worry in such processes.

It should be pointed out, however, that while these studies point to an interesting set of descriptors, further work concerning their possible role in the origin of the "electromagnetic hypersensitivity" are warranted before any more definite conclusions should be made.

Electric or magnetic fields and "electromagnetic hypersensitivity"

Provocation studies have been carried out on individuals with skin complaints during VDU work as well as on individuals with "electromagnetic hypersensitivity", mostly in Sweden and Norway. In one study, weak indications of reactions to electric/electrostatic fields in terms of tingling or pricking sensations

were reported, while in another, various symptom did appear after exposure to magnetic fields at varying frequencies (0.1 Hz to 5 MHz). (It should be noted that the US study cited above with varying frequencies - together with a UK study - is based on individuals primarily claiming multiple chemical sensitivity, and that the relationship between this syndrome and "electromagnetic hypersensitivity" has not been resolved.) The results in the other 9 of the 11 studies were an inability to a/ detect fields and/or b/ to react to them in terms of symptoms. Individuals with "electromagnetic hypersensitivity" often developed symptoms during these tests, but these symptoms appeared to be independent of the field variation in the studies.

Taken altogether, provocation studies to date have not been able to verify a direct link between (mainly) low frequency fields and problems of "electromagnetic hypersensitivity" that is shown to be independent of awareness of the fields. For fields of higher frequencies, the limited number of studies and the limited number of individuals actually tested enable no conclusions to be made.

Other suggested factors for "electromagnetic hypersensitivity"

A noteworthy observation obtained in a few of these provocation studies was that while the actual fields were not associated with increased discomfort occurrence in the subjects during the test, guessing that the fields were "on", were so related. While this is an interesting observation in terms of the possibility of psychosomatic (worry-driven) mechanisms, the interpretation is far from clear (did discomforts influence the guesses that the fields were on, or did the belief in the fields being on influence the development or perception of symptoms?).

Among some cases of "electromagnetic hypersensitivity", attribution has been to "electrical" appliances that also emit modulated light (VDUs, fluorescent tubes). Based on these observations, a few investigations have indicated that some "electromagnetic hypersensitive" individuals are more sensitive to such light modulations ("flicker") than the controls. At present, the limited amount of data offer no firm conclusions - beyond observing that other physical factors than EMFs might be of interest for at least some subgroups of "electromagnetic hypersensitive" individuals.

Finally, it should be observed that a number of cases of skin problems among VDU operators have been diagnosed as "normal" skin disorders (such as contact dermatitis).

Perception and communication of risks due to electromagnetic fields

Risk perception

Along with ongoing debates, the awareness of possible risks of exposure to electromagnetic fields radiated or emitted by a variety of sources is increasing in all industrialised countries. The way these risks are perceived by different people, however, is not the same.

The personal risk attitude influences the response of individuals, including to some extent subjective health symptoms, which thus might be of psychosomatic nature. This hypothesis is supported by a recent study by McMahan and Meyer (14) on residents living adjacent to power lines. The results indicate that the prevalence of subjective EMF-related health problems (headache, migraine, poor appetite, etc.) is higher in people who are more worried about EMFs (see further discussion in the previous section above). Therefore, understanding the mechanisms of risk perception is of fundamental importance not only to improve the communication between scientists and the general public, but also to evaluate the plausibility and relevance of claimed effects such as "electromagnetic hypersensitivity".

Factors influencing risk perception

Some general methods of analysis have been developed, which are described in overview papers (e.g., 22). In particular, Covello (3) identified a number of factors which influence the perception of risks in studies concerning nuclear power, toxic substances and environmental pollution (see Table 2). Kunsch (10) also suggested a number of such factors which may be relevant for the perception of risks from EMFs. However, their relevance varies for different sources. The importance of individual factors seems in fact to differ from one kind of EMF to another.

With this regard, it is important to note that, also due to the large use of generic terms in different countries such as "electromagnetic pollution" or "electrosmog", lay people tend to consider non-ionising radiation as a whole, with no clear idea of the basic differences, for example, between magnetic fields from power lines and high frequency fields radiated by cellular phones.

Table 2. Factors involved in public risk perception, from Covello (3)

Factor	Conditions associated with increased public concern
Accident history	Major and sometimes minor accidents
Benefits	Unclear benefits
Catastrophic potential	Fatalities and injuries grouped in time and space
Controllability	Personally uncontrollable
Dread	Effects dreaded
Effects on children	Children specifically at risk
Effects on future generations	Risk to future generations
Equity	Inequitable distribution of risks and benefits
Familiarity	Unfamiliar
Media attention	Much media attention
Origin	Caused by human activities or failures
Personal stake	Individual personally at risk
Reversibility	Effects irreversible
Scientific evidence	Risk estimates based on human evidence
Trust in institutions	Lack of trust in responsible institutions
Uncertainty	Risks scientifically unknown or uncertain
Understanding	Mechanisms of process not understood
Victim identity	Identifiable victims
Voluntary exposure	Involuntary

As a consequence, factors which are mainly related to a specific source may also influence the attitude of the public towards others. The most evident example is the problem of cancer, connected with several of the factors listed in Table 2: effects on children, effects on future generations, (ir)reversibility etc. There is some evidence, though controversial, of an association between ELF magnetic fields and cancer, but no such evidence exists for high-frequency fields (18). In spite of that, concern is widespread within the public, e.g. for brain tumours from cellular phones. On the other hand, symptoms which were initially reported for VDU operators, such as dermatological effects, are claimed also in the case of

residence near power lines, where an etiological role of EMFs is difficult to substantiate.

The effects of familiarity also seem different for power frequency and high frequency fields. People are generally not familiar with radiofrequency and microwaves, but are familiar with electricity. In the first case, the lack of familiarity may be a cause of concern, as suggested by Covello (3); on the other hand, it has been noted that people tend to strongly react with fear when they discover, or suspect, hazards from agents they are used to live with, and which have been considered safe for a long time, such as electricity.

As shown in the Appendix 4, it may be presumed that most of the factors listed in Table 2 are relevant in the case of electromagnetic fields, the exceptions being limited to catastrophic potential, victim identity and accident history.

