

**Electromagnetic hypersensitivity in Denmark
A challenging handicap**

2019





Electromagnetic hypersensitivity in Denmark - A challenging handicap

Prepared for the EHS association by Heine Bertelsen

Graphical layout: Karin Nørgaard

English translation: Karin Weiser

The Danish EHS Association

Fåborgvej 75 A

5762 Vester Skerninge

www.EHSF.dk

Category: Investigation
Keywords: EHS, electromagnetic hypersensitivity, handicap, public health, prevention
Language: English (originally in Danish)
Version: 1.0
Date: September 15th 2019 (English version September 2021)
Format: PDF
Photos: Cover page: Anyaberkut/Adobe Stock, page 6: Jivko/Adobe Stock, page 24: Lolostock/Fotolia

ISBN : 978-87-971636-0-3

Published by the EHS Association on September 15th 2019

The publication can be used as a reference if the source is clearly stated.

Preface

Electromagnetic hypersensitivity (EHS) is an environmental disorder that has increased a lot in recent years. EHS is not yet recognized either as an illness or a disability in Denmark, therefore, it is difficult to investigate, treat or get support in everyday life.

It is not a sustainable situation for citizens living with EHS who experience major functional barriers and disabilities in everyday life, and whose lives must be completely reorganized as a result. It is society's task to remedy (change) this situation. We all bear a responsibility, especially politicians, the National Board of Health, doctors, and health professionals.

To date in Denmark, there is no overview of this disability, and the current study sheds light on the topic from a quantitative perspective. The study adds a new and insightful overview of EHS based on demographics, health, connection to the workforce, socio-economic costs and some of the limitations that are encountered in everyday life.

There is still a lack of interdisciplinary research in relation to EHS where the focus must be on early diagnosis to preserve the quality of life for the increasing number of people with EHS. Experience shows that early diagnosis and intervention significantly increases the ability to work and thus enables a decent and dignified life on almost equal terms with the rest of the population.

Addressing this challenge in society will require an appreciative and open-minded approach in the years to come.

John Jalving, MD
Specialist in General Medicine
Lecturer Emeritus at the University of Southern Denmark

Table of Contents

1. Summary.....	5
2. Background and purpose.....	6
3. What is elektromagnetic hypersensitivity?.....	7
3.1 History of electromagnetic field (EMF) exposure.....	7
3.2 Provocation experiments on electromagnetic hypersensitive.....	7
3.3 Research into EHS as a physical environmental disorder.....	8
4. Electromagnetic hypersensitivity in Denmark.....	9
5. Who is electromagnetically hypersensitive?.....	10
5.1 Gender, age and geography.....	10
5.2 Education.....	11
5.3. Socioeconomics.....	13
6. Health.....	15
6.1 Symptoms in everyday life.....	15
6.2. Importance of early diagnosis.....	18
7. Quality of life.....	20
8. Workforce and economy.....	22
8.1. Employment.....	22
8.2. Finances and support.....	23
9. The socioeconomic costs of electromagnetically hypersensitive citizens.....	26
10. Inclusion in society.....	28
11. Appeal to politicians and the National Board of Health.....	29
12. References.....	30

1. Summary

More and more people are becoming increasingly sensitive to their surroundings. EHS is an environmental disorder that causes children, adolescents, and adults a variety of physical symptoms when using and staying near electrical devices and equipment that emit electromagnetic radiation.

EHS is on the increase in Danish society and today 1 in 10,000 people are members of the association. At the same time, this increase is exponential. In recent years (2018), the number of members increased by just over 50% compared to the membership base, and the estimate for 2019 shows an even larger increase.

The population group that develops EHS is mostly women and middle-aged people. Compared to the rest of the population, they often have an academic educational background, and are otherwise evenly distributed across the country's five regions. There is a high unemployment rate of approximately 35% compared to the Danish population which leads to a socioeconomic imbalance.

The symptoms are experienced differently which can be explained by the severity of EHS. People with mild EHS experience mild symptoms, and can cope with everyday life with a few allowances, whereas people with severe EHS experience strong and persistent symptoms. It's clear that the earlier EHS is diagnosed, the more the symptoms are controlled.

The impact of EHS on quality of life is huge. Again, this is experienced very differently. People with mild EHS have a similar quality of life to those of the average population, and they can therefore thrive. The more severe the degree of EHS, the lower the quality of life. In people with extreme EHS, the quality of life is so low that some people

contemplate and have even committed suicide. The connection to the workforce is, as mentioned above, conditioned by the degree of severity of EHS. People with mild EHS have an unemployment rate of 0%. People with moderate to severe EHS have, despite their disability, a low employment rate. However, for people with extreme EHS, the unemployment rate is 100%. The figures conceal that many people with EHS are self-employed which makes it easier for them to organize their work according to their disability.

The socioeconomic costs of EHS are extensive. One person costs society an average of 10,220 EUR annually. In 2019, the annual cost was approximately 5.1 million EUR alone for self-diagnosed people with EHS in the EHS Association. An approximate estimate of the accumulated cost to society over the next 10 years will be 136,770 million EUR.

As a result of their disability, many (people with EHS) experience great limitations in everyday life. In some cases, this means that EHS prevents basic consultations and care with their doctor, dentist and at the hospital, as radiation sources occur, to a large extent, in these places. The same applies to public transport. The result can be a geographical lock-in and isolation in Denmark's outlying areas.

Finally, the EHS Association wants to achieve recognition of EHS as a disability, to be able to help this group of citizens to live a dignified and decent life, which human rights have enshrined. In addition, it is important to help future citizens with EHS, by giving unbiased priority to impartial research into EHS, in collaboration with the EHS Association, where the focus must be on diagnosis and treatment.

2. Background and purpose

EHS in Denmark has not previously been elucidated in a quantitative study, and therefore this study will be able to shed light on characteristics of this group of citizens.

Questionnaires were prepared with the primary starting point as a theoretical frame of reference (Eltiti et al, 2007). In addition, several questions are identical to several reference tables in Denmark's Statistics database, to be able to compare the population with people with EHS.

The questionnaires were both collected electronically and by letter during the period September 2018 to February 2019. The questionnaire was sent to all members of the EHS Association in Denmark. The response rate was 52.3%.

The purpose of the study was to form an objective and fact-based starting point for a dialogue. This ensures that the dialogue is based on trends and contexts, rather than prejudices and individuals' experiences. It is hoped that this study will create a greater understanding of the existential challenges of EHS individuals and that it is in everyone's interest to address these.



3. What is electromagnetic hypersensitivity?

EHS is a functional impairment (Johansson, 2015) and is characterized by several non-specific, multiple, and complex symptoms from several organ systems, where clinical signs of identifiable disease, according to the ICD-10 classification, are missing. The symptoms arise from adverse health effects from exposure to non-ionizing microwave

radiation in non-thermal intensities from a wide range of wireless radiation sources (mobile transmitting masts, smart meters, Wi-Fi, smartphones, smart TVs, computers, etc.), as well as from low frequency electromagnetic fields, for example, electrical equipment (WHO EMF).

3.1 History of electromagnetic field (EMF) exposure

EHS has been publicly known since the introduction of radar systems when the first people were named radar sick. Since then, the exposure to electromagnetic radiation has increased exponentially, see Figure 3.1.1 below published from The Lancet (Bandera, 2018). Researchers therefore ask that the health aspects of this exponentially increasing environmental factor be thoroughly investigated, as there may be a connection to several disorders (Pritchard, 2019).

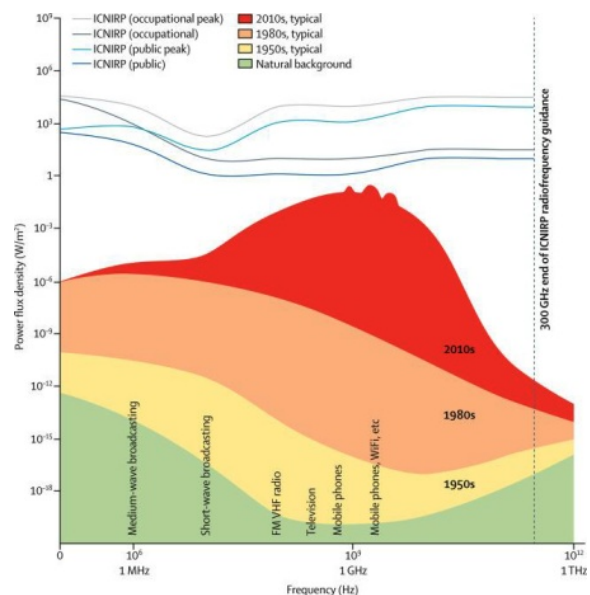


Figure 3.1.1 - Historical development of EMF exposure
Source: Bandera 2018

3.2 Provocation experiments on electromagnetic hypersensitive

Over the course of time, several provocation studies have been conducted on people with EHS. Most experiments have not been able to establish a correlation between exposure and symptoms (Rubin et al, 2010), yet some have shown crystal clear statistical correlations (Rea et al, 1991). What the failed provocation experiments have in common, is that they use electromagnetic radiation in short time intervals, and at the same time

the radiation's frequency, intensity and modulation do not necessarily trigger symptoms in the patient group. For many, the symptoms are delayed from minutes to hours, and the symptoms often last for several days. Therefore, experiments with, for example, 10-minute intervals, with exposure, pause, exposure, pause, etc., respectively, could not be reliably assessed by subjective measurement methods. Therefore, a

roll of the dice can be an equally accurate bid. In addition, the sensitivity is variable in relation to the degree to which the disorder is under control, which is why it sometimes takes a small, and other times greater exposure to provoke symptoms. Furthermore, the subjects are exposed to background radiation during their journey to and at the test site. This exposure before the start of the experiment, combined with the delay of the symptoms and their duration, makes the possibility of a statistically significant conclusion unlikely.

