Prevention of Occupational Hand Eczema among Danish Healthcare Workers

Ph.D. Thesis
University of Copenhagen 2012

Kristina Sophie Ibler, MD
University of Copenhagen, Faculty of Health Science
Department of Dermatology
Roskilde and Bispebjerg Hospitals
Denmark
Prevention of Occupational Hand Eczema among Danish Healthcare Workers

Kristina Sophie Ibler
The PH.D. Thesis is based on the following manuscripts:


II  Ibler KS, Jemec GBE, Agner T. Exposures related to hand eczema. A study of healthcare workers. Accepted for publication in Contact Dermatitis.


Supervisors

Tove Agner, Prof., MD, DMSc
University of Copenhagen, Health Science Faculty
Department of Dermatology,
Bispebjerg Hospital,
Denmark

Gregor Borut Ernst Jemec, Prof., MD, DMSc
University of Copenhagen, Health Science Faculty
Department of Dermatology
Roskilde Hospital,
Denmark

Thomas Diepgen, Prof., MD, Ph.D.
Department of Social Medicine
Occupational. & Environmental Dermatology,
University of Heidelberg
Germany
PREFACE

The work of this Ph.D. thesis was conducted between October 2008 and November 2011 at Department of Dermatology, Roskilde University Hospital, in a cooperation with Department of Dermatology, Bispebjerg Hospital.

The first part of the thesis is based on data collected from a survey among 3181 healthcare workers in three Danish hospitals situated in Region Zealand in Denmark. The questionnaire included 56 questions on self-reported hand eczema, exposures at work and at home, severity of hand eczema and working conditions.

The second part of the thesis is based on a randomised clinical trial of skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema.

The study was funded by Region Zealand’s Research Fund and The Danish Working Environment Research Fund.
ACKNOWLEDGEMENTS

Gratefully I thank Professor Tove Agner and Professor Gregor Jemec for their confidence and belief in my research skills and for giving me the opportunity to participate in this Ph.D. program. They have both contributed with invaluable expertise, enthusiasm and support when it was needed, and I deeply appreciate their engagement.

I would also like to extend special thanks to all the participants in the study and the hospital management in Region Zealand; Ib Steen Mikkelsen (Director), Teis Andersen (Vice Director) and Susanne Lønborg Friis (Vice Director) for making the study possible.

My co-investigator, Vibeke West Isaksen, is warmly thanked for her dedication and flexibility and for helping me to keep up the spirit when things were difficult.

Professor Thomas Diepgen and his German colleagues in Heidelberg as well as senior researcher Mari-Ann Flyvholm from The National Research Centre for the Working Environment are gratefully thanked for valuable advice during the construction of the questionnaire.

I am also grateful to Christian Gluud and Jane Lindschou Hansen from Copenhagen Trial Unit for constructive criticism and eye-opening discussions about the trial design and Aksel Jensen and Karl Christensen from Dept. of Biostatistics, Copenhagen University, for statistical support.

Colleagues at Roskilde and Bispebjerg Hospitals are thanked for good company and laughs. I am especially indebted to Solveig Esmann for her excellent computer skills.

I thank the financial contributors to this study: The Danish Working Environment Research Fund and Region Zealand’s Research Fund, and furthermore MEKOS Laboratories and ALK-Abelló A/S, Denmark for kindly donating some of the TRUE-tests® and prick tests.

…and finally my dear family for never ending patience and support.
ABBREVIATIONS

QoL = Quality of Life

DLQI = Dermatology Life Quality Index

HECSI = Hand eczema severity index

CTU = Copenhagen Trial Unit

T.R.U.E. TEST® = Thin-layer Rapid Use Epicutaneous-Test®

OR = Odds Ratio

CI = Confidence Interval
TABLE OF CONTENTS

1. BACKGROUND ................................................................. 9
   1.1. Definition ................................................................. 9
   1.2. Occupational hand eczema ........................................... 9
   1.3. Risk factors and prognosis of hand eczema ....................... 10
   1.4. Hand eczema in healthcare workers ............................... 10
   1.5. Classification of hand eczema ....................................... 11
   1.6. Consequences and socio-economic impact of occupational hand eczema ............................................... 11
   1.7. Prevention of hand eczema ............................................ 12

2. AIMS OF THE STUDIES ....................................................... 13
   2.1. Part 1 ................................................................. 13
   2.2. Part 2 ................................................................. 13

3. MATERIALS AND METHODS ............................................... 14
      3.1.1. Study population ............................................... 14
      3.1.2. Questionnaire design ......................................... 15
      3.1.3. Pilot testing of the questionnaire ........................... 15
      3.1.4. Definitions .................................................... 16
      3.1.5. Data collection and entering ................................ 19
      3.1.6. Statistical analyses .......................................... 19
   3.2. Part 2: A randomised clinical trial of skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema ........................................ 19
      3.2.1. Study population ............................................... 20
      3.2.2. Trial conduction ............................................... 20
3.2.3. Trial design 20
3.2.4. Trial flow chart 22
3.2.5. Randomisation 23
3.2.6. Blinding 23
3.2.7. Assessment of outcome variables 23
3.2.8. The intervention 24
3.2.9. Data collection and entering 25
3.2.10. Sample size calculation 26
3.2.11. Statistical analyses 26

4. **RESULTS** 26

4.1. **Part 1: A survey of healthcare workers** 26
4.1.1. Response rate 26
4.1.2. Respondents 27
4.1.3. Differences between respondents and non-respondents 27
4.1.4. Prevalence of self-reported hand eczema 27
4.1.5. Factors associated with hand eczema 28
4.1.6. Self-reported severity of hand eczema 28
4.1.7. Factors associated with severe hand eczema 28
4.1.8. Exposures associated with hand eczema 29
4.1.9. Sick leave due to hand eczema 31
4.1.10. Notification to the authorities 31

4.2. **Part 2: A randomised clinical trial of skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema** 38
4.2.1. Trial population 38
4.2.2. Non-participants 38
4.2.3. Discontinuation 38
1. BACKGROUND

1.1. Definition

Hand eczema is an inflammatory skin disease belonging to the group of eczematous skin disorders. The condition is frequently multifactorial and a broad range of factors can play a role. These include not only endogenous well as exogenous biological factors but also behavioural, psychological and cultural parameters. It can be located anywhere on the hands, and the symptoms include itching, erythema, vesicles, oedema, dryness, scaling, fissures and hyperkeratosis. Hand eczema has the capacity to spread to the wrists and distal forearms, and in rare cases to the whole body, depending on the degree of exposure to irritants and allergens. Hand eczema can be long-lasting and incapacitating. A 1-year prevalence of 9.7%, and a point prevalence of 6% has been found in the background population in Scandinavia [1], and an incidence of 5.5 to 8.8 per 1000 person-years has been reported [2;3].

1.2. Occupational hand eczema

Hand eczema is the most common occupational skin disease and over all one of the most frequent occupational disorders. It is the most frequently recognized occupational disease in Denmark with around 1500 cases per year, and in questionnaire studies an incidence of approximately 0.32 per 1000 person- 0.7 to 0.8 per 1,000 employees has been reported in the back ground population [2;4;5]. The number of unreported occupational skin conditions is suspected to be many times greater.

An increased risk is found in occupations with high exposure to wet work, skin irritants, and contact allergens [1;3]. The occupations with the highest risk of developing hand eczema in Denmark are bakers, hairdressers, dental surgery assistants, kitchen workers and cooks. Other high risk occupations include butchers, cashiers, carpenters, cleaners and healthcare workers.

The largest group of recognized occupational hand eczema cases in Denmark is formed by healthcare workers [6].
1.3. Risk factors and prognosis of hand eczema

There are several well known risk factors for development of hand eczema. These include past or present atopic dermatitis, which is a strong endogenous risk factor [7-13] and wet work. Female sex has also been reported as a risk factor in univariate analysis, however, when adjusted for wet work this does not seem to be the case [7]. Genetic predisposition is also a risk factor [7], and filaggrin null mutations, are currently being investigated as a possible risk factor [14-18]. Filaggrin null mutations have been shown to increase the risk of hand eczema in patients with atopic eczema [17].

There are several exogenous risk factors for hand eczema, chiefly repeated exposures to irritants or allergens. Well known irritants include wet work, detergents, disinfectants and soaps and cutting oils, food and gloves. Contact allergy is also a well know risk factor [7]. The most common relevant allergens include metals, rubber, preservatives, fragrances, plants, epoxy, acrylates and adhesives [19]. General environmental factors such as low humidity during winter or in an occupational setting, has also been reported as a risk factor [20] [21].

A Danish study found that severe hand eczema is associated with higher age, atopic dermatitis and contact allergy [22]. Being an unskilled worker, having frequent eruptions and a delay in seeking medical attention were associated with a poor prognosis [22;23].

1.4. Hand eczema in healthcare workers

Healthcare workers are known to be at increased risk of developing hand eczema due to wet work and contact with environmental irritants such as detergents, protective gloves and disinfectants [24]. Surveys in the healthcare sector have found prevalences of hand eczema as high as 20 to 50%. Most of the studies have been conducted among nurses [25-32]. A Danish study found that nurses, assistant nurses, and nursing assistants were at particularly high risk, with about one third reporting hand eczema[33].
1.5. Classification of hand eczema

Several classification systems of hand eczema have been suggested, but no general consensus has yet been reached on a preferred system [34]. The lack of consensus is a disadvantage for communication in clinical practice as well as a drawback when comparing clinical trials. For subclassification of hand eczema, a history of atopic dermatitis and environmental exposures to various agents needs to be clarified and patch tests performed. In 2008, a classification system was proposed based on data from a multicenter study of the aetiology and morphology of hand eczema in 416 patients from 10 European centers with a special interest in hand eczema [35]. A classification system of seven subdiagnoses of hand eczema was suggested of which two were combined diagnoses. The proportion of the diagnoses was: Irritant contact dermatitis (ICD) 22%, allergic contact dermatitis (ACD) 15%, ACD+ICD 15%, atopic hand eczema (AHE)+ICD 8%, AHE 6%, Vesicular (endogenous) contact dermatitis 9% and hyperkeratotic (endogenous) contact dermatitis 5%. A similar classification system and an algorithm for the diagnosis and classification of chronic hand eczema has been suggested recently [36].

1.6. Consequences and socio-economic impact of occupational hand eczema

Complications and consequences of occupational hand eczema include chronic severe eczema, prolonged sick leave, unemployment, and impaired quality of life [37-41], and the burden for society and employers is considerable. In addition to the individual problems experienced, hand eczema patients also impose marked costs onto society in terms of medical resources, rehabilitation, productivity loss, sickness benefit and disability pensions [42-45]. In a Danish survey of 427 individuals with hand eczema, 67% had visited a general practitioner and 44% had been seen by a dermatologist [46].

Hand eczema has been shown to have a measurable negative impact on quality of life [25;39;47;48]. A study found that younger patients were more negatively affected than older patients. This could be explained by development of better coping strategies in older patients who have had hand eczema for a longer time than the
younger patients [48]. One study found that quality of life among hand eczema patients was negatively influenced by increased severity of hand eczema and by lower socio-economic background [39], while another study found no association between quality of life and socio-economic background [48]. Females have been shown to be more affected in quality of life than men [47]. It may be speculated that the general psycho-social resources of the individual patients influence their coping abilities and hence the impact of hand eczema.

1.7. Prevention of hand eczema

Preventing any disease can be grouped into three levels. The levels are named for the stages of disease they target. The three levels of prevention are primary, secondary, and tertiary (Table 1).

Preventive programmes have proven to be effective as primary prevention in wet work occupations, i.e., healthcare workers, hairdressers, gutcleaners and cheese dairy workers [49-58]. The evidence for secondary prevention programmes is more limited. Multidisciplinary intervention programmes have been introduced in secondary prevention of hand eczema in healthcare workers, but the programmes were not based on randomised clinical trials [59-61].

A previous literature review [62] evaluated the effectiveness of intervention programmes for hand eczema. Seven randomised studies were included in the review [52-56;60;63], and it concluded that there was moderate evidence for reducing the occurrence of hand eczema and improving adherence to preventive measures. A low level of evidence for the effect on improving clinical outcomes and self-reported outcomes was found.
Table 1:

Levels of prevention

<table>
<thead>
<tr>
<th>Stage of disease</th>
<th>Level of prevention</th>
<th>Type of response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre disease</td>
<td>Primary prevention</td>
<td>Health promotion and specific protection</td>
</tr>
<tr>
<td>Latent disease</td>
<td>Secondary prevention</td>
<td>Pre-symptomatic diagnosis and treatment</td>
</tr>
<tr>
<td>Symptomatic disease</td>
<td>Tertiary prevention</td>
<td>Disability limitation for early symptomatic disease</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rehabilitation for late symptomatic disease</td>
</tr>
</tbody>
</table>

2. AIMS OF THE STUDIES

This thesis is structured into two parts: A descriptive part and an intervention. The aims for each of these are stated here.

2.1. PART I

1. To estimate the prevalence and severity of self-reported hand eczema in a cohort of healthcare workers and to relate the findings to gender, age, skin complexion and atopic dermatitis as well as profession, medical speciality, shifts and working hours.

2. To investigate the relationship between exposure (at work and at home) and 1-year prevalence of hand eczema as well as severity of hand eczema.

3. To investigate sick leave and notification to the National Board of Industrial Injuries in healthcare workers with self-reported hand eczema.

2.2. PART II

1. To evaluate the effect of an intervention, consisting of a simple secondary preventive programme including skin care education and individual counselling
(on work related and domestic exposures and contact allergies) in healthcare workers.

3. MATERIALS AND METHODS

Data in this thesis is based on a questionnaire study (Part 1) and a randomised clinical trial (Part 2). Both studies were approved by the Danish Data Protection Agency, and the trial was approved by the Danish Research Ethics Committee System.

3.1. Part 1: A survey of healthcare workers

In April 2009, a questionnaire was distributed by email to 3181 healthcare workers from three hospitals (Roskilde, Holbæk and Køge) in the same geographical area of Denmark.

Those who did not respond within two weeks received a 2nd copy by email. If this was not answered, a paper version was sent to the work address and finally to their home address, if needed. Only after this procedure were all further attempts at obtaining information abandoned.

The study was announced on the hospital intranet and at staff meetings, and the workers were encouraged to respond the questionnaire by the chair persons in the departments, the safety officers and the hospital management. A monetary reward was given by lottery to one respondent, and the department with most respondents was rewarded with a basket of goodies.

3.1.1. Study population

The questionnaire was distributed to all physicians, nurses, nursing assistants and biotechnicians working in the three hospitals. The hospitals accounted for 33%, 27% and 40% of the surveyed persons, respectively.
3.1.2. Questionnaire design

The questionnaire was designed for healthcare workers. It was partly based on a previously validated questionnaire, The Nordic Occupational Skin Questionnaire (NOSQ 2002, long version), which was designed for surveying work-related skin diseases and exposures [64]. However, also several new questions were constructed.

The questionnaire included 56 items. The main questions concerning hand eczema was “Have you ever had hand eczema?” (NOSQ question D1), “Have you had hand eczema during the past 12 months?” and “Do you have hand eczema currently?”. In validation studies, the specificity of the self-report of hand eczema has been high (usually over 90%) while the sensitivity has been lower (less than 70%) [65-69]. The results indicate that self-report is more likely to underestimate than overestimate the true prevalence of hand eczema.

Other aspects covered in the questionnaire were: knowledge of hand eczema (4 multiple choice questions), demographic data, atopic disposition, skin type, medical profession, working hours, shifts, type of department, allergies, skin exposures at work (water, hand washing, local disinfectants, protective gloves, handling of medicines, laboratory reagents, rubber materials, food preparation, detergents) and domestic skin exposures (hand washing, food preparation, cleaning, dish washing, laundering by hands, caring for infants and toddlers, gardening, redecorating, renovation, repairing of engines), use of moisturisers, smoking habits, physical activity, change of job/tasks at work, sick leave, notification to the authorities, aggravating exposures, management of hand eczema and self-evaluated disease severity. The questionnaire is demonstrated in the appendix.

3.1.3. Pilot testing of the questionnaire

The questionnaire was developed by the principal investigator (KI) and the supervisors. A pilot test was performed in one hospital department with 32 employees. After the pilot test, the respondents were interviewed and minor changes made in the questionnaire according to remarks and suggestions by the respondents where appropriate.
3.1.4. Definitions

Self-reported hand eczema

Self-reported hand eczema was defined as an affirmative answer to the question “Have you had hand eczema during the past 12 months?”. This was reported by 397 of the respondents (21%).

Self-reported severity of hand eczema

Self-reported severity of hand eczema was reported by use of a previously validated photographic guide [70;71]. The original photographic guide was modified by omitting the group representing “clear”, which left the questionnaire with 16 clinical photos of hands presenting four severity groups of hand eczema; mild/almost clear, moderate, severe and very severe. Each group was represented by pictures of male and female hands, dorsal and palmar views and different morphological features of hand eczema.

The respondents were asked to grade the severity of their hand eczema when at its worst according to the four severity groups.

Atopic dermatitis

Atopic dermatitis was defined using the UK Working Party’s diagnostic criteria [72-74], based on the Hanifin and Rajka criteria [75]. Validation of the UK Working Party’s diagnostic criteria found a sensitivity of 80% and a specificity of 97% corresponding to positive and negative predictive values of 80% and 97% [76]. The criteria include five questions concerning specific characteristics of atopic dermatitis. To obtain the diagnosis of atopic dermatitis one major criteria (“Have you ever had an itchy skin condition?”) and three of five minor criteria (flexural, neck or facial involvement; age of onset below two years; personal history of asthma or hay fever; a history of generally dry skin; and visible flexural eczema) must be fulfilled. However, in questionnaire studies, one major and two minor criteria are enough to obtain the diagnosis of atopic dermatitis since questionnaires do not allow for visible flexural eczema.

Quality of life
Quality of life (QoL) was measured in Part 2 of the study by use of The Dermatology Life Quality Index (DLQI) which is a validated dermatology-specific questionnaire concerning health related Quality of Life. It contains 10 items on symptoms and feelings, daily activities, leisure, work or school, personal relationships and side-effects of treatment. Each item is scored on a four-point scale: 0, no at all/not relevant; 1, a little; 2, a lot; 3, very much. The scores of individual items (0-3) are added to yield a total score ranging between 0 and 30 points. Higher scores mean greater impairment of the patient’s quality of life [77]. A banding system of the DLQI has been suggested aiding the clinical interpretation of the DLQI score (Table 2)[78].

**Responsiveness to change** measured by the DLQI has been validated in skin diseases as psoriasis[79], acne[80], eczema[81] and non melanoma skin cancer[82]. The *minimal clinically important difference in DLQI* has been investigated in skin diseases as hyperhidrosis, psoriasis and chronic idiopathic urticaria, and a change in DLQI ranging from 2.2 to 3.2 points was found to be the minimal important difference in the studies [83-85]. To our best knowledge, the minimal clinically important difference in DLQI has never been investigated in hand eczema patients.

We used the DLQI since no disease-specific instrument exists evaluating the specific problems encountered by patients with hand eczema. The DLQI questionnaire has proved to be valuable in patients with hand eczema [39;47;77;86]. A standardized and validated Danish translation of the questionnaire was used.

**Table 2:**

Banding of the DLQI [78]

<table>
<thead>
<tr>
<th>DLQI bands</th>
<th>Scores</th>
<th>QoL Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Band 0</td>
<td>0–1</td>
<td>No effect</td>
</tr>
<tr>
<td>Band 1</td>
<td>2–5</td>
<td>Small effect</td>
</tr>
<tr>
<td>Band 2</td>
<td>6–10</td>
<td>Moderate effect</td>
</tr>
<tr>
<td>Band 3</td>
<td>11–20</td>
<td>Very large effect</td>
</tr>
<tr>
<td>Band 4</td>
<td>21–30</td>
<td>Extremely large effect</td>
</tr>
</tbody>
</table>
Skin type/complexion

Skin type was self-evaluated according to the Fitzpatrick Classification which classifies complexion and tolerance of sunlight from one to six, see Table 3 [87].

For the comparative analyses in our study we chose to compile Fitzpatrick’s skin types into three groups: fair skin (Fitzpatrick 1+2), medium skin (Fitzpatrick 3+4) and dark skin (Fitzpatrick 5+6). This was done since only few respondents belonged to skin type 1 and 6.

Table 3:

Fitzpatrick skin types I-VI.

<table>
<thead>
<tr>
<th>Skin type</th>
<th>Typical features</th>
<th>Tanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Pale white skin, blue/hazel eyes, blond/red hair</td>
<td>Always burns, does not tan</td>
</tr>
<tr>
<td>II</td>
<td>Fair skin, blue eyes</td>
<td>Burns easily, tans poorly</td>
</tr>
<tr>
<td>III</td>
<td>Darker white skin</td>
<td>Tans after initial burn</td>
</tr>
<tr>
<td>IV</td>
<td>Light brown skin</td>
<td>Burns minimally, tans easily</td>
</tr>
<tr>
<td>V</td>
<td>Brown skin</td>
<td>Rarely burns, tans darkly easily</td>
</tr>
<tr>
<td>VI</td>
<td>Dark brown or black</td>
<td>Never burns, always tans darkly</td>
</tr>
</tbody>
</table>
3.1.5. Data collection and entering

Electronic datagathering was primarily used. The questionnaire was set up on the internet. The participants received an email containing a link to the questionnaire and a personal internet code for the internet based survey system [88]. Data were exported from the internet based survey system to Microsoft Office Excel 2003 and from Excel to PASW statistics 18 for data analyses.