The appraisal of risk

Both the overall perception of risks and the relative importance of the factors listed above differ from one individual to another, and among social groups, depending on e.g. education, age, gender, social class etc. Other questions can therefore be addressed by risk research, such as: "How does risk perception differ in different groups?" or "How is risk perception modified by knowledge (on mechanisms, scientific findings, etc.)?". In particular, a question of crucial importance to improve good communication is: "How different is the perception of risks between lay people and experts?". This question has been addressed by Fremling (6) and by the Harvard Center for Risk Analysis (7, 8) who indicated a substantial difference in appraisal, and a large variety in the confidence about the very existence of health risks, even within the scientific community.

The relationship of knowledge and familiarity of risks with their perception has been the object of a study on power lines performed by Morgan and co-workers (16) and more recently by Maerli (13). The main findings of these studies, which are discussed more extensively in Appendix 4, are that the same risk is perceived differently according to voluntarity, and that information about scientific findings generally leads to the perception of risks as more dreadful.

This confirms once again the crucial importance of correct communication, which influences not only the perception of risks, but also its possible modifications, as analysed by Wiedemann and Schütz (22). They identified several factors which might influence the further development of risk perception in the society, and found that the most relevant are science and technology (i.e. the capability of science to prove or disprove the existence of risks, and of technology to mitigate them); societal structure (i.e. possible new social and political conflicts that may limit the attention given to technological risks); and economy (i.e. the economic capability of the society to deal with the problem of health hazards from EMFs).

The future relevance of qualitative factors discussed above, and consequently the development of the EMF controversy, will depend to a large extent on these societal conditions.

Risk communication

The American National Research Council stated that risk communication is "an interactive process of exchange of information and opinion among individuals, groups and institutions; often involves multiple messages about the nature of risk or expressing concerns, opinions or reactions to risks messages or to legal and institutional arrangements for risk management" (17). This definition clearly shows that communication about risks, especially highly uncertain risks is a very intricate and demanding process. The roots of risk communication research date back to the 1980s where the first research activities in the United States where supported e.g. by the Environmental Protection Agency, the National Science Foundation and also the industry. Up to now most groups have been working on questions related to nuclear power, radon or chemical pollution (e.g. 1, 4). Only a few research teams have been studying risk communication with respect to non-ionising electromagnetic fields (e.g. 15, 22).

In the following, the application of risk communication to EMFs, with a glance at the role of the media, will be discussed.

Risk communication about electromagnetic fields

Until recently, EMF risks have not constituted a subject of high involvement by the general public, but the public is currently quite attentive towards this issue as was discussed above. People having very close and/or permanent contact with sources of EMF, e.g. living very close to powerlines, broadcasting or mobile phone towers and particularly sensitive people attribute a high relevance to EMF. Nevertheless, issue research (2) tells us that risk controversies start in small fringe groups, they "name" the risk, as has happened with EMFs, e.g. "electromagnetic pollution" as the term is used in some English speaking countries, or "electrosmog" in German speaking countries. Then the media coverage grows, as has also already happened in this case. The next stages described in issue research have not yet been reached in general through Europe: such as an escalation of media reports and the reaching of a crisis point, where related products or industries face a decisive decrease in acceptance and report dropping sales. Therefore it is necessary to analyse carefully the current debate in order to prevent such a crisis situation and not to enhance apprehensions of people which may lead to a reduced quality of life.

The traditional approach to risk communication has involved conferring with experts to see what people need to know. Subsequently, information material have then been prepared. However, this approach very often encounters cognitive difficulties and does not show the desired result. At Carnegie Mellon University/Pittsburgh, USA, a new approach to risk communication was developed and also applied to low frequency EMF (15). In this approach, expert understanding on EMF was obtained in parallel with investigations on how people frame this problem and what they know or belief about it. Then the decision problems

people face were extracted and a mental model was developed, i.e. a model describing the process of understanding and decision taking. In a further step the ability of this model to support people's decisions was tested and only then was information material designed and communicated to the people. This approach takes into account that people do not process and interpret new information in an isolated way. They process and filter information with reference to existing knowledge understandings and beliefs. The main finding of this study was that lay people do have a variety of incomplete and confused understandings about low frequency EMF, but relatively few beliefs that are outright wrong. However, some of these incomplete and incorrect understandings will pose problems in public policy decision making.

A German study (22), also using interview and discussion group techniques, focused on risk perception and risk assessment in the case of high frequency fields. Additionally, it considered the differences in risk assessment among experts, because risk discussion is also a discussion led by experts, depending very much on the credibility of experts, especially when new technologies such as mobile phones begin to spread. One of the main findings was that among different groups very different communication patterns exist and therefore different strategies have to be used to address them effectively.

The role of the media

The influence of mass media on the communication of positive or negative news is tremendous, even rational people can be influenced quite a bit by the media. Journalists are trained how to spread, control and sell news effectively because this is a big business; some main aspects of which are:

- Facts, background knowledge and any correlations are presented in a very reduced way, so to speak as a black and white picture. However, scientific findings usually do not fit such a picture but have many facets, so when they are forced in such a black and white scheme the content as well as the message could become wrong.
- News may be created from opinions only, however opinions are very variable and public opinions can change in the process as a topic develops.
- News are presented as a kind of entertainment.

Due to the entertainment aspect, bad news or even panics are well received by the people but they are very slow in actually changing the habits of the people permanently. They may however make people want others, officials or industry, to change something. This is a way of passing the responsibility, something which also already happens at the stage when news are consumed but there is an artificial distance between the consumer and the action on the screen or the text in the paper.

Therefore journalists themselves do believe that the influence on the public or the individual is very much overestimated and that people are very well able to

discern between serious news and entertainment (Harrington, R., presented to the project group in München 1996). In order to produce such serious news one does not only need journalists with a special training in e.g. science but one also has to train the researchers: Good journalists do have to discern between results of a single study, which cannot be generalised and replicable results which can be used as a basis for further conclusions. On the other hand, researchers have to present their results in an understandable way, avoiding technical language and complicated descriptions when they appear in the media (Grönqvist, L., presented to the project group in München 1996). They also should learn how to present themselves when asked for an interview. An analysis of how the media treated information about EMFs (21) lead to similar conclusions.

