THE DANISH RESEARCH CENTRE FOR CHEMICAL SENSITIVITIES

Final report prepared in 2013 for the Danish Ministry of the Environment

Covering the period 2010 – 2013
Including an annual report for 2013

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Preface

This report is a summary and status of the activities at the Danish Research Centre for Chemical Sensitivities, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, and covers the period from 2010 through 2013. A description of the activities specifically for each year can be found in the annual reports.

The interest of the Danish Ministry of the Environment for building a Danish knowledge base in the epidemiology and disease specific mechanisms of multiple chemical sensitivity (MCS) has made major contributions to this field. To establish a Danish Research Centre for Chemical Sensitivities has proven to be a unique and important initiative with international impact, and an expert evaluation drawn up in 2012 concluded that Denmark occupies a pre-eminent position in this field.

Since the Center was established in 2006, it has produced three PhD theses from the University of Copenhagen, and three more are currently being prepared. Some 23 scientific papers have been published in international journals with peer-review, and more are in the making.

A large network of both national and Nordic partners from scientific institutions within e.g., epidemiology, public health, pain research, psychology, immunology and genetics, occupational medicine and dermatology has made invaluable contributions to the ongoing research at the Center and has made it possible to bring the field forward.
On the initiative of the Research Center´s scientific advisory group, a new classification code for MCS was published in the Danish healthcare classification system in 2012 providing the possibility to follow the number of hospital contacts for MCS.

An improved and more informative Danish and English website was launched early in 2010, and a patient booklet was prepared and distributed to General Practitioners, hospital departments, medical specialists and to pharmacies throughout the country later the same year. A telephone “hotline” has been open every Tuesday for chemically sensitive and professionals. About 170 people a year have made a call.

There has been a continuous and constructive dialog between the Research Centre and the Danish Association of MCS Patients, and a growing number of patients have contributed to the knowledge base through participation in the ongoing research at the Centre.

In the following a more detailed overview of the activities of the Center is provided.

Summary in Danish

Opbygningen af viden i Centrets anden bevillingsperiode fra 2010 – 2013 baserer sig dels på konklusionerne fra den første periode og dels på den internationale viden på området. I alt 3 nye ph.d.-studier blev igangsat. Heraf afsluttes et ph.d. forløb inden for bevillingsrammen og de 2 øvrige afsluttes i henholdsvis foråret 2014 og sommeren 2015. En lang række videnskabelige artikler baseret på Centrets arbejder er enten publiceret i videnskabelige tidsskrifter med peer - review eller er i proces frem mod publicering.

På foranledning af Miljøministeriet/Miljøstyrelsen blev i 2012 foretaget en faglig evaluering af Centret af to internationale eksperter på området. Konklusionerne på rapporten var bl.a. at Centret havde etableret sig som et videncenter både nationalt og internationalt, og generet ny viden om duft – og kemikalieoverfølsomhed på et højt videnskabeligt niveau. Evalueringen anbefalede en fortsættelse af Centret.

Sammenfattende har Centret generet ny viden om duft – og kemikalieoverfølsomhed, som peger på:

- Kronisk systemisk inflammation hos patientgruppen og et afvigende Th2-medieret cytokin respons, som ikke omfatter et klassisk allergisk respons.

- Et abnormt og reproducerbart centralt medieret smerte respons hos patientgruppen.

- At et mindfulness-baseret forløb kan bedre håndteringen af lidelsen og derfor kan overvejes som støtte til patienterne med henblik på at styrke individuelle håndteringsstrategier, eller som et supplement til andre behandlingsmetoder.

- Flere studier er forsat i proces og forventes først endeligt afsluttende i de kommende år. Et igangværende studie evaluerer effekten af pulserende elektromagnetisk stimulation rettet mod hjernen, og to øvrige studier undersøger henholdsvis genekspression efter kontrolleret kemisk provokation, samt risikofaktorer og symptomernes forløb over en 5-årig periode.

I juli 2012 blev på initiativ fra Centrets følgegruppe oprettet en diagnosekode for duft – og kemikalieoverfølsomhed i Sundhedsvæsnets Klassifikationssystem, som på sigt kan give viden om antal sygehuskontakter på dette område. Følgegruppen forfattede en status artikel om duft – og kemikalieoverfølsomhed til Ugeskrift for Læger med information om diagnosekoden. Statusartiklen udkom i sommeren 2013.

Sammenfattende underbygger resultaterne fra Centrets anden bevillingsperiode konklusionerne fra den første periode, som beskrevet i statusrapporten 2006 – 2010 forfattet af daværende forskningsleder, ph.d. Jesper Elberling. Den nuværende viden om duft – og kemikalieoverfølsomhed peger således forsat på det centrale nervesystem som omdrejningspunkt for studier af sygdomsmekanismer og en afklaring af de kemiske stoffers rolle for udvikling af lidelsen. Fundet af ændringer i immunforsvaret hos patientgruppen underbygger denne konklusion. Kognitive – og følelsesmæssige faktorer synes også at spille en rolle, men det er endnu uafklaret hvilken og i hvilket omfang. En mindfulness-baseret intervention synes at medvirke til at kunne styrke håndteringen af lidelsen. På trods af den mængde af ny viden som Videncentret har produceret inden for en relativ kort tidsramme, er duft – og kemikalieoverfølsomhed dog en lidelse af så kompleks karakter, at der forsat er et særdeles stort behov for en langsigtet og systematisk vidensopbygning på dette område, så der en dag er et veldokumenteret grundlag for at hjælpe denne patientgruppe.

Purpose and terms of reference

The overall purpose of the Research Center has been to investigate the event(s) and biological mechanisms by which common airborne chemicals lead to the complex array of symptoms characteristic of MCS in order to identify possible preventive measures.

More specifically the wording of the Centre's mandate is as follows: "The role of the Danish Research Centre for Chemical Sensitivities is to work towards remedying the lack of knowledge on MCS. Little is known about why the symptoms develop and can lead to a chronic, disabling disease in some people. The pathophysiological mechanisms behind the development of MCS are largely unknown. Likewise, the extent of the disease and its consequences for both the individual and society as a whole in Denmark remain unclear. The Centre's task is to systematically generate scientific documentation on MCS —its extent and consequences - and to advance counseling concerning all aspects of the disease. The work is carried out within the Centre's remit."

Based on the mandate the following objectives were formulated:

- To investigate the prevalence and severity of symptoms attributed to common airborne chemicals in the Danish population.
- To identify disease mechanisms and risk factors involved in MCS.
- To do research into possible treatments and into how progression of MCS is avoided.
- To inform and advise on MCS based on existing, research-based knowledge.

Scientific advisory group

The Research Centre has been led by a scientific advisory group consisting of representatives from the Danish Environmental Protection Agency and the Danish National Board of Health as well as a number of medical experts.

From 2010 to 2013 the Research Centers scientific advisory group has consisted of the following members:

- Rikke Holmberg, the Danish Ministry of the Environment/Environmnetal Protection Agency (Chairman).
- Jette Blands, MD, MPH, the Danish Health and Medicines Authority.
- Claus Zachariae, Dr.Med., Head of Department of Dermato-Allergology, Copenhagen University Hospital Gentofte.
- Jeanne Duus Johansen, Professor, Director of the National Allergy Research Center, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte.
- Søren Vesterhauge, Dr.Med., Consultant, Aleris-Hamlet.
- Jens Peter Bonde, Professor, Dr.Med., Department of Public Health, University of Copenhagen.
- Allan Linneberg, MD, PhD., Head of Research, The Research Center for Prevention and Health, Copenhagen University Hospital Glostrup.
- Jesper Elberling, MD, PhD., the Danish Research Center for Chemical Sensitivities, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte.
- Sine Skovbjerg, MSc, PhD., Head of Research, the Danish Research Center for Chemical Sensitivities, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte.