A paper version of the questionnaire was distributed to those who did not respond via the internet. After collection of the paper questionnaires, the data was scanned by an external company, www.datascanning.dk. The scanned data was monitored by the principal investigator (KI) and checked for systematic errors before it was exported to PASW statistics 18 for data analyses. The original data set was also saved.

3.1.6. Statistical analyses

Data analyses were performed in PASW (Predictive Analytics SoftWare) Statistics 18, formerly known as SPSS (Statistical Package for the Social Sciences), IBM Software Group's Business Analytics Portfolio. The statistical analyses were performed with help from a statistician (Department of Biostatistics, Copenhagen University).

Probabilities were recognized as significant if the level was less than 5%, and 95% confidence intervals were used. Comparisons were made by using the Chi-square test. Multivariate logistic regression model was used to adjust for confounders when investigating associations between hand eczema or severity and selected variables. Associations were expressed as odds ratios (OR) with confidence intervals (CI) of 95%.

3.2. PART 2: A randomised clinical trial of skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema

The trial was registered in ClinicalTrials.Gov, NCT01012453, and it was approved by the Danish Research Ethics Committee System for Region Zealand, registration number SJ 126.
3.2.1. Study population

The participants in the trial were recruited from the survey (Study Part 1). Inclusion criteria was an affirmative answer to the validated question “Have you had hand eczema during the past twelve months?”. Informed written consent was a prerequisite for participation. The written information and the consent form were approved by the Danish Research Ethics Committee System. The consent form was signed by the participants and the investigator seeking the consent.

Exclusion criteria were pregnancy, systemic use of immunosuppressive drugs, systemic use of retinoids, active psoriatic lesions on the hands, any serious medical condition which, in the opinion of the investigator, could interfere with the evaluation of the results, and lack of informed written consent.

3.2.2. Trial conduction

The randomisation of participants took place between October 2009 and February 2010, in Roskilde Hospital, Holbæk Hospital and Køge Hospital.

3.2.3. Trial design

The trial was a randomised, observer-blinded parallel group superiority clinical trial. Baseline data were taken at entry to the trial (T = 0) and outcome measures were taken at follow-up (T = 5 months).

All included participants were clinically examined at entry into the trial, and information about baseline variables were obtained by a trained nurse just before randomisation. The examination included scoring of severity, self-reported severity assessment (by use of a photographic guide), quality of life, number of eruptions during the past three months, questions on preventive measures (use of protective gloves, moisturisers and disinfectants) and knowledge of hand eczema. Immediately after the examination, all participants were randomised individually to the intervention group or to the control group (no intervention or treatment as usual). The participants in the intervention group were subsequently patch and prick tested, and three days later, reading of the patch test and individual counselling was done by a trained physician (see details later). ‘Treatment as usual’ was offered if needed. The
participants in the control group received no further treatment, and no restrictions were given regarding past or future management of hand eczema.

At follow-up after 5 months, all participants were clinically re-examined and the outcome measures were obtained by the same nurse as at onset in an observer-blinded fashion.

According to the protocol, follow-up was supposed to take place 6 months from entry. However, the follow-up time was 5 months due to logistic and seasonal reasons. Firstly, the inclusion lasted longer than expected, and secondly, we wanted to evade the possible effect of increased UV-radiation and humidity on eczema during summertime.

Trial flow chart: see next page
Invited to participate in survey  
\( n=3181 \)  
Participants in survey  
\( n=2269 \)  
Participants with hand eczema within the last year = 397  
invited to participate in the hand eczema trial  
\( n=397 \)  
Did not participate in survey  
\( n=912 \)  
No hand eczema  
\( n=1444 \)  
Participants excluded  
\( n=142 \)  
Participants included  
\( n=255 \)  
\( T=0 \)  
- Disease severity (HECSI)  
- Self evaluated disease severity  
- Number of eruptions  
- Quality of life (DLQI)  
- Skin protective behaviour  
\( n=123 \)  
\( n=132 \)  
Randomisation  
Experimental group  
\( n=123 \)  
\( T=0 \)  
- patch test  
- prick test  
\( n=123 \)  
\( T=0 + three \text{ days} \)  
- subtype the HE diagnosis and  
- interpret the patch test,  
- demonstrate hand washing  
- demonstrate appliance of emollients  
- individual, thorough counselling  
- skin care programme  
\( n=122 \)  
\( T=5 \text{ months (follow-up)} \)  
- clinical examination  
- quality of life  
- knowledge of skin protection and  
- skin protective behaviour  
\( n=119 \)  
Control group  
\( n=132 \)  
\( T=5 \text{ months (follow-up)} \)  
- clinical examination  
- quality of life  
- knowledge of skin protection and  
- skin protective behaviour  
\( n=128 \)
3.2.5. Randomisation

Randomisation to intervention or control group was performed individually, and was handled centrally at the Copenhagen Trial Unit (CTU). Immediately after consent and baseline data were obtained, CTU was contacted via telephone, and the CTU staff randomised the participant. For randomisation concealment a computer generated allocation sequence with a block size of ten was used which was unknown to the investigators. The randomisation was stratified according to three factors: hospital, profession (physicians versus nurses, nursing aids and biotechnicians) and HECSI score at entry (HECSI < 8 versus HECSI ≥ 8).

3.2.6. Blinding

The trial was single blinded and involved three investigators. Investigator 1 (a nurse) obtained baseline data and outcome measures and was the only blinded person in the trial. After obtainment of baseline data, the participants went on directly to investigator 2 (a nurse) who was situated out of sight from investigator 1. Investigator 2 was responsible for the randomisation and allocation through contact with CTU via telephone. Investigator 2 was also responsible for application of the patch and prick test. Investigator 3 (principal investigator KI) was responsible for the intervention (subtyping the hand eczema diagnose, interpreting the patch test and counselling).

The participants in the trial were not blinded. Since the randomisation was individual and not a cluster randomisation, there was a risk of sharing of knowledge between the participants in the intervention group and the control group. To amend this problem, participants in the intervention group were encouraged not to share information with others and not to reveal their randomisation allocation at any time until cessation of the trial.

Investigator 3 was responsible for the investigational conclusions based on primary and secondary outcomes.

3.2.7. Assessment of outcome variables

The primary outcome was defined as the difference in Hand Eczema Severity Index (HECSI) at entry compared with follow-up. The HECSI scoring system is validated and grades the intensity of erythema, induration, papules, vesicles, fissures, scaling
and oedema for five areas of each hand (fingertips, fingers (except the tips), palms, back of hands, wrists) on a scale from 0-3 with the score values for each of the areas added up. The extent of affected skin of each area is graded from 0-4. The intensity and extent are multiplied and the total score ranges from 0-360 [89].

In a multicenter study of 416 hand eczema patients from 10 European patch test clinics, a median HECSI value of 17 (range 8 to 35) was found [47]. A study among hair dressing apprentices found a median HECSI value of 6 (range 2 to 21) [90].

The secondary outcomes were the difference in Dermatology Life Quality Index (DLQI) (see section 3.1.4) from entry to follow-up, the difference in self-evaluated disease severity from entry to follow-up, the differences in number of eruptions during the past three months, skin protective behaviour (preventive measures) and knowledge of skin protection from entry to follow-up. Self-evaluated disease severity was measured by use of a validated photographic guide (see section 3.1.4) [71]. Skin protective behaviour (preventive measures) was measured as instances of daily hand washing and hand disinfection and use of protective gloves and moisturisers at work and at home. Knowledge of skin protection was measured as the total number of points achieved in a repeated multiple choice questionnaire with four questions on skin protection. A maximum score of 10 was obtained if all answers were correct. The minimum score was 0 points.

3.2.8. The intervention

At entry, the participants in the intervention group were patch tested (T.R.U.E. TEST® (SmartPractice®, Phoenix USA) standard series panel 1 and 2 supplemented by chlorhexidine digluconate 0.5%, primin 0.01%, sesquiterpene lactone mix 0.1%, budesonide 0.01%, tixocortol pivalate 0.1%, hydroxyisohexyl-3-cyclohexene carboxaldehyde 5%, methylidibromo glutaronitrile 0.5% and fragrance mix II 14%) and prick tested (ALK-Abello Soluprick ® (ALK, Hørsholm, Denmark) standard series, chlorhexidine 0.5%, latex). The patch test was removed by the participants after 48 hours. One day after removal, reading was done by the principal investigator (KI), and hand eczema was subtyped according to allergic, atopic or irritant aetiology. In all participants, however, irritancy was considered evident due to the extensive exposure to water, detergents and occlusive gloves in the hospital environment. A history of work-related and domestic exposures was obtained. Instructions in avoidance of
relevant allergens, as well as in general skin protection at work and at home were
given. The participants demonstrated application of a fluorescent emollient on their
hands, and UV-light was used to detect if the application was appropriate. Hand
washing was observed by the principal investigator (KI), and the participants were
recommended to use cold or lukewarm water, to wet the hands before application of
the detergent and to dry the hands carefully [91]. Wearing of rings was discouraged.
Participants were instructed according to a skin protection programme, and a written
version of the instruction was handed out [50]. The participants were encouraged to
replace hand washings with disinfectants when hands were not visibly dirty
(according to the recommendations for the workplace), to use a fat moisturiser, free
of fragrances, at least three times during the working hours; upon arrival, before lunch
and before leaving, and also at bedtime. Use of protective gloves was recommended
for wet work, and when handling medications, cleaning and cooking (handling of
vegetables, raw meat and fish). When the use of protective gloves was expected to
exceed five to ten minutes, it was recommended to wear cotton gloves underneath.
The time spent on reading of the patch test and individual counselling was 20 to 30
minutes per participant.

If participants in the intervention group had severe hand eczema which needed
medical treatment, they were advised to consult their general practitioner or
dermatologist for further treatment. One participant in the intervention group was
prescribed topical corticosteroids, and one was advised to visit the general
practitioner or a dermatologist.

Control group

No intervention was given to the participants in the control group. If participants in the
control group had severe hand eczema which needed medical treatment, they were
advised to consult their general practitioner or dermatologist for further treatment.

3.2.9. Data collection and entering

Data were registered directly in standardised paper record forms in separate files at
each visit by investigator 1, 2 and 3. After cessation of the trial, all data from the
paper record forms was entered manually in Microsoft Office Excel 2003 by double
data entry performed by investigator 1. Approximately 50% of the data was monitored
and checked for errors by the principal investigator (KI) who later exported data from Excel to PASW statistics 18 for data analyses in a blinded fashion.

3.2.10. **Sample size calculation**

The clinical trial was planned to include a minimum of 262 participants. The sample size calculation was based on the mean HECSI score (primary outcome) at follow-up, which was expected to be 10 in the intervention group and 14 in the control group. Alpha error level was 5% and beta error level 20%. With a standard deviation of 13 on the HESCI score, the sample size calculation was 131 in each intervention group [92].

3181 healthcare workers were invited to participate in the questionnaire survey. This was the number of employed physicians, nurses, nursing aids and biotechnicians in the three included hospitals. According to previous findings in the background population a prevalence of hand eczema of at least 8% was expected [93], which led to an expected number of 255 participants (8% of 3198) with selfreported hand eczema.

3.2.11 **Statistical analyses**

All statistics were calculated using PASW statistics 18 version 18.0.0. Unpaired t-test was used when comparing unpaired data and paired t-test for paired data. A two sided P-level < 0.05 was considered significant.

4. **RESULTS**

4.1. **PART 1: A Survey of Healthcare Workers**

4.1.1. **Response rate**

The questionnaire was distributed to 3181 healthcare workers from the three hospitals, and 2274 responded (response rate 71%).
4.1.2.  **Respondents**

Of the respondents, 17% (387) were physicians, 55% (1239) were nurses, 19% (443) were nursing assistents and 9% (204) were biotechnicians. The three hospitals accounted for 34% (770), 25% (570) and 41% (934) of the respondents, respectively, reflecting the size of the hospitals and the participation rates from the three hospitals were 73%, 67% and 73%. 87% of the respondents were females and 13% were males which reflected the gender distribution in the surveyed population.

4.1.3.  **Differences between respondents and non-respondents**

The response rate was significantly higher for the male healthcare workers (81%) compared to the female healthcare workers (70%) (P<0.001), and the respondents were significantly older (mean age 46.2 years, SD 10.3) than the nonrespondents (mean age 44.8, SD 11.1) (P<0.001). The response rates differed significantly among the professionals; 62% (387 of 621) of the physicians, 74% (1239 of 1672) of the nurses, 70% (443 of 631) of the nursing assistants and 80% (204 of 255) of the biotechnicians responded to the questionnaire (P<0.001). The participation rates differed significantly between the three involved hospitals; Roskilde Hospital 73%, Holbæk Hospital 73%, Køge Hospital 67% (P=0.005). Figure 1 shows the distribution of the total cohort, the respondents and the prevalence of self-reported hand eczema according to departments.

4.1.4.  **Prevalence of self-reported hand eczema**

*The 1-year prevalence* of hand eczema among healthcare workers was 21% (397 of 1843) with a 95% C.I. of 20% to 23%.

*The point prevalence* of hand eczema among healthcare workers was 12% (195 of 1641) with a 95% C.I. of 10% to 14%.

*The life time prevalence* was 35% (764 of 2210) with a 95% C.I. of 33% to 37%.

In the study hand eczema was defined as having had hand eczema within the last year. Thus the results of Part 1 of the thesis are based on data achieved from the respondents reporting to have had hand eczema within the last year.
4.1.5. **Factors associated with hand eczema**

Univariate analyses found that hand eczema was significantly associated with male sex, younger age, fair skin type and a history of atopic dermatitis. In a logistic regression model adjusted for explanatory variables, hand eczema was found to be significantly associated with male sex (OR=1.8), younger age (OR=2.44) and a history of atopic skin disease (OR= 2.66). Those working 30-39 hours per week had a significantly lower OR (0.54) than those working 40-60 hours per week (OR=1) (Table 4).

4.1.6. **Self-reported severity of hand eczema**

According to the photographic guide, severity of hand eczema was reported as mild in 50% (201 of 397), moderate in 39% (156 of 397), severe in 9% (36 of 397) and very severe in 2% (8 of 397) of the cases.

4.1.7. **Factors associated with severe hand eczema**

Logistic regression analysis was conducted comparing two severity groups; those with mild lesions and those with moderate, severe and very severe lesions. The two groups were comparable in sizes (201 versus 200). A history of atopic skin disease was the only factor found to be associated with severe hand eczema (OR= 2.29) (Table 5).

When leaving out the 8 individuals with very severe hand eczema from the analysis there was still a significant association between atopic skin disease and increased severity of hand eczema (P=0.047). A significant association was also found between department and severity of hand eczema; those working in anaesthesiology reported significantly milder hand eczema than those working in the other departments with an OR of 0.36 compared to medical in-patient department with an OR of 1 (P=0.018).
4.1.8. Exposures associated with hand eczema

4.1.8.1. Exposures at work

Hand washing

Participants with hand eczema washed their hands significantly more often at work than those without hand eczema (Table 6). Hand washing more than ten times per day at work was reported by 52% of those with hand eczema and 43% of those without. Hand eczema was not associated with surgical hand washing.

Severity of hand eczema was not associated with hand washing.

Disinfectants

No association was found between use of disinfectants and hand eczema (table 6). Severity of hand eczema was not associated with use of disinfectants.

Protective gloves, wet work and other exposures

There was no association between the time spent on wearing protective gloves or the time spent on wet work and hand eczema (Table 7).

Regarding type of gloves used, synthetic gloves and cotton gloves were used significantly more by those with hand eczema compared to those without (synthetic gloves: 34% versus 27%, cotton gloves: 2% versus <1% respectively).

Healthcare workers with hand eczema reported increased use of protective gloves in the following situations compared to those without hand eczema: while handling medications, collecting blood and while in contact with detergents. Healthcare workers without hand eczema reported increased use of protective gloves while handling food articles (Table 8).

Hand eczema was not associated with daily time spent on patient care, handling of medications, blood collection and contact with laboratory agents, rubber and plastics, food articles, detergents or plaster (Table 9).
Moisturisers

An almost equal proportion of healthcare workers with hand eczema (39%) and without hand eczema (41%) reported daily use of moisturisers at work.

The frequency of moisturisers used differed significantly in the two groups. Use of moisturisers more than 2 times per day at work was reported by 14% of those without hand eczema and 8% of those with hand eczema.

In direct contrast, regular use of moisturisers outside of work was reported by significantly more healthcare workers with hand eczema (82%) than without (74%).

More severe hand eczema was significantly associated with more frequent use of moisturiser at work.

Working hours

In the multivariate logistic regression analysis, a reduced risk of hand eczema was found among those working 30-39 hours (OR=0.54) per week compared to those working 40-60 hours (OR=1) per week and may be explained by exposure time.

4.1.8.2. Domestic exposures

Hand washings

Those with hand eczema washed their hands significantly more often during leisure time than those without (P<0.001). Hand washings more than10 times per day outside of work was reported by 23% of those with hand eczema and 16% of those without. The highest frequency reported in either group was 6-10 times per day. No association was found between severity of hand eczema and frequency of handwashing outside of work.

Other domestic exposures

A significantly higher proportion of those with hand eczema (31%) reported having children younger than four years old in the household than those without hand eczema (23%) (P=0.002). Use of protective gloves while cooking, cleaning, dish
washing and washing clothes by hands was also reported significantly more often by those with hand eczema than those without. Of those with hand eczema, 11% reported use of protective gloves while preparing food and 30% while cleaning, dish washing and washing clothes by hands. Of those without hand eczema the numbers were 5% and 20% respectively. None of the other domestic activities registered (gardening, contact with soil and plants, renovation and redecoration, repairing motor vehicles or engines) were significantly related to hand eczema or severity of hand eczema.

Tobacco use was not associated with hand eczema (P=0.465). 20% of those without hand eczema and 18% of those with hand eczema reported smoking during the past year.

Level of physical activity during leisure time was not associated with hand eczema (P=0.23). The majority in both groups (67% and 65% respectively) reported spending at least four hours of light exercise (including bicycling or walking to work, gardening and walks) per week.

4.1.9. Sick leave due to hand eczema

Sick leave (ever) due to hand eczema was reported by 8% (33 of 397), and 2% (8 of 397) reported sick leave for 1-4 weeks within the past year. Sick leave was statistically significantly associated with profession and was reported by 15% (1 of 38) of the nursing assistants, 9% (22 of 233) of the nurses and 3% (1 of 38) of the biotechnicians. None of the physicians reported sick leave (P=0.013). Age, sex and severity were not associated with sick leave due to hand eczema.

Improvement in hand eczema during time off work at weekends was reported by 25% (101 of 397), during one week off work by 35% (137 of 397) and during longer periods off work by 27% (107 of 397). No association was found between improvement during time off work and severity.

4.1.10. Notification to the authorities

12% (46 of 397) of the healthcare workers with hand eczema were reported to the Danish National Board of Industrial Injuries Registry as occupational hand eczema.
Among the different professionals, the notification rates were: biotechnicians 16% (6 of 38), nurses 12% (27 of 230), the nursing assistants 12% (8 of 64) and physicians 9% (5 of 58). Sex, profession and atopic dermatitis were not significantly associated with notification. Severity of hand eczema was significantly associated with notification to the authorities (P<0.001).

