HEALTH SYMPTOMS ASSOCIATED WITH ELECTROMAGNETIC RADIATION - A QUESTIONNAIRE SURVEY

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Abstract

Started in June 2001, health questionnaires have been distributed to people who complained about health symptoms, which they associated with exposure to electromagnetic radiation. The objective of the survey was to gain a better knowledge of the anxieties of the afflicted population, to obtain hints of possible problems and of actions that should be taken to solve the problems. The survey was not designed to establish a causal association between exposure to electromagnetic fields and health symptoms. Until March 2002, 342 questionnaires have been sent back. The average age of the responders was 49.5 years, 59 percent were female. Generally, more than one health symptom was named. Sleep disorders (59%), headaches (43%), nervousness/distress (20%), concentration difficulties (18%), and fatigue (16%) were most prevalent. The responders related their symptoms most frequently to exposure to mobile phone base stations (78%), followed by mobile phones (38%), and power lines (28%). 87 percent of the people who consulted a public authority due to their symptoms were unsatisfied with the answers, whereas consultations to self-help groups or building ecologists have mostly fulfilled the expectations. Two third of the afflicted people had taken steps to reduce their symptoms. The most common step was reducing the exposure by avoiding the source (if possible) or by shielding.

Introduction

Nowadays, electromagnetic fields are ubiquitously present in buildings and in the environment. Parallel to the increasing exposure to electromagnetic fields over the last years an increasing number of people have been claiming that they are hypersensitive to electromagnetic fields. Such patients suffer generally from unspecific health symptoms such as headache, sleep disorders, skin rash, dizziness, etc. The prevalence of the electric hypersensitivity syndrome (EHS) is varying in a broad range across countries. It is estimated that less than 1 percent of the population is afflicted at maximum [1,2]. Recently, a representative survey in Stockholm found that 1.5 percent of the population declared themselves as suffering from EHS [3]. Though many acute health effects have been cited, the results of controlled experiments have been contradictory [4-10]. Thus, a direct causal link between exposure to electric or magnetic fields below recommended reference levels and self-reported symptoms has not been established so far. There is no specific symptom profile or validated diagnostic criteria to diagnose EHS. Apart from a pure field phenomena, other causes of EHS, such as distress, neuroticism, psychiatric morbidity and public debate have also been discussed [11-13].

In Switzerland, the public discussion about EHS was rapidly increasing in the mid nineties, when the expansion of the mobile phone system led to many new base stations. Many people were concerned about adverse health effects and some of them reported health symptoms since they were exposed to mobile phone base station. As it

is not clear who is responsible for such complaints, afflicted persons have contacted public authorities, self-help groups, building ecologists and doctors. In order to get a better knowledge of the anxieties of the afflicted population a questionnaire was developed and distributed to people who complained about health symptoms, which they associated with exposure to electromagnetic fields. Additional objectives of this survey was to obtain hints of possible problems and of actions that should be taken to solve the problems. It was not aimed to establish a causal association between exposure to electromagnetic fields and health symptoms.

Method

The questionnaire was designed for people who complained about health symptoms, which they associated with exposure to electromagnetic fields. The questionnaire included questions about 5 topics: health symptoms, exposure, measures and consultations that have been taken, the general health status and demographic characteristics. We used open questions to ask about health symptoms in order to be as little suggestive as possible. Exposure was inquired by a given choice of the most important sources in the daily life. For each source we wanted to know the exposure of the responders (minutes per day or distance to living place or work place, respectively) and how sure the responders were that a specific source caused their health symptoms. We further asked about measures and consultations they had been undertaking and how satisfying those measures and consultations were. Questions about the general health status were mainly adopted from the Swiss Health Survey from 1997. Among others this part contained questions from the Coping Inventory for Stressful Situations (CISS) [14]. Demographic questions gave information on age, gender, education, living arrangements, etc.

In June 2001, the survey was presented to public authorities, building ecologists, telephone companies and other bodies which may be consulted by the afflicted population. We asked them to motivate people, who where complaining about health symptoms they associated with exposure to electromagnetic fields, to fill in a questionnaire. We collected questionnaires during one year. However, in this paper we present preliminary results of the questionnaires which were sent back between June 2001 and March 2002.