Conclusions

According to the findings of risk perception and risk communication research in general and of studies on electromagnetic fields, as well as due to the key aspects of the use of media, the following conclusions can be drawn:

- The personal attitudes, not only towards one specific risk, influence the response of individuals.
- The perception of risks differs among individuals, social groups, countries, as well as between lay people on one side and experts on the other one.
- Risk perception and risk communication are deeply interrelated: understanding perception is important for communication approaches, whereas communication strongly influences the appraisal of risks.
- For a valuable communication it is essential to find out how much scientific background people of different groups do have on electromagnetic fields and on what kind of mental model they base their decisions. Information programmes should then be based on these models.
- Different approaches are also needed for different countries, because the risk perception, the type of problems and the attitude towards information as well as authority and the administrative structures do vary considerably.
- Risk communication should not be mistaken as just another type of public relations or advertisement. Therefore it is wrong to rely on the usual spreading of information or on the effect of mass media. The interaction between the communicating parties is very important.
- The strategies of risk communication have to be adapted carefully to the focus group to be reached. Different focus groups concerning EMFs are e.g.: the general public, especially vulnerable people, such as pacemaker patients or people showing symptoms due to the use or the proximity to sources of EMFs.
- It has to be taken into account that not only the content of a piece of information is important but also the roles taken by the people communicating and the opinion they have on each other.
- The question of credibility of the experts, i.e. how to remain or become credible has to be addressed.

Information material used in different countries of the EU

There are many stakeholders involved in the communication of possible health effects of electromagnetic fields (EMFs). The ones trying to reach the public or certain groups of the public through written information material are mainly: companies selling technologies which involve EMFs, health authorities, media, scientists and self aid groups. Information materials distributed by some of these groups were collected within the EU - see Appendix 5 for a list of solicited and received material. It should be noted, however, that it was not possible to reach all sources of information material within the time interval given. In addition, new channels for information such as the world-wide web are increasingly used also for this type of information, and the material offered there is changing rapidly. Therefore, the material collected cannot be considered complete, but sufficient material was obtained to draw certain overall conclusions.

In the following, first of all possible aims and means of the stakeholders, as seen from the range of information material obtained, are described. Then a classification of the information material is made according to the target groups. For that reason, layout, content and argumentation space as well as general data of each document were independently evaluated by three members of the project group according to a standard evaluation form (see Appendix 5). Additionally, five non-experts were asked to evaluate one of the leaflets using the same evaluation form. This led to the conclusion that experts tended to evaluate such documents in a more positive way and that the evaluations appeared to depend on the professional education of the reader.

Stakeholders involved in the preparation and dissemination of information material

Companies

Two priorities of public or private companies selling technologies or devices which involve EMFs are to maximise the technical effectiveness of their product and to earn money. In addition, companies have to observe current norms and safety regulations in general. In the case of relatively "old technologies", such as power lines, the policy of the utilities usually is to deal with any EMF concerns professionally (there already is a background for it) and to ensure that the position of the company is known: Pamphlets are distributed, especially when new sites are proposed, hearings are given, measurements in homes are offered and presentations in schools are made including special written information material

for schools. Concerning relatively new technologies, such as mobile phones, it was shown more clearly that there are groups of different acceptance levels among the public. For example, "yuppies" like to use handies whereas much protests arise with the public whenever a new mobile phone tower is to be built. The companies, especially the big ones, need to tailor their information strategies much better according to the group addressed. As the market for new technologies is still much more variable compared to the older technologies, more money is likely to be invested in the communication of possible risks and even the help of communication experts is used.

Health authorities

There are international, national and regional health authorities. The international health authorities such as the ICNIRP (the International Commission on Non-Ionising Radiation Protection) or WHO usually write comprehensive reports for scientists and other specialists. These reports are, however, not intended for nor suited to be used directly for the general public. Therefore only national and regional authorities will be dealt with here as sources of information leaflets. They usually give advice to the government, regulatory bodies and to the public. Reports on different aspects are written on request e.g. from the government, sometimes with the help of invited scientists. Information brochures are prepared on subjects of general interest, specific advice may be given by phone or letters. Additionally, press releases on new topics are prepared and sometimes there are telephone help lines with changing information on special subjects.

National health authorities usually choose very careful wording, due to the fact that they try to take into account all different sources of knowledge. However, this is not always appreciated or accepted by the public and by the mass media because they would prefer more definite answers. There are examples where information brochures prepared by local health authorities, e.g. in cities, are rather emotional and subjective. This may be due to the fact that such brochures are used as an instrument of local politics. It is also obvious that the authors often did not have much background knowledge about EMFs.

In general, health authorities do not - as yet - use the latest techniques of risk communication and up to now did not employ such specialists to help them with the information material. Mostly scientists and technicians employed at the authority together with the public relations department will devise the information material.

Depending on different cultural backgrounds etc., information given by authorities is either believed by the public (or even demanded) or it is mistrusted.

Scientists

Scientists are used to describe their results to other scientists, therefore they use many technical terms and intricate descriptions which are difficult to understand for non-experts. Nowadays scientists - involuntarily as well as voluntarily - get

increasingly involved in communicating with the public. They may be asked for interviews in the media or they give presentations of their findings for the press. Scientists may also be asked to assist with official reports on specific subjects, such reports are written e.g. for the government but could be available on request for the public. Then they have to change their wording and streamline their descriptions (compare the section on risk communication above), otherwise their message will not reach the public and may lead to misunderstandings.

Self-aid groups and other private organisations

Papers prepared by self aid groups are in general usually highly emotional and often mix science with non-scientific statements. Sound background information for the reader is often missing and the style used is very persuasive. Usually the layout is poor. Often the authors do not have enough background knowledge. However, such information may be widespread, e.g. by Internet.

In some countries, private organisations have appeared, offering "environmental counselling". As they want to sell information, measurements or certain devices, such as "protective material", they tend to offer information brochures with a well prepared layout. These are, however, often found to present biased views and to lack substantial information, due to the fact that the content is intended to support the services offered.