Panagopoulos et al (2015) further point out that provocation experiments are erroneously set up with simulated electromagnetic radiation, and not with the actual sources that cause the symptoms. Finally, patient material is important, where the most sensitive do not manage to show up for an experiment. Most of the above factors were addressed in the most thought out and highly significant provocation experiment conducted by Rea et al (1991).

3.3 Research into EHS as a physical environmental disorder

In recent years, there has been research into the identification of biological markers and medical measuring devices that can locate the specific physiological abnormalities in EHS individuals. In short, the biological studies show that EHS individuals can be diagnosed by biomarkers.

In addition, the first pilot study using fMRI scanning was conducted as late as 2018. This showed that all 10 EHS subjects studied had abnormal brain activity, in the form of hyperactivity in specific centres in the brain (Heuser, 2017).

The publication of EUROPAEM's guidelines for the assessment of EHS syndrome was prepared by 14 environmental medical research centres in Europe (Belyaev et al, 2016), which account for the documented biophysiological changes in oxidative cell stress triggered by electromagnetic radiation in non-thermal intensities.

EHS can be diagnosed by biomarkers



- ROS (reactive oxygenic substances) which reflect the degree of the body's oxidative cell stress) are detected by measuring nitroperoxide in the blood.
- The lipid oxidation has a central position in the bio pathological response pattern and is easily monitored by Malondialdehyde Analysis in blood (MDA).
- Melatonin index (the secretion of sleep hormone in urine) as a measure of damage to brain cell membranes and depletion of the melatonin content of brain cells under the influence of microwaves for a longer period.
- Using additional markers: Heat protein, Glutathione peroxidase enzyme and histamine assays increased the specificity so that the diagnostic evidence relative to a control group became significant.

(Irigaray et al, 2018; Belpomme et al, 2015; Chiara et al, 2014)

4. Electromagnetic hypersensitivity in Denmark

The EHS Association has existed since 1992 and during the early years saw a low increase in the number of members. Over the past 15 years, it has increased steadily, and in August 2019 the number of members was over 600, corresponding to approximately 1 member per 10,000 citizens. With this current membership increase, this number is set to increase steadily in the future, due to the ever-increasing exposure to electromagnetic radiation in the form of, for example,

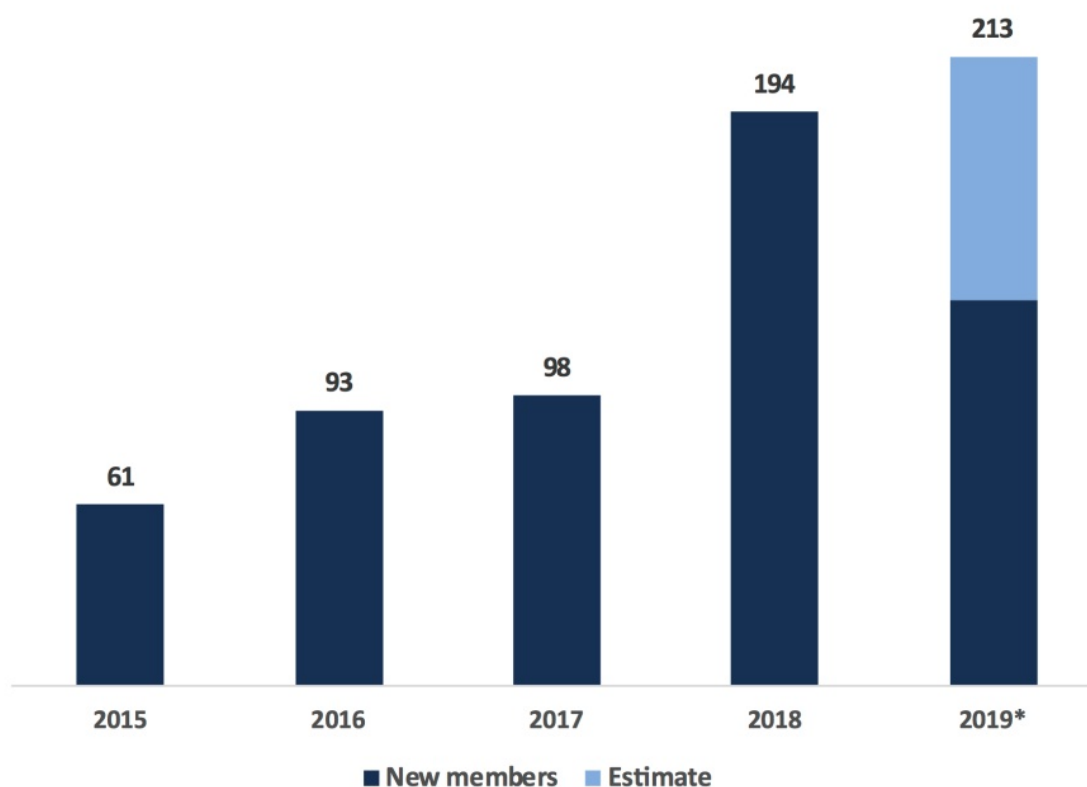
mobile masts (cell towers), mobile phones, Wi-Fi, smart meters, 5G rollout etc.

Figure 4.1 shows the increase in the number of members registered with the EHS Association. Due to the EHS syndrome's lack of recognition and diagnosis, the actual number in Denmark is underestimated. For the same reason, there have been quite varied estimates of the incidence or prevalence of EHS over time.

Figure 4.1

Number of new registrations in the last five years

Note: 2019 is a linear estimate reflecting the increase up to and including 12th of August 2019



5. Who is electromagnetically hypersensitive?

A demographic and socioeconomic overview

The following sections provide an overview of the differences and similarities between EHS individuals and the general population.

5.1 Gender, age and geography

Previous studies have shown that approximately two thirds of people with EHS are women, and the typical age group is the middle-age group (Eltiti et al, 2007; Hagström et al, 2013; Kato et al, 2012; Belpomme et al, 2015). This study supports previous studies in which women make up approximately 71%.

Figure 5.1.1 below shows the distribution and difference in the population of people with EHS

by gender and age. This shows that young people (20 - 39 years) are statistically significantly under-represented, and that the correspondingly statistics for middle-aged people are significantly over-represented. In addition, women are statistically significantly overrepresented.

People with EHS are equally distributed in the country's five regions, as shown in Figure 5.1.2.

Figure 5.1.1 - The distribution of people with EHS by gender and age

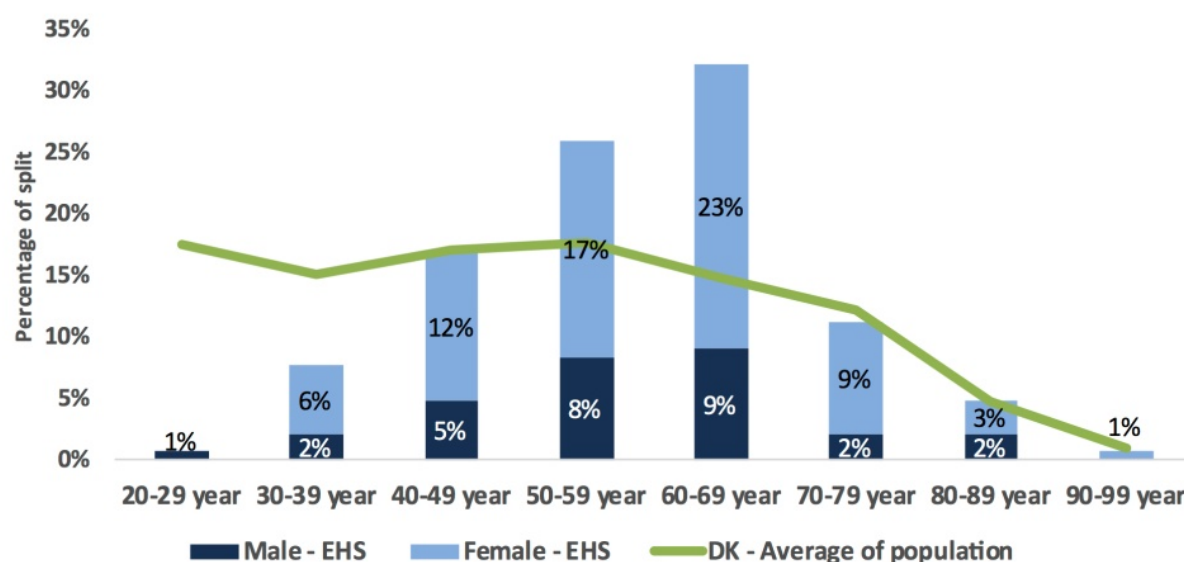
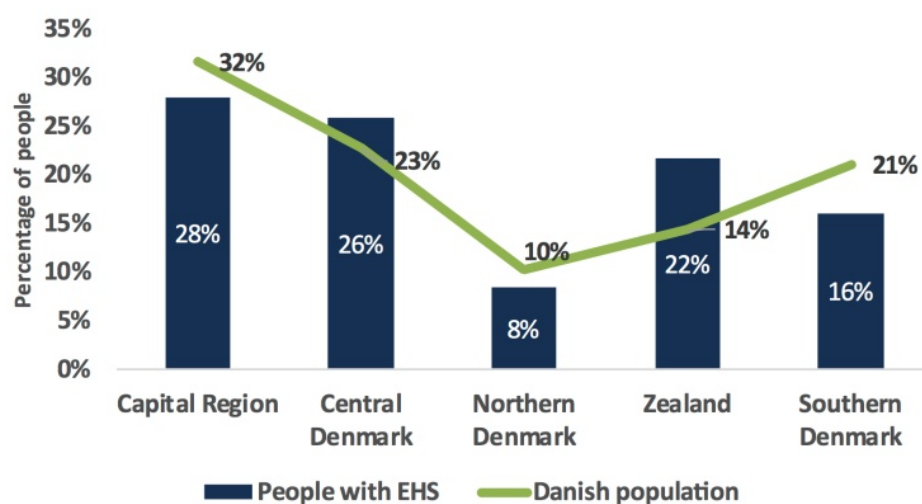