Results

Demographic characteristics of the sample

342 individuals filled in a questionnaire between June 2001 and March 2002. Thereof, 310 individuals complained about own experienced health symptoms. The remaining 32 responders either claimed that they were against mobile phone base station in residential areas and on schools (7 responders) or they mentioned that they were not yet suffering from health complaints (5). From 20 responders the reason to fill in the questionnaire was not obvious. Thus, analyses were made with the data from the 310 individuals who were suffering from health symptoms. Table 1 presents the proportion of various demographic characteristics of the responders with health complaints. Overall there were more female complainants (59%) than male. Almost half of the sample was between 40 and 59 years old, about a third was older. Two third of the responders were married, which is more than in the Swiss population (46%). Most of the responders were Swiss. The demographic characteristics of the sample according to the five main complaints was compared by means of Pearson's chi-square tests. Significant ($p<0.01$) different demographic characteristics were found for the responders with concentration difficulties. Compared to the whole sample, persons with concentration difficulties were more frequently male, younger, less often married, and lived more often in suburban regions. Complainants with sleep disorders, headache, nervousness/distress and fatigue were not substantially different from the whole sample with respect to demographic characteristics.

Symptom prevalences and severity

Overall, 47 different symptoms were reported from the responders. The questionnaire allowed to state 5 symptoms at maximum. On average 2.8 different health symptoms were listed per questionnaire. Figure 1 shows the number of the most frequently stated symptoms in decreasing order and classified by sex. Sleep disorders (59%), headache (43%), nervousness/distress (20%), concentration difficulties (18%), and fatigue (16%) were most prevalent. The Pearson's chi-square test did not reveal a significant difference between the symptom prevalence of men and women ($p=0.79$).

Group	All [# (%)]	With Sleep disorders [# (%)]	With Headache [# (%)]	With Nervousness/ distress [# (%)]	With Concentration difficulties [# (%)]	With Fatigue [# (%)]
Total responders with complaints	310 (100%)	182 (59%)	134 (43%)	63 (20%)	55 (18%)	51 (16%)
Gender						
Male	126 (41%)	70 (23%)	54 (17%)	23 (7%)	29 (9%)	20 (6%)
Female	182 (59%)	111 (36%)	79 (25%)	39 (13%)	26 (8%)	30 (10%)
Age (years)						
0-19	21 (7%)	13 (4%)	10 (3%)	6 (2%)	14 (5%)	3 (1%)
20-39	54 (17%)	27 (9%)	33 (11%)	8 (3%)	7 (2%)	10 (3%)
40-59	140 (45%)	83 (27%)	63 (20%)	31 (10%)	26 (8%)	28 (9%)
>60	93 (30%)	58 (19%)	27 (9%)	17 (5%)	8 (3%)	9 (3%)
Education (highest level)						
No/little professional education	55 (18%)	29 (9%)	31 (10%)	7 (2%)	15 (5%)	7 (2%)
Apprenticeship	129 (42%)	79 (25%)	56 (18%)	22 (7%)	13 (4%)	18 (6%)
Higher education/University	111 (36%)	65 (21%)	38 (12%)	29 (9%)	22 (7%)	23 (7%)
Marital status						
Single	69 (22%)	39 (13%)	29 (9%)	16 (5%)	19 (6%)	7 (2%)
Married	193 (62%)	112 (36%)	87 (28%)	35 (11%)	24 (8%)	33 (11%)
Widowed/divorced/separated	44 (14%)	29 (9%)	15 (5%)	11 (4%)	11 (4%)	9 (3%)
Nationality						
Swiss	266 (86%)	150 (48%)	113 (36%)	50 (16%)	43 (14%)	46 (15%)
Other nationalities	37 (12%)	27 (9%)	16 (5%)	9 (3%)	11 (4%)	4 (1%)
Characteristics of living place[1)]						
Rural	106 (34%)	50 (16%)	43 (14%)	17 (5%)	12 (4%)	17 (5%)
Suburban	133 (43%)	90 (29%)	59 (19%)	32 (10%)	34 (11%)	21 (7%)
Urban	52 (17%)	29 (9%)	23 (7%)	10 (3%)	9 (3%)	11 (4%)
At high traffic road	55 (18%)	31 (10%)	25 (8%)	13 (4%)	7 (2%)	9 (3%)
Near industry	24 (8%)	15 (5%)	10 (3%)	7 (2%)	1 (0%)	5 (2%)

Table 1: Demographic characteristics of the complainants in absolute numbers and in percent.
[1)] Multiple answers possible