Figure 1:
Distribution of total cohort, respondents and prevalence of self-reported hand eczema according to departments.
Table 4:
1-year prevalence of self-reported hand eczema among the respondents. Univariate analysis and multivariate logistic regression controlled for explanatory variables (sex, age, profession, department, skin complexion, atopy and working hours).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Respondents total</th>
<th>Self-reported Hand eczema Numbers (% of total)</th>
<th>p-value (Chi^2)</th>
<th>Odds ratio (95% confidence intervals)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1843</td>
<td>397 (21%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>242</td>
<td>76 (31%)</td>
<td>&lt;0.001</td>
<td>2.02 (1.02-4.01)</td>
<td>0.043</td>
</tr>
<tr>
<td>Females</td>
<td>1598</td>
<td>321 (20%)</td>
<td></td>
<td>1.8 (30-2.54)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29 years</td>
<td>102</td>
<td>29 (28%)</td>
<td>&lt;0.001</td>
<td>2.02 (1.02-4.01)</td>
<td>0.043</td>
</tr>
<tr>
<td>30-39 years</td>
<td>479</td>
<td>139 (29%)</td>
<td></td>
<td>2.44 (1.44-4.14)</td>
<td>0.001</td>
</tr>
<tr>
<td>40-49 years</td>
<td>515</td>
<td>110 (21%)</td>
<td></td>
<td>1.82 (1.07-3.10)</td>
<td>0.026</td>
</tr>
<tr>
<td>50-59 years</td>
<td>829</td>
<td>99 (12%)</td>
<td></td>
<td>1.48 (0.87-2.52)</td>
<td>0.147</td>
</tr>
<tr>
<td>60-65 years</td>
<td>187</td>
<td>20 (11%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>300</td>
<td>58 (19%)</td>
<td>0.227</td>
<td>0.97 (0.43-2.15)</td>
<td>0.948</td>
</tr>
<tr>
<td>Nurses</td>
<td>1009</td>
<td>232 (23%)</td>
<td></td>
<td>1.36 (0.63-2.91)</td>
<td>0.429</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>349</td>
<td>64 (18%)</td>
<td></td>
<td>1.13 (0.50-2.52)</td>
<td>0.760</td>
</tr>
<tr>
<td>Bio-technicians</td>
<td>169</td>
<td>38 (22%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Department</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthesiology</td>
<td>300</td>
<td>33 (11%)</td>
<td>0.194</td>
<td>0.68 (0.43-1.08)</td>
<td>0.105</td>
</tr>
<tr>
<td>Bio/physiol/pathol/radiol</td>
<td>220</td>
<td>49 (22%)</td>
<td></td>
<td>1.12 (0.57-2.21)</td>
<td>0.735</td>
</tr>
<tr>
<td>Surgical out –patient</td>
<td>135</td>
<td>35 (26%)</td>
<td></td>
<td>1.04 (0.65-1.68)</td>
<td>0.848</td>
</tr>
<tr>
<td>Surgical in-patient</td>
<td>457</td>
<td>89 (19%)</td>
<td></td>
<td>0.73 (0.53-1.00)</td>
<td>0.051</td>
</tr>
<tr>
<td>Medical out-patient</td>
<td>104</td>
<td>19 (18%)</td>
<td></td>
<td>0.62 (0.35-1.11)</td>
<td>0.112</td>
</tr>
<tr>
<td>Medical in-patient</td>
<td>729</td>
<td>172 (24%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skin complexion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Fitzpatrick 1+2</td>
<td>490</td>
<td>135 (28%)</td>
<td>&lt;0.001</td>
<td>2.20 (0.95-5.07)</td>
<td>0.063</td>
</tr>
<tr>
<td>2: Fitzpatrick 3+4</td>
<td>1271</td>
<td>252 (20%)</td>
<td></td>
<td>1.52 (0.67-3.45)</td>
<td>0.313</td>
</tr>
<tr>
<td>3: Fitzpatrick 5+6</td>
<td>60</td>
<td>7 (12%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atopy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>281</td>
<td>115 (41%)</td>
<td>&lt;0.001</td>
<td>2.66 (1.98-3.57)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>1562</td>
<td>282 (18%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shifts (predominantly)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day shift</td>
<td>1482</td>
<td>314 (21%)</td>
<td>0.908</td>
<td>1.14 (0.63-2.04)</td>
<td>0.659</td>
</tr>
<tr>
<td>Evening shift</td>
<td>179</td>
<td>40 (22%)</td>
<td></td>
<td>1.17 (0.60-2.26)</td>
<td>0.633</td>
</tr>
<tr>
<td>Night shift</td>
<td>94</td>
<td>19 (20%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly working hours</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>296</td>
<td>62 (21%)</td>
<td>0.300</td>
<td>0.65 (0.34-1.23)</td>
<td>0.187</td>
</tr>
<tr>
<td>30-39</td>
<td>1749</td>
<td>299 (17%)</td>
<td></td>
<td>0.54 (0.32-0.91)</td>
<td>0.021</td>
</tr>
<tr>
<td>40-60</td>
<td>209</td>
<td>36 (17%)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 5: Severity of hand eczema among the respondents. Multivariate logistic regression controlled for explanatory variables (sex, age, profession, department, skin complexion, atopy and working hours).

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Mild hand eczema (N=194)</th>
<th>Moderate, severe &amp; very severe hand eczema (N = 200)</th>
<th>Odds ratio (95 % c.i.)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>40</td>
<td>33</td>
<td>0.76 (0.43-1.35)</td>
<td>0.357</td>
</tr>
<tr>
<td>Females</td>
<td>154</td>
<td>167</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29 years</td>
<td>14</td>
<td>15</td>
<td>0.59 (0.17-2.09)</td>
<td>0.422</td>
</tr>
<tr>
<td>30-39 years</td>
<td>67</td>
<td>72</td>
<td>0.92 (0.33-2.51)</td>
<td>0.876</td>
</tr>
<tr>
<td>40-49 years</td>
<td>55</td>
<td>55</td>
<td>0.91 (0.32-2.56)</td>
<td>0.872</td>
</tr>
<tr>
<td>50-59 years</td>
<td>48</td>
<td>48</td>
<td>1.09 (0.38-3.10)</td>
<td>0.861</td>
</tr>
<tr>
<td>60-65 years</td>
<td>10</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Profession</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>28</td>
<td>29</td>
<td>0.51 (0.21-1.25)</td>
<td>0.143</td>
</tr>
<tr>
<td>Nurses</td>
<td>116</td>
<td>139</td>
<td>0.64 (0.23-1.80)</td>
<td>0.407</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>27</td>
<td>37</td>
<td>0.98 (0.21-4.61)</td>
<td>0.983</td>
</tr>
<tr>
<td>Biotechnicians</td>
<td>18</td>
<td>20</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Department</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthesiology</td>
<td>20</td>
<td>12</td>
<td>0.52 (0.21-1.24)</td>
<td>0.141</td>
</tr>
<tr>
<td>Bio/physiol/pathol/radiol</td>
<td>24</td>
<td>25</td>
<td>0.47 (0.12-1.73)</td>
<td>0.260</td>
</tr>
<tr>
<td>Surgical out -patient</td>
<td>17</td>
<td>18</td>
<td>1.15 (0.50-2.64)</td>
<td>0.738</td>
</tr>
<tr>
<td>Surgical in-patient</td>
<td>43</td>
<td>45</td>
<td>0.83 (0.47-1.48)</td>
<td>0.543</td>
</tr>
<tr>
<td>Medical out-patient</td>
<td>12</td>
<td>7</td>
<td>0.74 (0.25-2.17)</td>
<td>0.593</td>
</tr>
<tr>
<td>Medical in-patient</td>
<td>78</td>
<td>93</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Skin complexion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Fitzpatrick 1+2</td>
<td>63</td>
<td>71</td>
<td>2.10 (0.37-11.90)</td>
<td>0.399</td>
</tr>
<tr>
<td>2: Fitzpatrick 3+4</td>
<td>125</td>
<td>124</td>
<td>1.87 (0.33-10.38)</td>
<td>0.474</td>
</tr>
<tr>
<td>3: Fitzpatrick 5+6</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Atopy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>40</td>
<td>74</td>
<td>2.29 (1.40-3.73)</td>
<td>0.001</td>
</tr>
<tr>
<td>No</td>
<td>154</td>
<td>126</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Shifts</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day shift</td>
<td>148</td>
<td>36</td>
<td>1.77 (0.62-5.05)</td>
<td>0.286</td>
</tr>
<tr>
<td>Evening shift</td>
<td>23</td>
<td>16</td>
<td>0.92 (0.27-3.13)</td>
<td>0.906</td>
</tr>
<tr>
<td>Night shift</td>
<td>12</td>
<td>7</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Weekly working hours</td>
<td>&lt;30</td>
<td>33</td>
<td>0.98 (0.49-1.97)</td>
<td>0.966</td>
</tr>
<tr>
<td></td>
<td>30-39</td>
<td>31</td>
<td>0.32 (0.09-1.12)</td>
<td>0.075</td>
</tr>
<tr>
<td></td>
<td>40-60</td>
<td>27</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 6:
Daily number of hand washing/use of local disinfectants during a working day among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema</th>
<th>Never</th>
<th>1-5 times</th>
<th>6-10 times</th>
<th>11-15 times</th>
<th>16-20 times</th>
<th>&gt;20 times</th>
<th>( p )-value ( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Local disinfectants</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ hand eczema</td>
<td>9 (2%)</td>
<td>39 (10%)</td>
<td>36 (9%)</td>
<td>58 (15%)</td>
<td>66 (16%)</td>
<td>189 (48%)</td>
<td>100%</td>
<td>0.62</td>
</tr>
<tr>
<td>- hand eczema</td>
<td>42 (3%)</td>
<td>117 (8%)</td>
<td>165 (12%)</td>
<td>221 (15%)</td>
<td>236 (16%)</td>
<td>658 (46%)</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td><strong>Hand washing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ hand eczema</td>
<td>6 (2%)</td>
<td>77 (19%)</td>
<td>105 (27%)</td>
<td>80 (20%)</td>
<td>51 (13%)</td>
<td>77 (19%)</td>
<td>100%</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>- hand eczema</td>
<td>10 (1%)</td>
<td>369 (26%)</td>
<td>446 (31%)</td>
<td>256 (18%)</td>
<td>181 (13%)</td>
<td>174 (12%)</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

Table 7:
Self-reported daily exposure to water and protective gloves during a working day among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema</th>
<th>&lt; ½ hour</th>
<th>½-2 hours</th>
<th>2-3 hours</th>
<th>3-5 hours</th>
<th>&gt; 5 hours</th>
<th>( p )-value ( \chi^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ hand eczema</td>
<td>180 (46%)</td>
<td>32 (8%)</td>
<td>20 (5%)</td>
<td>24 (6%)</td>
<td>9 (2%)</td>
<td>100%</td>
<td>0.13</td>
</tr>
<tr>
<td>- hand eczema</td>
<td>625 (44%)</td>
<td>119 (8%)</td>
<td>70 (5%)</td>
<td>59 (4%)</td>
<td>72 (5%)</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td><strong>Protective gloves</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ hand eczema</td>
<td>63 (18%)</td>
<td>184 (53%)</td>
<td>61 (18%)</td>
<td>29 (8)</td>
<td>11 (3%)</td>
<td>100%</td>
<td>0.69</td>
</tr>
<tr>
<td>- hand eczema</td>
<td>257 (21%)</td>
<td>592 (49%)</td>
<td>219 (18%)</td>
<td>101 (8%)</td>
<td>35 (4%)</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Table 8:
Use of protective gloves among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema while exposed to patient care, medications, blood collection, laboratory agents, rubber and plastics, food articles, detergents and plaster (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema &lt; 12 months</th>
<th>No use of protective gloves</th>
<th>Use of protective gloves</th>
<th>Not regular use of protective gloves</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient care</strong></td>
<td>-hand eczema +hand eczema</td>
<td>118 (10%)</td>
<td>698 (61%)</td>
<td>326 (29%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>33 (10%)</td>
<td>203 (64%)</td>
<td>83 (26%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Handling of medications</strong></td>
<td>-hand eczema +hand eczema</td>
<td>484 (47%)</td>
<td>188 (18%)</td>
<td>359 (35%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>114 (39%)</td>
<td>73 (25%)</td>
<td>107 (36%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Blood collection</strong></td>
<td>-hand eczema +hand eczema</td>
<td>378 (47%)</td>
<td>289 (36%)</td>
<td>140 (17%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>87 (37%)</td>
<td>100 (42%)</td>
<td>51 (21%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Laboratory agents</strong></td>
<td>-hand eczema +hand eczema</td>
<td>371 (53%)</td>
<td>239 (34%)</td>
<td>92 (13%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>94 (49%)</td>
<td>71 (37%)</td>
<td>29 (15%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Rubber and plastics</strong></td>
<td>-hand eczema +hand eczema</td>
<td>208 (18%)</td>
<td>700 (62%)</td>
<td>226 (20%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>60 (19%)</td>
<td>203 (64%)</td>
<td>52 (17%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Handling of food articles</strong></td>
<td>-hand eczema +hand eczema</td>
<td>728 (82%)</td>
<td>78 (9%)</td>
<td>86 (10%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>198 (77%)</td>
<td>16 (6%)</td>
<td>43 (17%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Detergents</strong></td>
<td>-hand eczema +hand eczema</td>
<td>381 (43%)</td>
<td>335 (38%)</td>
<td>164 (19%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>82 (34%)</td>
<td>109 (45%)</td>
<td>49 (20%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Plaster</strong></td>
<td>-hand eczema +hand eczema</td>
<td>449 (77%)</td>
<td>109 (19%)</td>
<td>28 (5%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>108 (72%)</td>
<td>32 (21%)</td>
<td>11 (7%)</td>
<td>(100%)</td>
</tr>
</tbody>
</table>
Table 9:

Daily time spent on patient care, handling of medications, blood collection and contact with laboratory agents, rubber and plastics, food articles, detergents and plaster among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th>Time spent on (daily)</th>
<th>Hand eczema &lt; 12 months</th>
<th>0 hours</th>
<th>&lt;½ hours</th>
<th>½-3 hours</th>
<th>3-5 hours</th>
<th>&gt;5 hours</th>
<th>p-value Chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient care</td>
<td>-hand eczema</td>
<td>339 (24%)</td>
<td>315 (22%)</td>
<td>563 (40%)</td>
<td>143 (10%)</td>
<td>58 (4%)</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>82 (21%)</td>
<td>86 (22%)</td>
<td>167 (43%)</td>
<td>38 (10%)</td>
<td>16 (4%)</td>
<td></td>
</tr>
<tr>
<td>Handling of medications</td>
<td>-hand eczema</td>
<td>502 (36%)</td>
<td>488 (35%)</td>
<td>369 (27%)</td>
<td>16 (1%)</td>
<td>8 (1%)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>124 (32%)</td>
<td>125 (33%)</td>
<td>131 (34%)</td>
<td>3 (1%)</td>
<td>2 (1%)</td>
<td></td>
</tr>
<tr>
<td>Blood collection</td>
<td>-hand eczema</td>
<td>880 (64%)</td>
<td>362 (26%)</td>
<td>94 (7%)</td>
<td>20 (2%)</td>
<td>16 (1%)</td>
<td>0.08</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>221 (57%)</td>
<td>118 (31%)</td>
<td>33 (9%)</td>
<td>6 (2%)</td>
<td>9 (2%)</td>
<td></td>
</tr>
<tr>
<td>Laboratory agents</td>
<td>-hand eczema</td>
<td>1025 (75%)</td>
<td>256 (19%)</td>
<td>71 (5%)</td>
<td>12 (1%)</td>
<td>5 (0.4%)</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>281 (73%)</td>
<td>71 (19%)</td>
<td>21 (6%)</td>
<td>9 (2%)</td>
<td>2 (0.5%)</td>
<td></td>
</tr>
<tr>
<td>Rubber and plastics</td>
<td>-hand eczema</td>
<td>347 (25%)</td>
<td>607 (44%)</td>
<td>391 (28%)</td>
<td>41 (3%)</td>
<td>10 (0.7%)</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>84 (22%)</td>
<td>179 (46%)</td>
<td>110 (28%)</td>
<td>12 (3%)</td>
<td>4 (1%)</td>
<td></td>
</tr>
<tr>
<td>Handling of food articles</td>
<td>-hand eczema</td>
<td>718 (52%)</td>
<td>485 (35%)</td>
<td>172 (13%)</td>
<td>4 (0.3%)</td>
<td>1 (0.1%)</td>
<td>0.80</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>189 (49%)</td>
<td>147 (38%)</td>
<td>50 (13%)</td>
<td>1 (0.3%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Detergents</td>
<td>-hand eczema</td>
<td>735 (53%)</td>
<td>523 (38%)</td>
<td>117 (9%)</td>
<td>2 (0.1%)</td>
<td>2 (0.1%)</td>
<td>0.19</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>200 (52%)</td>
<td>161 (42%)</td>
<td>23 (6%)</td>
<td>2 (0.5%)</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Plaster</td>
<td>-hand eczema</td>
<td>1235 (90%)</td>
<td>83 (6%)</td>
<td>52 (4%)</td>
<td>0</td>
<td>0</td>
<td>0.78</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>338 (88%)</td>
<td>26 (7%)</td>
<td>19 (5%)</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>
4.2. PART 2: A randomised clinical trial of skin care education and individual counselling versus treatment as usual in healthcare workers with hand eczema

4.2.1. The trial population

A total of 397 healthcare workers reported having had hand eczema during the past year and they were all invited to participate in the trial. The participation rate was 64% (255 of 397). Of the 255 participants, 123 were randomised to the intervention group and 132 were randomised to the control group. 236 of the participants were women and 19 were men. The population consisted of 25 physicians, 155 nurses, 46 nursing assistants and 28 biotechnicians. The participants were randomised according to hospital, profession and clinical scoring of hand eczema.

The baseline characteristics of the participants in the two groups are shown in Table 10.

4.2.2. Non-participants

The 142 non-participants were contacted to obtain information about reasons for not participating in the trial and information was obtained in 102 of the participants. No wish to participate was reported by 65%, pregnancy by 15%, change of job or having moved by 13%, lack of time by 4%, immunosuppressive drugs 3%, one was on long term sick leave, and one had died.

4.2.3. Discontinuation

Of the 123 participants in the intervention group, follow-up data were available in 119 of the participants (97%). One was lost just after enrolment, two were excluded due to pregnancy and one did not attend at follow up.

Of the 132 participants in the control group, follow-up data were available in 128 of the participants (97%). One was excluded due to systemic use of corticosteroids and three participants did not show up at follow-up.
4.2.4. Primary outcome: HECSI score

At entry to the trial, the mean HECSI score was 8.94 in the intervention group and 9.40 in the control group. In the intervention group there was a significant decrease of 2.98 points in the mean HECSI score from entry to follow-up whereas a slight increase of 0.19 points was found in the control group. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

4.2.5. Secondary outcomes:

4.2.5.1. DLQI score

At entry to the trial, the mean DLQI score was 2.87 in the intervention group and 2.81 in the control group. In the intervention group there was a significant decrease (improvement) of 0.81 points in the mean DLQI score from entry to follow-up, whereas a slight increase of 0.02 points was found in the control group. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

4.2.5.2. Self-evaluated disease severity

In the intervention group, there was a significant decrease in the mean self-evaluated severity score from entry to follow-up, whereas a slight increase was found in the control group. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

4.2.5.3. Skin protective behaviour

In the intervention group, there was a significant increase in the mean use of disinfectants from entry to follow-up, whereas an insignificant increase was found in the control group. Comparing the difference in means from the two groups by the independent group T-test, no significant difference in means was found between the two groups (Table 11).

In the intervention group, there was a significant decrease in the mean number of daily hand washings at work from entry to follow-up, whereas a slight increase was found in the control group. Comparing the difference in means from the two groups by the independent
group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

In both groups, there was a significant increase in the mean *use of moisturisers at work* from entry to follow-up. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group. This was also the case for *use of moisturisers at home*, however no significant change was found in the control group from onset to follow-up (Table 11).

In both groups there were no significant changes in the mean *daily use of protective gloves* while at work from onset to follow-up. However, there was a significant increase in the *use of protective gloves during wet work* in the intervention group from onset to follow-up, and when the difference in means from the two groups were compared by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

In both groups there was a significant increase in the mean *use of protective gloves during cleaning* from entry to follow-up. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 8). In the intervention group, there was a significant increase in the mean *use of protective gloves during cooking* from entry to follow-up, whereas the control group was almost unchanged. Comparing the difference in means from the two groups by the independent group T-test, a significantly higher difference in means was found in the intervention group compared with the control group (Table 11).

In the control group there was a significant decrease in the mean *knowledge of hand eczema* from entry to follow-up, whereas no significant change was found in the intervention group. When comparing the difference in means from the two groups by the independent group T-test, no significant difference was found (Table 11).
Table 10:
Characteristics of the participants in the intervention group (I) and in the control group (C) at enrolment.

<table>
<thead>
<tr>
<th>Score definitions</th>
<th>I: Intervention group</th>
<th>C: Control group</th>
<th>Mean score</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HECSI score</td>
<td>I: n=123</td>
<td>C: n= 132</td>
<td>8.94</td>
<td>8.51</td>
</tr>
<tr>
<td>DLQI score</td>
<td>I: n=123</td>
<td>C: n=132</td>
<td>2.87</td>
<td>3.13</td>
</tr>
<tr>
<td>Self -evaluated disease severity</td>
<td>I: n=123</td>
<td>C: n=132</td>
<td>1.69</td>
<td>0.84</td>
</tr>
<tr>
<td>Hand disinfections at work</td>
<td>I: n=123</td>
<td>C: n=132</td>
<td>4.80</td>
<td>1.41</td>
</tr>
<tr>
<td>Hand washings at work</td>
<td>I: n=122</td>
<td>C: n=132</td>
<td>4.0</td>
<td>1.39</td>
</tr>
<tr>
<td>Moisturisers at work</td>
<td>I: n=122</td>
<td>C: n=132</td>
<td>2.13</td>
<td>0.91</td>
</tr>
<tr>
<td>Protective gloves at work</td>
<td>I: n=110</td>
<td>C: n=113</td>
<td>2.16</td>
<td>0.88</td>
</tr>
<tr>
<td>Protective gloves while wet work</td>
<td>I: n=123</td>
<td>C: n=132</td>
<td>2.38</td>
<td>0.75</td>
</tr>
<tr>
<td>Protective gloves while cooking</td>
<td>I: n=112</td>
<td>C: n=129</td>
<td>1.13</td>
<td>0.41</td>
</tr>
<tr>
<td>Protective gloves while Cleaning</td>
<td>I: n=113</td>
<td>C: n=128</td>
<td>1.40</td>
<td>0.69</td>
</tr>
<tr>
<td>Hand washings at home</td>
<td>I: n=122</td>
<td>C: n=132</td>
<td>2.03</td>
<td>0.86</td>
</tr>
<tr>
<td>Moisturisers at home</td>
<td>I: n=122</td>
<td>C: n=132</td>
<td>1.86</td>
<td>0.35</td>
</tr>
<tr>
<td>Knowledge of hand eczema and skin protection</td>
<td>I: n=123</td>
<td>C: n=132</td>
<td>9.41</td>
<td>1.22</td>
</tr>
</tbody>
</table>
Table 11: Outcomes in relation to the intervention group (I) and the control group (C). Paired samples test of means comparing data at t=0 and t= 5 months within each group, and independent samples t-test for equality of means between the intervention group and the control group.