Information material prepared for different target groups

Among the different target groups addressed are: the general public including schools or special fringe groups such as "electromagnetic hypersensitive" individuals, occupationally exposed persons, authorities and medical doctors. In the following, scientific reports, sometimes ordered and/or paid by authorities or the industry or written by international organisations such as the WHO, generally will not be included. Their content usually cannot be used as such for general information.

As most information material obtained is directed to the general public, this part will be discussed more thoroughly than the information material directed to other target groups.

General public, including schools and fringe groups

The contents of the information brochures for the general public range from general information on EMFs to information on special questions only, such as mobile phones. In addition there is quite a variation in length, ranging from a short folder to book format; for schools also posters were prepared. Usually the brochures contain fairly good comprehensive information on the nature of the fields and the possible sources. The results of different studies can only be reported in any details in the somewhat longer brochures, however most of the

brochures did hint at some existing controversies. Only in half of the information material were limits cited, when cited however, mostly national limits are given, although in some cases the values recommended by international organisations such as ICNIRP or WHO were presented. In about half of all brochures obtained some recommendations were given for daily life. Only very rarely did the information material for the general public contain information on the question of "electromagnetic hypersensitivity", the only brochures referring to "electromagnetic hypersensitivity" more clearly, including examples, came from Sweden and Switzerland.

The layout in general relied on the presentation of some pictures or photos, often well chosen, with graphs and tables or lists and inserts used to underline the text. In some cases the graphs and tables seem to be somewhat complicated for the public addressed. The language was usually also well suited for the readers referred to. As was already discussed in the chapter above, the professionally of layout and the type of presentation used differs depending on the type of stakeholder preparing the information.

The argumentation space used was a little more heterogeneous, as here the influence of the authors or editors seemed to have quite some influence. The type of information can in most cases be described as an instruction. The form of a dialogue or a persuasion appeared rarely. In almost no documents were the argumentation written as a clear warning. About the same number of brochures contained either no clear cut between information and debating or such a clear cut. Most documents seem to be fairly objective, but there were some that were very subjective.

Many brochures only gave the address of the authors and thus do not give the interested reader a chance to get a source for further information.

The brochures directed to schools were nor written directly for pupils but they obviously rely on the interpretation of a teacher of natural sciences. However, the information given was usually a good enough background for some hours of teaching, with all the possible criteria discussed above well fulfilled.

We did not find brochures specifically prepared for fringe groups such as "electromagnetic hypersensitive" people apart from those from the self aid groups themselves. The general layout was then usually very poor, as already discussed in the chapter above, and the content did not cover well either the nature of EMFs, the sources, the results of respective studies or established limits for fields strengths. The argumentation space tended to be very subjective in those cases, with no clear cut between informing and debating; sometimes even the information value was very small.

Occupationally exposed people

Only some brochures obtained were directed at people exposed at the working place. (This is also due to the fact that we asked for information for the public when collecting the brochures.) Information material for working people was usually more technical. The nature of EMFs and their sources as well as studies

were well described. Compared to the information material for the public, limits such as norms or international recommendations were much more emphasised. Possible psychosomatic effects were practically not mentioned. The content of the brochure was mostly instructive and objective, the language was well suited. The photos, tables and graphs used were fairly well laid out, however their number per brochure differed largely.

Two brochures were directed at medical doctors, specialised in working life. They were fairly comprehensive, however the style used was somewhat dry. As they were meant to be used in counselling occupationally exposed people, they used dialogues to explain facts. A clear cut was made between arguing and explaining.

Authorities, such as health authorities, ministries and other decision makers

As was already mentioned above, the relatively large number of scientific or technical reports written for them is excluded from this discussion. There were, however, a few brochures which are well worth a short discussion: They were either directed directly to other decision makers, experts or the industry and contained mainly information on possibilities of risk communication with the public. Therefore they contained almost no background information on the subject of electromagnetic fields, sources and electromagnetic field limits.

Conclusions

Notwithstanding the difficulties in obtaining an objective evaluation of the collected information material and also that the collection of such material was not complete, the following general conclusions and suggestions can be made:

Within the EU countries the distribution of information material on EMFs appears to be quite inhomogenous. The information material obtained appeared in most cases to be fairly suitable for the target groups and did also give quite objective information of today's knowledge. However, the layout and the contribution themselves could be improved with the help of communication experts. Photos, tables and graphs should be selected more carefully according to the respective target group. In addition, different target groups should be identified and the subject of the information material could be more specifically geared towards such target groups (i.e. not only containing information on EMFs in general) in order to improve information flow. It would be helpful to choose target groups which could serve as intermediates, e.g. physicians or labour inspectors. The Internet can be used to advertise such a brochure, e.g. on the home page of the organisation who prepared it.

Handling of individuals claiming "electromagnetic hypersensitivity"

Rationale for handling

A basic premise is that "electromagnetic hypersensitivity" is a real condition in the sense that many afflicted individuals suffer real and - for some - serious health problems. This seriousness, and also the consequences for others around that person (family, work place, etc.) dictate a need for remedial activities and/or help in coping with the situation. Such actions could be taken both in occupational or general public settings as well as by health care (medical) institutions. Close cooperation between these activities is advantageous.

The following recommendations on handling are based on what was elaborated in this report and partly also on some experience gained primarily in Sweden. As this chapter is a very central one in the report, the main findings of this report which was considered useful for determining what actions should be taken, are summarised also here.

On the identity of " electromagnetic hypersensitivity"

- The identification of an "electromagnetic hypersensitive" individual is based on his/her experience of adverse effects while using or being in the vicinity of electric, magnetic or electromagnetic devices (EMF devices). Thus, the individual's appreciation or apprehension of being in the vicinity of some EMF devices is (normally) a precondition for the term "electromagnetic hypersensitivity" to be applied.
- However, situations where individuals in one country or region may attribute their problems to "electromagnetic hypersensitivity", may not lead to such attribution in another area. This is presumably or at least partly due to differences in available information and media attention - major geographical differences occur in these respects.
- "Electromagnetic hypersensitivity" has different appearance and extent in different countries.
- There are currently no methods for identifying individuals with "electromagnetic hypersensitivity" apart from these individuals' attribution of their ill health (symptoms).
- Due to the general non-specificity of the symptoms, the lack of consistent objective findings, the absence of an establish aetiology, and the probable heterogeneity of the problem, the designation "electromagnetic hypersensitivity" should not be confused with a medical diagnosis.