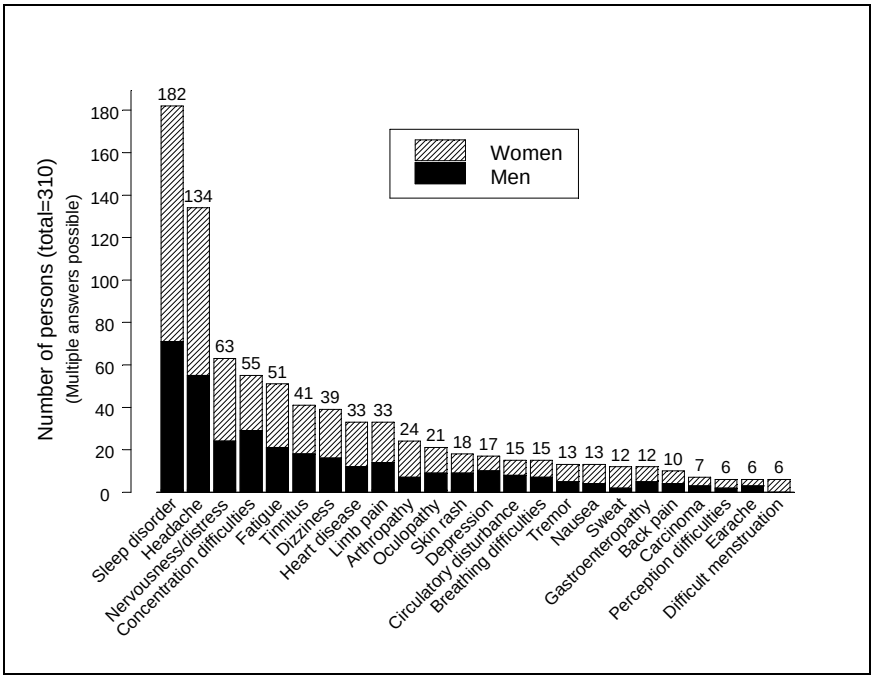

Figure 1: Number of named symptoms in decreasing order and classified by sex.

Generally, the afflicted people declared that the physical impairment due to their symptoms was severe (see Fig. 2). 15 percent of the responders stated their physical impairment with ‘very severe’, 32 percent with ‘severe’, 34 percent with ‘medium’, 7 percent with ‘slight’ and 1 percent with ‘none’. The mental impairment was evaluated less profound and the social impairment was predominantly assessed from none to medium. Quality of life was assessed to be most affected. 15 percent of the responders stated that they were at least partly incapacitated for work due to their health complaints. In average they stated an incapacity of 50 percent.

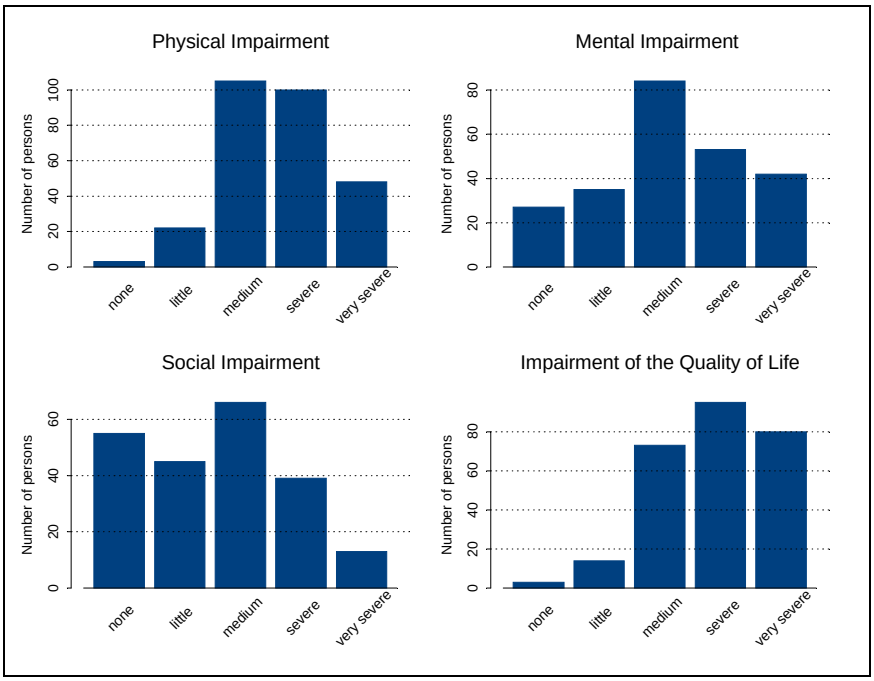

Figure 2: Assessment of the severity of the complaints.