Organization

The Danish Research Centre for Chemical Sensitivities was financed by the Danish Ministry of the Environment under the Danish Chemical Action Plan 2010 – 2013, but has been administratively placed under the Department of Dermato - Allergology at Copenhagen University Hospital Gentofte.

The organisation of the Centre has consisted of a director and researchers (PhD students and post-doctoral researchers) with only little administrative and technical support (secretary, IT-competence) giving an optimal efficacy. A close connection to the National Allergy Research Center, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte and the affiliation to Copenhagen University Hospital Gentofte have provided an optimal organizational platform for the education of PhD students, for conducting multidisciplinary research with ongoing contacts and collaboration with several medicine disciplines within and outside Denmark, and for providing information to both patients and professionals through Danish and English websites, a telephone hotline, patient booklet and numerous articles. An evaluation of the running of the Research Center prepared for the Danish Ministry of the Environment in 2012 strongly supported this organization[1].

The Research Centre employed the following people in 2013:

Sine Skovbjerg, MSc in health science, PhD, Head of research.
Jesper Elberling, MD, PhD, senior researcher.
Thomas Meinertz Dantoft, MSc in biotechnology, PhD-student.
Marie Thi Dao Tran, MD, PhD-student.
Christian Riise Hauge, MA in psychology, PhD-student.
Anne Marie Topp, project nurse.

Former employees in the period from 2010 – 2013:

Birgitte Therkelsen, journalist and web-coordinator.
Patrick Renault, MA in psychology, research assistant.

[1] Evaluering af Videncenter for Allergi og Videncenter for Duft – og Kemikalieoverfølsomhed. Miljøprojekt nr. 1466, 2013. ISBN nr. 978-87-92903-93-8

Expert evaluation

An expert evaluation of the Research Center was prepared for the Danish Ministry of the Environment/Environmental Protection Agency in 2012 by the two international experts, Eva Millqvist, professor, Department of Internal Medicine/Respiratory Medicine and Allergology, Sahlgrenska Academy, University of Gothenburg, Sweden and Steven Nordin, professor, Department of Psychology, Umeå University, Umeå, Sweden[2].

The expert evaluation included the period from January 2006 to January 2012. The aim was to analyse and synthesize, in an international perspective, the Research Center within the following areas:

The value and impact of the concept and organisation of the Centre in relation to fulfilling the aims and performing the tasks.
The relevance and impact of the knowledge building activities with specific emphasis on the scientific production in relation to the aims of the Centre.
The quantity and quality of the knowledge building activities in relation to the resources allocated.

- The ability of the Centre to disseminate information to patients, health care professionals, authorities and society in general.
- The value of the educational programme of the Centre for young researchers.
- Benchmarking to other similar international Centres concerning productivity and impact.

The conclusions of the expert evaluation were among others, that in the short time since the Research Centers foundation, it has established itself as an institution of excellence. The Research Centre has in an effective way and on a high scientific level provided new knowledge of chemical sensitivities and has been highly successful both in a national and in an international perspective.

Considering the relatively limited amount of resources allocated to the Research Center, the quantity of the knowledge building activities can be considered particular high and especially considering that the amount of resources also was intended to include dissemination of information to patients, health care professionals, authorities and society in general as well as to educate young researchers.

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2 Expert evaluation of the Danish Research Centre for Chemical Sensitivities for the period of January 2006 to January 2012 (6 years). Prepared for the Danish Ministry of the Environment / Environmental Protection Agency 2012.

The Research Centre has offered a structured PhD programme, which has produced three successfully defended PhD theses and three more are presently in the making (for more details please see the section "Transmission of knowledge). The theses have been found to be of excellent scientific quality, and to have made important national and international contributions to the field of MCS.

In line with the first expert evaluation of the Research center covering the period from 2006 – 2008[3], the latest evaluation thus strongly supported the current research strategy, informational activities and organizational structure of the Research Centre, and emphasized the importance of continuing the current model of the Center, preferably with increased funding.

3 Videncenter for Duft – og Kemikalieoverfølsomhed, evaluering, august 2008. Miljø- og Planlægningsudvalget. MPU alm. del - Bilag 218

National partners

The following list of persons and national institutions have contributed to the knowledge base of the Research Center from 2010 - 2013:

Department of Dermato – Allergology, Copenhagen University Hospital Gentofte.
The National Allergy Research Centre, Department of Dermato – Allergology, Copenhagen University Hospital Gentofte.

Professor Lars Arendt-Nielsen, Center for Sensory-Motor Interaction, University of Aalborg.

Associate professor Karl Bang Christensen, Department of Public Health, Section of Biostatistics, University of Copenhagen.

Professor Jens Peter Bonde, Department of Public Health, Copenhagen University Hospital Bispebjerg.

Consultant Alice Rasmussen, Psychiatric Center, Copenhagen University Hospital Bispebjerg.

The Research Center for Prevention and Health, Copenhagen University Hospital Glostrup.

Consultant, dr.med. Pal Szecsi, Department of Clinical Biochemistry, Copenhagen University Hospital Gentofte.

Consultant, dr. med. Søren Vesterhauge, Aleris-Hamlet Hospitals.

Associate professor Lars Hellgren, the Technical University of Denmark, Department of Systems Biology, Center for Biological Sequence Analysis.

Senior researcher Kåre Engkilde, The National Allergy Research Centre, Department of Dermato – Allergology, Copenhagen University Hospital Gentofte.

Consultant, PhD Lone Fjordback, the Research Clinic for Functional Disorders and Psychosomatics, Aarhus University Hospital.

MA in psychology, PhD Jacob Piet, the Research Clinic for Functional Disorders and Psychosomatics, Aarhus University Hospital.

MA in Psychology Antonia Sumbundo, Psychological Counseling.

Professor Per Bech, the Psychiatric Research Unit, Psychiatric Center, north Zealand.

Nordic partners

The Research Center has held seminars and exchanged ideas with following list of persons and Nordic Institutions form 2010 - 2013:

Professor Steven Nordin, Department of Psychology, University of Umeå, Sweden.

Senior researcher Linus Andersson, Department of Psychology, University of Umeå, Sweden.

Senior researcher Anna-Sara Claeson, Department of Psychology, University of Umeå, Sweden.

Professor Eva Millqvist. Department of Internal Medicine/Respiratory Medicine and Allergology, Sahlgrenska Academy, University of Gothenburg, Sweden.

Adjunct Professor Mats Bende, Institute of Clinical Sciences, Sahlgrenska Academy, University of Gothenburg, Sweden.

Professor Berndt Stenberg, Department of Public Health and Clinical Medicine, Section of Dermatology and Venereology, University of Umeå, Sweden.

Yrkeshögskolan Novia, Vasa, Finland.

Knowledge base

The conclusions from the first report covering the period from 2006 - 2009 prepared by MD, PhD Jesper Elberling were that MCS is not caused by a classical allergic reaction. Instead the sensory nervous system and the perception and processing of sensory stimuli in the brain seem to play an important role. In addition, personality traits in terms of somato-sensory amplification and autonomic perception that may cause individuals to over-interpret normal bodily signals as unusually intense and disturbing may be connected to more severe states of MCS. Also negative emotional reactions such as reports of depressive and anxiety symptoms have been found increased. However, the cause and effect relationship needs to be determined, and therefore the exact role of psychology in the development and course of MCS is not clarified. Finally, the report concluded that the foundation for testing the effect of interventions for MCS had been laid.

For the period from 2010 – 2013 the research strategy has been based on the conclusions from the initial period. More specifically the collection of prospective epidemiological data was initiated, the role of sensory perception and processing of painful stimuli in the brain was further investigated, genetic data and data on the immunological system was collected, and two large randomized clinical trials testing the effect of two types of interventions were undertaken. Each will be described in more detail below in relation to the overall purpose of the Research Center as described under the heading “Purpose and terms of reference”.

The first purpose was formulated:

- To investigate the prevalence and severity of symptoms attributed to common airborne chemicals in the Danish population.