On the causation of "electromagnetic hypersensitivity"

- The causation of "electromagnetic hypersensitivity" is not established. The term, if used, should not be taken as a suggestion that e.g. electric or magnetic fields have been identified as causal factors.
- Manifestations - and presumably also the origin - of "electromagnetic hypersensitivity" are likely due to combinations of different factors, both internal (predisposing factors for the individual) and external (factors present in a specific situation).
- So far, investigations concerning a mechanism by which the vicinity to electrical devices and appliances is involved in the appearance of health problems, have not established a direct physical link between electric or magnetic fields and the health problems, even if further investigations into these and other possible external factors appear warranted.
- There are other external factors which have, at least tentatively, been indicated in the problem, ranging from physical factors such as modulated light ("flicker") to more organisational factors such as various stress conditions.
- Indications exist that psychosomatic reactions may play an important part in the rise and/or maintenance of the syndrome. If so, concern and worry could be important factors for the effect.
- "Electromagnetic hypersensitivity" may be a heterogeneous condition - different afflicted individuals would then not be expected to have the same set of causal factors.

On handling of individuals with "electromagnetic hypersensitivity"

- Upon medical investigations, some individuals claiming to be "electromagnetic hypersensitive" have been found to have other, medically known and often treatable conditions.
- A common experience is that problems - for an afflicted individual - will be less pronounced, and improvements in the situation easier to accomplish, if intervention is made early.
- If the problem of "electromagnetic hypersensitivity" is indeed multifactorial and heterogeneous, then care should be taken not to concentrate efforts on one preconceived type of factor(s) - a broad approach appear better motivated.
- Based on the observation that the occurrence of "electromagnetic hypersensitivity" is sometimes ("clustered"),and the possibility that concern and worry are at least aggravating factors in "electromagnetic hypersensitivity", careful considerations must be given also to individuals around an afflicted individual, so that remedial actions warranted for one individual do not increase their worry or concern ("they are doing things, so it must be dangerous"). Information efforts should be made in order to explain what is being done and why. This may be especially relevant in occupational settings.

General outline

We have not found any officially sanctioned handling program in any of the European nations that we studied. The Norwegian Board of Health is currently evaluating the possibility of developing a strategy for treatment (Turid Vendshol, presented to the project group in Stockholm 1997). There are, however, several programs used at single medical centers for prevention, intervention and treatment of individuals with "electromagnetic hypersensitivity", and also a number of programs adapted by e.g. several larger companies (Lena Hillert and Oswald Jahn, presented to the project group in München 1996). The majority of such programs - as far as we have found - do emanate from Sweden.

Different approaches to handle "electromagnetic hypersensitive" individuals should be made in different countries, since the approach taken must - in our opinion - be geared to the varying appearances of the phenomena. A balance must also be set between the legitimate need for an individual to receive help, and the problem of increasing concern among others. This balance is most likely different in different countries or regions. The structure of health care systems also varies in different European nations and this variation must be taken into account as well.

Any system or informal way set up to handle the problem of "electromagnetic hypersensitivity", should include means by which early detection of an individual's problem is made. Profound differences in possible such means obviously differ between occupational settings and the general public domain, and between different European countries. This also implies that different strategies should be used for problems attributed to situations in the workplace - where often organisational possibilities for early handling are fairly good - and problems appearing in other situations. In the latter, the general practitioner is most likely a prime candidate for early handling, and thus an important target for information concerning "electromagnetic hypersensitivity".

In principle, the effort undertaken should be structured in accordance with the following normal procedures:

- Prevention of symptom appearance in a population.
- Intervention or early handling of afflicted cases.
- Treatment of individuals with long-lasting symptoms and severe handicap.

As already indicated, these activities would normally be handled by various organisations and professionals; occupational safety officers in workplaces, general practitioners, medical personnel in occupational health centers or special clinics etc. The important role played by information in adequate handling of "electromagnetic hypersensitivity" also suggests that it is important that these professionals do have access to balanced information on the topic - and that they share a common view.

Prevention of symptom appearance in a population

Prevention is used for the situation where no cases of "electromagnetic hypersensitivity" have appeared. Since the symptoms involved are non-specific, they could also be caused by various commonly occurring factors such as skin- and airway irritants, allergens and different stressors such as noise, flickering light, and psychosocial factors. However, increased concerns about such symptoms - regardless of their factual origin - might increase their intensity, causing still more concern etc. in a vicious circle.

Thus, the recommended strategy is to generally reduce excessive exposure to factors known to cause these symptoms or to reduce mental stress (see further Table 3). This should be combined with balanced information on what we know and do not know about suspected health effects from the use of electricity or from exposure to EMFs - in order to interrupt or prevent such viscous circles. This information should be composed of several components such as:

- a better understanding of the fields,
- current understanding of the causes and appearance of "electromagnetic hypersensitivity", and
- current knowledge concerning the possibility of disorders such as cancer being linked to EMF exposure.

Table 3. Some suggestions for actions to be taken for prevention of symptom appearance in a population.

	Workplace	General environment
Information	About EMF, health risks, and national standards. Information about company policy to meet present standards and recommendations.	About EMF, health risks and national standards.
Environmental actions	Optimising the work environment: indoor climate, air pollution, noise, lighting, ergonomic factors, psychosocial factors.	Optimising the general environment including traffic pollution, environmental tobacco smoke, and emissions from factories and houses.
Stakeholders	Government agencies and institutions. Occupational health services. Employers.	Government agencies and institutions. Electricity companies. Mobile phone manufacturers and network providers.

In our opinion, the information must be balanced and avoid the extreme positions of either inflating or neglecting the issues involved. In practice, information activities may often prove to be the main effort at this stage.

Intervention or early handling of afflicted cases

In situations where symptoms and the attribution to "electromagnetic hypersensitivity" has occurred among one or some individuals, early handling of the situation is essential in order to prevent a chronic situation with aggravation of the symptoms (see also Table 4).