52 percent of the sample stated that they are able to perceive electromagnetic fields whereas 38 percent stated that they are not capable (10 percent did not answer this question).

Exposure to EMF

81 percent of the complainants declared themselves as exposed to radiation from mobile phone base stations either at the living place or at the work place. Exposure to train and tram wires was stated by 39 percent of the sample, to power lines by 32 percent , and to radio and TV broadcast transmitters by 18 percent. 59 percent considered themselves as not exposed to radiation from mobile phones. The residuals either used a mobile phone or felt exposed due to other users in public places.

The responders had to rate how sure their health complaints were caused by different sources of electromagnetic fields. 78 percent related their symptoms for sure or rather sure to exposure to mobile phone base stations. The causality of other sources was assessed considerably lower: mobile phones (38%), power lines (28%), cordless phones (28%), train and tram lines (21%), broadcast transmitters (20%), computer displays (20%), transformer (19%), TV display (16%), lighting (14%), and electrical devices (13%).

Three group of sources were generated according to the electromagnetic frequency range. Mobile communication and broadband technique emits in the radio and microwave frequency range. Computer and TV displays emit mainly in the frequency range of a few kilohertz, and use of electricity (power lines, transformer, lighting, electrical devices) is related to emission in the extremely low frequency range (ELF). Figure 3 shows the source group to which the symptoms were predominantly associated. Almost half of the responders did not favour sources from a sole frequency range. From the ones who did, most were concerned about sources from the group ‘communication technique’ which emits in the radio or microwave frequency range. Only a few persons related their symptoms predominantly to displays or to electric sources (ELF).

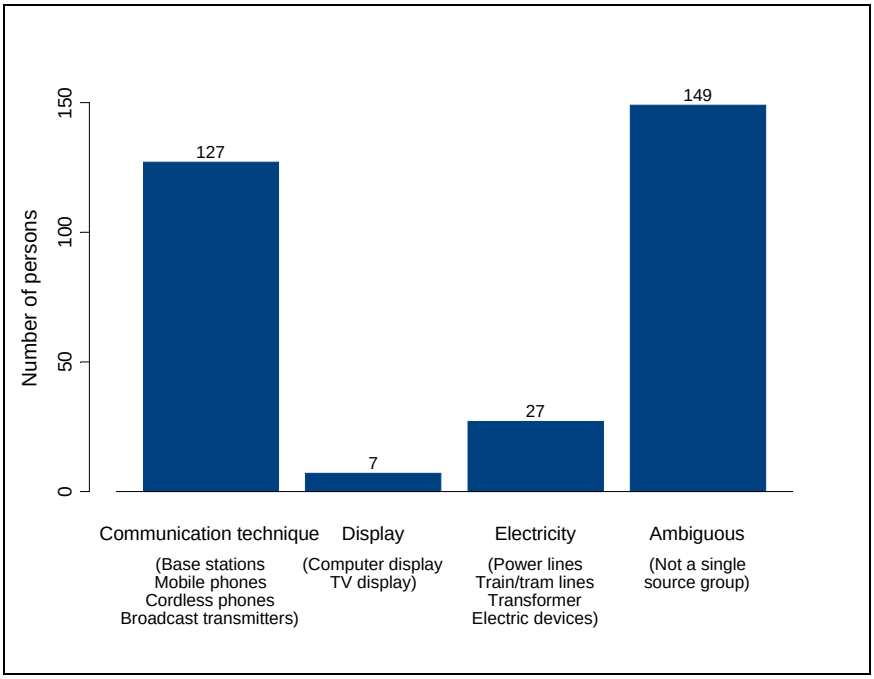

Figure 3: Source group according to the electromagnetic frequency range which the symptoms were predominately associated to.

Figure 4 shows the 10 most prevalent symptoms in relation to the electromagnetic frequency range of the ascribed causal source group. The Mann-Whitney rank sum test yielded statistical significant differences ($p<0.01$) between the symptom pattern of the group 'electricity' and the group 'communication technique' and the group 'ambiguous', respectively. Persons who ascribed their symptoms to electric sources suffered more often from nervousness/distress, fatigue, limb pain, heart disease, arthropathy, and muscular spasm than persons who ascribed their symptoms to communication technique sources. Further significant differences were ($p<0.01$) found between the symptom pattern of the group 'display' and the group 'communication technique' and the group 'ambiguous', respectively. Headache was the most prevalent symptom in the group 'display', though this group consisted only of 7 complainants. All other group comparisons were not statistical significant.