Population-based studies on self-reported symptoms to common airborne chemicals suggest that reports of such symptoms are a common phenomenon in the general adult population with estimates from 9 – 33%, and with predominance in women. Symptom reports appear to be distributed across ethnicity, education, marital status and employment status. The Research Center has previously estimated that 27% of the Danish adult population report non-specific symptoms when encountering, e.g. fragranced products either worn by other people or in public places, or other commonly found airborne

chemicals such as cleaning agents, air fresheners or cigarette smoke. An estimated 0.5 %, or about 17.000 Danish adults between 18 and 65 years of age, report disruptions in their social life and working conditions because of their reactions and may thus be considered as MCS cases. Symptoms of MCS may involve multiple organ systems, but non-specific central nervous system complaints, including fatigue, headache and difficulty concentrating are common, and have been found to be a predictor of functional disability (Odds Ratio 3.2). Only few studies have examined the stability of MCS over time, and the course and factors involved in the persistence of symptoms is thus poorly understood. In a five-year follow-up study including 10.485 respondents from the Southern part of Sweden, approximately half of the respondents who had reported annoyance to environmental factors at baseline, e.g. electrical equipment, breathing air that smells of chemicals and other smells, did not report any annoyance at follow-up. In another study from Germany, Josef Bailer and colleagues examined the 1-year stability of MCS based on more strict case-criteria. This study found that 92% of the initial cases still met the case criteria at follow-up. Michael B. Lax and Paul K. Henneberger interviewed 35 patients from an occupational health clinic, who fulfilled study criteria for MCS. When asked whether the symptoms had worsened, stayed the same or improved since the initial visit to the occupational health clinic, nearly half of the patients stated that their symptoms had improved. Altogether there is a great need for longitudinal data from well conducted population-based studies on the course and risk factors of MCS.

A collaboration between the Research Center and the Research Center for Prevention and Health at Copenhagen University Hospital Glostrup has secured the provision of such data in the near future.

- The Health2006 re-examination
- The Danish Study on Functional Somatic Disorders (DanFund)

The Health2006 re-examination

MCS is a complex disorder and one step towards a better medical understanding is to analyse data from a well conducted epidemiological study. A number of questions on MCS were therefore included in the Health2006 study, and subsequently included in the 5-year re-examination that took place in 2011 – 2012 at the Research Center for Prevention and Health at Copenhagen University Hospital Glostrup. Data for the study is based on the re-examination of a random sample of 18 to 69 year olds (n=3471) drawn from

the Danish civil registration system and invited to participate in a general health examination. Data from the study has now been made available, and is currently under statistical work up at the Research Center in collaboration with a statistician from the University of Copenhagen.
Questions on MCS included symptoms, symptom-eliciting chemicals and consequences on daily life, i.e. lifestyle, social activities and occupation. The questions are described in more detail in Berg ND et al. 2008. The Health2006 study offers a unique possibility for gaining new and highly needed knowledge on risk factors in MCS as well as the course of symptoms over a five-year period. The results will be important for the future direction of research.

Results from the study are planned to be published in 2014.

DanFund

The DanFund project is a coordinated research plan initiated by the Research Center for Prevention and Health at Copenhagen University Hospital Glostrup, involving various both national and international partners. The Research Center is part of the projects steering group. DanFund has received funding from TrygFonden and the Lundbeck Foundation. The project involves clinical examinations and collection of questionnaire data from more than 10.000 people, and will in the future provide new knowledge on the epidemiology of MCS and its medical relationship with other medically unexplained disorders, i.e. whether MCS can be defined as a clinical entity.

The DanFund project, initiated in 2010, is an ongoing project which presently employs a project manager, a senior researcher and two PhD. Students. Data from the project will be published in the years to come.

The second purpose was formulated:

- To identify disease mechanisms and risk factors involved in multiple chemical sensitivity

MCS is currently best categorized as a medically unexplained disorder because a clarification of the basic disease mechanims and events involved in the generation of symptoms is lacking. Several theories on the pathophysiology (the physiological changes involved in disease) and risk factors involved in the development of MCS have been suggested,

but considering the clinical data available, no single theory alone has satisfactorily explained the presentations of multiple symptoms and no definitive conclusions can thus be drawn at this point. With the available scientific literature it is likely that MCS is caused by individual susceptibility factors rather than by an actual toxicological response, and the scientific approach to the study of disease mechanisms at the Research Center has thus been based on the study of individual factors. More specifically the focus has been on the theory of central sensitization, immunology and genetics.

- Central sensitization
- Immunology
- Genetics (a Nordic collaboration)

Central sensitization

Central sensitization refers to a prolonged but reversible increase in the excitability and synaptic efficacy of neurons in central nociceptive (pain) pathways, and two independent studies from the Research Center support the theory of central sensitization as a possible factor accounting for the multiple symptoms in MCS.
The objectives of the latest of the two studies, which was published in 2011 (Tran MT et al. Int J Hyg Environ Health 2013), were to study different aspects of central pain processing in MCS. This included three different pain models in terms of a capsaicin pain model, a conditioned pain modulation model, and a tonic heat pain model. The first pain model had been tested in the previous study on central sensitization (Holst H et al. Clin J Pain. 2011). This study suggested that the area of secondary hyperalgesia (pain developed outside the area of injury) was increased in MCS when compared to a healthy control group. For a more detailed description please see the report prepared by MD, PhD Jesper Elberling[4]. Results from the second study and the capsaicin pain model supported the initial findings of an increased area of secondary hyperalgesia in MCS when compared to a healthy control group. No significant differences were found for the other two pain models, suggesting that altered central pain processing in MCS is related to only some areas of the sensory system.

A later study aimed to investigate the stability of central sensitization based on the

4. Statusrapport 2006-2009 Videncenter for Duft- og Kemikalieoverfølsomhed, Dermato-allergologisk Afdeling, Gentofte Hospital. ved Jesper Elberling, læge, ph.d., seniorforsker.

capsaicin pain model by testing the same groups of MCS patients and healthy controls at a one-year follow-up. This study pointed to a continuous and possibly clinically relevant abnormal response to painful stimuli in the central nervous system in MCS patients. The results of this study thus suggest that structures in the brain could be a possible therapeutic target.

Both studies are part of Marie Thi Dao Trans PhD study.

Immunology

In the scientific literature, an altered regulation of the immune system has frequently been suggested as a plausible mechanism in MCS, but as with many other theories concerning MCS sound scientific evidence has been missing.

In 2011 the Research Center initiated a study aimed at testing the theory of immune dysregulation by comparing blood samples from 150 MCS patients with a comparable healthy control group of 148 persons. Target immunological parameters in terms of cytokines (small proteins important in cell signaling) included the following: Interleukin-1β (IL-1β), interleukin-2 (IL-2), interleukin-4 (IL-4), interleukin-5 (IL-5), interleukin-6 (IL-6), interleukin-10 (IL-10), interleukin-12p70 (IL-12p70), interleukin-13 (IL-13), tumor necrosis factor-β (TNF-β) and interferon-β (IFN-β), interleukin-8/chemokine (C-X-C motif) ligand 8 (IL-8/CXCL8), monocyte chemotactic protein-1/chemokine (C-C motif) ligand 2 (MCP-1/CCL2), platelet derived growth factor-BB (PDGF-BB) and vascular endothelial growth factor (VEGF).

Analyses of the blood samples suggested that MCS patients display a distinct systemic immune mediator profile with increased levels of pro-inflammatory cytokines (promotes systemic inflammation) and interleukin-2, and an inverse regulation of Th2 associated cytokines interleukin-4 and interleukin-13. Altogether these findings are suggestive of a low-grade systemic inflammation, along with a deviating Th2-associated cytokine response, that does not involve IgE-mediated mechanisms. While these are indeed interesting findings, more research is needed before any conclusions on a possible altered regulation of the immunological system in MCS and its clinical importance can be drawn and therefore the findings cannot be readily utilized. However, they may offer an explanation to the flu-like symptoms often reported in MCS, such as headache, fatigue, concentration difficulties and general malaise (Dantoft T et al. Psychoneuroendocrinology 2013).