Table 4. Some suggestions for actions to be taken for intervention or early handling of afflicted cases.

	Workplace	General environment
Medical actions	Medical investigation motivated by symptoms and signs to identify specific medical illnesses or conditions, but not to identify "electromagnetic hypersensititvity" - since this latter condition cannot be identified by medical examinations.	Same.
Environmental actions	Work environment investigation to reduce exposure to factors other than EMFs that might be associated with the presented symptomatology. Such factors might be these listed under primary prevention and work place above.	Environmental investigation to reduce exposure to environmental factors known to give rise to the presented symptomatology. Such factors may be those listed under primary prevention and general environment above.
	Concerning electromagnetic fields see table 6 and the text below.	Concerning electromagnetic fields see table 6 and the text below.
Stakeholders	The afflicted individual. Occupational health service. Employers.	The afflicted individual. General health service. Community health and welfare officers. Environmental health agencies.

A fundament in the handling should always be a medical examination performed by a physician. This is to identify if a "known" disease is responsible for the symptom and which should then be subject to appropriate medical handling. The non-specificity of the symptoms involved makes it - in some cases - entirely possible that the symptoms could be manifestations of other disorders, but misinterpreted by the individual or his/her surroundings. It has occasionally been reported that individuals with alleged "electromagnetic hypersensitivity" have been found to suffer from e.g. hypothyreosis, tumours in the nervous system or contact allergy.

The second basic step is a thorough check for possible contributing environmental factors by a hygienist. Examples of such environmental factors are listed

in Table 3 above, and the actions are partly motivated by the same argument as when performing primary prevention, but - here - perhaps with increased priority. Another reason for these actions is to initiate a communication with the patient attempting to find strategies for coping with the situation, i.e. to gain control of environmental factors of possible importance for the symptoms.

It is - in our view - important that whatever action is taken here is done with the following two objective in mind:

- Actions taken should be done in close co-operation with the afflicted individual.
- Actions should preferably have a broad basis. This means that one should avoid all activities and discussion to be focused on only one or a few factors.

This latter point requires some further comments and perhaps justification. The non-specificity of the symptoms, and the possibility that increased concern might aggravate symptoms leads - in our evaluation - to the possibility that concentration on one factor (which might not be justified for that particular case) would then lead to increasing demands for reductions when actions taken are not effective - again increasing the vicious circle problem. It should be pointed out that this argument is - in our opinion - general, not just geared towards EMF.

Finally, correct and balanced information is also an important part at this stage.

Treatment of individuals with long-lasting symptoms and severe handicap

For individuals claiming "electromagnetic hypersensitivity" with long-lasting and severe symptoms, therapy should primarily be directed towards reducing symptoms and functional handicap (see Table 5). We recommend that this should be handled in close co-operation between:

- a physician (for adequate medical handling),
- a hygienist (to exclude or eliminate factors in the environment that are known to cause symptoms or adverse health effects of relevance to those of the patient), and
- a psychotherapist (who would initially focus on the patient's situation in conjunction with the development of symptoms and consequences brought on by the symptoms).

Table 5. Some suggestions for actions aimed at reducing symptoms and functional handicap.

	Workplace	General environment
Medical actions	Actions to reduce symptoms and functional handicaps.	Same.
Environmental actions	As above. Concerning electromagnetic fields, see Table 6 and the text below.	Same.
Stakeholders	The afflicted individual. Occupational health service in collaboration with other specialists.	The afflicted individual. General health services.

In principle, information activities are relevant at all stages - including this. There is a need here, however, to avoid situations of conflict between e.g. the physician and the patient as to the causes of the disorder - the emphasis here should probably be more on alleviating and assisting in coping, not to change opinions.

Concerning actions directed towards electric, magnetic or electromagnetic field sources

To measure and to reduce the exposure to EMFs in the relevant situation(s) is a commonly asked for action by many of the individuals claiming "electromagnetic hypersensitivity". As illustrated in Table 6, there are, however, both advantages and disadvantages of such actions. Any action taken should balance the need for remedial activity for an afflicted individual with that of avoiding unnecessary worry and concern among others. Again, this balance should be tailored to the varying situation in different countries.

General preventive action to reduce e.g. electric or magnetic fields can not be motivated on the basis of the phenomenon of "electromagnetic hypersensitivity". This is due both to the lack of any solid information that they are indeed involved in the causality, and to the need to avoid the preconception among other individuals that the fields have been shown to have such a relation.

In view of these considerations, companies and other stakeholders involved should consider the various advantages and disadvantages of measuring or reducing electric and magnetic fields - some of which are noted in Table 6 below.

It should be observed that these discussions on field measurements and reductions are relevant to situations where field levels are known to be well below established standards and hygienic limits. If there are grounds to suspect that exposure levels could be in excess of such standards, then of course measurements and - if called for - actions to reduce exposures are warranted,

regardless of reported cases of "electromagnetic hypersensitivity". In such a situation, relevant guidelines and protocols for measurements do exist.

Table 6. Arguments for and against actions concerning electric or magnetic field exposures in situations where individuals with "electromagnetic hypersensitivity" exist.

	Arguments for	Arguments against
Measuring fields	Ensure that levels of exposure of EMF meet excising standards and recommendations.	A causal relationship has not been proven and taking measurements might be interpreted as an indication that a hazard exists.
	May provide a basis for possible actions to be taken by the individual to reduce exposure.	Lack of knowledge of possible exposure parameter of relevance and consequently lack of relevant guidelines or protocols for measurements of such parameters.
	To respond to the concerns of the individual.	The absence of dose-response relationship.
	If measured levels are low this may have a reassuring effect.	Might draw attention away from other factors that might be more relevant.
	By using dosimeters and symptom records, the hypothesis of an association between symptoms and exposure levels in the individual case might be investigated.	
Reducing fields	As part of a prudent avoidance strategy.	No medical or scientific basis on which to reduce exposure to levels lower than those limits that already exists.
	To respond to the concerns of the individual.	In view of the ubiquitous nature of EMFs, reducing the levels in a particular location may not contribute significantly to a reduction in the individual's total exposure.
	May have a placebo effect in reducing symptoms.	May create unnecessary anxiety among others.