<table>
<thead>
<tr>
<th>Score definitions</th>
<th>I: Intervention group</th>
<th>C: Control group</th>
<th>Mean scores at follow-up (t= 5 months)</th>
<th>Mean score diff. (paired)</th>
<th>Confidence intervals 95%</th>
<th>P-value, Paired samples test</th>
<th>P-value, T-test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td>HECSI score</td>
<td>I: n=119</td>
<td>C: n=128</td>
<td>6.10</td>
<td>2.98</td>
<td>1.587 to 4.363</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>DLQI score</td>
<td>I: n=119</td>
<td>C: n=128</td>
<td>2.03</td>
<td>0.81</td>
<td>0.301 to 1.313</td>
<td>&lt;0.01</td>
<td>0.92</td>
</tr>
<tr>
<td>Self - evaluated disease severity</td>
<td>I: n=118</td>
<td>C: n=128</td>
<td>1.42</td>
<td>0.28</td>
<td>0.147 to 0.412</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Hand disinfections at work</td>
<td>I: n=117</td>
<td>C: n=127</td>
<td>5.22</td>
<td>-0.40</td>
<td>-0.672 to -0.132</td>
<td>&lt;0.01</td>
<td>0.19</td>
</tr>
<tr>
<td>Hand washings at work</td>
<td>I: n=116</td>
<td>C: n=127</td>
<td>3.34</td>
<td>0.66</td>
<td>0.418 to 0.910</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Moisturisers at work</td>
<td>I: n=106</td>
<td>C: n=120</td>
<td>3.19</td>
<td>-1.09</td>
<td>-1.296 to -0.874</td>
<td>&lt;0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Protective gloves at work</td>
<td>I: n=99</td>
<td>C: n=107</td>
<td>2.20</td>
<td>-0.08</td>
<td>-0.275 to 0.114</td>
<td>0.41</td>
<td>0.92</td>
</tr>
<tr>
<td>Protective gloves while wet work</td>
<td>I: n=119</td>
<td>C: n=126</td>
<td>2.53</td>
<td>-0.17</td>
<td>-0.298 to -0.038</td>
<td>0.01</td>
<td>0.02</td>
</tr>
<tr>
<td>Protective gloves while cooking</td>
<td>I: n=102</td>
<td>C: n=117</td>
<td>1.36</td>
<td>-0.23</td>
<td>-0.346 to -0.105</td>
<td>&lt;0.01</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Hand washings at home</td>
<td>I: n=118</td>
<td>C: n=126</td>
<td>1.99</td>
<td>0.05</td>
<td>-0.126 to 0.227</td>
<td>0.56</td>
<td>0.93</td>
</tr>
<tr>
<td>Moisturisers at home</td>
<td>I: n=118</td>
<td>C: n=126</td>
<td>1.98</td>
<td>-1.10</td>
<td>-0.177 to -0.044</td>
<td>&lt;0.01</td>
<td>0.03</td>
</tr>
<tr>
<td>Knowledge of hand eczema and skin protection</td>
<td>I: n=119</td>
<td>C: n=128</td>
<td>9.50</td>
<td>-0.11</td>
<td>-0.343 to 0.124</td>
<td>0.36</td>
<td>0.25</td>
</tr>
</tbody>
</table>
5. DISCUSSION

5.1. Part 1

In the present study we found a 1-year prevalence of hand eczema of 21% in healthcare workers which confirms that hand eczema is almost twice as common in healthcare workers as in the background population [1]. Hand eczema was positively correlated to younger age, male sex, working hours and atopic dermatitis. Severe hand eczema was also correlated to atopic dermatitis. 12% of the cases were registered in the Danish National Board of Industrial Injuries Registry as occupational hand eczema and sick leave in the past year was reported by 8%.

The prevalence of hand eczema was almost the same in physicians, nurses, nursing aids and biotechnicians, although the frequency of exposure at work differed significantly between the professions. This may indicate that the regularity of exposure and the length of the intervening restitution period may be more important than the average frequency and severity of exposures at work.

Generally we found that healthcare workers with hand eczema were younger with a mean difference of 3.75 years. This correlates to findings from other population studies [93;94]. It is speculated that this may be due to increased exposure at home due to children in the household or that older healthcare workers with hand eczema leave the job due to skin problems (healthy worker effect). Differences in predispositions to hand eczema may naturally also play a role.

Male sex was significantly associated with hand eczema in our study. This is in contrast with previous population studies finding female gender being predominant [7;95;96]. The response rate among the surveyed healthcare workers was 11% higher for the males than for the females, and this could partly explain the higher prevalence in males. The males with hand eczema were predominantly physicians, and the surgeons were more frequently affected than the other specialists. However, these associations were based on rather low numbers, since only 14% (N=325) of the respondents were males. The response rates differed significantly among the health professionals with significantly fewer respondents among the physicians. Physicians of both genders reported significantly less sick leave compared to the other health professionals, and significantly fewer of the physicians with
hand eczema considered job change (3%) compared to the other health professionals (11-19%). These findings may indicate a decreased attention to self-related work environmental problems among physicians, who also had the lowest relative frequency of notified cases of hand eczema and no sick leave.

A significant association between fair skin (Fitzpatrick skin type 1+2) and presence of hand eczema was found in a univariate analysis. This association was, however, not found in a multivariate logistic regression analysis with hand eczema as fixed variable and sex, age, profession, department, skin type, atopy and working time as independent variables (p-value= 0.07). To reduce the risk of falsely reported fair skin type due to scaling in atopic skin, atopy was excluded from the multivariate analysis, and this led to statistical significance again. The association between fair skin and hand eczema has, to our knowledge, not been described before in the literature and it supports the assumption of an association between skin colour and skin susceptibility. There are, however, diverging opinions on the association between skin colour and susceptibility [97-101].

The association between hand eczema and atopic dermatitis has been known for decades, and atopic hand eczema is associated with a poor prognosis [102;103]. Despite this knowledge, our results imply that the current preventive strategies for atopics are not adequate at least in the healthcare sector, and future focused preventive programmes in atopics on prevention of hand eczema are needed.

A reduced risk of hand eczema was found among those working 30-39 hours (OR 0.54) per week compared to those working 40-60 hours (OR 1) per week and may be explained by exposure time.

Frequent hand washing at work and at home was found to be the most important behavioural risk factor for hand eczema in our study. Hand washing has been reported as a risk factor in previous studies [33;104-106] and reduced skin irritation from disinfectants compared to detergents has been documented [107]. In recent years, disinfection of the hands instead of washing has therefore been recommended to healthcare workers, whenever the hands are not visibly dirty. In spite of these recommendations, hand washing at work is still a major risk factor for development of hand eczema in the healthcare sector in Denmark. Reasons for not complying with the advice about replacement of hand washing with use of disinfectants may comprise the perception that it is more damaging than hand washing [108], or that the hands will not become as clean when disinfected compared to hand washing and these uncertainties should be addressed in future
campaigns. Some patients with hand eczema may also find the use of disinfectants unpleasant due to fissures and abrasions in the eczematous skin, thereby inadvertently perpetuating a more damaging hygienic procedure, i.e. handwashing. However, this does not explain the increased number of hand washing instances in participants with hand eczema in the present study, since the use of disinfectants was similar among those with and without hand eczema. An increased number of hand washing instances during leisure time also appeared related to hand eczema. Apparently some people habitually wash their hands more often, and a change of this habit could prevent hand eczema. Habitual behaviour may be associated with personality structure.

The use of moisturisers constitutes a mainstay in the treatment of hand eczema. Interestingly, those without hand eczema used moisturisers more frequently at work than those with hand eczema suggesting a preventive effect of use of moisturisers in healthcare workers during working hours. This has yet to be proved in field intervention studies in healthcare workers, but data indicates that immediate access to moisturisers provides a potent preventive intervention. In contrast, our study found that frequent use of moisturisers outside of work was reported by significantly more of those with hand eczema and was positively correlated to severity degree of hand eczema, and this observation is most likely explained as treatment of the eczema during leisure time.

It is a general assumption that occupational skin disease is under-reported, and that the notification rate is low. In this study we had the opportunity to test this hypothesis. The notification rate of 12% is remarkably low in professions with clearly documented work related irritant exposures to the skin, and with an expected high information level regarding disease. The low notification rate may indicate that hand eczema is not considered important by the affected, or that healthcare workers are not aware of the notification procedures. Notification to the authorities is important for the individual, but is also an important corner stone in disease surveying and the planning of necessary preventive regulations in society.

### 5.2. Part 2

To the best of the Author’s knowledge this is the first single-blinded randomised controlled trial of a cognitive intervention as secondary prophylaxis in hand eczema

The trial conducted in healthcare workers with hand eczema showed that a simple intervention of skin care education and individual counselling with respect to exposures at
work and at home and contact allergies, had a statistically significantly positive effect on the primary as well as several secondary outcome measures after 5 months follow-up.

The participants in the intervention group improved significantly in HECSI-score (33% improvement), DLQI-score (30% improvement), and self-evaluated severity score (17% improvement) whereas the participants in the control group did not change significantly. However, the clinical significance of the changes in HECSI-score and DLQI-score can be discussed. Unfortunately no previous studies have measured the clinical significance in relation to changes in HECSI-score, and the DLQI-score may not cover all relevant aspect of life quality in hand eczema patients. The mean HECSI score of the trial participants was 9.17 (at entry) indicating rather mild disease. A mean reduction of 2.98 points in HECSI at follow-up in the intervention group may not seem high, but the fact that all outcome parameters (objective, subjective and behavioural) improved significantly strengthens the results even further. In the intervention group, the skin protective behaviour at work improved significantly reflected by decreasing instances of hand washing (17% improvement) and increasing use of disinfectants (8% improvement) and moisturisers (51% improvement). At home, they improved significantly in wearing of protective gloves while cooking (20% improvement) and cleaning (30% improvement), as well as in increasing their use of moisturisers (6% improvement). Cotton gloves worn underneath protective gloves were used significantly more often in the participants in the intervention group than in the control group at follow-up. The participants’ knowledge of hand eczema did not change significantly. However, the questions asked may have been too simple.

Since hand eczema is a common occupational disease in healthcare workers, these findings are of utmost importance and provide us with a step towards a solution of how to handle and prevent hand eczema in healthcare workers. Our trial is the first to provide high level evidence, confirming that secondary prevention is effective in healthcare workers with mild to moderate hand eczema. This is an important finding since we know that early intervention prevents chronicity and improves the prognosis [22;23]. We also know that many healthcare workers are affected, and the consequences of hand eczema constitute a major impact in life [42;59;102;109;110]. The long-term effect of the intervention is not known due to the limited follow-up time. However, our data, together with data from previous observational studies, strongly suggest the efficacy of preventive programmes in healthcare workers.
Implementation of a preventive programme as used in the present trial in the healthcare sector is considered to be cost effective, but this has not been a topic of this trial or shown in previous intervention studies [62]. Effectiveness in terms of fewer sick leaves, less need of rehabilitation and fewer awarded disability pensions was not investigated in the present trial, where data is based on a short term follow-up. Future studies with focus on these outcomes are needed to evaluate the cost-effectiveness of preventive programmes.
The main conclusions drawn from the thesis are:

6.1. **Part I (Manuscript II + III):**

- The 1-year prevalence of self-reported hand eczema in healthcare workers was: Physicians 19%, nurses 23%, nursing assistants 18%, biotechnicians 22%, with no significant differences between the professions.
- Hand eczema was significantly associated with younger age, male gender, working hours and atopic dermatitis.
- Hand eczema was significantly associated with increased frequency of hand washings at work and at home, less use of moisturisers at work and increased use of moisturisers at home.
- Severity of hand eczema was positively associated with atopic dermatitis.
- Notification to the authorities was reported by 12% and significantly associated with increased severity.
- Physicians differed significantly from the other professions by a lower response rate, less sick leave and a lower notification rate.

6.2. **Part II (Manuscript IV):**

The intervention trial proved to have a statistically significant improving effect on the following outcomes:

- HECSI-score (30% improvement)
- DLQI-score (30% improvement)
- Self-evaluated severity (17% improvement)
- Instances of hand washings (17% improvement)
- Use of disinfectants (8% improvement)
- Use of moisturisers (51% improvement)
- Use of protective gloves while cooking (20% improvement)
- Use of protective gloves while cleaning (30% improvement)
- Use of cotton gloves underneath protective gloves (improvement)

7. STRENGTHS AND LIMITS

7.1. Part I

Strengths:
Questionnaires allow for a large amount of data. The strengths of the present study include a high response rate and the inclusion of different medical professions.

Limits:
Questionnaires are less reliable than observational studies. Self-evaluated duration of exposure may lead to over- or underestimation [105;111;112]. It is however suggested that the comparison between cases and controls from the same population used in this study compensates for the possible inaccuracies and supports the validity of the relative differences identified.

7.2. Part II

Strengths:
This is the first randomised trial which finds that skin care education and individual counselling regarding hand eczema improves the symptoms significantly in healthcare workers with hand eczema within the past year. The strengths of the trial include the centrally and individually performed randomisation, the observer-blinded assessment of the primary outcome and the very high completion (97%) with only few participants lost to follow-up.

The randomisation was stratified according to profession, hospital and HECSI-score at entry which ensured balance between the intervention group and the control group according to these factors. The intervention was simple in design and included patch and prick testing. Counselling was performed individually and was not only restricted to exposures at work but also domestically.
**Limits:**
Our sample size calculation estimated inclusion of 262 participants, but we only succeeded in including 255 participants. However, considering the highly significant differences found and the very low drop-out rate, the lack in sample size was not considered to be of significant influence.

A risk of information bias between participants in the intervention group and the control group was present. To prevent this, the participants in the intervention group were individually requested not to share information with others.

The long-term effect of the intervention is not known due to the limited follow-up time of five months.

The trial was not monitored by an external authority. However, double data entry was performed by the observer-blinded investigator, and 50% of the data was monitored and checked for errors by an unblinded coinvestigator. The statistical analyses were performed unblinded for treatment allocation.

8. **PERSPECTIVES AND FUTURE STUDIES**

**Perspectives:**

- The study confirms the effectiveness of a secondary prevention programme – this should be implemented in the future

- The thesis confirms that atopic skin disease constitutes a major risk for development of hand eczema. 1/3 of healthcare workers with hand eczema had a history of atopic dermatitis, and among all respondents with a history of atopic dermatitis, 41% had hand eczema in the past year. These high numbers underline the need of preventive measures focused on patients with atopic skin disease

- Despite increased use of disinfectants in the healthcare sector, hand washing is still the most significant exposure associated with hand eczema. Frequent hand washing may be a question of behavioural habits, and focus for future guidance should be on change of hand washing habits
Future studies:

- The more general usefulness of the programme should be investigated in other kind of high-risk occupations with more severe hand eczema being predominant (i.e., among hairdressers, cleaners and kitchen assistants) and in patients with just notified hand eczema

- The use of moisturisers at work seems to have a protective effect in the development of hand eczema. Future follow-up studies are needed to investigate the preventive effect of moisturisers used at work

- Future studies evaluating the clinical significance in relation to change in HECSI score would be helpful and ease the interpretation of the HECSI-score from a clinical perspective

- Studies focussing on the cost effectiveness of intervention programmes in hand eczema patients are also needed
9. SUMMARY

9.1. Summary in English

Hand eczema is a common disease in healthcare workers due to extensive exposure to skin irritants as wet work, use of protective gloves and disinfectants. It often has a chronic course and the individual as well as societal costs related to the disease are high. In 2009, hand eczema accounted for almost one third of the recognized occupational diseases in Denmark. Preventive programmes are known to be effective as primary prevention for wet work occupations, but the evidence for secondary prevention programmes is limited.

The aims of the thesis were:

1) To investigate the prevalence of hand eczema and factors related to development of hand eczema in healthcare workers in three Danish Hospitals

2) To evaluate the effect of a simple secondary prevention programme in healthcare workers with hand eczema.

Method:

The prevalence of hand eczema and factors related to development of hand eczema were investigated by a questionnaire distributed to 3181 healthcare workers. The questionnaire contained 56 items regarding hand eczema, relevant exposures and data on the exact workplace, duty hours and profession. Measures on self-evaluated disease severity were obtained using a validated photographic guide and knowledge of skin protection was assessed with a multiple choice test. Domestic exposures and allergic and atopic dispositions were also explored. Those who reported hand eczema during the past year in the survey were invited to participate in an individually randomised and observer-blinded trial on secondary prevention consisting of skin care education and individual counselling regarding work related, domestic exposures and contact allergies.

Results:

A total of 2274 of 3181 healthcare workers (71%) responded to the questionnaire. The one-year prevalence of hand eczema among the respondents was 21% and positively associated with atopic dermatitis, younger age, male gender (male physicians), and working hours. The most important exposure found to be related with hand eczema was frequent hand washing.
Subsequently, 255 of 397 invited healthcare workers participated in the clinical trial, with 123 participants randomised to the intervention group and 132 to the control group. Follow-up data (5 months) were available for 247 of 255 participants (97%). The intervention was associated with a significant improvement of the primary outcome (difference in Hand Eczema Severity Index from entry to follow-up) as well as in the secondary outcomes (differences in Dermatology Life Quality Index, self-evaluated disease severity and skin protective behaviour).

**Conclusion:**

The prevalence of hand eczema is twice as high in healthcare workers compared to the background population. The need for preventive programmes is evident and attention should especially be given to atopics who were overrepresented in the group of healthcare workers with hand eczema in this study, as well as in previous studies of hand eczema.

The intervention study provides a significantly improved level of evidence indicating that a secondary preventive programme of skin care education and individual counselling, including allergy testing is effective, and it is suggested that such programmes should be implemented in the health-care sector in the future. Hopefully this would improve not just the severity of hand eczema and quality of life of the affected individuals, but also socio-economic relations in terms of less sick leave and rehabilitation in the health-care sector.
9.2. Summary in Danish

Håndeksem er en almindeligt forekommende sygdom blandt sundhedspersonale p.g.a. hyppig udsættelse for hudirriterende påvirkninger som f.eks. vådt arbejde, brug af beskyttelseshandsker samt desinfektionsmidler. Sygdommen har ofte et kronisk forløb, og de samfundsøkonomiske udgifter relateret til sygdommen er betydelige. I 2009 udgjorde håndeksem ca. 1/3 af de anerkendte arbejdsskader i Danmark. Primære forebyggelsesprogrammer vides at have en effekt på arbejdspladser med vådt arbejde, men der er kun begrænset viden om effekten af sekundære forebyggelsesprogrammer.

Formålet med aktuelle Ph.D.:

1) At undersøge et års prævalensen af håndeksem samt faktorer af betydning for udvikling af håndeksem blandt sundhedspersonaler på tre danske sygehuse.

2) At evaluere effekten af et sekundært præventionsprogram udført på sundhedspersonaler med håndeksem.

Metode:

Prævalensen af håndeksem samt faktorer af betydning for udvikling af håndeksem blev undersøgt ved hjælp af et spørgeskema uddelt til 3181 sundhedspersonaler. Spørgeskemaet indeholdt 56 spørgsmål omfattende håndeksem, udsættelser på arbejdet samt arbejdsmæssige oplysninger om profession, hospitalsafdeling og arbejdstid.

Sværhedsgraden af håndeksem blev vurderet ved brug af en valideret fotografisk guide, og viden om håndeksem blev belyst ved en multiple choice test. Udsættelser i hjemmet samt allergisk og atopisk disposition blev også belyst.

De sundhedspersonaler, som i spørgeskemaet bekræftede at have haft håndeksem inden for det seneste år, blev inviteret til at deltage i et individuelt randomiseret og observatør-blindet interventionsstudie. Interventionen bestod af oplæring i et hudplejeprogram samt individuel rådgivning vedrørende kontaktallergi samt arbejdsrelaterede og hjemlige udsættelser af betydning for udvikling af håndeksem.

Resultater:

Spørgeskemaet blev besvaret af 2274 af 3181 sundhedspersonaler (71%). Et års prævalensen af håndeksem blandt respondenterne var 21%, og sygdommen var assciereret til atopisk eksem, yngre aldersgrupper, mandligt køn (særligt mandlige læger).
samt arbejdstid. Hyppig håndvask var den mest betydende udsættelse relateret til håndeksem.

Ialt 255 of 397 inviterede sundhedspersonaler deltog i interventionsstudiet, hvor 123 deltagere blev randomiseret til interventionsgruppe og 132 til kontrolgruppe. Ved opfølgningstidens udløb (5 måneder) var data tilgængelige for 247 af 255 deltagere (97%). Interventionen viste sig at have signifikant effekt på det primære effektmål (ændring i Hand Eczema Severity Index fra begyndelsen af studiet til opfølgningstidens udløb) samt de sekundære effektmål (ændring i livskvalitet, selvvurderet sværhedsgrad samt hudbeskyttende adfærd fra begyndelsen af studiet til opfølgningstidens udløb).

**Konklusion:**

1-års prævalensen af håndeksem er ca. dobbelt så høj blandt sundhedspersonale sammenlignet med baggrundsbefolkningen. Atopisk eksem er stærkt associeret til udvikling af håndeksem, og grundig vejledning vedrørende hudbeskyttelse er vigtig for atopikere.