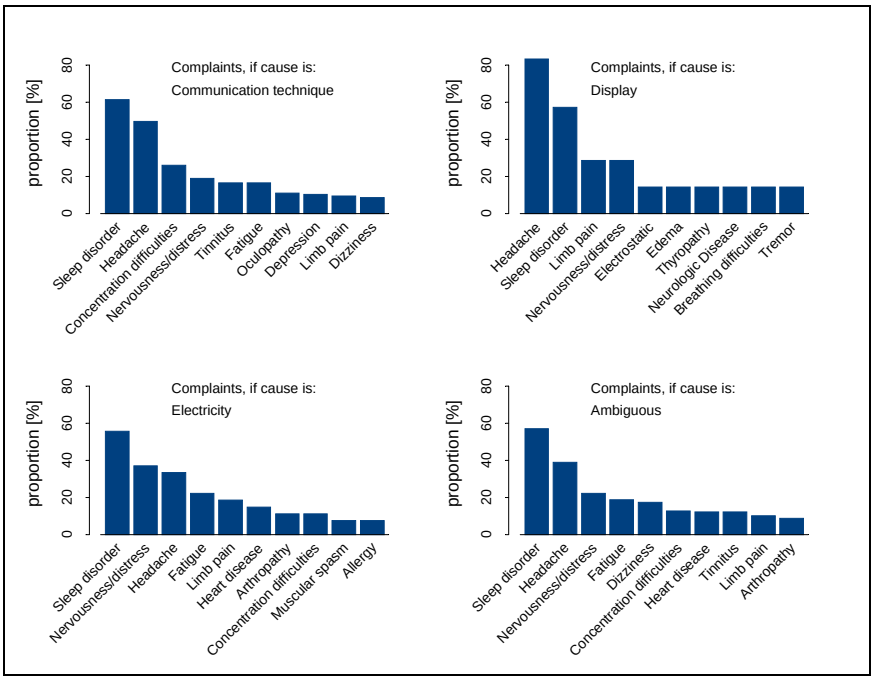

Figure 4: Symptom occurrences in relation to the source group of the ascribed cause.

Measures and consultations

Two third of the responders stated that they had at least one consultation due to their health complaints. Family doctors and municipal authorities were contacted most often (see Figure 5). Complainants consulted in average 3.2 different bodies. The complainants were asked to state whether the consultations were satisfying or not. Advise from public authorities and source related companies were judged as dissatisfying. Advises from self aid groups, therapists, building ecologists and others obtained a considerably higher rating.

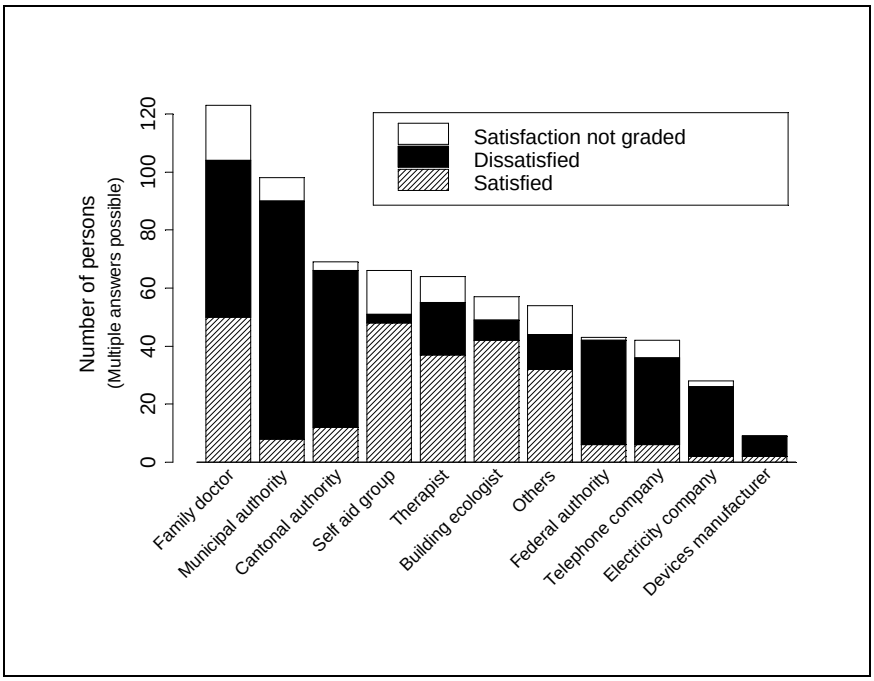

Figure 5: Number of contacts due the health complaints and whether these contacts were satisfying or not.