Further testing of the immunological response was initiated by the Research Center in 2013 in a collaborative study with the Technical University of Denmark, Department of Systems Biology, Center for Biological Sequence Analysis and the Department of Psychology, University of Umeå, Sweden. In order to test the peripheral immune response in MCS patients compared to a healthy control group before and after a controlled chemical exposure with butanol, fluid from the nose was collected. Material was collected by inserting strips into both nostrils. Total proteins fractions were extracted from the filter papers and levels of 23 selected immunologic mediators (cytokines) will subsequently be quantified. Results will be available in 2014.

Both studies are part of Thomas Dantofts PhD study.

Genetics

In collaboration with the Department of Psychology, University of Umeå, Sweden a study on gene expression in MCS was initiated in 2013 in Umeå. Gene expression profiling is one way to study possible disease mechanisms, and the technique is commonly used for both diagnostic purposes and in basic research.

The study focus on selected genes with relevance for three of the most plausible theories concerning disease mechanisms in MCS, which is central sensitization, the stress responsive system and the chemical defensive system. The following hypotheses are tested: 1) Are the selected genes differentially expressed in MCS cases at baseline and/or after a controlled chemical exposure compared to a matched healthy control group?, and 2) Do the gene expression profiles and physiological measures support the proposed theoretical models for MCS?

MCS patients and healthy controls were exposed individually in an exposure chamber to a 4.7 ppm concentration of butanol. This exposure level is far below the Swedish maximum limit value established for occupational health purposes (AFS, 2005). The participants were seated in the chamber that has the dimensions of 150 × 90 × 200 (L × W × H) cm and an air exchange rate of six times/h for a total of 60 minutes. The concentration of vaporised exposure compound in the chamber was continuously monitored and regulated to keep any required concentration.

Blood samples for gene expression analyses were collected at baseline and after 10 and

60 minutes during the exposure as well as 8 hours after chemical exposure. During the period of exposure, participants rated the intensity and unpleasantness once every five minutes, and symptoms were rated at baseline and after 30 minutes and 1 hour. Supplementing physiological recordings for the measure of stress level were also obtained.

Results from the study will be available late 2014 or early 2015 as part of Thomas Dantofts PhD study.

The third purpose was formulated: To do research into possible treatments and into how progression of multiple chemical sensitivity is avoided.

How to approach treatment in MCS is complex because of the many speculations concerning whether the multiple symptoms characteristic of MCS is either initiated by physiological mechanisms or cognitive factors, or both. Complicating matters even further is the fact that an internationally accepted case definition is missing, and therefore MCS most likely constitute a heterogeneous patient group today. The consequence is that until the basic disease mechanisms in MCS is clarified and a clear case definition of MCS is agreed upon, the process of establishing the effects of possible treatments is a challenging task. Most likely, effectively treating MCS will prospectively be based on an interdisciplinary approach and not one single option. However, recommendations for a treatment approach are in high demand from both patients and medical specialists, and therefore the Research Center considered it highly relevant to test the effect of two different approaches to treatment. The first is mindfulness-based cognitive therapy and the second is transcranially applied pulsed electromagnetic fields.

- Mindfulness-based cognitive therapy
- Pulsed electromagnetic fields

Mindfulness-based cognitive therapy

Mindfulness, defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment”, is becoming increasingly popular and mindfulness based therapies have shown promising results in the treatment of stress-related medical disorders by improving disease management and reducing psychological distress.

The Research Center has previously (2008) tested the feasibility of mindfulness-based cognitive therapy (MBCT) for MCS in a pilot trial, which was published in Scandinavian

Journal of Psychology in 2012 (Skovbjerg S et al.). The pilot trial provided the rationale for a larger randomized trial initiated in 2010.

The mindfulness based intervention applied by the Research Center was modelled after the MBCT program, which is an 8-week group skills based training approach. The main treatment ingredients were mindfulness exercises; exercises that contribute to the cultivation of present moment awareness. They include the body scan in which attention is directed to every part of the body in succession, the sitting meditation, in which the attention is directed to the breath, the body and in later part of the program, any experience that arise in the present moment, and finally, yoga, which comprise different body stretches and postures performed with mindful awareness. The purpose of the mindfulness exercises is to cultivate the ability to stay present with full awareness and to practice an attitude of acceptance of whatever sensation, pleasant or unpleasant, that arise in the present moment.

The program comprised 8 weekly 2.5 hour sessions in addition to half a day of silent retreat between weeks six and seven. Furthermore, participants were encouraged to carry out homework assignments for up till 45 minutes, 6 days a week during the program. Finally, participants were offered follow-up sessions one, three and six months post treatment. The therapists in the trial were two clinical psychologists with extensive experience in delivering mindfulness-based treatment.

Altogether 69 MCS patients participated in the study and were randomized to either MBCT or treatment as usual, i.e. to continue as usual. Participants were followed up till 1 year after end of the 8-week program. The drop-out rate in the MBCT groups was low suggesting that MBCT is feasible for MCS. A sample of 18 participants in the MBCT group was interviewed in either Copenhagen or Aarhus 9 – 12 months after finalizing the MBCT program about their experiences and thoughts about the potential benefits of MBCT.

Results from the study suggest that MBCT does not improve MCS in terms of the programs effect on symptoms and the negative social consequences associated with the disorder. However, positive changes were seen in the cognitive and emotional representations of MCS, and hence MBCT may reduce the degree to which MCS is perceived as threatening by the patient and thereby improve disease management strategies.

This is further supported by the individual interviews, which intended to explore the participants experience with MBCT. Predominantly with regard to their MCS and in particular how the participants experienced their MCS after having completed their MBCT

training, and if the training had had any influence on the way they experienced and dealt with their illness. Each interview lasted between 45 and 70 minutes, and were recorded by a digital recorder and later transcribed verbatim. The interviews revealed that the majority of the participants reported positive experiences with MBCT with regards to living better with their MCS, and some did experience that the program had a positive effect on their symptoms.
In conclusion, MBCT cannot be recommended as a treatment for MCS per se. However, the results of both the quantitative and qualitative studies suggest that MBCT may improve individual disease management, and may thus be offered MCS patients as such or provide a valuable supplement to other and yet unidentified treatment options.
The studies are part of Christian Riise Hauges PhD-study.

Pulsed electromagnetic fields

Pulsed electromagnetic fields (PEMF) applied transcranially is a technology that utilizes alternating magnetic fields to stimulate the brain. The technology used in both the initial pilot trial and later in the much larger double-blind, placebo-controlled, randomized trial at the Research Center was Re5 Independent System. The Re5 Independent System is worn by the recipient as a helmet consisting of seven electromagnetic coils. The electromagnetic pulses delivered from Re5 have a frequency of 55 Hz.

Initially a pilot trial was conducted in 2012 testing the feasibility of PEMF for MCS in three patients (Tran MT et al. Scand J Pain. 2013). The results were promising and a larger double-blind, placebo-controlled, randomized trial was conducted in 2013 including 39 MCS patients randomized to either active treatment or placebo. Participants received either PEMF therapy or placebo for 30 minutes twice a day for 7 days a week over 6 consecutive weeks. Outcomes were measured at baseline, once weekly during treatment, post treatment, and at 2.5-month and 4.5-month follow-up according to a predefined timetable. The primary outcome was the impact of MCS on everyday life. The secondary outcomes were measurements of MCS symptoms, psychological distress (stress, anxiety or depressive symptoms), capsaicin-induced secondary punctate hyperalgesia, immunological markers in serum, and quality of life.

Results from the trial will be available in 2014, and are part of Marie Thi Dao Trans PhD-study.