Figure 5.1.2 - Proportion of people with EHS compared to the general population in each region

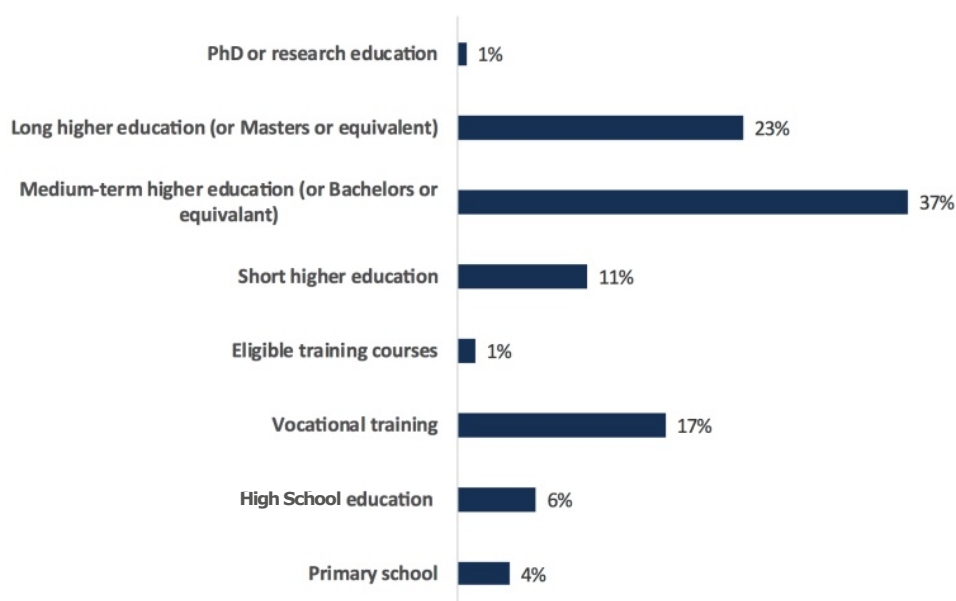


5.2 Education

The level of education is included to help provide a picture of the background of people with EHS. Figure 5.2.1 shows the highest completed education. To make a fair comparison with the rest of

the population, it is subsequently corrected for age and gender, both of which have already been shown to deviate from the population average.

Figure 5.2.1 - Educational background for electromagnetic hypersensitive



The focus is on the 35- to 49-year-olds and the 50- to 69-year-olds to compare with the general population, as represented in Figure 5.2.2 and Figure 5.2.3, respectively.

Based on the figures below and by statistical significance ($P < 0.01$), it appears that women with EHS are overrepresented in the group which

consists of people with a Bachelor, Masters, and PhD educations, compared to the group of other (education) programmes. The same is true for men ($P < 0.01$). It can therefore be concluded that the average educational background for people with EHS is to a greater extent academic compared with the general population.

Figure 5.2.2 - Comparison of 35-to-49-year old's' level of education

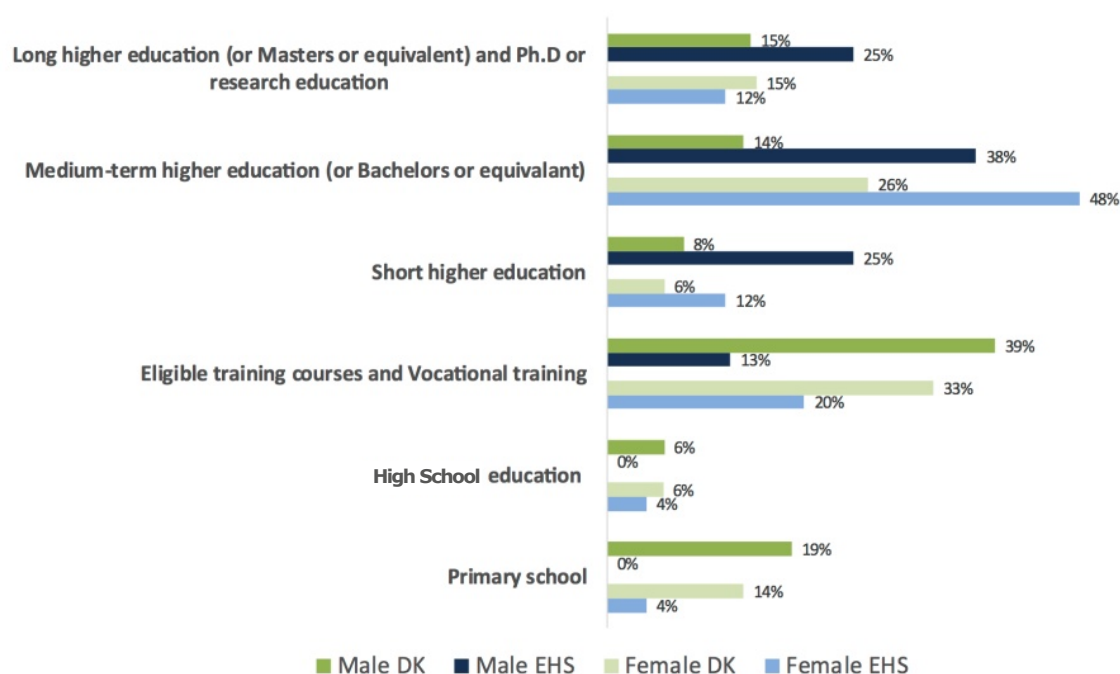
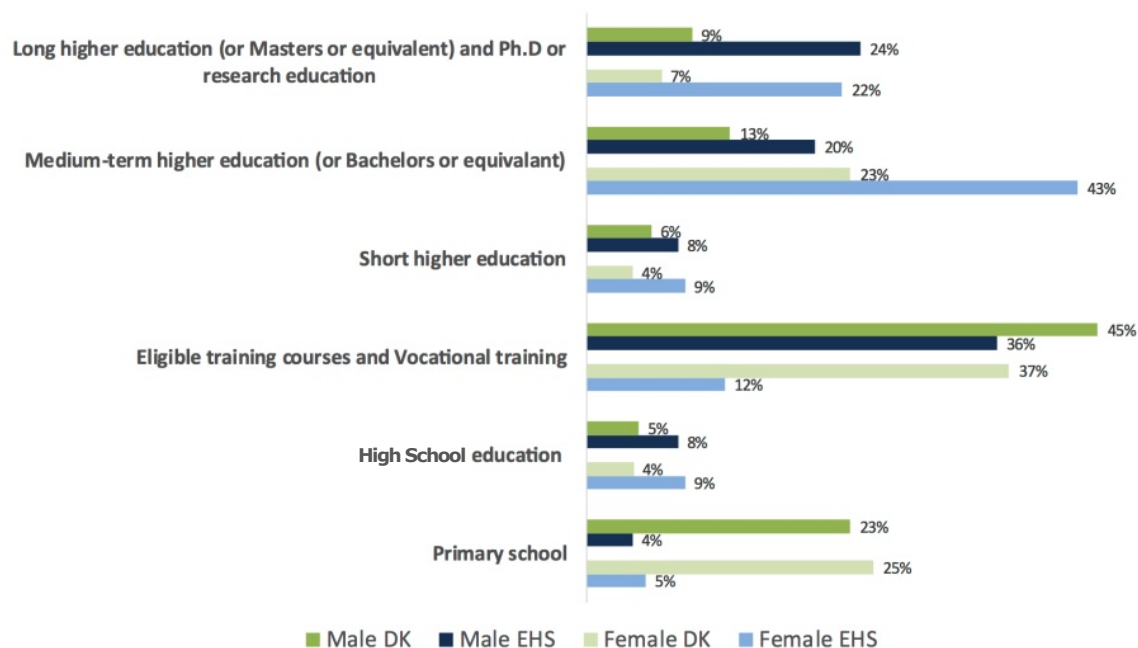