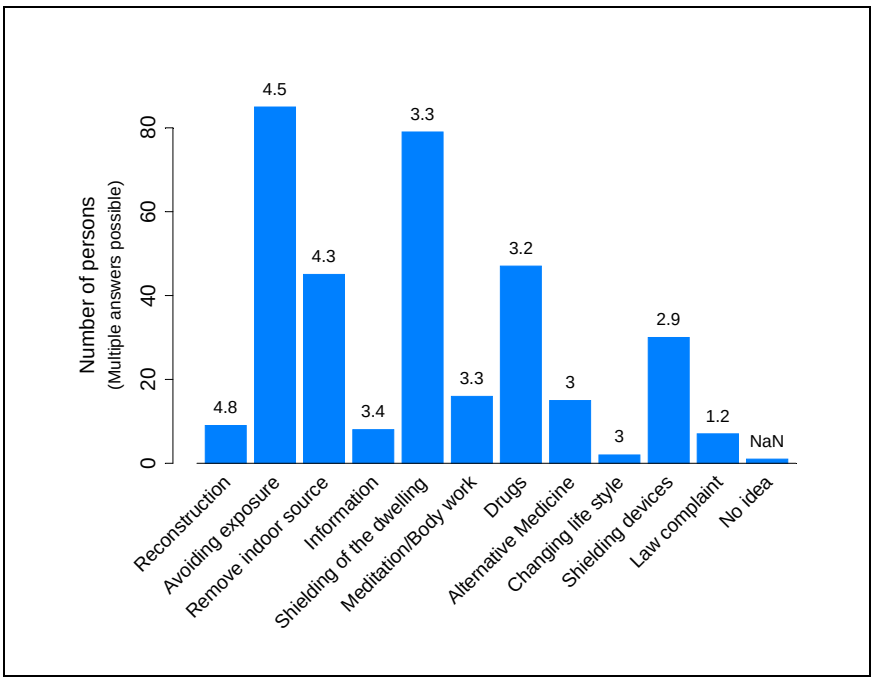

Figure 6: Number of persons who took steps to reduce their symptoms. The figures above the bars represent the average efficiency which had been estimated from the complainants who took the corresponding measure (1=ineffective; 6=very useful). Steps are ordered in decreased efficiency.

205 complainants (66%) had taken steps to reduce their symptoms (see Figure 6). Most afflicted people stated that they were avoiding exposure situations, if possible. For instances they changed the places of residence, the office, or the places of the bed. Shielding of the dwelling area was practised likewise often. Usually, this meant that a curtain or net was constructed which attenuated electromagnetic radiation. For each step taken we asked the complainants to grade the efficiency from 1 (ineffective) to 6 (very useful). Reconstruction, avoiding exposure and removing indoor sources were evaluated as most useful (see Figure 5). In contrast, law complaints, shielding devices, alternative medicine and change in lifestyle obtained the lowest rating. From the 205 complainants who had taken steps to reduce the symptoms, about one third stated that the symptoms were unchanged afterwards, one third felt a little improvement afterwards and one third a substantial improvement.

Discussion

The symptom pattern which was found in this survey corresponds to the symptom pattern which is associated to exposure to electromagnetic fields in the public debate. However, this survey must be carefully interpreted with respect to causal associations. Though causal associations cannot be excluded at the present knowledge, the result of this survey may reflect primarily a concern among a part of the Swiss population about health risks from the ubiquitous exposure to electric and magnetic fields.

First of all, this survey was designed to gain a better knowledge of the afflicted population's point of view. The survey showed, that complainants rated their physical impairment quite severe. Comments in some of the questionnaires support this finding. The severity of the symptoms prompted two third of the complainants to consult different bodies and to take measures to reduce their symptoms. Consultations by public authorities showed to be very unsatisfactory. It has to be taken into account that public authorities may be consulted with different expectations than a self aid group or a building ecologist. For instance, the removal of a mobile phone base station is expected from the former but not from the latter. Nevertheless, the results of this survey give some suggestions how to improve consultations by public authorities.

The data analysis of this survey is not yet completed. Additional 100 to 150 questionnaires will be included into the final analysis. It is intended to compare the results of this survey with the result of the Swiss Health Survey from 1997, which is based on a representative collective.

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