Other research activities

In 2010, the Research Center conducted a study aimed at evaluating a Danish translation of the widely applied questionnaire for MCS, the Quick Environmental Exposure and Sensitivity Inventory (QEESI). The QEESI contains five single scales measuring different aspects of MCS, e.g. symptoms, chemical exposures and consequences on daily living.

The study included to groups of respondents: 1) a general population sample of 2000 18-69 year-olds randomly drawn from the Danish Civil Registration System, and 2) an MCS sample of 315 patients from the Research Center´s patient database.

The original American version of the QEESI was translated into Danish by a professional translation agency. The final Danish translation was included in a questionnaire and sent to all participants.
The QEESI has later been included in a number of studies at the Research Center.
Results from the study have been published in Skovbjerg S et al. J Environ Public Health 2012.

A Classification Code for MCS

In July 2012 a new classification code for MCS was published in the Danish healthcare classification system on the initiative of the Research Centers scientific advisory group. The Classification System is administered by the Danish Health and Medicines Authority.

The name of the code is "Symptoms related to scents and chemicals" and it is placed under the main category "Medically unexplained symptoms" (DR688A), which is a specialization of the ICD-10 code "R68.8 Other specified general symptoms and signs". The overall purpose is to register hospital contacts for patients who report these symptoms in Denmark.

The code is purely descriptive and without any assumptions about the pathophysiology of the symptoms. The classification and criteria were decided with reference to the present lack of scientific understanding of the factors involved in the development and course of the symptoms.

The following 5 criteria must be fulfilled:

- Symptoms are attributed to common scents and chemicals, e.g. fragranced products, freshly printed papers or magazines, tobaco smoke and new furniture.
- Symptoms from the central nervous system such as headache, dizziness, concentration difficulties and exhaustion are mandatory. In addition symptoms from other organ systems are often reported, e.g. from the mucosa/respiratory tract, musculo-skeletal system and gastro-intestinal tract.
- Symptoms improve or are resolved when exposures are removed.
- The condition is chronic (of at least 6 months duration)
- Symptoms are associated with significant life-style or functional impairments, e.g. loss of job or social network.

A status article describing the new classification code and the current status on MCS was subsequently prepared by all members of the scientific advisory group and later published in the Danish medical journal "Ugeskrift for Læger" in 2013 (Elberling J et al. The patient with symptoms related to odours and chemicals. Ugeskrift for Læger 2013).

Transmission of knowledge

The transmission of knowledge on MCS has been executed through several channels as described in detail below.

Publications in peer-reviewed journals

The following list shows that 22 publications, originating from the Research Center for the period 2010 – 2013, have been published, accepted for publication or submitted to international peer-reviewed journals:

Elberling J et al. The patient with symptoms related to odours and chemicals. Ugeskrift for Læger 2013.

Tran MT et al. Two of three patients with multiple chemical sensitivity had less symptoms and secondary hyperalgesia during and after transcranially applied pulsed electromagnetic fields. Scand J Pain. 2013.

Tran MT et al. Trancranial pulsed electromagnetic fields for multiple chemical sensitivity: a study protocol for a randomized double-blind, placebo-controlled trial, Trials 2013; 16;14:256.

Tran MT et. Al. Multiple Chemical Sensitivity: On the Scent of Central Sensitization. Int J Hyg Environ Health 2013;216 (2):202 – 10.

Tran MT et al. Chemical intolerance among Hairdressers in Denmark. PlosOne 2013; 12;8(8).

Dantoft T et al. An elevated pro-inflammatory cytokine profile in un-exposed individuals with multiple chemical sensitivity. Psychoneuroendocrinology 2013.

Hauge CR et al. Mindfulness-based cognitive therapy for multiple chemical sensitivity: a qualitative study of participants´ experiences. Submitted for publication 2013.

Hauge CR et al. Mindfulness-based cognitive therapy (MBCT) for multiple chemical sensitivity (MCS): Results from a randomized controlled trial with 1 year follow-up. Submitted for publication 2013.

Hutton Carlsen K et al. Living with a chemically sensitive wife: A ”we” situation. ISRN Public Health. 2012.

Skovbjerg S et al. Evaluation of the Quick Environmental Exposure and Sensitivity Inventory in a Danish population. J Environ Public Health 2012;304 – 314.

Skovbjerg S et al. Mindfulness-based cognitive therapy to treat multiple chemical sensitivities: A randomized pilot trial. Scand J Psychol. 2012;53(3):233-238.

Hauge CR et al. Mindfulness-based cognitive therapy for multiple chemical sensitivity: a study protocol for a randomized controlled trial. Trials. 2012;13:179.

Skovbjerg S et al. The association between idiopathic environmental intolerance and psychological distress, and the influence of social support and major life events. Environ Health Preven Med. 2012;17(1):2-9.

Holst H et al. Capsaicin-induced neurogenic inflammation in the skin in patients with symptoms induced by odorous chemicals. Skin Res Technol 2011; 17(1):82-90.

Berg ND et al. Non-allergic cutaneous reactions in airborne chemical sensitivity – a population based study. Int J Hyg Environ Health. 2011;214(3):239-45.

Holst H et al. Increased capsaicin-induced secondary hyperalgesia in patients with multiple chemical sensitivity. Clin J Pain; 2011: 27(2):156-62.

Elberling J et al. ECT substantially reduces symptom severity and social disability associated with MCS: a case report. J ECT 2010; 26(3):231-3.

Berg ND et al. Genetic susceptibility factors for multiple chemical sensitivity revisited. Int J Hyg Environ Health. 2010;213(2):131-9.

Holst H et al. The capsaicin cough reflex in patients with symptoms elicited by odourous chemicals. Int J Hyg Environ Health. 2010; 213 (1):66-71.

Skovbjerg S et al. Attention to bodily sensations and symptom perception in individuals with idiopathic environmental intolerance. Environ Health Preven Med. 2010;15(3)141-50.

Skovbjerg S et al. Repressive coping and alexithymia in idiopathic environmental intolerance. Environ Health Preven Med. 2010;15(5):299-310.

Elberling, J: Respiratory Symptoms from Fragrances and the Link with Dermatitis Chapter 23, Contact Dermatitis, 5. Edition, 2010, Springer.

PhD – Theses in preparation

Christian Riise Hauge, MA in psychology, PhD-student. Working title: "Mindfulness-based cognitive therapy for multiple chemical sensitivity: Results from a randomized controlled trial with one year follow-up, and a qualitative exploration of participants' experiences".

Deadline: 31.12.2013

Marie Thi Dao Tran, MD, PhD-student. Working title: Central sensitization in multiple chemical sensitivity.

Deadline: 31.03.2014.

Thomas Meinertz Dantoft, MSc in biotechnology, PhD-student: Working title: Immunology and genetics in multiple chemical sensitivity.

Deadline: 15.06.2015.

Articles

A number of articles about the Research Centers activities have been published in both Danish and international magazines and papers, such as:

Discover Magazine, Health & Medicine: Extreme Chemical Sensitivity Makes Sufferers Allergic to Life. 2 October 2013 by Jill Neimark.

Politiken: Duftsygdom invaliderer 17.000 danskere. August 2013 by Mette Guldagger.
Samvirke: Sådan får du sagt: Du lugter! September 2013 by Bente Schmidt.

DRinde (DR´s internal webmagazine): Når velduft bliver til voldduft. June 2013 by Kirsten Stubbe-Teglbjærg.

Astma-Allergi Danmark: ASTMA, ALLERGI ELLER MCS: Hvad lider du af? January 2013 by Martine Bentsen.

Dagbladet Norge: Fakta om parfyme- og duftoverfølsomhet. November 2013 by Hilde Marie Tvedten.

Dagens Medicin: Duft – og kemikalieoverfølsomhed bliver en diagnose. June 2012.

Søndag: Er du duft overfølsom? June 2011 by Ilona S. Jacobsen.

Videnskab.dk: Duft – og kemikalieoverfølsommes hjerner granskes for svar. August 2010.