Interventionsstudiet giver en signifikant bedre evidens for at konkludere, at et sekundært forebyggelsesprogram bestående af oplæring i hudpleje samt individuel rådgivning og allergitest er effektivt, og vi foreslår at sådanne programmer implementeres i sundhedssektoren i fremtiden. Ud over en forbedring af håndeksem, livskvalitet og hudbeskyttende adfærd hos de ramte, vil der formentlig også være en samfundsmæssig økonomisk gevinst målt på færre sygedage og mindre behov for rehabilitering i sundhedssektoren.


49. 2011. The National Board of Industrial Injuries in Denmark, The National Board of Industrial Injuries in Denmark. 18-6-2010.


100. Modjtahedi SP, Maibach HI. Ethnicity as a possible endogenous factor in irritant contact dermatitis: comparing the irritant response among Caucasians, blacks, and Asians. Contact Dermatitis 2002; 47(5):272-278.


Manuscript I:


Authors:  Ibler KS*, Jemec GBE*, Flyvholm M-A***, Diepgen TL****, Jensen A*****,
Agner T**

* Dept. of Dermatology, Roskilde Hospital, University of Copenhagen, Denmark

**Dept. of Dermatology, Bispebjerg Hospital, University of Copenhagen, Denmark

***National Research Centre for the Working Environment, Copenhagen, Denmark

****Dept. of Social Medicine, Occupupalional & Environmental Dermatology., University of Heidelberg, Germany

*****Dept. of Biostatistics, University of Copenhagen, Denmark

Corresponding author:

Kristina Ibler
Dept. of Dermatology
Roskilde University Hospital

Køgevej 7-13

4000 Roskilde

Denmark

Email: kristinaibler@hotmail.com

tel: +45 50186000, fax: +45 47322698
Funding sources: Region Zealand Research Fund and the Danish Working Environment Research Fund

Conflict of interest: All authors declare no conflicts of interests

Author contributions: Each of the authors has contributed substantially to the manuscript

Running head: Prevalence and risk factors of hand eczema in healthcare workers
ABSTRACT

**Background:** Healthcare workers are at increased risk of developing hand eczema.

**Objectives:** To investigate prevalence and severity of self-reported hand eczema and to relate findings to demographic data, occupation, medical speciality, wards, shifts and working hours.

**Patients/ Materials/ Methods:** Survey of 3181 healthcare workers. Data was analysed using logistic regression. Data on sick leave and notification to the authorities were obtained.

**Results:** The response rate was 71% (2274 of 3181). The 1-year prevalence of hand eczema was 21% and positively associated with atopic dermatitis, younger age, male sex (male doctors), and working hours. 89% reported mild/moderate lesions. Atopic dermatitis was the only factor significantly related to severity. Sick leave was reported by 8% and notification to the authorities by 12%.

**Conclusions:** The prevalence of 21% hand eczema in healthcare workers is doubled as compared to prevalences in the background population. 11% of hand eczema cases reported severe/very severe eczema. No significant differences were found between professions or medical specialities with respect to prevalence or severity, but cultural differences between professions with respect to coping with the eczema were significant. Atopic dermatitis was related to increased prevalence and severity, and future preventive efforts should be addressed in healthcare workers with atopic dermatitis.

**Key words:** Hand eczema, contact dermatitis, healthcare workers, occupational skin disease, exposures, risk factors
INTRODUCTION

Occupational hand eczema is the most frequently recognized occupational skin disease in Denmark, with an incidence of approximately 0.56 per 1000 person-years (1) or of 0.7 to 0.8 per 1000 employees per year (2,3). In 2009 healthcare workers accounted for 33% of the recognized occupational skin diseases in Denmark, and the number of skin diseases reported as occupational has been increasing over the past decade (1). Nurses, assistant nurses, and nursing aids were found to be at particularly high risk in a Danish study, with about one third reporting hand eczema (4). Studies among nurses in other countries report prevalences of hand eczema ranging from 17% to 50% (5-13) and increased prevalence of hand eczema has been reported in nurses working in intensive care units (7,13,14). However, most of the studies are based on surveys using different outcome definitions and questionnaires, and comparability is therefore discussable. Not much information is available regarding prevalence of hand eczema in relation to different specialities or other professions than nurses working in the healthcare system. With respect to physicians, a Chinese hospital study found an overall one-year prevalence of hand eczema of 13% among 361 physicians with the highest prevalence among those working in gynaecology followed by internal medicine, intensive care unit, surgical unit and orthopaedics (15). A Danish study found a one-year prevalence of hand eczema among physicians to be 16% (4) and other Scandinavian studies have suggested an average prevalence of 10% to 20% in healthcare workers (6,16). No previous studies on the prevalence of hand eczema according to in/out patient clinics, shifts or working hours have, to our best knowledge, been published.

In previous studies on occupational hand eczema, severe eczema was found related to higher age, decreased quality of life and male sex (17), as well as to atopic dermatitis and
having a positive patch test (18). There are no available data on severity of hand eczema in healthcare workers.

The aim of this cross-sectional study was to collect data on prevalence and severity of self-reported hand eczema among healthcare workers and to relate the findings to sex, age, skin complexion and atopic dermatitis as well as profession, medical speciality, shifts and working hours. Sick leave and notification to the National Board of Industrial Injuries due to hand eczema was also investigated. The National Board of Industrial Injuries is an agency under the Ministry of Employment and is an impartial authority who make decisions on workers’ compensation claims. It decides whether an injury or disease qualifies for recognition as an industrial injury and decides the amount of the compensation to be given for an industrial injury.

MATERIALS AND METHODS

STUDY POPULATION AND DESIGN

In March 2009, a self-administered questionnaire was sent to all physicians, nurses, nursing auxiliaries, and biotechnicians working in three hospitals in the same geographical area of Denmark. A total of 3181 individuals were surveyed of which 13% were males and 87% were females. The questionnaire was distributed by email, and to those who did not respond within fourteen days, the questionnaire was redistributed by email. Four weeks after the commencement of the study, a paper version of the questionnaire was sent to each non-responder’s work address, and if this was not returned, a paper version was sent to the home address. Before commencement of the study, it was announced on the hospital intranet, at staff meetings and in posters at the hospitals. To enhance respondents, a lottery with a monetary reward was announced and awarded (19).
THE QUESTIONNAIRE

The questionnaire was partly based on questions from the Nordic Occupational Skin Questionnaire (NOSQ-2002) (20) and addressed to healthcare workers. Additional questions were addressed only to healthcare workers with self-reported current or past hand eczema and included questions on self-evaluated disease severity, change of job or behaviour at work and questions on exposures at home and at work. Data on exposures related to presence of hand eczema are published elsewhere.

Definitions

The definition of self-reported hand eczema in the study was the answer ‘yes’ to the question ‘Have you had hand eczema within the past year?’. Additional questions were ‘Do you have hand eczema currently?’ and ‘Have you ever had hand eczema?’. Self-reported eczema has been validated in earlier studies (21-23).

Skin type/complexion was self-evaluated according to the Fitzpatrick Classification (skin type 1-6) (24).

Atopic dermatitis was diagnosed according to the U.K. criteria, question-only version (25,26).

Self-evaluated disease severity was reported by use of a photographic guide. The respondents were asked to grade severity of their hand eczema by choosing one of four groups of photographs representing differing severities of hand eczema. The photographic guide has been validated in a previous study (27).
Statistical analyses

The study was cross sectional. Probabilities were recognized as significant if the level was less than 5%, and 95% confidence intervals were used. Analyses comprised Chi-square tests and multivariate logistic regression. Analyses were performed in PASW Statistics version 18.

RESULTS

The response rate to the questionnaire was 71% (2274 of 3181). 81% of the questionnaires were responded to by email and 19% by paper. Of the respondents, 17% (387) were doctors, 55% (1239) were nurses, 19% (443) were auxiliary nurses and 9% (204) were biotechnicians. Most respondents were females (87%) reflecting the sex distribution among the surveyed. The three hospitals accounted for 34% (770), 25% (570) and 41% (934) of the respondents, respectively, reflecting the size of the hospitals and the participation rates from the three hospitals were 73%, 67% and 73%.

The respondents were older (mean age 46.2 years, SD 10.3) than the non-respondents (mean age 44.8, SD 11.1), and the response rate was statistically significantly higher among males (81%) than females (70%) (p<0.001). The response rates differed significantly among the professionals (p<0.001); 62% (387 of 621) of the doctors, 74% (1239 of 1672) of the nurses, 70% (443 of 631) of the auxiliary nurses and 80% (204 of 255) of the biotechnicians responded to the questionnaire.

Prevalence of hand eczema

Of the responders, 397 reported hand eczema in the past year. The 1-year prevalence of hand eczema among healthcare workers was 21% with a 95% confidence interval (CI) of 20% to 23%. 195 reported current hand eczema, and the point prevalence was 12% with a
95% CI of 10% to 14%. 764 reported hand eczema during life time, and the life time prevalence was 35%, with a 95% CI of 33% to 37% (Table 1).

Severity of hand eczema

Severity of hand eczema was reported as mild in 50% (201 of 397), moderate in 39% (156 of 397), severe in 9% (36 of 397) and very severe in 2% (8 of 397) of the cases. Logistic regression analysis was conducted comparing two severity groups; those with mild lesions and those with moderate, severe and very severe lesions (Table 2). The two groups were comparable in sizes (201 versus 200). Logistic regression analysis was also conducted excluding the 8 reporting very severe hand eczema. Compared to the numbers in table 2, exclusion of the most severe cases led to a significant decrease of 35% in OR \( p=0.047 \) among those with atopic skin disease, underlining an association between atopic skin disease and increased severity of hand eczema. According to department (place of work), it led to a significant decrease of 30% in OR \( p=0.018 \) among those working in anaesthesiology who reported milder hand eczema than those working in the other departments.

Demographics

Sex and age

Of the respondents, 14% (325) were males and 86% (1946) were females. Of those with hand eczema, 19% (76) were males and 81% (321) were females. The prevalence of hand eczema was statistically significantly higher among the males and was reported by 31% (76 of 242) of the males and 20% (321 of 1598) of the females (Table 1). No association was found between severity and sex (Table 2).
Healthcare workers with hand eczema were younger ($p<0.0001$) (Table 1). The median age for those with hand eczema was 42 years and for those without it was 47 years. No association was found between severity and age (Table 2).

**Profession**

Hand eczema was present in 19% (58 of 302) of the doctors; 23% (233 of 1019) of the nurses; 19% (68 of 364) of the auxiliary nurses and 23% (38 of 167) of the biotechnicians.

Profession was not significantly associated with presence or severity of hand eczema when analysing both sexes together (Table 2). However, looking at males only, a significantly higher prevalence of self-reported hand eczema was found among male doctors (59%, 13 of 22) compared to males of other professions (nurses 28% (40 of 141), auxiliary nurses 35% (16 of 46), biotechnicians 21% (7 of 33)) ($p= 0.016$). Of the 13 male doctors with hand eczema, 69% (9) were surgeons which was statistically significant ($p<0.001$). Of the 45 female doctors with hand eczema, 31% (14) were surgeons. The highest prevalence of hand eczema among female doctors was found in medical in-patient departments (52%, 24 of 45) and the second highest prevalence was found in surgical in-patient departments (31%, 14 of 45). For nurses and auxiliary nurses of both sexes, those with hand eczema were mainly working in medical in-patient departments. The median number of years in the current profession was 11 years among those with hand eczema and 16 years among those without.

**Departments**

The departments were categorized as medical in-patient, medical out-patient, surgical in-patient, surgical out-patient, anaesthetics and pathology/radiology/biochemistry/clinical physiology. Most respondents were recruited from medical in-patient wards (Fig. 1). Presence and severity of hand eczema were not associated with hospital or type of
department (Table 1). Grouping the departments into three categories only (in-patient ward, out-patient ward and pathology/radiology/biochemistry/clinical physiology) also showed no association to hand eczema. Of those working in anaesthetics, fewer (15%) reported moderate lesions compared to those from the other departments (26%-45%) ($p=0.049$), and more reported very severe hand eczema (9%) compared to those from the other departments (0%-3%) ($p=0.038$). However, this was based on few observations, and no association was found between severity of hand eczema and type of department in the multivariate logistic regression analysis (Table 2).

**Working hours, day- evening- and night shifts**

In the multivariate analysis, a statistically significantly lower risk of hand eczema was found among those working 30-39 hours per week (odds ratio, OR 0.54) compared to those working 40-60 hours (OR=1) per week (Table 1). Of those with hand eczema, 16% reported working <30 hours per week which was the case for 12% of those without.

No association was found between severity of hand eczema and number of weekly working hours (Table 2). Day- evening- and night shifts were equally reported among those with hand eczema and those without; 84% reported working mainly in day shifts, 11% in evening shifts and 5% in night shifts. Severity was not associated with day, evening or night shifts (Table 2).

**Skin type (self-reported)**

The prevalence of hand eczema among those with skin type 1, 2, 3, 4, and 5 was 27% (9 of 34), 28% (126 of 56), 21% (178 of 853), 18% (74 of 418), and 12% (7 of 57), respectively. Skin type 6 was only reported by three respondents, and none of those had hand eczema. Due to few respondents in groups 1, 5 and 6, skin types were compiled as 1+2 (fair skin), 3+4 (medium skin) and 5+6 (dark skin) for comparative
analyses. A significant association was found between fair skin and hand eczema ($p=0.0003$). However, logistic regression analysis showed no significant association when the covariate *atopic dermatitis* was included, although there was still a trend ($p=0.063$) (Table 1). Severity was not associated with skin type (Table 2).

**Atopic dermatitis**

A statistically significant association was found between atopic dermatitis and hand eczema ($p<0.001$) (Table 1). Atopic dermatitis was reported by 29% (115 of 397) of those with hand eczema and 11% (166 of 1446) of those without. Atopic dermatitis was also found to be significantly related to severity of hand eczema ($p=0.001$) with more severity being reported by those with atopic dermatitis (Table 2). A statistically significant association was also found between atopic dermatitis and skin type ($p<0.0001$). Atopic dermatitis was reported by 25% (151 of 605) of those with fair skin, 16% (249 of 1565) of those with medium skin and 6% (4 of 72) of those with dark skin.

**Sick leave**

Sick leave ever due to hand eczema was reported by 8% (33 of 397), and 2% (8 of 397) reported sick leave for 1-4 weeks within the past year. Sick leave was statistically significantly associated with profession and was reported by 15% (1 of 38) of the auxiliary nurses, 9% (22 of 233) of the nurses and 3% (1 of 38) of the biotechnicians. None of the doctors reported sick leave ($p=0.013$). Age, sex and severity were not associated with sick leave due to hand eczema.

Improvement in hand eczema during time off work at *weekends* was reported by 25% (101 of 397), during *one week off work* by 35% (137 of 397) and during *longer periods off work*
by 27% (107 of 397). No association was found between improvement during time off work and severity.

Change of job and tasks at work

89% (285 of 397) reported being in the same profession currently as when the first eruption of hand eczema appeared. Change of job due to hand eczema was reported by 3% (13 of 397) and considered by 15% (58/397). Job change was considered by 25% (29 of 114) of those with atopic dermatitis which was significantly more than those without, of which 10% (29 of 281) considered job change ($p<0.001$). Job change was considered by 3% of doctors with hand eczema which was significantly fewer than for the other professionals of which 10-18% considered job change ($p=0.022$). Change of tasks at work due to hand eczema was reported by 6% (22 of 397). Profession was significantly related to change of tasks and was reported by 12% (7 of 57) of the doctors, 11% (4 of 38) of the biotechnicians, 4% (10 of 233) of the nurses and 2% (1 of 68) of the auxiliary nurses ($p=0.02$). Atopic dermatitis was also significantly related to change of tasks and was reported by 10% (12 of 115) of those with atopic dermatitis and by 4% (10 of 281) of those without ($p=0.007$).

Notification to the authorities

12% (46 of 397) of the healthcare workers with hand eczema were reported to the Danish National Board of Industrial Injuries Registry as occupational hand eczema. Among the different professionals, the notification rates were: biotechnicians 16% (6 of 38), nurses 12% (27 of 230), the auxiliary nurses 12% (8 of 64) and doctors 9% (5 of 58). Sex, profession and atopic dermatitis were not significantly associated with notification. Severity of hand eczema was significantly associated with notification to the authorities ($p<0.001$).
DISCUSSION

The present study finds a 1-year prevalence of hand eczema of 21%, with no significant association to any profession. Presence of hand eczema was positively correlated to younger age, male sex, working hours and atopic dermatitis. Severity was strongly correlated to atopic dermatitis. 12% of the cases were registered in the Danish National Board of Industrial Injuries Registry as occupational hand eczema and sick leave was reported by 8%.

Our data show that hand eczema among healthcare workers in Denmark is approximately twice that of the background population (28). Prevalences of 17-50% among nurses are previously reported (5-7,9-12,29-31) but data are sparse regarding hand eczema among other health professionals. In our study, no significant differences were found in prevalences of hand eczema among the different health professionals.

The response rates differed significantly among the health professionals with significantly less respondents among the doctors. This finding indicates a decreased interest in self-related work environmental problems among doctors, who also had the lowest relative frequency of notified cases of hand eczema and no sick leave due to hand eczema.

Atopic dermatitis was strongly associated with presence of hand eczema and a higher degree of severity in the multivariate analysis, even when those with very severe eczema (n=8) were excluded from the analysis. This association is not new, and hand eczema patients with atopic skin disease are known to have a poorer prognosis than those without atopic skin disease (32,33). A history of atopic dermatitis has been a well known risk factor for development of hand eczema for several decades, and our data emphasizes that there is a need of future preventive programmes in atopics focusing on prevention of hand eczema.
Healthcare workers with hand eczema were younger and this corresponds to findings from other population studies (34,35). A speculative explanation to this may be increased exposure at home due to children in the household or that older healthcare workers with hand eczema leave the job due to skin problems (healthy worker effect).

In the present study, the prevalence rate of hand eczema was higher among males than females in contradiction to previous population studies (5,6,35-37,39). Of the males with hand eczema, significantly more were doctors. A speculative reason for this could be, that male doctors endure having hand eczema to a greater extent than males and females of other professions, reflecting differences in the trade-off between health, status and job satisfaction. Doctors of both genders reported significantly less sick leave compared to the other health professionals, and this supports the impression that doctors do not focus on self-related work environmental problems.

Our data suggested a relation between fair skin and hand eczema ($p=0.06$), and this trend is new. However, conflicting findings regarding the association between skin colour and skin barrier function are found in previous studies (40-43).

No association was found between presence of hand eczema and working hours in the univariate analysis. However, in the multivariate logistic regression analysis, a reduced risk of hand eczema was found among those working 30-39 hours (OR 0.54) per week compared to those working 40-60 hours (OR 1) per week and is explained by exposure time.

It is a general assumption that occupational skin disease is under reported, and that the notification rate is low. In this study we had the opportunity to test this hypothesis. The notification rate of 12% is remarkably low in professions with clearly documented work related irritant exposures to the skin, and with an expected high information level regarding disease. Notification to the authorities is important for the individual, but is also an
important corner stone in disease surveying and the planning of necessary preventative regulations in society.

**Limitations and strengths**

Cross-sectional studies using questionnaires have several limitations. Critical points are the representativeness of the respondents and their ability to give correct answers. Information bias may be present as the healthcare workers may have been aware of some of the research hypotheses, and the answers may have been biased due to an interest in improving the working environment. This could lead to an over-representation of individuals reporting hand eczema. However, under-representation could also be present with respondents trying to avoid any problems or discussions that may jeopardize their job situation.

The strengths of the present study include a high response rate and the inclusion of different medical professions.