In Sweden, five authorities responsible for activities related to electromagnetic fields under general legislation, have recommended a precautionary principle based primarily on suspected cancer risks in relation to low frequency magnetic fields. It should be noted that that document is not directed to the problem of "electromagnetic hypersensitivity".

Recommendations

This investigation of "electromagnetic hypersensitivity" across Europe included an evaluation of questionnaires to various organisations concerning their appraisal of the situation, descriptions of some case reports, a review of the relevant literature on possible causal factors, a description of the available information for the public on electromagnetic fields and did also take into account the concepts of risk perception and risk communication.

Based on these deliberations, the group has come to certain recommendations. These are presented under three headings; recommendations on how to handle individual with alleged "electromagnetic hypersensitivity", recommendations on information activities, and recommendations on further scientific research. It is of course recognised that some of these are closely interrelated.

A central observation found when examining descriptions of cases, appraisals by various organisations as well as evaluating the scientific literature is that "electromagnetic hypersensitive" individuals do not appear to form a homogeneous group, but are more likely described best in terms of subgroups - a few of which have been at least tentatively identified. This non-homogeneity of the phenomenon is of major importance also for a variety of the recommendations made.

Handling of individuals with "electromagnetic hypersensitivity"

The existence of individuals with severe health problems is a clear motivation for adequate medical care and situation handling. The fact that most people claiming to be "electromagnetically hypersensitive" only do show very mild symptoms also requires - in our opinion - adequate handling. Such preventive activity would most likely have a major information content (see further below on recommendations concerning information). In any case it is important that "electromagnetic hypersensitive" persons are taken seriously and that their complaints are analysed and taken care of in a proper way.

The main facets of adequate handling can be summarised as follows:

- individual approaches,
- approaches relevant to various stages (prevention, intervention, treatment) of the individual, and
- avoid concentration on single factor explanation.

It should be recognised that handling and medical care have the prime objective of helping an individual, not of providing scientific information. In practice, a decision as to when and how to emphasise scientific information in the handling should be made on a case-to-case basis.

Further elaboration and comments of ways to handle individuals with "electromagnetic hypersensitivity" are found in a separate section (above).

Information activities

As already stated above, the communication of information on electromagnetic fields in general and on "electromagnetic hypersensitivity" forms an important part of prevention. Such information must of course be balanced, and appropriate for the specific target group and situation. A case could be made for information on electromagnetic fields in general to be available in similar fashion across Europe - keeping the different receivers in mind (general public, various professionals etc.). For specific information on "electromagnetic hypersensitivity", we would rather advocate a more varied approach, where also the situation in different countries (media attention, current existence of widespread concern or not, etc.) could motivate different activities.

Concerning the general preparation of information material, the following should be kept in mind:

- Proper communication techniques have to be used for public appearance, for private consultation and for written material. Therefore communication and/or layout specialists should be hired and workshops or training for scientists should be offered and used in order to learn effective communication skills.
- For successful written information there should be a definition of the target group, tests of the target group for specific omissions in information and a feedback on trial information.

Concerning general information on electric, magnetic and electromagnetic fields, the following additional recommendations hold:

- The most important target groups to be addressed should be: general practitioners, local health authorities, politicians and other decision makers and schools i.e. intermediators. Journalist may serve as important links to various target groups.
- The information material should be diverse and also specified, i.e. not only on electromagnetic fields in general but there should also be shorter brochures on special questions, e.g. mobile phones, household devices, powerlines etc.

Finally some recommendations concerning information on "electromagnetic hypersensitivity":

- Here the most important target groups to be reached are: self-aid groups, general practitioners and occupational health physicians.
- There should be a clear statement that there is currently no scientific basis for a connection between "electromagnetic hypersensitivity" and exposure to electromagnetic fields.
- Other factors that could lead to the same symptoms should be included in the information, thus emphasising concepts such as "multifactorial", "broad approaches" etc.

- Depending on target groups, the emphasis between "etiological" information about knowledge on causes, and information on how to handle individuals should be balanced.

Further scientific research

Further scientific investigations are needed because it is not currently possible to either clearly describe the syndrome or definitively identify the cause(s) of "electromagnetic hypersensitivity". The following aim and comments are appropriate to the situation:

- A better characterisation of the adverse health effect is required. This would include the utilisation and in some cases the development of standard questionnaires as well as standard anamnestic and medical protocols. Asides from its use in research (see below), such improved effect assessments could also assist in the handling of individual cases.
- Standardized assessments of effect could lead to a better development of a data basis. This could also enable comparison between a/ different European nations, b/ different syndromes (see below) and c/ with the general population, and thus more clearly address the specificity or non-specificity of the different symptoms and signs.
- When performing etiological research, specific hypotheses have to be formulated and tested. This applies both to EMF and to other factors that could presumably lead to the adverse health reactions. One problem here is the non-specificity of e.g. some EMF-based hypothesis ("some parameters of the field could be....."), such vague formulations are not easily testable in research. The specificity of hypothesis is also aimed at the effect assessment - we would argue for hypothesis to be geared towards specific effect endpoints rather than "electromagnetic hypersensitivity" - taking cofactors such as higher specific sensitivity into account.
- Research hypothesis should be aimed at both physical and non-physical factors. The possibility of interactions or synergetic effects have also to be taken into account.
- Provocation studies offer one important approach to etiological studies, and should be focused on both EMF as well as on other factors. Careful considerations have, however, to be given to inclusion criteria for testees, as well as the occurrence of various cofactors.
- Possible connections or analogies with other syndromes of (partly) unclear aetiology should be examined, such as multiple chemical sensitivity, amalgam sensitivity, chronic fatigue syndrome, sick building syndrome etc.

In the fields of risk perception and risk communication, certain research issues are also advocated, as their development would greatly contribute to understanding and handling of "electromagnetic hypersensitivity".