Videnskab.dk: Duftoverfølsomme må klare sig selv. February 2010.

TV2 News: Feature on multiple chemical sensitivity. October 2010.

Dental: Tema om duft – og kemikalieoverfølsomhed. April 2010 by Ib Asmussen.

Website

A new and improved Danish and English website was published in February 2010[5]. The website contains information on multiple chemical sensitivity in terms of symptom eliciting odours and chemicals, common symptoms, possible causes, diagnosis, case reports, and on the Research Center´s many activities. A number of new functions were introduced with the new website, such as news from the Research Center, search features, questions and answers and a medical dictionary.

Patient booklet

In September 2010 the Research Center published a booklet on MCS for patients. The booklet contains information on the current status on MCS and a case description. The booklet was prepared in order to provide and distribute easy accessible information on MCS for patients, professionals and other interested parties.

5. Information on number of visits to the website is described in the annual reports prepared by the Research Center for the Danish Environmental Protection Agency.

The booklet was printed in 10.000 copies and distributed to all Danish General Practitioners, and to pharmacies, medical specialists, hospital wards and public libraries.

The "Hot-line"

A telephone "Hotline" has been available for patients and professionals once a week from 09.00 am to 02.00 pm. The number of calls per year has been stable with between 164 to 177 calls.
In 2010 almost 90% of all calls to the Hotline were from patients with an average time of 40 minutes per call. In 2013 the corresponding number of calls from patients was 87%. Contact to the Research Centre and has also been possible through the website.

Scientific lectures

A large number of scientific presentations and lectures have been provided by the Research Centers staff, and have been described in more detail in the annual reports prepared for the Danish Ministry of the Environment/Environmental Protection Agency.

Some examples have been:
Skovbjerg S. "A status on multiple chemical sensitivity". The Research Clinic for Functional Disorders and Psychosomatics, Aarhus University Hospital 2013.

Skovbjerg S. "The approach to multiple chemical Sensitivity from the perspective of the Danish Research Center for Chemical Sensitivities". The Cosmetics Council, the Danish Environmental Protection Agency, June 2013.

Elberling J. "Multiple Chemical Sensitivity", Dagens Medicin, residency for medical doctors, Copenhagen University Hospital Bispebjerg 2012.

Elberling J. "Odour intolerance: on the scent of central sensitization", Research Seminar at Allergicentrum, Orebro Låns Landsting, Sweden 2012.

Hauge CR. "Relatives perspectives on multiple chemical sensitivity: "I feel like a watchdog" Poster presentation at the annual conference: Towards a New Agenda: Cross-disciplinary Approach to Psychosomatic Medicine, University of Aarhus 2012.

Dantoft T. “Gene expression profiling as a diagnostic tool for Chronic Fatigue Syndrome, and its potential use in chemical sensitivity research”. Presentation of research idea at scientific meeting, University of Umeå, Sweden 2012.

Skovbjerg S. “Altered processing of sensory signals in multiple chemical sensitivity”. Poster presentation at the annual conference: Towards a New Agenda: Cross-disciplinary Approach to Psychosomatic Medicine, University of Aarhus 2012.

Elberling J. “Multiple chemical sensitivity – seminar on the hypersensitive person”. For employees at the Pension Companys. Comwell, Holte 2011.

Topp AM. ”What is multiple chemical sensitivity?” Course for Danish Lung - and Allergy nurses, Vejle 2011.

Tran MT. “Central sensitization and multiple chemical sensitivity”. Scientific meeting for employees and researchers at Department of Occupational Medicine, Copenhagen University Hospital Bispebjerg 2011.

Conclusion

In the second period stretching from 2010 – 2013, the Research Center has initiated three new PhD-studies whereof one will be finalized within this timeframe. The remaining two will follow in 2014 and 2015 respectively. More than 20 scientific papers have been published or submitted for publication in international scientific journals with peer-review. More will follow as the present ongoing studies are finalized.

An Expert evaluation was prepared in 2012 for the Danish Ministry of the Environment/ Danish Environmental Protection Agency. The conclusions were among others that the Research Center had established itself as a center of excellence, and provided new knowledge of chemical sensitivities of high scientific quality and has been highly successful in both a Danish and in an international perspective. The conclusions are supported by a simultaneous report on the running of the Research center.

In July 2012 a new classification code for MCS was published in the Danish healthcare classification system on the initiative of the Research Centers scientific advisory group. The classification code will provide future information on the number of hospital contacts in this area. A status article describing the new classification code and the current status on MCS was subsequently prepared by all members of the scientific advisory group and published in 2013.

Based on a number of research studies the Research Center has provided new knowledge on MCS, which points to:

- low-grade systemic inflammation in MCS patients, along with a deviating Th2-associated cytokine response that does not involve a classic allergic response.
- Abnormal and reproducible central pain processing in MCS patients.
- that a mindfulness-based intervention may improve individual disease management, and may thus be offered MCS patients as such or provide a valuable supplement to other and yet unidentified treatment options.

A number of studies are still in process and will be finalized in the years to come. These studies will evaluate the therapeutic effects of pulsed electromagnetic fields acting on the brain, the expression of selected genes after a controlled chemical exposure, the

peripheral immune response also after a controlled chemical exposure, the role of anxiety and the stability of MCS over a five-year period.

In conclusion the scientific results from the period of 2010 – 2013 supports the conclusions from the first status report prepared by MD, PhD Jesper Elberling. The present state of knowledge on MCS still points to the central nervous system as a target for future research into the disease mechanisms of MCS and clarification of the role of chemical exposures for the development and course of the disorder, as well as possible therapeutic options. Findings of an altered regulation of the immunological system in MCS support this conclusion. Cognitive and emotional factors also seem to be involved, but the nature and extent of the role of psychology in MCS are not yet clarified. In terms of treatment, a mindfulness-based intervention may serve as a valuable path to improve individual disease management in MCS. However, despite these promising findings produced within the Research Centers relatively short timeframe of existence it appears that we have only just scratched the surface. The situation for the patients today is that there is no available treatment with a documented effect on their symptoms and apart from a diagnosis, the healthcare system can do very little for these patients. Thus, there is still a great need for a systematic and long-term effort and prioritization of research in MCS.

Annual Report for 2013

In the following a brief overview and status of the Research Centers activities for 2013 specifically will be provided. All activities are also described in the final report covering the period 2010 – 2013 and will therefore only be presented in brief.

In summary two new research projects were initiated in 2013 and two other collaborative projects were continued. One of three ongoing PhD-projects was completed and the defence of the PhD thesis is expected to take place in March 2014. Eight papers have been either published or submitted for publication in peer-reviewed scientific journals, and the Research center´s work has been described in six popular articles from different papers and magazines. The telephone hotline received 150 calls, which is in line with previous years. Collaboration and dialog with the Association of MCS patients was continued, and included, e.g. letters in the associations´ member´s magazine about the status of various research activities and the closure of the Research Center

Research activities

Studies that were continued in 2013:

- With reference to the first purpose of the Research Center: To investigate the prevalence and severity of symptoms attributed to common airborne chemicals in the Danish population.
- The Health2006 re-examination
- DanFund

The Health2006 re-examination

A number of questions on MCS were included in the Health2006 study in collaboration with the Research Center for Prevention and Health at Copenhagen University Hospital Glostrup, and subsequently included in the 5-year re-examination that took place in 2011 – 2012. Data for the study is based on the re-examination of a random sample of 18 to 69 year olds (n=3471) drawn from the Danish civil registration system and invited to participate in a general health examination. Data from the study has now been made available, and is currently under statistical work up at the Research Center in collaboration with a statistician from the University of Copenhagen.

Results from the study are planned to be published in 2014.