Figure 5.2.3 - Comparison of 50-to-69-year old's' level of education

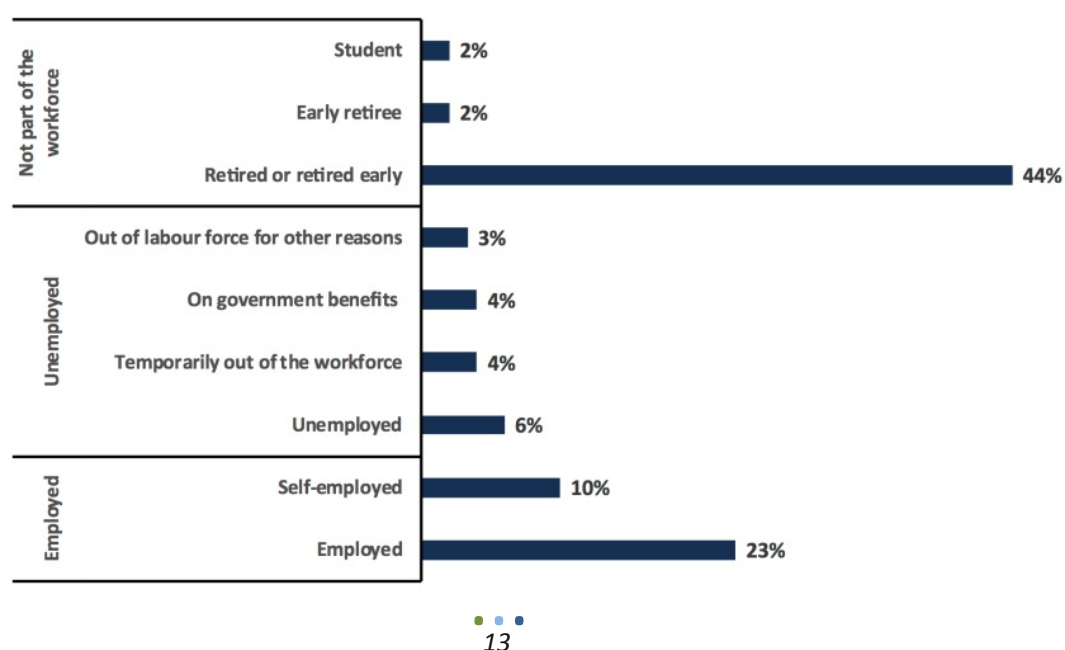


5.3. Socioeconomics

It is important to assess the socioeconomic status to shed light on the consequences of EHS.

Figure 5.3.1 below shows the distribution of those inside and outside the workforce.

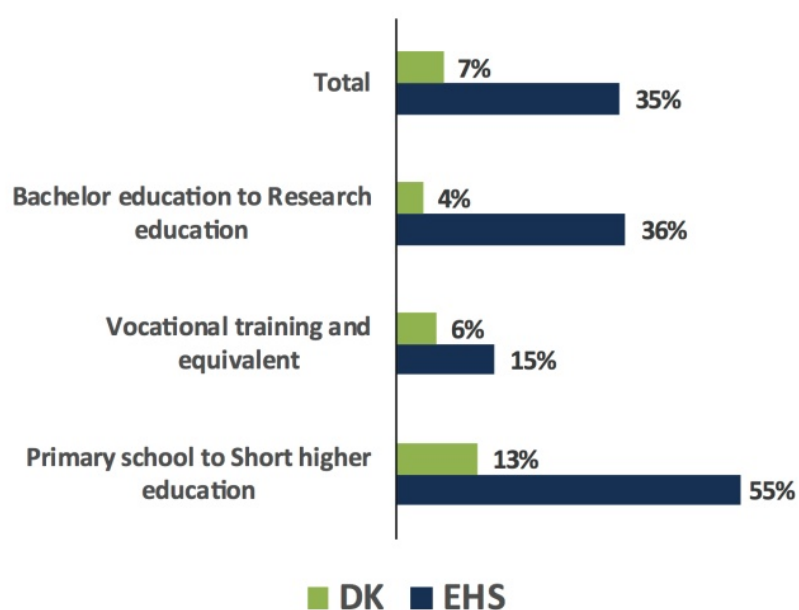
Figure 5.3.1 - Socioeconomic status of people with EHS



The unemployment rate has been assessed, corrected for age, gender, and educational background to be able to compare with the general population. Thereafter, the educational background has been grouped to be able to assess the deviation statistically.

The figure shows that the unemployment rate is significantly higher than average for people aged 35 to 69 within the workforce ($P < 0.0001$). A more in-depth analysis of this can be found in the section "Workforce and economics".

Figure 5.3.2 - Comparison of unemployment



6. Health

This section aims to shed light on the health of those living with EHS as health is one of the most basic and crucial factors to maintain a balanced and satisfying life. In Table 6.1, different degrees of EHS are introduced to show the different severities.

Table 6.1 Severity of electromagnetic hypersensitivity

Severity of EHS	Definition
Slight	Has a normal everyday life, can work, and takes few precautions for electromagnetic radiation.
Moderate	Has an almost normal everyday life and can work under the right conditions. Takes several precautions for electromagnetic radiation.
Severe	Can use electronics to a very limited extent and is severely limited in everyday life.
Extreme	Completely incapacitated. Experiences major inconveniences at the slightest exposure. No use of electronics.

6.1 Symptoms in everyday life

The symptoms of EHS have been documented several times in scientific articles (Eltiti et al, 2007; Kato et al, 2012), and the present study is based on these articles. Table 6.1.1 shows an overview of symptoms and their severity. The syndromes are characterized by non-specific

symptoms triggered by the central nervous system and the autonomic nervous system. There are differences in the combinations of symptoms each person experiences as being most prominent.

Table 6.1.1 - Symptoms divided by degree of electromagnetic hypersensitivity severity

Symptoms / Degrees of EHS	Slight	Moderate	Severe	Extreme
The nervous system	1.0	1.4	1.8	2.0
Depression	0.4	0.8	1.1	1.0
Anxiety	0.4	0.7	1.0	0.6
Irritability	0.7	1.1	1.4	1.3
Difficulty concentrating	1.5	1.8	2.1	2.2
Fatigue	1.6	2.2	2.7	2.8
Memory difficulties	1.3	1.9	2.2	2.4
Dizziness	0.6	1.0	1.5	2.2
Difficulty sleeping	1.3	1.5	2.2	2.8
Stress	1.1	1.8	2.0	2.6
Skin	0.6	0.9	1.3	1.7
Skin irritation	0.8	1.0	1.5	2.1
Skin rash and eczema	0.6	0.8	1.3	1.7
Redness of the skin	0.6	0.8	1.2	1.3
Ears	1.1	1.4	1.7	2.0
Ringing in the ears	1.5	1.8	2.1	2.2
Sound hypersensitivity	1.6	2.1	2.1	3.0
Pressure in the ear	0.7	1.2	1.6	1.6
Earache	0.6	0.6	0.9	1.4
Headaches	0.6	0.8	1.3	1.3
Migraine	0.4	0.5	0.7	0.8
Headaches	0.8	1.2	1.8	1.9
Cardiovascular system	0.6	0.9	1.3	1.6
Cardiac arrhythmias	0.7	0.9	1.6	1.9
Heart palpitations	0.9	1.1	1.7	2.5
High blood pressure	0.3	0.6	0.7	0.3
Gastrointestinal system	0.5	0.8	1.0	1.3
Stomach acid	0.3	0.7	1.0	0.7
Food intolerances	1.1	1.9	1.8	3.0
Nausea	0.4	0.5	1.0	1.2
Vomiting	0.1	0.1	0.3	0.1

Note: The scores are based on the average answers. The scale used is: 0 = not at all, 1 = a little bit, 2 = to a moderate degree, 3 = a lot, 4 = to a great extent. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

See Table 6.1.2 for an overview of the most prominent symptoms and degree of severity of EHS.

This is sorted by the most prominent symptoms. The table shows that symptoms easily perceived as moderate can become extremely debilitating, where fatigue, difficulty in sleeping, sound hyper-

sensitivity, food intolerances and stress are characteristic of the extremely sensitive. At the same time, it appears that the first significant symptoms of EHS are fatigue, sound hypersensitivity, difficulty in concentrating, ringing in the ears and difficulty in sleeping.