**Conclusion**

The 1-year prevalence of hand eczema in healthcare workers was 21%, which is more than the double of what has previously been reported in the background population, but corresponds to previous studies of hand eczema in healthcare workers. Atopic dermatitis was, as found in previous studies, strongly related to presence as well as increased severity of hand eczema, and this problem should be addressed in future preventive efforts. A higher prevalence was found in younger age groups, in male healthcare workers and in workers with long working hours. Among males with hand eczema, significantly more were doctors and mostly surgeons. Differences in response rates, sick leave and notification rate between the professions reflect that cultural differences may play a role in coping of disease and that this may be influenced by level of education.
Table 1:

1-year prevalence of self-reported hand eczema among the respondents. Univariate analysis and multivariate logistic regression controlled for explanatory variables (sex, age, profession, department, skin complexion, atopy and working hours)

<table>
<thead>
<tr>
<th>Respondents total</th>
<th>Self-reported Hand eczema Numbers (% of total)</th>
<th>p-value (Chi^2)</th>
<th>Odds ratio (95% confidence intervals)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>1843</td>
<td>397 (21%)</td>
<td>&lt;0.001</td>
<td>1.8 (1.30-2.54)</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>242</td>
<td>76 (31%)</td>
<td></td>
<td>1.8 (1.30-2.54)</td>
</tr>
<tr>
<td>Females</td>
<td>1598</td>
<td>321 (20%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-29 years</td>
<td>102</td>
<td>29 (28%)</td>
<td>&lt;0.001</td>
<td>2.02 (1.02-4.01)</td>
</tr>
<tr>
<td>30-39 years</td>
<td>479</td>
<td>139 (29%)</td>
<td></td>
<td>2.44 (1.44-4.14)</td>
</tr>
<tr>
<td>40-49 years</td>
<td>515</td>
<td>110 (21%)</td>
<td></td>
<td>1.82 (1.07-3.10)</td>
</tr>
<tr>
<td>50-59 years</td>
<td>829</td>
<td>99 (12%)</td>
<td></td>
<td>1.48 (0.87-2.52)</td>
</tr>
<tr>
<td>60-65 years</td>
<td>187</td>
<td>20 (11%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Profession</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physicians</td>
<td>300</td>
<td>58 (19%)</td>
<td>0.227</td>
<td>0.97 (0.43-2.15)</td>
</tr>
<tr>
<td>Nurses</td>
<td>1009</td>
<td>232 (23%)</td>
<td></td>
<td>1.36 (0.63-2.91)</td>
</tr>
<tr>
<td>Nursing assistants</td>
<td>349</td>
<td>64 (18%)</td>
<td></td>
<td>1.13 (0.50-2.52)</td>
</tr>
<tr>
<td>Bio-technicians</td>
<td>169</td>
<td>38 (22%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Department</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anaesthesiology</td>
<td>300</td>
<td>33 (11%)</td>
<td>0.194</td>
<td>0.68 (0.43-1.08)</td>
</tr>
<tr>
<td>Bio/physiol/pathol/radiol</td>
<td>220</td>
<td>49 (22%)</td>
<td></td>
<td>1.12 (0.57-2.21)</td>
</tr>
<tr>
<td>Surgical out – patient</td>
<td>135</td>
<td>35 (26%)</td>
<td></td>
<td>1.04 (0.65-1.68)</td>
</tr>
<tr>
<td>Surgical in-patient</td>
<td>457</td>
<td>89 (19%)</td>
<td></td>
<td>0.73 (0.53-1.00)</td>
</tr>
<tr>
<td>Medical out-patient</td>
<td>104</td>
<td>19 (18%)</td>
<td></td>
<td>0.62 (0.35-1.11)</td>
</tr>
<tr>
<td>Medical in-patient</td>
<td>729</td>
<td>172 (24%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Skin complexion</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: Fitzpatrick 1+2</td>
<td>490</td>
<td>135 (28%)</td>
<td>&lt;0.001</td>
<td>2.20 (0.95-5.07)</td>
</tr>
<tr>
<td>2: Fitzpatrick 3+4</td>
<td>1271</td>
<td>252 (20%)</td>
<td></td>
<td>1.52 (0.67-3.45)</td>
</tr>
<tr>
<td>3: Fitzpatrick 5+6</td>
<td>60</td>
<td>7 (12%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Atopy</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>281</td>
<td>115 (41%)</td>
<td>&lt;0.001</td>
<td>2.66 (1.98-3.57)</td>
</tr>
<tr>
<td>No</td>
<td>1562</td>
<td>282 (18%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Shifts (predominantly)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Day shift</td>
<td>1482</td>
<td>314 (21%)</td>
<td>0.908</td>
<td>1.14 (0.63-2.04)</td>
</tr>
<tr>
<td>Evening shift</td>
<td>179</td>
<td>40 (22%)</td>
<td></td>
<td>1.17 (0.60-2.26)</td>
</tr>
<tr>
<td>Night shift</td>
<td>94</td>
<td>19 (20%)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td><strong>Weekly working hours</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;30</td>
<td>296</td>
<td>62 (21%)</td>
<td>0.300</td>
<td>0.65 (0.34-1.23)</td>
</tr>
<tr>
<td>30-39</td>
<td>1749</td>
<td>299 (17%)</td>
<td></td>
<td>0.54 (0.32-0.91)</td>
</tr>
<tr>
<td>40-60</td>
<td>209</td>
<td>36 (17%)</td>
<td></td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2:
Severity of hand eczema among the respondents. Multivariate logistic regression controlled for explanatory variables (sex, age, profession, department, skin complexion, atopy and working hours)

<table>
<thead>
<tr>
<th>Covariates</th>
<th>Mild hand eczema (N=194)</th>
<th>Moderate, severe &amp; very severe hand eczema (N = 200)</th>
<th>Odds ratio (95 % c.i.)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Males 40</td>
<td>Females 154</td>
<td>0.76 (0.43-1.35)</td>
<td>0.357</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>20-29 years 14</td>
<td>20-29 years 67</td>
<td>0.59 (0.17-2.09)</td>
<td>0.422</td>
</tr>
<tr>
<td></td>
<td>30-39 years 55</td>
<td>30-39 years 55</td>
<td>0.92 (0.33-2.51)</td>
<td>0.876</td>
</tr>
<tr>
<td></td>
<td>40-49 years 48</td>
<td>40-49 years 55</td>
<td>0.91 (0.32-2.56)</td>
<td>0.872</td>
</tr>
<tr>
<td></td>
<td>50-59 years 10</td>
<td>50-59 years 10</td>
<td>1.09 (0.38-3.10)</td>
<td>0.861</td>
</tr>
<tr>
<td></td>
<td>60-65 years</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Profession</td>
<td>Physicians 28</td>
<td>Nurses 116</td>
<td>0.51 (0.21-1.25)</td>
<td>0.143</td>
</tr>
<tr>
<td></td>
<td>Nursing assistants 27</td>
<td>Biotechnicians 18</td>
<td>0.92 (0.33-2.51)</td>
<td>0.407</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.98 (0.21-4.61)</td>
<td>0.983</td>
</tr>
<tr>
<td>Department</td>
<td>Anaesthesiology 20</td>
<td>Bio/physiol/pathol/radiol 24</td>
<td>0.52 (0.21-1.24)</td>
<td>0.141</td>
</tr>
<tr>
<td></td>
<td>Surgical out –patient 17</td>
<td>Surgical in-patient 43</td>
<td>0.47 (0.12-1.73)</td>
<td>0.260</td>
</tr>
<tr>
<td></td>
<td>Medical out-patient 12</td>
<td>Medical in-patient 78</td>
<td>1.15 (0.50-2.64)</td>
<td>0.738</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.83 (0.47-1.48)</td>
<td>0.543</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>0.74 (0.25-2.17)</td>
<td>0.593</td>
</tr>
<tr>
<td>Skin complexion</td>
<td>1: Fitzpatrick 1+2 63</td>
<td>2: Fitzpatrick 3+4 125</td>
<td>2.10 (0.37-11.90)</td>
<td>0.399</td>
</tr>
<tr>
<td></td>
<td>2: Fitzpatrick 3+4 125</td>
<td>3: Fitzpatrick 5+6 5</td>
<td>1.87 (0.33-10.38)</td>
<td>0.474</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atopy</td>
<td>Yes 40</td>
<td>No 154</td>
<td>2.29 (1.40-3.73)</td>
<td>0.001</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shifts</td>
<td>Day shift 148</td>
<td>Evening shift 23</td>
<td>1.77 (0.62-5.05)</td>
<td>0.286</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Night shift 12</td>
<td>0.92 (0.27-3.13)</td>
<td>0.906</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly working hours</td>
<td>&lt;30 33</td>
<td>30-39 141</td>
<td>0.98 (0.49-1.97)</td>
<td>0.966</td>
</tr>
<tr>
<td></td>
<td>30-39 141</td>
<td>40-60 27</td>
<td>0.32 (0.09-1.12)</td>
<td>0.075</td>
</tr>
</tbody>
</table>
Figure 1:

Distribution of total population, respondents and prevalence of self-reported hand eczema according to departments
Reference List

(1) The National Board of Industrial Injuries in Denmark, The National Board of Industrial Injuries in Denmark. 18-6-2010. Ref Type: Online Source. http://www.ask.dk/Statistik/~/~/media/E3212E1BE5A644B3BBA76AC0EBDCAF5F.ashx


Exposures related to hand eczema. A study of health-care workers.

Ibler K*, Jemec GBE*, Agner T**

*Dept. of Dermatology, Roskilde Hospital, and **Dept. of Dermatology, Bispebjerg Hospital; Health Sciences faculty, University of Copenhagen

Corresponding author:

Kristina Ibler
Dept. of Dermatology
Roskilde University Hospital

Køgevej 7-13
4000 Roskilde
Denmark

kristinaibler@hotmail.com
tel: +45 50186000, fax: +45 47322698

Disclosures:

The study was funded by The Region Zealand Research Fund and The Danish Working Environment Research Fund.

All authors declare no conflicts of interests

Author contributions: Each of the authors has contributed substantially to the manuscript

Running head: Hand eczema in health care workers
ABSTRACT

Objectives: Hand eczema is common in health-care workers due to intensive exposure to wet work and skin irritants. Targeted interventions and vocational guidance based on documented exposures and risk factors are needed. The aims of the study were to investigate the relationship between exposures (domestic and at work) and prevalence and severity of hand eczema.

Methods: Self-administered questionnaires were sent to 3.181 health-care workers in Denmark.

Results: 2269 (71%) responded the questionnaire. Frequent hand washing was significantly related to presence of hand eczema. Having children less than four years in the household was also related to presence of hand eczema. A lower prevalence of hand eczema was found among those using moisturizers at work while a higher prevalence was found among those using moisturizers at home.

Conclusions: Although health-care workers are recommended to use disinfectants when the hands are not visibly dirty, hand washing is still significantly related to hand eczema. Frequent hand washing may be a question of behavioural habits, and focus for future guidance should be on change of hand washing habits. Attention should also be payed to health-care workers with small children at home. The preventive effect of moisturizers used during working hours should be tested in future follow up studies.

Key words: Hand eczema, contact dermatitis, health care workers, occupational skin disease, exposure assessment
INTRODUCTION

Hand eczema is a common disease among health-care workers and prevalences of 17-70% are previously reported \(^1\)-\(^{12}\). Consequences of hand eczema include disability due to chronicity, sick leave, loss of job and socio-economic impact \(^{13}\)-\(^{15}\), and health-care workers’s constitute 21% of those with recognized occupational hand eczema in Denmark \(^{16}\). The high prevalence suggests that targeted interventions based on well documented risk factors may provide a particularly beneficial cost-benefit effect in this group.

Vocational guidance regarding risk factors is therefore important and precise knowledge of exposure in hospital settings is needed to provide the best vocational guidance to health-care workers with hand eczema \(^{17}\). Some of these risk factors, however, are quite general and not limited to occupational exposure only. A concomitant description of occupational and non-occupational exposures may therefore be necessary to provide adequate depth to the guidance.

The aims of the present study were to investigate the relationship between exposure (at work and at home) and prevalence of hand eczema, as well as the relationship between exposure and severity of hand eczema, in a population of 3181 health-care workers in Denmark.
MATERIALS AND METHODS

STUDY POPULATION AND DESIGN

In March 2009, a self-administered questionnaire was sent to 3181 physicians, nurses, nursing aids, and biotechnicians in three hospitals in the same geographical area of Denmark. The questionnaire was distributed by email, and to those who did not respond within fourteen days, the questionnaire was redistributed by email. Four weeks after commencement of the study, a paper version of the questionnaire was sent to the non-respondents’ work address, and if this was not returned, a paper version was sent to the home address. Before starting, the study was announced on the hospital intranet, at staff meetings and in posters at the hospitals. To increase respondents, a lottery with a monetary reward was announced and awarded.

THE QUESTIONNAIRE

The questionnaire was partly based on questions from the Nordic Occupational Skin Questionnaire (NOSQ-2002) which is a standardised questionnaire for work-related skin diseases and exposures. The questions were modified for the hospital environment and included questions on self-reported hand eczema, medical profession, working hours, type of department, skin exposures at work (water, hand washing, local disinfectants, protective gloves, handling of medicines, laboratory reagents, rubber materials, food preparation, detergents) and domestic skin exposures (hand washing, food preparation, cleaning, dish washing, laundring by hands, caring for infants and toddlers, gardening, redecorating, renovation, repairing of engines), use of moisturisers, smoking habits and physical activity. Additional questions only addressed to respondents with current or past hand eczema.
included questions on change of job/tasks at work, aggravating exposures, management of hand eczema and self-evaluated disease severity.

**Definitions**

*Self-reported hand eczema* was defined as the answer ‘yes’ to the question ‘Have you had hand eczema within the past year?’ Self-reported eczema has been validated in earlier studies.\(^{20-22}\)

*Self-evaluated disease severity* was reported by use of a photographic guide. The respondents were asked to grade severity of their hand eczema at its worst by choosing one of four groups of photographs representing differing severities of hand eczema.\(^{23}\)

*Instances of hand washings and disinfectant use* per day were reported as 1-5 times, 6-10 times, 11-15 times, 16-20 times and more than 20 times.

*Use of moisturisers* per day was reported as no use, not every day, 1-2 times and more than 2 times.

*Time spent on domestic exposures* (food preparation, cleaning, dish washing and washing clothes by hands, caring for children, gardening, contact with soil and plants, renovation and redecoration, repairing motor vehicles or engines) was reported as no time, <\(\frac{1}{2}\) hour, \(\frac{1}{2}\)-3 hours, 3-5 hours and >5 hours per day.

**Statistical analyses**

The study was cross sectional. Probabilities were recognized as significant if the level was less than 5%, and 95% confidence intervals were used. Analyses comprised Chi-square
tests and multivariate logistic regression and were performed in PASW Statistics version 18. All results were corrected for missing response values in the respective questions.

RESULTS

Of the 3181 invited health-care workers, 71% (2269) responded the questionnaire. The respondents were older (mean age 46.2 years, SD 10.3) than the non-respondents (mean age 44.8 years, SD 11.1) and the response rate was statistically significantly higher among males (81%) than females (70%). The response rate differed significantly among the professions: biotechnicians 80%, physicians 62%, nurses 74%, auxiliary nurses 70%. Results concerning prevalence, sick leave, notification of the authorities and severity of hand eczema in the cohort are published elsewhere.

EXPOSURES AT WORK

Hand washings and disinfectants

Participants with hand eczema washed their hands significantly more often than those without (p<0.001). The most reported in both groups, however, was hand washings 6-10 times per day at work. Hand washing more than ten times per day at work was reported by 52% of those with hand eczema and 43% of those without.

No difference was found in the use of disinfectants between participants with or without hand eczema. For both groups, the majority reported use of disinfectants >20 times per
Severity of hand eczema was not associated with daily instances of hand washing or use of disinfectants, and no association was found between surgical hand washings and hand eczema or severity.

Use of protective gloves and wet work

Synthetic rubber gloves were used by 34% of those with hand eczema and 27% of those without, and the difference was statistically significant (p=0.009). Cotton gloves were used by 2% of those with hand eczema and by less than 1% of those without, which was also statistically significant (p=0.030). Natural rubber gloves were used by 49% of health-care workers with hand eczema and by 54% of those without, and the difference was not statistically significant.

Regarding time spent on water exposure or time spent on use of protective gloves there was no difference between participants with and without hand eczema (Table 2).

Severity of hand eczema was not found to be associated with daily time spent on water exposure or use of protective gloves.

Other exposures

Statistically significant associations were found between hand eczema and the wearing of protective gloves while handling medications (p=0.014), foods (p=0.004), detergents (p=0.035) and blood collection (p=0.019). For the statistically significant findings, health-care workers with hand eczema were more likely to use protective gloves than those without (Table 3). For the other exposures there were no statistical associations with hand eczema. A trend was found for handling of medications (p=0.08), blood collection (p=0.08),...
and hand eczema. Those without hand eczema reported less time spent on handling medication and blood collection than those with hand eczema (Table 4).

Moisturisers

95% of all health-care workers reported that moisturisers were available at work. An almost equal amount of health-care workers with hand eczema (39%) and without hand eczema (41%) reported daily use of moisturisers at work. Significantly more of those without hand eczema (14%) reported use of moisturisers >2 times per day at work than those without (8%) (p=0.009). In direct contrast, regular use of moisturisers outside of work was reported by significantly more health-care workers with hand eczema (82%) than without (74%) (p=0.001). Severity of hand eczema was significantly associated with use of moisturisers. Those with more severe hand eczema reported more frequent use of moisturisers at work (p=0.035).

DOMESTIC EXPOSURES

Hand washings (outside of work)

Those with hand eczema washed their hands significantly more while outside of work than those without (p<0.001). Hand washings more than 10 times per day outside of work was reported by 23% of those with hand eczema and 16% of those without. The most reported in both groups was 6-10 times per day which was reported by 51% of those with hand
eczema and 47% of those without. No association was found between severity of hand eczema and number of times hands were washed outside of work.

Other domestic exposures

Significantly more of those with hand eczema (31%) reported having children younger than four years old in the household than those without hand eczema (23%) (p=0.002). Use of protective gloves while cooking, cleaning, dish washing and washing clothes by hands was reported significantly more often by those with hand eczema than those without (p<0.001). Of those with hand eczema, 11% reported use of protective gloves while preparing food and 30% while cleaning, dish washing and washing clothes by hands. Of those without hand eczema the numbers were 5% and 20% respectively. Regarding other domestic activities (gardening, contact with soil and plants, renovation and redecoration, repairing motor vehicles or engines) none were significantly related to hand eczema or severity of hand eczema.

DISCUSSION

The present study investigates exposures that relate to hand eczema in health-care workers based on data from a questionnaire study.

Frequent hand washing at work and at home was found to be the most important behavioural risk factor for hand eczema. Hand washing has been reported as a risk factor in previous studies \(^{24,25-28}\), and reduced skin irritation from disinfectants compared to detergents has been documented \(^{29}\). In recent years, disinfection of the hands instead of washing has therefore been recommended to health-care workers whenever the hands
are not visibly dirty

(http://intra.regionsjaelland.dk/Regionshus/Fagligt/Afdelingsintranet/Kvalitet%20og%20udvikling/Documents/IH%2050355.pdf). In spite of these recommendations throughout the health-care sector in Denmark, it is both interesting and surprising that hand washing at work is still a major risk factor for development of hand eczema. Reasons for not complying with the advice about replacement of hand washing with the use of disinfectants may comprise the perception that it is more damaging than hand washing, or that the hands will not become as clean when disinfected compared to hand washing and these uncertainties should be addressed in future campaigns. Some patients with hand eczema may also find the use of disinfectants unpleasant due to fissures and abrasions in the eczematous skin. However, this does not explain the increased number of hand washing instances in participants with hand eczema in the present study, since the use of disinfectants was similar among those with and without hand eczema. It is interesting that increased number of hand washing instances during leisure time also appears related to hand eczema. This indicates that some people habitually wash their hands with an increased frequency, at work as well as at home, and that change of this habit and diminishing number of hand washings could prevent hand eczema. Studies of obsessive compulsive washers have suggested that the activity is related to anxiety and disgust, suggesting that broader psychological factors may also play a role in determining behaviour and subsequent risk of hand eczema. A possible relationship between personality structure, hand washing and hand eczema has previously been suggested in an occupational setting. The educational strategy of health-care workers with hand eczema may benefit from a re-evaluation focussing on influencing the pattern of hand washing. Use of disinfectants instead of hand washing diminish skin irritation and prevents hand eczema, and this way round also diminish the number of carriers of Staphylococcus...
Possible microbiological concern about use of disinfectant in special settings should be carefully pursued \(^{37,38}\).

The use of moisturisers constitute a mainstay in the treatment of hand eczema. Interestingly, those without hand eczema used moisturisers more frequently at work than those with hand eczema suggesting a preventive effect of use of moisturisers in health-care workers during working hours. This has yet to be proved in field intervention studies in health-care workers but data indicates that immediate access to moisturisers provides a potent preventive intervention. In a recent study among metal workers with hand eczema, significant improvement was found among those using skin protection (barrier cream and mild cleansing) at work and skin care (moisturisers) at home compared to those using skin protection at work only or skin care at home only \(^{39}\). In contrast, our study found that frequent use of moisturisers outside of work was reported by significantly more of those with hand eczema and was positively correlated to severity degree of hand eczema and this observation is most likely explained as treatment of the eczema during leisure time (reversed causality).

Synthetic rubber gloves and cotton gloves were used significantly more by health-care workers with hand eczema due to lower tolerance of natural rubber gloves and friction, and an increased use of protective gloves while exposed to foods and wet work at home was also reported in this group (reversed causality). These findings confirm that there are behavioural differences between those with hand eczema and those without regarding skin protective behaviour. Having children younger than four years at home was significantly related to hand eczema, indicating the importance of domestic exposure. Nursing of young children implies wet work and frequent hand washings, and the relation between hand eczema and children has been reported previously \(^{40}\).
LIMITATIONS

Questionnaire studies are less reliable than observational studies, however, they allow for a larger amount of data. Former studies aimed at validating questionnaire data through observational studies among nurses found that for wet work, the self-evaluated duration of exposure was overestimated while the frequency of exposure was underestimated.\textsuperscript{27,41} Overestimation of exposures was also present in a study among geriatric nurses, although the questionnaire was considered useful.\textsuperscript{42} Another study found a strong correlation between self-reports and observation for questions regarding exposure to water, foodstuffs and occlusive gloves, and a moderate correlation for questions regarding hand washing.\textsuperscript{43} It is however suggested that the comparison between cases and controls from the same population used in this study compensates for the possible inaccuracies and supports the validity of the relative differences identified.

CONCLUSION

Guidance in skin protection is important for prevention of hand eczema in health-care workers, and knowledge about exposures related to development of hand eczema is essential to optimise guidance. In the present study, frequent hand washing at work and in leisure time is significantly related to prevalence of hand eczema in spite of clear recommendations about replacement of hand washing with disinfection. Our findings indicate that focus for future guidance should be on change of hand washing habits at work and at home. It may be speculated that excessive hand washing is related to personality structure and psychological factors that influence behaviour and subsequent risk of hand eczema. It would therefore be interesting, in future studies, to investigate if people with hand eczema differ in personality structure, e.g. compulsive traits or
exaggerated assimilation to selected aspects of general advice leading to excessive zeal in hand washing both at work and at home.