DanFund

The DanFund project is a coordinated research plan initiated by the Research Center for Prevention and Health at Copenhagen University Hospital Glostrup, involving various both national and international partners. The Research Center is part of the projects steering group. DanFund has received funding from TrygFonden and the Lundbeck Foundation. The project involves clinical examinations and collection of questionnaire data from more than 10.000 people, and will in the future provide new knowledge on the epidemiology of MCS and its medical relationship with other medically unexplained disorders, i.e. whether MCS can be defined as a clinical entity.

The DanFund project, initiated in 2010, is an ongoing project which presently employs a project manager, a senior researcher and two PhD. Students. Data from the project will be published in the years to come.
Studies that were initiated in 2013:
With reference to the second purpose: To identify disease mechanisms and risk factors involved in multiple chemical sensitivity

- Genetics

Genetics

In collaboration with the Department of Psychology, University of Umeå, Sweden a study on gene expression in MCS was initiated in 2013 in Umeå. Gene expression profiling is one way to study possible disease mechanisms, and the technique is commonly used for both diagnostic purposes and in basic research. The study will focus on selected genes with relevance for three of the most plausible theories concerning disease mechanisms in MCS.

Results from the study will be available late 2014 or early 2015 as part of Thomas Dantofts PhD study.

With reference to the third purpose: To do research into possible treatments and into how progression of multiple chemical sensitivity is avoided.

- Pulsed electromagnetic fields

Pulsed electromagnetic fields

Pulsed electromagnetic fields (PEMF) applied transcranially is a technology that utilizes alternating magnetic fields to stimulate the brain. Initially a pilot trial was conducted in 2012 testing the feasibility of PEMF for MCS in three patients (Tran MT et al. Scand J Pain. 2013). The results were promising and a larger double-blind, placebo-controlled, randomized trial was initiated in 2013 including 39 MCS patients randomized to either active treatment or placebo.
Results from the trial will be available in 2014, and are part of Marie Thi Dao Trans PhD-study.

Distribution of knowledge and information

Publications in peer-reviewed journals

The following list shows the scientific papers prepared by the Research Center that have been either published or submitted for publications in international journals with peer-review.

Elberling J et al. The patient with symptoms related to odours and chemicals. Ugeskrift for Læger 2013.

Tran MT et al. Two of three patients with multiple chemical sensitivity had less symptoms and secondary hyperalgesia during and after transcranially applied pulsed electromagnetic fields. Scand J Pain. 2013.

Tran MT et al. Trancranial pulsed electromagnetic fields for multiple chemical sensitivity: a study protocol for a randomized double-blind, placebo-controlled trial, Trials 2013; 16;14:256.

Tran MT et. Al. Multiple Chemical Sensitivity: On the Scent of Central Sensitization. Int J Hyg Environ Health 2013;216 (2):202 – 10.

Tran MT et al. Chemical intolerance among Hairdressers in Denmark. PlosOne 2013; 12;8(8).

Dantoft T et al. An elevated pro-inflammatory cytokine profile in un-exposed individuals with multiple chemical sensitivity. Psychoneuroendocrinology 2013.

Hauge CR et al. Mindfulness-based cognitive therapy for multiple chemical sensitivity: a qualitative study of participants´ experiences. Submitted for publication 2013.

Hauge CR et al. Mindfulness-based cognitive therapy (MBCT) for multiple chemical sensitivity (MCS): Results from a randomized controlled trial with 1 year follow-up. Submitted for publication 2013.

Other articles

A number of articles about the Research Centers activities have been published in 2013 in both Danish and international magazines and papers:

Discover Magazine, Health & Medicine: Extreme Chemical Sensitivity Makes Sufferers Allergic to Life. 2 October 2013 by Jill Neimark.

Politiken: Duftsygdom invaliderer 17.000 danskere. August 2013 by Mette Guldagger.
Samvirke: Sådan får du sagt: Du lugter! September 2013 by Bente Schmidt.

DRinde (DR´s internal webmagazine): Når velduft bliver til voldduft. June 2013 by Kirsten Stubbe-Teglbjærg.

Astma-Allergi Danmark: ASTMA, ALLERGI ELLER MCS: Hvad lider du af? January 2013 by Martine Bentsen.

Dagbladet Norge: Fakta om parfyme- og duftoverfølsomhet. November 2013 by Hilde Marie Tvedten.

The “Hot-line”

The Research Center´s telephone “Hotline” available once a week for patients and professionals received 150 calls in 2013. This is in line with previous years.

Website

News from the Research Center has been continuously communicated via the Danish and English website and newsletters. The Danish website had 9.502 visits in 2013, whereas the English website had 1.001.

Scientific lectures and presentations

The Research Center has continuously strived to provide information about MCS through lectures and presentations. In 2013 the following list of lectures and presentations were delivered:

External:

Skovbjerg S. "A status on multiple chemical sensitivity". The Research Clinic for Functional Disorders and Psychosomatics, Aarhus University Hospital 2013.
Skovbjerg S. "The approach to multiple chemical Sensitivity from the perspective of the Danish Research Center for Chemical Sensitivities". The Cosmetics Council, the Danish Environmental Protection Agency, June 2013.
Hauge CR: "Mindfulness-based cognitive therapy for multiple chemical sensitivity". Poster presentation at the International Conference on Mindfulness, Sapienza – Università di Roma in Rome, Italy.

Internal:

Tran MT: "Central sensitization in multiple chemical sensitivity". Scientific meeting arranged by the National Allergy Research Center and the Danish Research center for Chemical Sensitivities.
Hauge CR: "Mindfulness-based cognitive therapy for multiple chemical sensitivity". Scientific meeting arranged by the National Allergy Research Center and the Danish Research center for Chemical Sensitivities.

The PhD programme

As part of the PhD training about 12 systematic readings and presentations have been held throughout the year, and 8 internal scientific meetings. All in a collaboration between National Allergy Research Center and the Danish Research center for Chemical Sensitivities.

Organisation

The Research Centre employed the following people in 2013:

Sine Skovbjerg, MSc in health science, PhD, Head of research.
Jesper Elberling, MD, PhD, senior researcher.
Thomas Meinertz Dantoft, MSc in biotechnology, PhD-student.
Marie Thi Dao Tran, MD, PhD-student.
Christian Riise Hauge, MA in psychology, PhD-student.
Anne Marie Topp, project nurse.

Annual report for 2013 in Danish

I det følgende gives en kort beskrivelse af Videncentrets aktiviteter for alene 2013. Alle aktiviteter er også beskrevet i den samlede rapport for perioden 2010 – 2013 og gentages derfor kun her i kortfattet form.

Sammenfattende blev to nye forskningsprojekter igangsat og to øvrige samarbejdsprojekter blev videreført fra det forgående år. Et ud af tre igangværende ph.d.-studier blev afsluttet som forventet og forsvaret forventes at finde sted i marts 2014. I alt ottevidenskabelige artikler er publiceret eller indsendt til videnskabelige tidsskrifter med henblik på publicering, og herudover er Videncentrets arbejde omtalt i seks populær artikler om duft – og kemikalieoverfølsomhed. Videncentrets telefonline modtog 150 opkald, hvilket er på niveau med de øvrige år. Samarbejde og dialog med MCS-Foreningen blev videreført og har bl.a. omfattet artikler og løbende information i foreningens medlemsblad.

Forskningsaktiviteter

Forskningsprojekter der blev videreført i 2013:

- I henhold til Videncentrets formal om: At undersøge duft- og kemikalierelaterede symptomers omfang og sværhedsgrad i befolkningen.
- Genopfølgning på helbred2006
- DanFund

Genopfølgning på helbred2006

Befolkningsundersøgelserne "Helbred2006" og "Helbred2006 – 5 års undersøgelse" forestås af Forskningscenter for Forebyggelse og Sundhed på Glostrup Hospital og er baseret på en tilfældig stikprøve på 5.000 personer. Undersøgelserne blev gennemført i 2006 og igen i 2011-12. Videncentret har i begge undersøgelser stillet spørgsmål om forekomsten og graden af gener over for almindeligt forekommende dufte og kemiske stoffer. Analysearbejdet er igangsat i samarbejde med Biostatistisk Afdeling, Københavns Universitet.