Table 6.1.2 - Top 10 symptoms by degree of severity of EHS

Top 10 Symptoms / Degrees of EHS	Slight	Moderate	Severe	Extreme
Fatigue	1.6	2.2	2.7	2.8
Sound hypersensitivity	1.6	2.1	2.1	3.0
Memory difficulties	1.3	1.9	2.2	2.4
Food intolerances	1.1	1.9	1.8	3.0
Difficulty sleeping	1.3	1.5	2.2	2.8
Difficulty concentrating	1.5	1.8	2.1	2.2
Ringing in the ears	1.5	1.8	2.1	2.2
Stress	1.1	1.8	2.0	2.6
Heart palpitations	0.9	1.1	1.7	2.5
Headaches	0.8	1.2	1.8	1.9

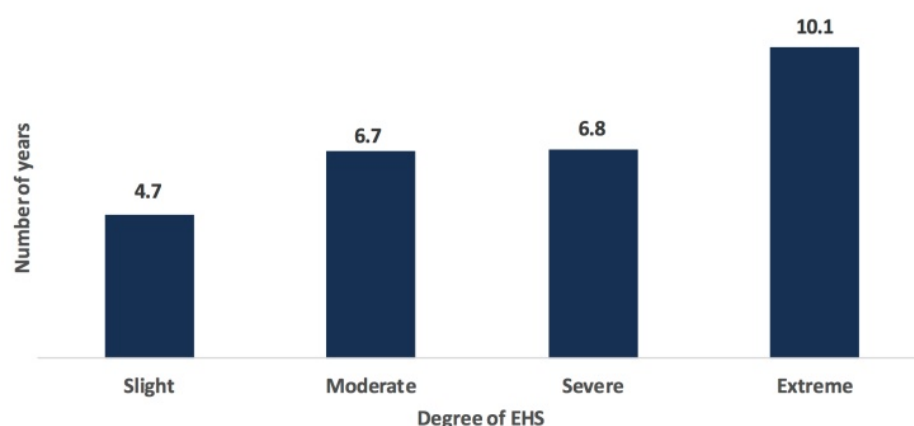
Note: The scores are based on the average answers. The scale used is: 0 = not at all, 1 = a little bit, 2 = to a moderate degree, 3 = a lot, 4 = to a great extent. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

6.2. Importance of early diagnosis

The fact that the symptoms are non-specific also means that it takes time to conclude the underlying cause of the symptoms. Figure 6.2.1 below shows that it takes a long time from the onset of symptoms until the self-diagnosis of EHS is available. In other words, the experience is that very few people have knowledge of EHS before reaching the conclusion that electromagnetic radiation is the cause of their symptoms, or they take a

very long time to accept that they have EHS. This also clearly indicates that it is not a placebo effect that is the cause of EHS. The figure also reflects the tendency that the earlier EHS is diagnosed, the better the individual can maintain a dignified life. This, combined with the increasing number of electromagnetic hypersensitives, means that the major focus must be in research of early diagnosis and treatment of EHS.

Figure 6.2.1 - Number of latent years and degree of severity of electromagnetic hypersensitivity

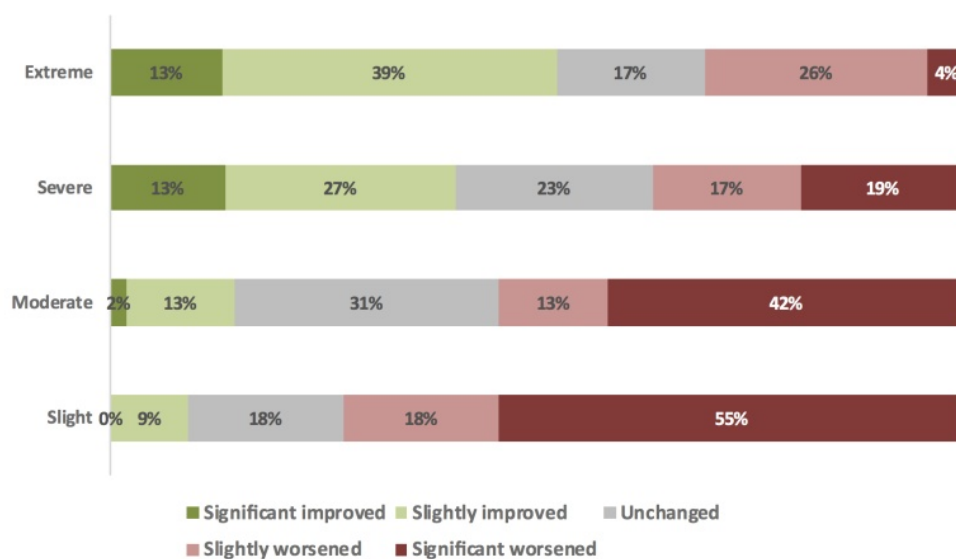


Note: latent years is the difference from EHS symptoms occurred and to when EHS is perceived as the cause

Furthermore, it is important to clarify whether the symptoms are kept in check or whether they gradually develop over time, as shown in Figure 6.2.2. This shows that people with mild EHS can predominantly maintain their condition, by protecting themselves as much as possible, from exposure to electromagnetic radiation. The more severe the degree of EHS, the more difficult it becomes to keep the condition at bay. From this it

can be assumed that by recognizing EHS as an environmental disorder and disability, can help people maintain a dignified life, for example, by offering assessment, support, and treatment. Studies have shown that it is possible to improve even the most difficult cases of EHS with the right help (Genuis, 2012), which is why there is also hope for a life on almost equal terms with the rest of the population.

Figure 6.2.2 - Development of EHS



Note: The question is: How has your EHS developed over the past year in terms of sensitivity to electromagnetic radiation?

7. Quality of life

In this section, the quality of life of the all-encompassing EHS handicap is assessed. The theoretical frame of reference from Denmark's Statistics has been used for assessment and corrected for education and gender.

Table 7.1 shows that people living with EHS experience a significantly lower quality of life based on all comparable measuring points compared with the general population. This is particularly evident in the opportunity to steer life in the di-

rection wanted and general satisfaction with life. People living with EHS experience having to move from their house and home, be without work and generally be cut off from society. Therefore, it is not surprising that this is the point where the biggest difference emerges. The table below also shows the stigma experienced by those who are electromagnetically hypersensitive.

Table 7.1 - Quality of life for people with EHS compared with the Danish population

Quality of life	DK	EHS	P-Level	Difference in pct.
How happy are you currently with your life?	7.50	5.98	0.000	-20%
How satisfied with life do you expect to be in 5 years?	8.28	6.84	0.000	-17%
To what extent are you happy with your own financial situation?	7.11	6.12	0.000	-14%
To what extent are you happy with your work life?	7.11	5.65	0.000	-21%
To what extent are you happy with your relationship with your family?	8.01	6.32	0.000	-21%
To what extent are you happy with your relationship with your friends?	7.73	6.43	0.000	-17%
To what extent do you feel valued and recognized by others in your everyday life?	7.68	6.43	0.000	-16%
To what extent do you feel you can steer your life in the direction you want?	7.33	5.12	0.000	-30%
To what extent do you feel you can trust people?	7.19	6.06	0.000	-16%

Note: The scores are based on the average answers. The scale used is: 0 = low degree, 10 = to a great extent.

The numbers have been adjusted for education and gender. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

In addition, there is a crucial difference in the quality of life for people living with EHS, which is determined by the degree of severity of EHS. Table 7.2 shows an overview of selected factors and concludes that the more severe the degree of EHS, the lower the quality of life. Furthermore, it is also clear that thoughts of suicide increase with sensitivity, just as experience has shown that the

suicide rate is high for electromagnetic hypersensitivity. This is probably due to the downward spiral caused by isolation and increasing symptoms, various meetings at the job centre, lack of recognition, health appointments, treatment and (lack of) understanding (about the condition) which ultimately lead to a feeling that there is no way out.

Table 7.2 - Quality of life versus degree of severity of EHS

Quality of life / Degree of EHS	Slight	Moderate	Severe	Extreme	EHS Total
How happy are you currently with your life?	7.8	6.6	5.5	2.9	6.1
How satisfied with life do you expect to be in 5 years?	8.3	7.4	6.2	4.5	6.9
All in all, how happy are you?	8.0	6.3	5.6	4.6	6.2
To what extent are you positive about life?	8.5	7.0	6.3	5.6	6.8
To what extent are you happy with your own financial situation?	7.2	6.1	5.9	4.3	6.1
To what extent are you happy with your work life?	7.8	6.6	3.3		5.6
To what extent are you happy with your relationship with love life?	6.8	5.9	5.3	2.8	5.6
To what extent are you happy with your relationship with your family?	7.3	6.3	5.9	6.7	6.3
To what extent are you happy with your relationship with your friends?	8.0	6.6	5.8	6.1	6.5
To what extent are you happy with your health?	7.0	5.3	3.7	1.4	4.6
Do you have high expectations to your future?	8.0	6.4	4.6	4.9	5.9
Do you have high expectations for the future of society?	5.3	3.8	3.1	2.3	3.6
To what extent do you feel valued and respected by others in your everyday life?	8.0	6.5	5.9	6.0	6.4
To what extent do you feel respected by others in your everyday life?	8.3	6.4	6.0	5.7	6.5
To what extent do you have people around you to talk to if you have problems or need support?	7.7	6.6	5.9	5.0	6.4
To what extent do you feel you can steer your life in the direction you want?	7.6	5.3	4.3	3.2	5.1
To what extent do you feel you can trust people?	7.1	5.9	5.7	6.1	6.1
To what extent do you experience close relationships with other people?	7.7	6.0	6.0	5.7	6.3
To what extent are you confident and have self-worth in your everyday life?	8.1	6.7	6.9	7.2	7.0
To what extent do you worry about your future?	5.0	5.2	7.1	5.9	6.0
To what extent do you think about suicide?	0.4	1.0	1.5	2.8	1.3