Special attention should be paid to health-care workers with small children at home, since our data confirms a relation between young children at home and hand eczema. The finding that increased use of moisturizer during working hours is related to not having hand eczema is interesting and new, and the preventive effect of moisturizers used during working hours should be tested in future follow up studies.
Table 1:
Daily number of hand washing/use of local disinfectants during a working day among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema</th>
<th>Never</th>
<th>1-5 times</th>
<th>6-10 times</th>
<th>11-15 times</th>
<th>16-20 times</th>
<th>&gt;20 times</th>
<th>p-value Chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local disinfectants</td>
<td>+ hand eczema - hand eczema</td>
<td>9 (2%)</td>
<td>39 (10%)</td>
<td>36 (9%)</td>
<td>58 (15%)</td>
<td>66 (15%)</td>
<td>189 (48%)</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>42 (3%)</td>
<td>117 (8%)</td>
<td>165 (12%)</td>
<td>221 (15%)</td>
<td>236 (16%)</td>
<td>658 (46%)</td>
<td>100%</td>
</tr>
<tr>
<td>Hand washing</td>
<td>+ hand eczema - hand eczema</td>
<td>6 (2%)</td>
<td>77 (19%)</td>
<td>105 (27%)</td>
<td>80 (20%)</td>
<td>51 (13%)</td>
<td>77 (19%)</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>10 (1%)</td>
<td>369 (26%)</td>
<td>446 (31%)</td>
<td>256 (18%)</td>
<td>181 (13%)</td>
<td>174 (12%)</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 2:
Self-reported daily exposure to water and protective gloves during a working day among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema</th>
<th>&lt; ½ hour</th>
<th>½-2 hours</th>
<th>2-3 hours</th>
<th>3-5 hours</th>
<th>&gt; 5 hours</th>
<th>p-value Chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>+ hand eczema - hand eczema</td>
<td>180 (46%)</td>
<td>32 (8%)</td>
<td>20 (5%)</td>
<td>24 (6%)</td>
<td>9 (2%)</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>625 (44%)</td>
<td>119 (8%)</td>
<td>70 (5%)</td>
<td>59 (4%)</td>
<td>72 (5%)</td>
<td>100%</td>
</tr>
<tr>
<td>Protective gloves</td>
<td>+ hand eczema - hand eczema</td>
<td>63 (18%)</td>
<td>184 (53%)</td>
<td>61 (18%)</td>
<td>29 (8)</td>
<td>11 (3%)</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>257 (21%)</td>
<td>592 (49%)</td>
<td>219 (18%)</td>
<td>101 (8%)</td>
<td>35 (4%)</td>
<td>100%</td>
</tr>
</tbody>
</table>
Table 3:

Use of protective gloves among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema while exposed to patient care, medications, blood collection, laboratory agents, rubber and plastics, food articles, detergents and plaster (out of 2269 respondents).

<table>
<thead>
<tr>
<th></th>
<th>Hand eczema &lt; 12 months</th>
<th>No use of protective gloves</th>
<th>Use of protective gloves</th>
<th>Not regular use of protective gloves</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient care</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>118 (10%)</td>
<td>698 (61%)</td>
<td>326 (29%)</td>
<td>(100%)</td>
<td>0.66</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>33 (10%)</td>
<td>203 (64%)</td>
<td>83 (26%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Handling of medications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>484 (47%)</td>
<td>188 (18%)</td>
<td>359 (35%)</td>
<td>(100%)</td>
<td>0.014</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>114 (39%)</td>
<td>73 (25%)</td>
<td>107 (36%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Blood collection</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>378 (47%)</td>
<td>289 (36%)</td>
<td>140 (17%)</td>
<td>(100%)</td>
<td>0.019</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>87 (37%)</td>
<td>100 (42%)</td>
<td>51 (21%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Laboratory agents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>371 (53%)</td>
<td>239 (34%)</td>
<td>92 (13%)</td>
<td>(100%)</td>
<td>0.53</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>94 (49%)</td>
<td>71 (37%)</td>
<td>29 (15%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Rubber and plastics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>208 (18%)</td>
<td>700 (62%)</td>
<td>226 (20%)</td>
<td>(100%)</td>
<td>0.39</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>60 (19%)</td>
<td>203 (64%)</td>
<td>52 (17%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Handling of food articles</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>728 (82%)</td>
<td>78 (9%)</td>
<td>86 (10%)</td>
<td>(100%)</td>
<td>0.004</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>198 (77%)</td>
<td>16 (6%)</td>
<td>43 (17%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Detergents</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>381 (43%)</td>
<td>335 (38%)</td>
<td>164 (19%)</td>
<td>(100%)</td>
<td>0.035</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>82 (34%)</td>
<td>109 (45%)</td>
<td>49 (20%)</td>
<td>(100%)</td>
<td></td>
</tr>
<tr>
<td><strong>Plaster</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>-hand eczema</td>
<td>449 (77%)</td>
<td>109 (19%)</td>
<td>28 (5%)</td>
<td>(100%)</td>
<td>0.32</td>
</tr>
<tr>
<td>+hand eczema</td>
<td>108 (72%)</td>
<td>32 (21%)</td>
<td>11 (7%)</td>
<td>(100%)</td>
<td></td>
</tr>
</tbody>
</table>
Table 4:

Daily time spent on patient care, handling of medications, blood collection and contact with laboratory agents, rubber and plastics, food articles, detergents and plaster among healthcare workers with hand eczema in the past year and healthcare workers without hand eczema (out of 2269 respondents).

<table>
<thead>
<tr>
<th>Time spent on (daily)</th>
<th>Hand eczema &lt; 12 months</th>
<th>0 hours</th>
<th>&lt;½ hours</th>
<th>½-3 hours</th>
<th>3-5 hours</th>
<th>&gt;5 hours</th>
<th>p-value Chi^2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient care</strong></td>
<td>-hand eczema</td>
<td>339 (24%)</td>
<td>315 (22%)</td>
<td>563 (40%)</td>
<td>143 (10%)</td>
<td>58 (4%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>82 (21%)</td>
<td>86 (22%)</td>
<td>167 (43%)</td>
<td>38 (10%)</td>
<td>16 (4%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Handling of medications</strong></td>
<td>-hand eczema</td>
<td>502 (36%)</td>
<td>488 (35%)</td>
<td>369 (27%)</td>
<td>16 (1%)</td>
<td>8 (1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>124 (32%)</td>
<td>125 (33)</td>
<td>131 (34%)</td>
<td>3 (1%)</td>
<td>2 (1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Blood collection</strong></td>
<td>-hand eczema</td>
<td>880 (64%)</td>
<td>362 (26%)</td>
<td>94 (7%)</td>
<td>20 (2%)</td>
<td>16 (1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>221 (57%)</td>
<td>118 (31)%</td>
<td>33 (9%)</td>
<td>6 (2%)</td>
<td>9 (2%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Laboratory agents</strong></td>
<td>-hand eczema</td>
<td>1025 (75%)</td>
<td>256 (19%)</td>
<td>71 (5%)</td>
<td>12 (1%)</td>
<td>5 (0.4%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>281 (73%)</td>
<td>71 (19%)</td>
<td>21 (6%)</td>
<td>9 (2%)</td>
<td>2 (0.5%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Rubber and plastics</strong></td>
<td>-hand eczema</td>
<td>347 (25%)</td>
<td>607 (44%)</td>
<td>391 (28%)</td>
<td>41 (3%)</td>
<td>10 (0.7%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>84 (22%)</td>
<td>179 (46%)</td>
<td>110 (28%)</td>
<td>12 (3%)</td>
<td>4 (1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Handling of food articles</strong></td>
<td>-hand eczema</td>
<td>718 (52%)</td>
<td>485 (35%)</td>
<td>172 (13%)</td>
<td>4 (0.3%)</td>
<td>1 (0.1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>189 (49%)</td>
<td>147 (38%)</td>
<td>50 (13%)</td>
<td>1 (0.3%)</td>
<td>0</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Detergents</strong></td>
<td>-hand eczema</td>
<td>735 (53%)</td>
<td>523 (38%)</td>
<td>117 (9%)</td>
<td>2 (0.1%)</td>
<td>2 (0.1%)</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>200 (52%)</td>
<td>161 (42%)</td>
<td>23 (6%)</td>
<td>2 (0.5%)</td>
<td>0</td>
<td>(100%)</td>
</tr>
<tr>
<td><strong>Plaster</strong></td>
<td>-hand eczema</td>
<td>1235 (90%)</td>
<td>83 (6%)</td>
<td>52 (4%)</td>
<td>0</td>
<td>0</td>
<td>(100%)</td>
</tr>
<tr>
<td></td>
<td>+hand eczema</td>
<td>338 (88%)</td>
<td>26 (7%)</td>
<td>19 (5%)</td>
<td>0</td>
<td>0</td>
<td>(100%)</td>
</tr>
</tbody>
</table>


(37) www.CMAJ.ca/site/earlyreleases/10aug11_hand-sanitizers-may-increase-norovirus-risk.xhtml


The Hand Eczema Trial (HET): design of a randomised clinical trial of the effect of classification and individual counselling versus no intervention among health-care workers with hand eczema

Author 1: Kristina Sophie Ibler  
(corresponding)  
MD, Ph.D.-student  
Department of Dermatology  
Roskilde Hospital  
Roskilde  
Denmark  
Email: kristinaibler@hotmail.com

Author 2: Tove Agner  
MD, DM science  
Department of Dermatology  
Bispebjerg Hospital  
Copenhagen  
Denmark  
Email: t.agner@dadlnet.dk

Author 3: Jane Lindschou Hansen  
MSc Demography and Health  
Copenhagen Trial Unit  
Centre for Clinical Intervention Research  
Rigshospitalet  
Copenhagen  
Denmark  
Email: JLH@ctu.rh.dk

Author 4: Christian Gluud  
MD, DM Science  
Copenhagen Trial Unit  
Centre for Clinical Intervention Research  
Rigshospitalet  
Copenhagen  
Denmark  
Email: cgluud@ctu.rh.dk
ABSTRACT

Background:
Hand eczema is the most frequently recognized occupational disease in Denmark with an incidence of approximately 0.32 per 1000 person-years. Consequences of hand eczema include chronic severe eczema, prolonged sick leave, unemployment, and impaired quality of life. New preventive strategies are needed to reduce occupational hand eczema.

Methods/Design:
We describe the design of a randomised clinical trial to investigate the effects of classification of hand eczema plus individual counselling versus no intervention. The trial includes health-care workers with hand eczema identified from a self-administered questionnaire delivered to 3181 health-care workers in three Danish hospitals. The questionnaire identifies the prevalence of hand eczema, knowledge of skin-protection, and exposures that can lead to hand eczema. At entry, all participants are assessed regarding: disease severity (Hand Eczema Severity Index); self-evaluated disease severity; number of eruptions; quality of life; skin protective behaviour, and knowledge of skin protection. The patients are centrally randomised to intervention versus no intervention 1:1 stratified for hospital, profession, and severity score. The experimental group undergoes patch and prick testing; classification of the hand eczema; demonstration of hand washing and appliance of emollients; individual counselling, and a skin-care programme. The control group receives no intervention. All participants are reassessed after six months. The primary outcome is observer-blinded assessment of disease severity and the secondary
outcomes are unblinded assessments of disease severity; number of eruptions; knowledge of skin protection; skin-protective behaviour, and quality of life.

**Trial registration:**

The trial is registered in ClinicalTrials.Gov, NCT01012453.
BACKGROUND

Hand eczema (HE) is a long-lasting disease with a point prevalence of 9.7% in the background population [1] and an incidence reported to be 5.5 to 8.8 per 1000 person-years [2,3]. Occupational hand eczema (OHE) is the most frequently recognized occupational disease in Denmark with an incidence of approximately 0.32 per 1000 person-years [4]. Other studies have revealed that the annual incidence of new reports of occupational skin diseases is 0.7 to 0.8 per 1,000 employees [5,3] and the number of unreported occupational skin conditions are many times greater. Despite governmental attempts to reduce exposures to harmful occupational allergens, the number of new OHE patients has remained almost unchanged during the past decade [4]. The prevalence is highest in females aged 20-30 years and there is an increased risk in occupations with high exposure to wet work, skin irritants, and contact allergens [1, 2]. Complications and consequences of occupational hand eczema include chronic severe eczema, prolonged sick leave, unemployment, and impaired quality of life [6-10].

In Denmark, 21% of the recognized occupational skin diseases are represented by healthcare workers [11]. Nurses, assistant nurses, and nursing aids are particularly at high risk, about a third reporting hand eczema [12].

Among factors that can lead to OHE are wet work with frequent hand washing, use of protective gloves, and local disinfectants [13-15]. There are no data available on the quantitative exposure to wet work in the different specialties and professions in a hospital.
Better methods to assess the exposure to wet work are needed, and information on allergens and irritants related to development of hand eczema is lacking [16].

**Clinical data**

Preventive measures and skin-care programmes have shown a significant positive effect in the prevention of HE among health-care workers [17, 18, 19, 20], and a recent study on Danish health-care workers shows that preventive efforts are necessary in hospitals [12]. Skin-care programmes have also been effective in studies of other occupations such as hairdressers [21, 22], gut cleaners [23], and cheese dairy industry workers [24]. Several of the mentioned trials were conducted as cluster randomised trials [17,18, 19, 20, 21, 23, 24] and assessed primary prevention [17, 18, 19, 20, 23, 24].

Secondary prevention of HE in individual geriatric nurses was examined in Germany in 2004 [25]. The participants were initially referred to the authorities (Berufsgenossenschaft fur Gesundheitsdienst und Wohlfahrtspflege, BGW) by their local dermatologist who suspected occupational skin disease. All participants were interviewed prior to trial initiation. The intervention was complex and comprised four visits in six months including one-to-one consultation by a dermatologist, three educational seminars with hands-on training in the correct use of skin protection and dermatologic treatment by an educationalist focusing on attitudes toward illnesses and motivation to remain at work. At each visit Δ transepidermal water loss (Δ TEWL) was measured. The intervention resulted in improvement in objective dermatologic findings and skin physiologic data (TEWL).
In Germany there is a special course of action for health-care workers with occupational skin disease [26]. Whenever a skin disease is reported to the BGW, the patient is immediately invited to attend a 2-day skin protection course that is organised in cooperation with dermatologists/allergists, specialists in occupational medicine, hygiene specialists, and BGW staff members. The educational part of the skin protection courses is complemented by a medical part obtained by a dermatologist in each patient. This comprises medical history including atopic dermatitis, further diagnostics, therapy, skin protection, and an assessment of whether the patient can remain in the job. The findings are sent to the BGW who decide how to handle the patient in the future. This can vary from initiation of a 3-weeks inpatient treatment programme (tertiary inpatient individual prevention programme) to initiation of an advisory/expert’s opinion. A follow-up investigation based on telephone interviews on 206 of 253 health-care workers showed that the skin lesions had decreased significantly, skin care and skin protection had improved, while the frequency of reported hand washing was reduced. A significantly positive impact on quality of life was also observed [27].

With respect to secondary prevention of HE, valid randomised clinical trials are lacking. Treatments are often used without differentiation between HE subtypes, and only a few clinical studies have identified subtypes [28-33]. According to morphology and aetiology, HE can be divided in the following subtypes: allergic contact dermatitis (ACD), irritant contact dermatitis (ICD), atopic HE (AHE), vesicular HE, hyperkeratotic and discoid HE. Combinations of the subtypes exist of which ACD and ICD are the most common followed by AHE and ICD [33]. In order to establish an effective prevention programme it is necessary to understand the aetiology of HE. In a Danish study on patients with OHE,
irritant contact dermatitis was found to occur more frequently than allergic contact dermatitis [34]. This was also found in a recent German study on geriatric nurses from nursing homes and home care facilities [35] and in a study on 1301 health-care workers from 1995 [36]. On the contrary, an English study on nurses with OHE found that allergic contact dermatitis was more common [37]. Previous studies indicate that the patient’s knowledge of the disease (HE) is important for the prognosis of the disease [38, 39].

The effect of a prevention programme consisting of a combination of classification of HE and individual, work-related counselling in skin protective behaviour, has not yet been investigated in Denmark. The HET trial is the first trial on secondary prevention that is individually randomised and stratified according to hospital (the three different hospitals involved), profession (physicians compared to nurses, nursing aids, and biotechnicians), and Hand Eczema Severity Index (HECSI) score.
METHODS and DESIGN

Trial participants
The trial participants are identified through a self-administered questionnaire comprising 3,181 health-care workers in three Danish hospitals in the same geographical region of the country. The questionnaire addresses the prevalence of HE, exposures and risk factors for development of HE in the different departments, duty hours, and professions. Furthermore, it addresses the knowledge of skin-protective behaviour among the health-care workers.

Inclusion criteria
- Participants who answered “yes” to the validated question “Have you had hand eczema within the past twelve months?”
- Informed written consent

Exclusion criteria
- Pregnancy
- Systemic use of immunosuppressive drugs
- Systemic use of retinoids
- Active psoriatic lesions on the hands
- Any serious medical condition which, in the opinion of the investigator, may interfere with the evaluation of the results
- Lack of informed written consent
Design

HET is a randomised, observer-blinded parallel trial. All included participants are clinically examined at the beginning and at the six months follow-up in the trial. Half of the participants will be randomised to the experimental intervention, the other half to the control intervention consisting of no intervention. The participants in the experimental group will, after the first clinical examination, pass on directly to the intervention which includes an allergological examination (patch and prick testing). Three days later they will be examined by a physician who will interpret the patch test and give a thorough, individual guidance in skin protection and occupational safety. The clinical examination of all participants at six-months follow-up will examine the outcomes in the intervention and the control group (Figure 1).

Randomisation

Randomisation will be individual and performed centrally at the Copenhagen Trial Unit (CTU) according to a computer generated allocation sequence with a block size unknown to the investigators. After a clinical examination, an investigator will contact the CTU by telephone and the CTU staff will randomise the participant to intervention or control group. The participants in the intervention group will then pass on directly to the intervention and they will be told not to share knowledge during the investigation. The percentage of participants allocated per intervention will be 50:50. Randomisation will be stratified according to three factors: hospital (the three hospitals involved), profession (physicians compared to nurses, nursing aids, and biotechnicians), and HECSI score at entry (HECSI <8 versus HECSI ≥ 8).
Detailed description of the experimental intervention

A self-administered questionnaire was distributed to all nurses, physicians, nursing aids, and laboratory technicians in three Danish hospitals, 3,181 individuals in all. The questionnaire was based on a standardised questionnaire for work-related skin diseases and exposure—the Nordic Occupational Skin Questionnaire (NOSQ-2002) [38]. Wherever needed questions were modified to the hospital environment. The questionnaire was distributed electronically by email and those who did not respond were sent a paper version.

The questionnaire investigates the prevalence of HE among health-care workers and the risk factors/exposures (amount of hand washing, use of hand disinfectants, protective gloves, emollients, etc) related to different hospital wards (medical, surgical, in- and out patient wards), duty hours, working procedures, and professions. The participants with HE were asked about self-evaluated disease severity and knowledge of skin protection was evaluated through multiple choice questions. Questions on domestic exposures as well as allergic and atopic dispositions were also posed.

The questionnaire identified 398 individuals who answered “yes” to the question: “Have you had hand eczema within the past year?”[40]. These individuals will be invited by a personal letter to a clinical examination which will focus on disease severity, self-evaluated disease severity, registration of eruptions through the past quarter, and quality of life. Disease severity will be measured by the use of the HECSI score, which is a validated scoring system including scoring of erythema, infiltration, vesicles, fissures, scaling and oedema [41] as well as scoring of the size of the affected area. The HECSI score ranges
from 0 (no HE) to 360 (maximum degree of HE). Self-evaluated disease severity will be reported by the participants by use of a validated photographic guide [42]. Number of eruptions through the past quarter will be reported as the number given by the participant. Quality of life will be registered by use of Dermatology Life Quality Index (DLQI) [43, 44], a validated dermatology-specific questionnaire, which has previously proved useful for assessment of quality of life in patients with HE [10, 45]. Skin protective behaviour will be studied by specific questions developed from a skin protection programme [46] and through information withdrawn from the questionnaire about daily handwashing, use of hand disinfectants, protective gloves, and emollients.

The person responsible for the clinical examination is a health-care person who has received training in the use of HECSI-score by a dermatologist. The time burden of the clinical examination is fifteen minutes.

After the clinical examination the participants are randomised to the intervention or the control group. The participants in the intervention group will pass on directly from the clinical examination to the intervention. They will be tested with a patch test (allergens: nickel sulfate, wool alcohols, neomycin sulfate, potassium dichromate, caine mix, fragrance mix, colophony, paraben mix, negative control, balsam of peru, ethylenediamine dihydrochloride, cobalt dichloride, p-tert-butylyphenol formaldehyde resin, epoxy resin, carba mix, Black Rubber mix, Cl+ Me- isothiazolinone, quaternium-15, mercaptobenzothiazole, p-phenylenediamine, formaldehyde, mercapto mix, thimerosal, thiuram mix, chlorhexidine digluconate 0.5%, primin 0.01% petrolatum, sesquiterpene lactone mix 0.1% petrolatum (pet), budesonide 0.01% pet, tixocortol pivalate 0.1% pet, hydroxyisohexyl-3-cyclohexene carboxaldehyde 5% pet, methylidibromo glutaronitrile 0.5% pet, fragrance mix II 14% pet) and a prick test (Alk-Abello soluprick standard series, chlorhexidine 0.5%, latex) for relevant allergies that could
explain the presence of HE. Patch and prick tests will be performed by a nurse. The time burden is fifteen minutes for the patch and prick testing.