Resultaterne fra undersøgelsen forventes publiceret i 2014.

DanFund

DanFunD projektet ledes af Forskningscenter for Forebyggelse og Sundhed, Glostrup Hospital og gennemføres i samarbejde med Forskningsklinikken for Funktionelle Lidelser og Psykosomatik, Århus Universitetshospital, Projektenheden for Psykiatrisk Rehabilitering, Psykiatrisk center Ballerup og Liaisonpsykiatrisk Klinik, Bispebjerg og Videncenter for Duft – og Kemikalieoverfølsomhed. Formålet med projektet er at opnå større viden om tilstande som duft – og kemikalieoverfølsomhed, fibromyalgi, kronisk træthed og irritabel tyktarm. Forskningsleder Sine Skovbjerg indgår i projektets styregruppe.
DanFund projektet er et igangværende projekt som blev igangsat i 2010. En projektleder, en seniorforsker og to ph.d.-studerende er i dag ansat på projektet. Data forventes offentliggjort løbende over de kommende år.

Forskningsprojekter der blev igangsat i 2013:

I henhold til Videncentrets formål om: At afdække hvilke sygdomsmekanismer og risikofaktorer, der er involveret i tilstanden.

- Genetik

Genetik

I samarbejde med Umeå Universitet i Sverige er i 2013 igangsat et studie om udtrykket af udvalgte gener (Gen ekspression) hos MCS patienter før, under og efter en kontrolleret kemisk provokation. Gen ekspression er en måde at studere sygdomsmekanismer og stratgien anvendes hyppigt i både diagnostik og grundforskning. Forskningsprojektet vil i selektionen af relevante gener have fokus på de tre mest fremtrædende teorier om MCS.

Resultater fra studiet forventes offentliggjort i 2014 eller først i 2015, som en del af Thomas Dantofts ph.d.- studie.

I henhold til Videncentrets formål om: At forske i behandling, og i hvordan udvikling og forværring af duft- og kemikalieoverfølsomhed kan forebygges.

- Elektromagnetisk stimulation

Elektromagnetisk stimulation

Pulserende elektromagnetisk stimulation er en metode som gør brug af vekslende magnetiske felter til stimulering af hjernen. Formålet med forskningsprojektet er at undersøge hvorvidt pulserende elektromagnetisk stimulation er egnet som behandling af MCS. Videncentret har i 2012 gennemført et mindre pilotforsøg med metoden og det er på baggrund af lovende resultater fra pilotforsøget, at et større forskningsprojekt er igangsat. I alt 39 MCS patienter indgår i projektet.

Resultater fra studiet forventes offentliggjort i 2014 som en del af Marie Thi Dao Trans ph.d.-studie.

Deling af viden og information

Videnskabelige publikationer

Den følgende liste viser de videnskabelige publikationer, som Videncentret enten har fået offentliggjort I 2013, eller har indsendt til videnskabelige tidsskrifter med peer-review med henblik på offentliggørelse.

Elberling J et al. The patient with symptoms related to odours and chemicals. Ugeskrift for Læger 2013.

Tran MT et al. Two of three patients with multiple chemical sensitivity had less symptoms and secondary hyperalgesia during and after transcranially applied pulsed electromagnetic fields. Scand J Pain. 2013.

Tran MT et al. Trancranial pulsed electromagnetic fields for multiple chemical sensitivity: a study protocol for a randomized double-blind, placebo-controlled trial, Trials 2013; 16;14:256.

Tran MT et. Al. Multiple Chemical Sensitivity: On the Scent of Central Sensitization. Int J Hyg Environ Health 2013;216 (2):202 – 10.

Tran MT et al. Chemical intolerance among Hairdressers in Denmark. PlosOne 2013; 12;8(8).

Dantoft T et al. An elevated pro-inflammatory cytokine profile in un-exposed individuals with multiple chemical sensitivity. Psychoneuroendocrinology 2013.

Hauge CR et al. Mindfulness-based cognitive therapy for multiple chemical sensitivity: a qualitative study of participants´ experiences. (Indsendt med henblik på publication 2013).

Hauge CR et al. Mindfulness-based cognitive therapy (MBCT) for multiple chemical sensitivity (MCS): Results from a randomized controlled trial with 1 year follow-up. (Indsendt med henblik på publication 2013).

Øvrige artikler

En række artikler i forskellige aviser og magasiner har bragt information om Videncentrets arbejde i 2013:

Discover Magazine, Health & Medicine: Extreme Chemical Sensitivity Makes Sufferers Allergic to Life. 2 Oktober 2013 af Jill Neimark.

Politiken: Duftsygdom invaliderer 17.000 danskere. August 2013 by Mette Guldagger.
Samvirke: Sådan får du sagt: Du lugter! September 2013 by Bente Schmidt.

DRinde (DR´s internal webmagazine): Når velduft bliver til voldduft. June 2013 by Kirsten Stubbe-Teglbjærg.

Astma-Allergi Danmark: ASTMA, ALLERGI ELLER MCS: Hvad lider du af? January 2013 by Martine Bentsen.

Dagbladet Norge: Fakta om parfyme- og duftoverfølsomhet. November 2013 af Hilde Marie Tvedten.

Telefonlinen

Videncentrets telefon rådgivning har også I 2013 været åben én gang ugentligt for henvendelser. Telefonlinien modtog 150 opkald i 2013, hvilket er på niveau med øvrige år.

Hjemmesiden

Nyheder fra Videncentret er løbende blevet formidlet via den danske og engelske hjemmeside, samt via nyhedsbreve. Den danske hjemmeside havde i alt 9.502 besøg i 2013, og den engelske i alt visits 1.001.

Videnskabelige præsentationer og undervisning

Videncentret bestræber sig kontinuerligt på at formidle viden om MCS gennem Videnskabelige præsentationer og undervisning. I 2013 omfattede det følgende aktiviteter:

Eksterne:

Skovbjerg S. "Status for forskning i duft – og kemikalieobverfølsomhed". Forskningsklinikken for funktionelle lidelser og psykosomatik, Aarhus Universitets Hospital 2013.
Skovbjerg S. "Videncentrets tilgang til duft – og kemikalieoverfølsomhed". Kosmetikrådet, Miljøstyrelsen, Juni 2013.
Hauge CR: "Mindfulness-based cognitive therapy for multiple chemical sensitivity". Poster præsentation at the International Conference on Mindfulness, Sapienza – Università di Roma in Rome, Italien.

Interne:

Tran MT: "Central sensibilisering ved duft – og kemikalieoverfølsomhed". Videnskabeligt seminar arrangeret i et samarbejde mellem Videncenter for Allergi og Videncenter for Duft – og Kemikalieoverfølsomhed.
Hauge CR: "Mindfulness-baseret kognitiv therapy ved duft – og kemikalieoverfølsomhed". Videnskabeligt seminar arrangeret i et samarbejde mellem Videncenter for Allergi og Videncenter for Duft – og Kemikalieoverfølsomhed.

Ph.d. program

Som en del af ph.d. uddannelsen afholdes årligt en række videnskabelige møder med systematisk gennemgang af relevant videnskabelig litteratur. I 2013 blev afholdt 12 litteratur møder og 8 interne videnskabelige møder arrangeret i et samarbejde mellem Videncenter for Allergi og Videncenter for Duft – og Kemikalieoverfølsomhed

Organisation

Videncentret havde I 2013 følgende ansatte:

Sine Skovbjerg, Forskningsleder, ph.d.
Jesper Elberling, Læge og senior forsker.
Thomas Meinertz Dantoft, civilingeniør, ph.d.-studerende.
Marie Thi Dao Tran, MD, læge, ph.d.-studerende.
Christian Riise Hauge, psykolog, ph.d.-studerende.
Anne Marie Topp, projektsygeplejerske.