Note: The scores are based on the average answers. The scale used is: 0 = low degree, 10 = to a great extent. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

8. Workforce and economy

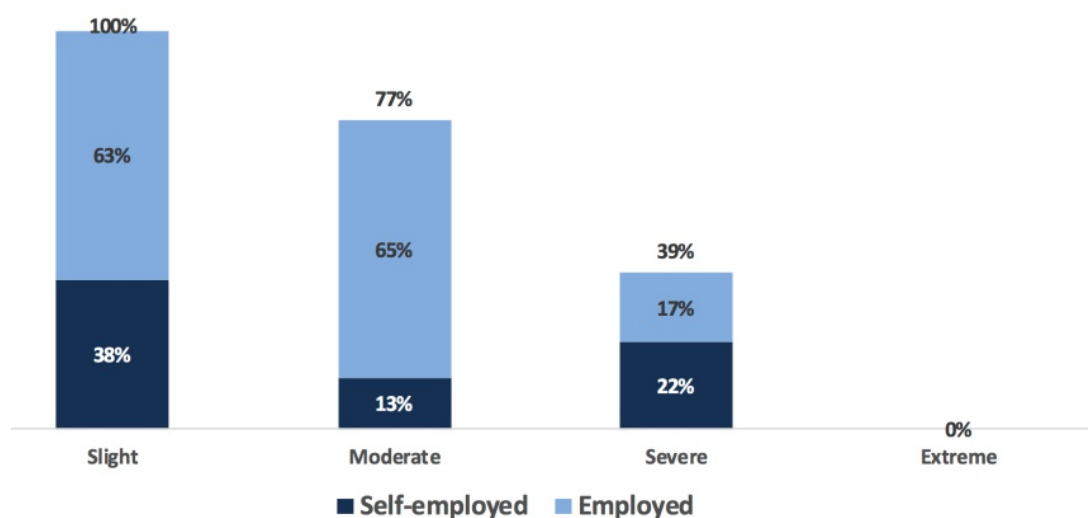
Having a job can be an important component for quality of life and being able to work contributes to having a normal life. This is both in terms of, for example, the desire to contribute and be useful, have variety in everyday life, and the accompanying financial and material opportunities.

8.1. Employment

Figure 8.1 below shows the percentage of people with EHS versus employment. People who have a mild degree of EHS all work, and then the number falls almost linearly towards 0%, depending on the degree of severity of EHS. It also means that people with EHS do everything they can to maintain a normal everyday life by going to work. The degree of severity of EHS makes it increasingly difficult to have a job, and for the most disadvan-

taged, it is impossible. The high employment rate, despite the handicap, is due to approximately 30% of people with EHS being self-employed, and thus they can organize their work-life around their disability. The self-employed maintain a personal income which corresponds to the unemployment benefit rate. This very high number of self-employed clearly shows that all avenues are explored to be able to work.

Figure 8.1 - EHS and employment



Note: pensioners, students and early retirees are disqualified.

A few have understanding employers. There are examples where the employer provides office facilities that are actively shielded from electromagnetic radiation and tasks are organized according to their disability. However, it is very individual whether this actually helps the individual with EHS, as there is no disability support for these measures, just as the justification for these measures is not based on medical statements

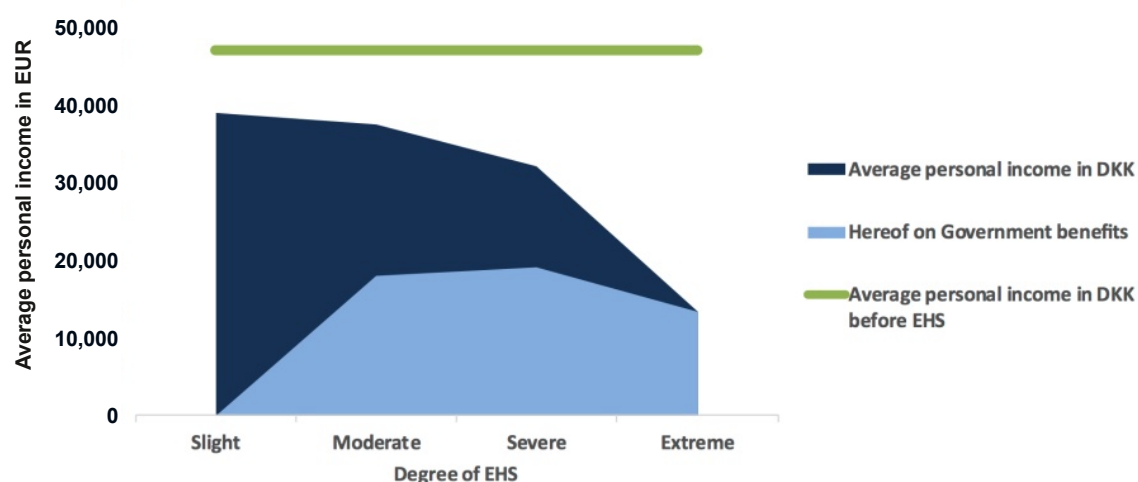
with clear recommendations. Overall, people with EHS really want to work and contribute to society. A lot is being done to maintain their connection to the workforce. At the same time, it is also clear that an early and effective intervention is needed, in the form of recognition, understanding, backing and support from society, to maintain their ability to work.

8.2. Finances and support

The unemployment rate for people with EHS is higher than that of the average population is discussed above. Consequently, their personal income is also lower. This section provides an insight into the finances of a person with EHS. The average income for a person with EHS is on average 47,500 EUR before EHS occurs. The personal financial consequences must be evalu-

ated using this background information. Figure 8.2.1 below shows that the income before EHS is in a normal bracket, but depending on the degree of severity of EHS, the personal income will be gradually and significantly lower. At the same time, the social transfers increases as a proportion of the personal income in relation to the degree of severity of EHS.

Figure 8.2.1 - Total personal income by degree of severity of EHS

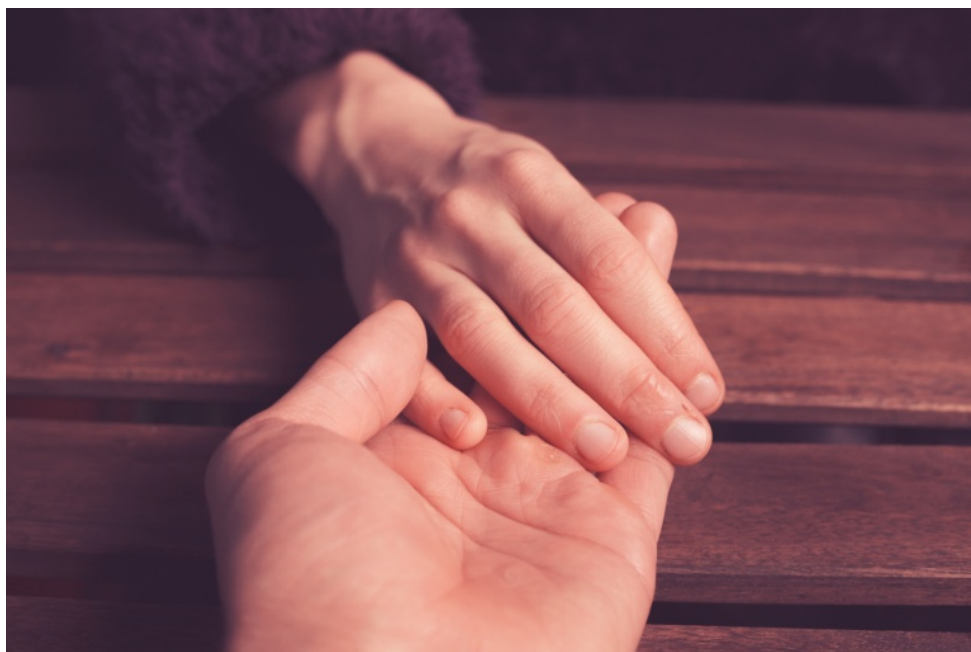
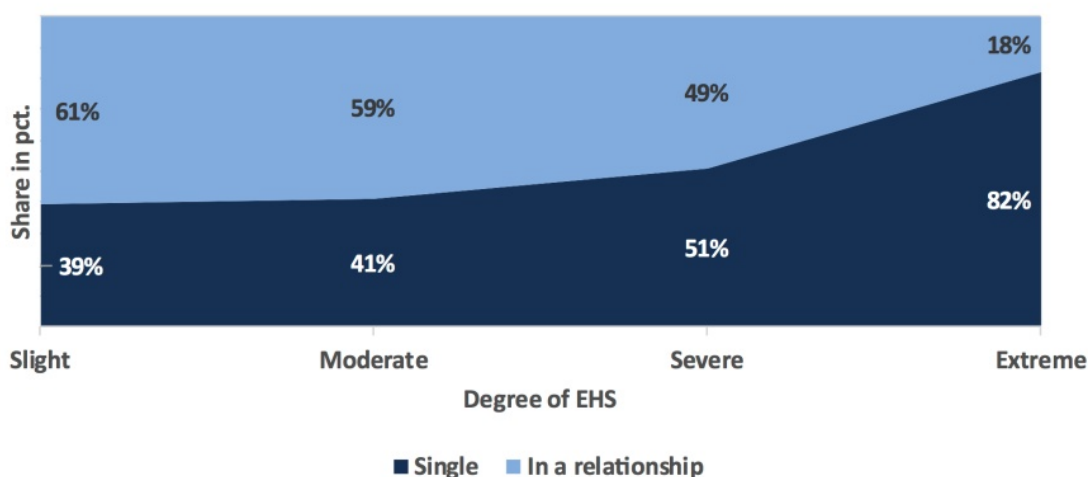


Note: Average personal income (dark blue) is the total average income for a person with EHS.