- Risk perception as a factor for attribution processes and also as a causal or contributing factor for adverse reactions relevant to "electromagnetic hypersensitivity" should be investigated. Such investigations should take into account research performed in other areas, and not be limited to "electromagnetic hypersensitivity", however.
- Means to identify possible risk groups and subgroups in terms of variations in risk perception should be identified or developed.
- Research concerning the design and the evaluation of risk communication, in general and for this specific purpose is also required.
- The issue of credibility of opinion leaders has to be taken up as well as the improvement of conflict culture in order to improve communication.

Research activities on these and other relevant topics should be compared and preferentially also co-ordinated between different countries. One important example of such co-ordination efforts is the international WMF project of the WHO.

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Appendix 1. Questionnaire results

Introduction

In the absence of a data base on "electromagnetic hypersensitivity" covering various European nations, it was decided to solicit some relevant information concerning awareness of the problem, estimates of its extent, situations where it would occur, symptoms and consequences for the individual. Within the framework of the nature of the information required, the time and resources available, a questionnaire sent to various organisations for their appraisals was considered feasible.

In some European nations, self aid groups (SAGs) created around this issue exist, thus constituting one obvious channel of such information. For two reasons, however, this avenue of information was not considered sufficient for our needs; the possibility that they - because of their aims and roles - would forward exaggerated estimates or at least estimates at the upper end of the scales, and the fact that SAGs were only identified in some European nations. Another type of organisation from which information could be solicited were those where medical attention is sought or cases are being referred to. In several or perhaps most European countries, centres for occupational medicine or similar organisations (COMs) would - according to our previous experience - constitute such sources. One alternative would be local physicians or general practitioners, but they would have two serious drawbacks; they would presumably seldom have the overview necessary to be able to estimate the overall extent of the problem, and to reach a sufficient number of them would also become a major practical undertaking. In addition, practical experience from some countries where it was felt that the general environment rather than workplaces provided the majority of cases of "electromagnetic hypersensitivity", suggested that a number of such cases were still referred to COMs. Accordingly, we decided to send the questionnaires to SAGs and COMs in the different European countries. Still, in countries where the general environment would provide the majority of the cases of "electromagnetic hypersensitivity", we would advocate some caution in the interpretation on two points; 1/ COMs could perhaps tend to underestimate the extent, and 2/ they could also be expected to overestimate the extent of serious cases in proportion to all cases, since the referral system would presumably tend to eliminate a number of non-serious cases.

Methods

A questionnaire designed to cover the basic information needs given above was created by the project group, with similar but not identical formulations for the two different target groups (COMs and SAGs), in that the questions regarding contact with patients/members were tailored to fit the two groups specifically. Apart from such questions, the questionnaires were essentially the same for both COMs and SAGs. Each questionnaire was written in several language versions; English, German, French, Italian and Swedish - see Appendix 2 for the English versions.

Addresses to COMs were provided by the different project group members in accordance with the structure of such centres in the countries concerned. Some self aid groups addresses were found in the Swedish self aid group monthly magazine, with additional addresses provided by the project participants. We have not approached organisations or SAGs dealing primarily with individuals suffering from some other (ill-defined) conditions such as Multiple Chemical Sensitivity or dental (amalgam) problems.

The questionnaires were sent to 138 different centres of occupational medicine or similar centres in the 15 different EU member countries and also to the Faroe Island, Iceland and Norway, and to self aid groups in Denmark, France, Germany, Italy, Norway, Sweden and Switzerland. In total, we solicited answers from 15 different self aid groups (see Table 1 below). The initial response rates for some countries were very low, necessitating a reminding letter to be sent out, in which we emphasised the importance of replying even if they had no contact with the problem of "electromagnetic hypersensitivity".

In all we received 72 answers, of which 10 were from SAGs. Ten questionnaires were sent back to us due to erroneous addresses. We had a response covering 10 of the EU member countries and 3 non-member countries; COMs in Belgium, Luxembourg, Greece, Spain, Portugal and the self aid group in Switzerland did not respond to our questionnaire. We also received replies from some COMs and SAGs that not were on our address list, including two SAGs from Ireland, who had obviously received questionnaires that were passed on from others. Accordingly, a strict response rate can't be given, nor is indeed called for, as the main emphasis of the interpretation should be qualitative rather than quantitative.

The symptoms reported by the COMs and SAGs were classified into different symptoms groups by the medical doctors of the working group, as were some other conditions reported. Two of the different symptoms groups, the skin and nerve symptom groups, also included a number of subgroups. Apart from this and some other categorisation of answers, the following information is basically presented as received - as we do not consider the material suitable for detailed numerical analysis.

Table 1. Number of distributed and received questionnaires by country.

Country	Questionnaires distributed to			
	COMs		SAGs	
	Sent out	Received	Sent out	Received
Austria	4	4	0	-
Belgium	1	0	0	-
Denmark	15	13	1	1
Faroe Island	1	1	0	-
Finland	5	2	0	-
France	24	6	4	2
Germany	17	8	7	3
Greece	2	0	0	-
Iceland	1	1	0	-
Ireland	2	1	0	2 a/
Italy	28	4	0	-
Luxembourg	1	0	0	-
Norway	9	6	1	1
Portugal	5	0	0	-
Spain	2	0	0	-
Sweden	10	8	1	1
Switzerland	0	-	1	0
The Netherlands	2	1	0	-
United Kingdom	9	7	0	-
Total	138	62	15	10

Notes for Table 1. a/ See text above for comments.

Results

Awareness and contact with the problem

Information was solicited whether the COMs received "questions or requests etc. related to individuals who consider themselves as "electromagnetic hypersensitive" - i.e. who experience symptoms or other adverse health effects which they attribute to electrical devices or to electric or magnetic fields". Furthermore, questions were asked whether they knew "of any (other) organisation that does". Finally, they were asked to report the number of requests received in a given time period "in the last year" (this information has been categorised - note that the <1/week category includes some answers from COMs that do not receive calls/ requests at all). In Table 2, the replies to these questions are shown.

Basically, most COMs reported that they received requests and that they knew about other COMs and other authorities, industries, organisations and universities that also received requests concerning "electromagnetic hypersensitivity". However, the large number of non-respondents should be kept in mind - it is quite possible that among the non-responders, the awareness of the problem would be