The change in personal income and the stressful health situation means that there is a huge need for support. Simultaneously, the data shows a total of 14% without any income at all. People with EHS receive virtually no support today, and this puts a high burden on friends and family. In

general, the more severe the degree of EHS, the more support is required. In this context, Figure 8.2.2 shows the people who need the most support are also the people who are most alone in everyday life. This is where society's help and support are needed.

Figure 8.2.2 - Overview of relationships



The friends who remain are somewhat understanding, whereas health professionals ignore this group of citizens until the symptoms are severely disabling. Thus, there is a great need to raise awareness about EHS among healthcare professionals.

This support and understanding from the outside world are important to function. Table 8.2.1 shows that family do support the electromagnetic hypersensitive, especially this most sensitive group. The friends who remain are somewhat

understanding whereas health professionals ignore this group of citizens until the symptoms are severely disabling. Thus, there is a great need to raise awareness about EHS among healthcare professionals, also pointed out by Gibson (2015).

Table 8.2.1 - Understanding from family, friends, colleagues, doctors, and healthcare professionals

Degree of EHS	Understanding of suffering from family	Understanding of suffering from friends and colleagues	Understanding of suffering from doctors and specialists
Slight	2.04	2.00	0.67
Moderate	2.37	2.04	0.55
Severe	2.18	1.98	0.88
Extreme	2.82	2.18	1.55
Total	2.28	2.02	0.78

Note: The scores are based on the average answers. The scale used is: 0 = not at all, 5 = to a great extent. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

Overall, people with EHS experience great variation in terms of employment and finances. On the one hand, people with mild EHS function well, can work and maintain their material buying power if EHS is kept under control. On the other hand, the most sensitive are much worse

off, are unable to work and in several cases are alone and without an income. This creates the need to keep those with mild EHS in employment, for example by electricity remediation and/or shielding, and give the most sensitive support in everyday life.

9. The socioeconomic costs of electromagnetically hypersensitive citizens

Several analyses have been made to estimate the cost of a person who loses his/her job and ends up on public support. In January 2013, the Ministry of Finance found that an industrial worker with an annual income of around 56.945,50 EUR costs society 44.373,12 EUR annually, when they transition to public benefits (Skovgaard, 2013). The average personal income of a person with EHS before self-diagnosis is 47.000 EUR. Using this data, a specific rate can be calculated for people with EHS. This amounts to 30.254,4 EUR per person.

This is calculated by the following: 47,500 EUR can, for example, give a tax revenue of approximately 18,150 EUR. After that, unemployment costs are added, which can be assumed to be around 12,100 EUR. This means that for every person who receives support and help to work, there is a gain of 30.250 EUR for society, in addition to the improved living conditions. The table below provides a brief overview of the costs to society for one person with EHS, 600 and 2,000 respectively. One person costs society an average of 10,200 EUR.

Table 9.1 - overview of socioeconomic costs of EHS

Degree of EHS	Number of people with EHS	Employment rate	Annual cost to society in EUR		
			Per EHS person on average	Per 600 people with EHS	Per 2,000 people with EHS
Slight	22%	100%	0	0	0
Moderate	42%	77%	2,856	1,714,130	5,713,767
Severe	31%	39%	5,713	3,428,260	11,427,535
Extreme	5%	0%	1,632	979,503	3,265,010
Total	100%	66%	10,203	6,121,894	20,406,312

Based on this information, we can make the following (conservative?) calculations. With an annual increase of 15%, we assume that there will be 120 new people with EHS of working age each year. At the same time, the degree of severity of EHS will be kept stable, and 3% will reach retirement age every year. The base is 400 based on the age composition and degree of severity of EHS, corresponding to 67% of 600 people of working age.

This means that the total accumulated costs would amount to 136,770,000 EUR after 10 years. See Table 9.2 for the cost estimates to society over the next 10 years.

This estimate is based solely on the individuals who self-diagnose EHS. The real number could be much higher. From an economic point of view, we are approaching a situation where society needs to prioritize research and recognize EHS.

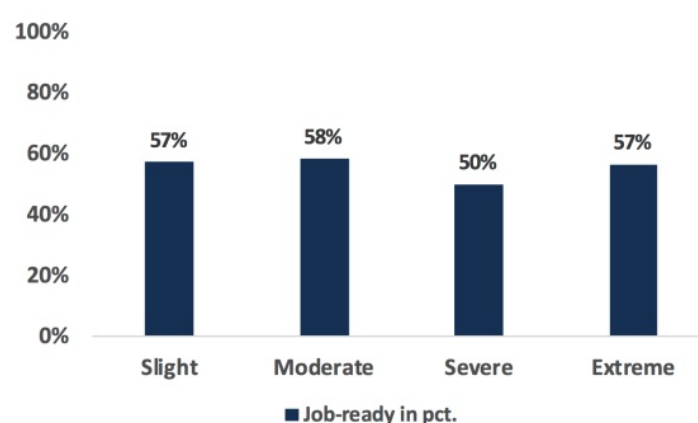
Table 9.2 - Cost estimates to society over the next 10 years

Year	Growth	Number of People with EHS	Annual cost to society in EUR
0		400	4,081,262
1	120	504	5,146,472
2	138	623	6,357,872
3	159	758	7,737,800
4	183	913	9,311,929
5	210	1,089	11,109,774
6	241	1,290	13,165,264
7	278	1,521	15,517,406
8	319	1,785	18,211,050
9	367	2,087	21,297,759
10	422	2,434	24,836,823
Total in EUR			136,773,411

A large part of these socioeconomic costs can be reduced by recognizing EHS, so the ability to work can be maintained and re-established for others (Genuis, 2012). This is also reflected in the current study. See Figure 9.1 below which shows the proportion of unemployed people with EHS of working age in employment who believe they can work under the right conditions. The right conditions include electrical decontamination and shielding at work, as well as the organization of

tasks and content according to the individual's disability, education, and skills. In other words, if an IT specialist is unable to use a computer due to EHS, it is difficult to work. However, if the IT specialist's degree of severity of EHS allows them to use a computer, then their productivity can, as a minimum, be as high as a person without EHS. Interestingly, even people with a severe degree of EHS want to work under the right conditions.

Figure 9.1 Proportion of job-ready unemployed people in the workforce.



Note: If you are of working age, will you be able to work at an electrically cleaned and screened workplace?

10. Inclusion in society

It can be difficult to imagine the limitations a person with EHS experiences in everyday life. The most normal day-to-day activities can be difficult or even impossible to complete. Table 10.1 below shows which everyday activities are frequently performed and shows the limitations that this disability brings. It's shocking to see that people with EHS are sometimes prevented from undertaking activities which support their health, such as going to the doctor, dentist, and hospital for appointments, due to lack of shielding. There are

many examples of people with EHS who completely avoid going to the dentist and postpone visits to the doctor for as long as possible. Or become chronically ill with EHS symptoms after attending hospital appointments and emergency admissions. Many therefore out-weigh the benefit of attending the doctor, hospital, etc., against the risk of subsequent symptoms due to exposure to electromagnetic radiation.

Table 10.1 - Inclusion in society

Does EHS prevent you from ...	Slight	Moderate	Severe	Extreme	EHS total
going to the doctor	0.3	0.6	1.4	3.2	1.1
going to the dentist	0.2	0.5	1.4	3.5	1.1
being at hospital	0.7	1.5	2.6	3.8	2.0
participating in social activities	0.8	1.9	3.2	3.9	2.4
being with your friends and family	0.6	1.3	2.6	3.5	1.9
exercising	0.2	0.8	1.7	2.6	1.2
using public transport	1.0	2.1	3.1	4.0	2.5
driving	0.1	0.7	1.4	3.2	1.1
participating in society	0.8	2.0	3.0	4.0	2.4

Note: The scores are based on the average answers. The scale used is: 0 = not at all, 1 = a little bit, 2 = to a moderate degree, 3 = a lot, 4 = to a great extent. The colour scale is based on the average answers, and it is intended to show a visual overview of the answers and their differences.

Furthermore, public transport can be difficult to use due to exposure to electromagnetic radiation in the public space. The lack of income for many people with EHS is another reason why they cannot afford to own a car, which leads to being geographically locked-in and isolated. The large exposure to electromagnetic radiation in public, combined with a lack of recognition, understanding and acceptance of EHS, also makes it difficult, and for some completely impossible, to participate socially and in public gatherings, for ex-

ample, concerts, the cinema, as well as activities with family and friends. Taking this into account means it can be difficult, or completely impossible, to participate in society in general.

The challenge for society is to recognize, understand and accept EHS, and at the same time create initiatives that enable this group of disabled people to move freely in Denmark, and hereby achieve a more dignified life, in accordance with their human rights.

11. Appeal to politicians and the National Board of Health

It is intended and hoped that this study will provide knowledge based on facts and invite a curious mindset and openness towards EHS. The EHS Association wants a constructive dialogue with politicians and healthcare professionals, so that opportunities and solutions can be found together, to ensure a dignified life (for people with EHS) on almost equal terms with the rest of the population.

This study shows that people with EHS constitute a growing group of citizens who are discriminated against by not receiving the necessary recognition, medical examination, treatment, help and support. This is primarily because EHS is not recognized as a disabling environmental disorder, which in principle is a disability in the form of a handicap. According to the UN's 22 Standard Rules and the Disability Convention (UN, 1993), citizens with the EHS disability have the right to live an equal life in society. With the right help, it is possible to have a life on approximately equal terms with the rest of the population.

By taking the socioeconomic costs of EHS in Denmark into account, means that we also need to examine the situation with an open-minded approach. We owe this to citizens in society.

Furthermore, we hope that children, young people, and future generations to come will not pay for our failure to implement secure technological solutions today. Children and young people do not have a voice in society, and therefore we must make this our common responsibility.

Thus, the EHS Association campaigns for:

- The recognition of EHS as a disability.
- The prioritization of a targeted impartial research into EHS, in collaboration with the EHS

Association, where the focus must be on diagnosis and treatment.

- Preventive actions to minimize the health effects of electromagnetic radiation.

We hope life will improve for this overlooked group of citizens.

Let's work together for a better future.

The EHS Association, September 2019
Christina Funch Mellgren
Chairwoman

12. References

- Belyaev I, Dean A, Eger H, Hubmann G, Jandrisovits R, Kern M, Kundi M, Moshhammer H, Lercher P, Müller K, Oberfeld G, Ohnsorge P, Pelzmann P, Scheingraber C, Thill R. (2016): "EUROPAEM EMF Guideline 2015 for the prevention, diagnosis and treatment of EMF-related health problems and illnesses" *Rev Environ Health* 2015; 30(4): 337-371
<http://www.degruyter.com/view/j/reveh.2015.30.issue-4/reveh-2015-0033/reveh-2015-0033.xml?format=INT>
- Belpomme B, Campagnag C, Irigaray P (2015): "Reliable disease biomarkers characterizing and identifying electrohypersensitivity and multiple chemical sensitivity as two etiopathogenic aspects of a unique pathological disorder" *Rev Environ Health* 2015; 30(4): 251-271 <http://www.ncbi.nlm.nih.gov/pubmed/26613326>
- Chiara De Luca, Jeffrey Chung Sheun Thai, Desanka Raskovic, Eleonora Cesareo, Daniela Caccamo, Arseny Trukhanov, Liudmila Korkina (2014): "Metabolic and Genetic Screening of Electromagnetic Hypersensitive Subjects as a Feasible Tool for Diagnostics and Intervention." *Mediators Inflamm.* 2014; 2014: 924184
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4000647/>
- Council of Europe - Parliamentary Assembly. "The potential dangers of electromagnetic fields and their effect on the environment. Resolution, Doc 1815." Text adopted by the Standing Committee, acting on behalf of the Assembly, on 27 May 2011 [Internet]. Available from: <http://assembly.coe.int/nw/xml/XRef/Xref-XML2HTML-en.asp?fileid=17994&lang=en>
- Eliti S, Wallace D, Zougkou K, Russo R, Joseph S, Rasor P, Fox E. (2007): "Development and evaluation of the electromagnetic hypersensitivity questionnaire." *Bioelectromagnetics.* 2007 Feb;28(2):137-51.
<https://www.ncbi.nlm.nih.gov/pubmed/17013888>
- Genuis Stephen J., Lipp Christopher T (2012): "Electromagnetic hypersensitivity: Fact or fiction?" *Sci Total Environ.* 2012 Jan 1;414:103-12. <https://www.ncbi.nlm.nih.gov/pubmed/22153604>
- Gibson Pamela Reed, Kovach Shannon, and Lupfer Alexis (2015): "Unmet health care needs for persons with environmental sensitivity" *J Multidiscip Healthc.* 2015; 8: 59–66.
<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4315542/>
- Hagström M, Auranen J, Ekman R. (2013): "Electromagnetic hypersensitive Finns: Symptoms, perceived sources and treatments, a questionnaire study" *Pathophysiology.* 2013 Apr;20(2):117-22
<https://www.ncbi.nlm.nih.gov/pubmed/23557856>
- Heuser G, Heuser SA (2017): "Functional brain MRI in patients complaining of electrohypersensitivity after long term exposure to electromagnetic fields." *Rev Environ Health.* 2017 Sep 26;32(3):291-299
<https://www.ncbi.nlm.nih.gov/pubmed/28678737>
- Irigaray P, Caccamo D, Belpomme D (2018): "Oxidative stress in electrohypersensitivity self reporting patients: Results of a prospective in vivo investigation with comprehensive molecular analysis." *Int J Mol Med.* 2018 Oct;42(4):1885-1898.
<https://www.ncbi.nlm.nih.gov/pubmed/30015864>
- Johansson O (2015): "Electrohypersensitivity: a functional impairment due to an inaccessible environment" *Rev Environ Health* 2015; 30(4): 311-321
<http://www.ncbi.nlm.nih.gov/pubmed/26613327>
- Kato Y, Johansson O. (2012): "Reported functional impairments of electrohypersensitive Japanese: A questionnaire survey." *Pathophysiology.* 2012 Apr;19(2):95-100.
<https://www.ncbi.nlm.nih.gov/pubmed/22458999>

Panagopoulos Dimitris J., Johansson Olle, Carlo George L. (2015): "Real versus Simulated Mobile Phone Exposures in Experimental Studies" *BioMed Research International* Volume 2015, Article ID 607053
<https://www.hindawi.com/journals/bmri/2015/607053/>

Pritchard C, Silk A, Hansen L (2019) : "Are rises in Electro-Magnetic Field in the human environment, interacting with multiple environmental pollutions, the tripping point for increases in neurological deaths in the Western World?" *Med Hypotheses*. 2019 Jun;127:76-83
<https://www.ncbi.nlm.nih.gov/pubmed/31088653>

Priyanka Bandara, David O Carpenter (2018): "Planetary electromagnetic pollution: it is time to assess its impact" *The Lancet* Volume 2, Issue 12, PE512-E514, December 01, 2018
[https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196\(18\)30221-3/fulltext](https://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(18)30221-3/fulltext)

Rea WJ, Pan Y, Yenyves EJ, Sujisawa I, Samadi N, Ross RH (1991): "Electromagnetic Field Sensitivity" *Journal of Bioelectricity* 10 (1&2): 241-256

Rubin GJ, Nieto-Hernandez R, Wessely S. (2010): "Idiopathic environmental intolerance attributed to electromagnetic fields (formerly 'electromagnetic hypersensitivity'): An updated systematic review of provocation studies." *Bioelectromagnetics*. 2010 Jan;31(1):1-11
<https://www.ncbi.nlm.nih.gov/pubmed/19681059>

Skovgaard, Lars Erik (2013): "Én ledig koster samfundet over 300.000 kr."
Set d. 2019-08-16 på <https://www.berlingske.dk/karriere/en-ledig-koster-samfundet-over-300.000-kr>

UN Resolution 48/96, Annex of 20 December 1993 "The Standard Rules on the Equalization of Opportunities for Persons with Disabilities." Set d. 2019-08-16 på:
<https://www.un.org/development/desa/disabilities/standard-rules-on-the-equalization-of-opportunities-for-persons-with-disabilities.html>
Dansk: "FN's Standard Regler om lige Muligheder for Handicappede" Det Centrale Handicapråd ISBN: 87-90985-39-7

UN Convention on the Rights of Persons with Disabilities. Set d. 2019-08-16 på:
<https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html>
Dansk: FN's Konvention om Rettigheder for Personer med Handicap
Set d. 2019-08-16 på: <https://dch.dk/sites/dch.dk/files/media/document/Handicapkonventionen2017.pdf>

World Health Organization: "Electromagnetic fields (EMF)"
Set d. 2019-08-16 på <https://www.who.int/peh-emf/about/WhatisEMF/en/>