Three days after application of the patch tests, a physician will interpret the patch test and subtype the HE diagnosis. The participants will demonstrate how they apply an emollient on their hands by use of a fluorescent lotion and UV-light (GlitterBug Potion) to detect areas where the lotion is not properly applied. Thereafter the emollient is washed off, and the investigator will register how the handwashing is performed by the participant. Correct instructions in handwashing/appliance of emollients will be given thereafter as well as individual, thorough counselling in occupational safety and skin protection based on a skin care programme [46] and individual information on protective behaviour. The time burden will be 20-30 minutes.

Any participant who presents in the trial with severe HE that needs medical treatment will be prescribed with moisturizers or local corticosteroids depending on severity. For further therapy, if needed, the participants will be referred to their general practitioner.

**Detailed description of the control intervention**

The participant in the control group will undergo the questionnaire assessment as well as the initial clinical examination including HESCI score assessment.

Any participant who present in the trial with severe HE that needs medical treatment will be prescribed with moisturizers or local corticosteroids depending on severity. For further therapy, if needed, the participants will be referred to their general practitioner.
After the six-month follow-up individual counselling and patch and prick test will be offered to the control participants.

**Concomitant medications**

Medication *not permitted* during the trial:

- Systemic immunosuppressive drugs (such as azathioprine, cyclosporine, or prednisolone).
- Systemic retinoids.

Medication *permitted* during the trial:

- Local immunomodulators (such as corticosteroids, pimecrolimus, or tacrolimus).
- All other medication that does not affect the immune system including rescue medication.

**Monitoring for participant compliance**

Participant compliance will not be monitored during the intervention period.

**Follow-up at six months**

All participants from the intervention group and the control group will have a clinical examination with registration of disease severity, self-evaluated disease severity, registration of eruptions through the past three months and quality of life by using the same instruments as mentioned at entry into the trial. Both groups will have a new questionnaire including multiple choice questions about knowledge of skin protection and questions on skin protective behaviour. The questions will be identical to those asked at entry to the trial.
After the clinical follow-up examination, the participants from the control group will be offered allergological patch test (European Standard Series; TRUE Test Panel 1 and 2 and chlorhexidine) and prick test (standard test, chlorhexidine and latex) applied by a nurse. Three days after appliance a physician will interpret patch test results, classify HE and give advise regarding relevant allergies, skin protection, and occupational safety.

**Blinding**

The trial is observer blinded and involves three investigators. Investigator 1 (the outcome assessor) is responsible for the clinical examination at entry and follow-up and will, together with the statistician, be the only blinded persons in the trial. The randomisation and allocation will not be done until after the first clinical examination, and the participants will be told not to share information with investigator 1 at follow-up. Investigator 2 (a nurse) will be responsible for patch and prick tests at entry and follow-up. Investigator 3 (a physician) will be responsible for subtyping the HE, interpreting the patch test at entry and follow-up and counselling of the intervention group at entry, and the control group at follow-up. Investigator 3 will be administrating the interventions and assessing the secondary outcomes.

As randomisation is individual, there is a risk of sharing knowledge among the participants. To minimise this problem, the participants will be told not to share knowledge with colleagues during the trial.

**Intervention accountability**

All necessary materials and tools will be handled as prescribed.
**Trial conduct**

The trial will be conducted in compliance with the protocol approved by the Danish Data Protection Agency and the local ethics committee. No deviation from the protocol will be implemented without prior review and approval of these authorities.

**Trial objectives**

The HET trial is based on the complex intervention of precise classification of HE, allergological investigation, and individual counselling compared with a control group receiving no intervention.

**Efficacy variables**

The effects that are to be assessed in the trial are the following:

**Primary outcome**

Objective blinded assessment of disease severity (HE), measured as the difference in HECSI-score at follow-up minus the HECSI-score at time entry.

**Secondary outcomes**

Subjective assessment of disease severity (HE), measured by use of a photographic guide, at follow-up minus at entry.

Number of eruptions registered by the participant through the past three months of the trial at follow-up minus at entry.
Knowledge of skin protection measured as numbers of points achieved in a repeated multiple choice questionnaire on skin protection at follow-up minus at entry.

Skin protective behaviour measured as number of daily handwashing and use of hand disinfectants and emollients at follow-up minus at entry. Skin protective behaviour will also be measured as number of correct answers according to questions developed from a specific skin care programme at follow-up minus at entry.

Quality of life will be measured as number of points scored in the Dermatology Life Quality Index at follow-up minus at entry.

**Adverse events**

Any undesirable event occurring to a participant during a clinical trial, whether or not related to the trial, is considered to be an adverse event.

Since no drugs are used in the trial, the only expected adverse events are unexpected reactions to patch and prick tests. These can be allergic and eczematous reactions with redness of the skin, vesicles, itching, and urticaria. However, these symptoms can be present as a normal, positive response to patch and prick testing. If the reactions are severe and long lasting with involvement of skin areas other than the tested areas, it will be considered as an adverse event.
Systemic reactions are rare and can be asthma, pruritic eyes, nose or pharynx, generalised pruritus, sneezing, and generalised urticaria [47]. Anaphylactic reaction is extremely rare [48] and will be reported as a serious adverse event. Adverse and serious adverse events will be reported in compliance to the ethics committee requirements.

**Serious adverse events**

Any serious adverse event will be registered. These include any experience that suggests a medically significant hazard including any event that: results in death; is life threatening; requires inpatient hospitalisation; results in persistent or significant disability/incapacity; is a congenital anomaly/birth defect.

**Recording of adverse events**

At six months, all adverse events either observed by the investigator or reported by the participant will be recorded in the participants file by the investigator and evaluated. Following variables will be recorded: description of event, onset and end of event, severity, relation to intervention product, action taken and outcome.

**Type and duration of the follow up of participants after adverse events**

Any adverse event occurring during the trial will be treated according to established standards and the participant will be followed until the event has disappeared or until the condition has been stabilised.
Ethical considerations

The intentions with the experimental intervention are to improve behaviour and knowledge of skin protection among health-care workers in order to prevent HE in this population. No drugs will be used in the trial and the participants are not put on any unacceptable level of risk and there are no perceived harms connected to the trial other than disadvantages correlating to patch and prick testing described above. Patch and prick testing are established diagnostic procedures that are used in daily practise in dermatological clinics and departments.

All participants are offered a standard allergological investigation to detect relevant allergies that can have an impact on HE. However, participants in the intervention group will be allergologically tested at entry to the trial, and participants in the control group will be tested after follow-up. Thus the participants in the control group are allergologically diagnosed six months later than the intervention group, and this is considered to be the main ethical dilemma in the trial. During the intervention period the participants in the control group do not know if they are allergic, and therefore might not avoid the relevant allergens. This can have a negative impact on the eczema, but it will not differ from the conditions before onset of the trial. We do, however, consider that the collective advantages exceed the disadvantages for the population as a whole. By the end of the trial all participants have been treated equally. In Denmark there are at present no standard procedures or standard treatments when it comes to patients with HE, and the participants in the control group are not considered to be treated worse than ‘usual standard care’. HE patients are followed by general practitioners, dermatologists in private practise, or dermatological departments. In general practise, allergological investigations are not done.
In dermatological practise or departments allergological testing is usually done depending on the patient’s history, the severity of the eczema, and treatment response. The treatment usually includes avoidance of wet work and irritants, use of emollients, and prescription of topical corticosteroids. Other treatments that can be used for HE include topical calcineurin inhibitors, oral steroids, azathioprine or cyclosporine, ultraviolet (UV) radiation, psoralene and UV-A radiation, alitretinoin, and retinoids.

**Participant information and informed consent**

This HET protocol has been approved by the local Ethics Committee. All participants considered for this trial will be provided with written and oral information on the trial so that the participants can make an informed decision about their participation in this trial. The consent form will be signed by the participant and the investigator seeking the consent.

**Data collection**

Data will be registered directly in standardised paper record forms at each visit by investigator 1, 2 and 3. All data from the paper files will be registered electronically in SPSS. This will be done manually by double data entry performed by the investigators:

At entry to the trial, all participants will have three coded case record forms to be used by investigator 1, 2 and 3. At follow-up, three new coded case records will be used.

**Participant withdrawal**

The participants are free to withdraw his/her informed consent from the trial at any time without effecting future treatment. All participants who enter the trial will be accounted for in the report, whether or not they are included in the analysis. All reasons for exclusion
from analysis will be documented. Participants who do not attend the follow-up visit will be identified and a letter will be sent containing a questionnaire on reasons for drop out and its relationship to treatment and outcome, on number of eruptions, subjective severity assessment, quality of life, knowledge of skin protection, and skin protective behaviour. The questions will be identical to the questions asked at the clinical examination supplemented by questions on skin protective behaviour for the participants in the intervention group. If the participant does not respond to the letter, they will be contacted by telephone and asked to take part in a telephone interview by investigator 1. The telephone interview will include the same questions as in the letter. Information on objective severity assessment cannot be obtained since that demands a clinical examination. Subjective severity assessment can only be obtained by the use of the photographic guide that will be distributed in a letter.

**Sample size estimation**

The clinical trial is planned to include a minimum of 262 participants. The sample size calculation is based on the mean HECSI score (primary outcome) after six months, which is expected to be 10 in the intervention group and 14 in the control group. Alpha error level is 5% and beta error level is 20%. With the standard deviation of 13 on the HESCI score, the sample size calculation is 131 each intervention group.

(\text{http://www.dssresearch.com/toolkit/sscalc/size_a2.asp}).

Since the prevalence of HE is approximately 10% in the health-care worker population, 3181 health-care workers were invited to participate in the questionnaire survey. This was the number of employed health-care workers (doctors, nurses, nursing aids and
biotechnicians) in the three included hospitals. The results of the survey identified 398 health-care workers with HE during the past year. All 398 health-care workers are invited to join the trial. We do, however, not expect that all invited HCW will participate. The time span between the survey and the clinical trial is five months and there will be a natural drop out among the invited health-care workers.

**Statistical methods and significance**

Statistical analysis will be performed in SPSS. Comparisons of quantitative exposures between different working conditions will be analysed using the Mann-Whitney test. Non-parametric statistics (Mann-Whitney test) will be used to compare independent groups. Changes between matched data over time (6 months) will be analysed through McNemar’s test for dichotomy variables and test of marginal homogeneity will be used for ordinal data. The significance level will be a p value ≤ 0.05.

The number of participants included in the statistical analyses will be reported. We intend to conduct intention-to-treat analyses.

A trained statistician will guide in the statistical aspects of the trial, and all data analyses will be conducted with the statistician blinded for intervention groups.

**Accountability procedure for missing data/population for analysis**

An analysis of dropouts will be made to describe the demographic data of the population. The analysis will be used to compare the drop outs with the participants and investigate whether the two groups differ in demographic conditions. If more than 5% of the data is
missing, multiple imputation will be performed if data are not missing completely at random.

**Direct access to source data and documentation**

The trial is not planned to be monitored by any other authority than the investigators. If a relevant authority, as the Danish Research Ethics Committee System or the Danish Data Protection Agency, plan to inspect the trial, all data and files will be available for inspection in accordance with the GCP guidelines.

**Data handling and record keeping**

Data will be handled and recorded in case record forms and kept in records marked with investigator number, patient identification number, name of hospital, and time. After follow-up all the case report forms from each participant will be collected in individual files. Any change in the files or case report forms will be documented with date and signature of the investigator.

Data from the records will be registered electronically in SPSS for statistical analyses. This will be done manually. Records will be archived for at least five years after termination of the trial.

**Quality control and quality assurance**

To ensure that the trial is conducted and reported in compliance with this protocol, the data will be monitored internally and externally. The investigators will monitor the data and check for systematic errors. All data will be registered in paper record forms and kept at an
investigator file site only available for the investigators. The data will be registered electronically by the investigators using double data entry. A random 5% of the data will be monitored by the investigators. Data will be handled with confidentiality.

**Trial organisation**

The trial takes place in three hospitals in Region Zealand who has provided the participants and localities for investigation. The Danish Working Environment Authority has been involved in the creation of the questionnaire.

The investigators are responsible for the protocol, conducting of the trial, and all other aspects involved.

**Finance and insurance**

The trial is financed by the Danish Working Environment Authority and Region Zealand Health Scientific Research Foundation who cover all expenses related to the trial. The participants in the study are covered by their work insurance and the patient insurance (Patientforsikringen: http://www.patientforsikringen.dk/en.aspx)

**DISCUSSION**

The overall purpose of the HET trial is to develop new strategies for secondary prevention of HE in health-care workers. The trial focuses on HE among nurses and nursing aids who account for almost 25% of recognized OHE in Denmark.
The project will assess exposures that can lead to OHE in hospitals and relate them to different wards, duty hours, and professions. It also focuses on the knowledge of skin protection and skin protective behaviour in health-care workers, which may make it possible to improve preventive strategies.

The project will also investigate the aetiology of HE in health-care workers. Aetiology and assessment of exposures in health-care workers are important factors for focused prevention of HE in the future. This combined with individual, focused counselling could make a basis for a new strategy in prevention of HE in health-care workers.

We have designed the HET trial in order to reduce the risks of systematic errors (‘bias’), random errors (‘play of chance’), and design errors to a minimum [49-51]. The risks of bias have been sought reduced by conducting central randomisation stratified for important prognostic factors. Furthermore, we employ blinded assessment of the primary outcome measure and will analyse our data with ‘intention to treat’. We are aware of the fact that the secondary outcome measures are at risk of being assessed with some bias favouring the experimental intervention. The risk of random error has been reduced by basing our sample size estimation on conservative estimate regarding the minimal relevant difference between the control and experimental group.

Randomised trials on complex interventions need proper description of the interventions, both before the launch of the trial as well as after the conduct of the trial [52]. In the present article we describe how we intend to apply the interventions in the experimental group and the control group. We will at the six month follow up collect information on how
the interventions have been administered in the two intervention groups, making it possible for us to ascribe any significant differences regarding the primary outcome to the interventions provided. Any significant differences regarding the secondary outcomes ought to be interpreted conservatively, first because they will be assessed without blinding and second because they may be due to random errors.
LIST OF ABBREVIATIONS

HE; hand eczema, OHE; occupational hand eczema, ACD; allergic contact dermatitis, ICD; irritant contact dermatitis, AHE; atopic hand eczema, HECSI; Hand Eczema Severity Index, DLQI; Dermatology Life Quality Index, CTU; Copenhagen Trial Unit, BGW; Berufsgenossenschaft fur Gesundheitsdienst und Wohlfahrtspflege, TEWL; transepidermal water loss.

COMPETING INTERESTS

The authors declare that they have no competing interests.

AUTHORS’ CONTRIBUTIONS

KI and TA are responsible for the design of the trial. KI is responsible for the protocol and for drafting the manuscript. The coordinating and principle investigator of the trial is KI. JLH and CG have contributed with important intellectual revision of the design of the trial and protocol, including statistical and ethical aspects. All authors have read and approved the final manuscript.

ACKNOWLEDGEMENTS

Special thanks to:

Gregor Borut Ernst Jemec, Dept. of Dermatology in Roskilde University Hospital, Denmark, for intellectual sparring and provision of materials essential for the trial.

Thomas L Diepgen and his research team, Dept. of Social Medicine, Occupational and Environmental Dermatology, University Hospital in Heidelberg, Germany, for valuable advice in questionnaire and trial design. Mari-Ann Flyvholm, National Research Centre for
the Working Environment, Denmark, for valuable advice in questionnaire design. Basilea Pharmaceuticals for providing the original photographic guide for this trial. Region Zealand Health Scientific Research Foundation and The Danish Working Environment Authority for financial support of the trial.
REFERENCES:


4. [www.ask.dk](http://www.ask.dk). Statistics on occupational diseases in Denmark


15. Pedersen LK, Held E, Johansen JD, Agner T: *Short-term effects of alcohol-based disinfectant and detergent on skin irritation.* *Contact Dermatitis* 2005, 52 (2): 82-87


28. Veien NK, Menne T: Treatment of hand eczema. *Skin Therapy Lett* 2003, **8**: 4-7


44. Finlay AY, Khan GK: *Dermatology Life Quality Index (DLQI) – a simple practical measure for routine clinical use.* *Clinical and Experimental Dermatology* 1994, 19: 210-216


Figure 1: Trial flow chart
Invited to participate in survey
N=3181

Participants in survey
N=2269

Participants with hand eczema within the last year = 398
invited to participate in the hand eczema trial
N=398

Participants included
N=?

T=0
- Disease severity (HECSI)
- Selfevaluated disease severity
- Number of eruptions
- Qol (DLQI)
- Skin protective behaviour
- Knowledge on skin protection

Randomisation

Intervention group
N=?

T=0
- patch test
- prick test
N=?

T=0 + three days
- subtype the HE diagnosis and
- interpret the patch test.
- demonstrate hand washing
- demonstrate appliance of emollients
- individual, thorough counselling
- skin care programme
N=?

T=6 months (follow-up)
- clinical examination
- knowledge of skin protection and
- skin protective behaviour
N=??

Control group
N=?

T=0
- patch test
- prick test
N=?

T=6 months (follow-up)
- patch test
- prick test
N=?

T=6 months + three days
- subtype the HE diagnosis and
- interpret the patch test
- skin care programme
N=??

Figure 1
The Hand Eczema Trial (HET): results of a randomised clinical trial of skin care education and individual counselling versus treatment as usual in health-care workers with hand eczema

Ibler KS\textsuperscript{1,2}, Jemec GBE\textsuperscript{1}, Diepgen TL\textsuperscript{3}, Gluud C\textsuperscript{4}, Hansen JL\textsuperscript{4}, Thomsen SF\textsuperscript{2}, Agner T\textsuperscript{2}

\textsuperscript{1} Department of Dermatology, Roskilde Hospital, Health Science Faculty, Roskilde, Denmark
\textsuperscript{2} Department of Dermatology, Bispebjerg Hospital, Health Science Faculty, Copenhagen, Denmark
\textsuperscript{3} Department of Social Medicine, Occupational & Environmental Dermatology, University of Heidelberg, Germany
\textsuperscript{4} Copenhagen Trial Unit, Centre for Clinical Intervention Research, Rigshospitalet, Copenhagen University Hospital, Denmark

Author : Kristina Sophie Ibler
(corresponding) MD, Ph.D.-student
Department of Dermatology
Roskilde Hospital, Health Science Faculty
Køgevej 7-13, 4000 Roskilde, Denmark
Email: kristinaibler@hotmail.com

Co-authors:
Tove Agner
MD, DM science
Department of Dermatology,
Bispebjerg Hospital, Health Science Faculty
Bispebjerg Bakke 23, 2400 Copenhagen, Denmark
Email: t.agner@dadm.net.dk

Gregor BE Jemec
Prof., MD, DM Science
Department of Dermatology
Roskilde Hospital, Health Science Faculty
Køgevej 7-13, 4000 Roskilde, Denmark
Email: GBJ@regionsjaelland.dk

Thomas L Diepgen
Prof., MD, Ph.D.
Department of Social Medicine
Occup., & Environmental Dermatology
University of Heidelberg, Germany
Email: thomas.diepgen@med.uni-heidelberg.de

Christian Gluud
MD, DM Science, Associate Professor
Copenhagen Trial Unit
Centre for Clinical Intervention Research
Rigshospitalet, Copenhagen University Hospital,
Blegdamsvej 9, 2100 Copenhagen, Denmark
Email: cgluud@ctu.rh.dk
Jane Lindschou Hansen  
MSc Demography and Health  
Copenhagen Trial Unit  
Centre for Clinical Intervention Research  
Rigshospitalet, Copenhagen University Hospital,  
Blegdamsvej 9, 2100 Copenhagen, Denmark  
Email: JLH@ctu.rh.dk

Simon Francis Thomsen  
MD, Ph.D.  
Department of Dermatology,  
Bispebjerg Hospital, Health Science Faculty  
Bispebjerg Bakke 23, 2400 Copenhagen, Denmark  
Email: sft@city.dk
Title:
The Hand Eczema Trial (HET): results of a randomised clinical trial of skin care education and individual counselling versus treatment as usual in health-care workers with hand eczema.

Authors:
Ibler KS, Jemec GBE, Diepgen TL, Gluud C, Hansen JL, Thomsen SF, Agner T

Corresponding author:
Kristina Sophie Ibler
MD, Ph.D.-student
Department of Dermatology
Roskilde Hospital, Health Science Faculty
Køgevej 7-13, 4000 Roskilde, Denmark
Email: kristinaibler@hotmail.com
ABSTRACT

Objectives To evaluate the effect of a secondary prevention programme including skin care education and individual counselling versus treatment as usual in health-care workers with hand eczema.

Trial design Randomised, observer-blinded parallel group superiority clinical trial. Randomisation was conducted centrally and stratified for profession, severity of hand eczema and hospital.

Setting Secondary prevention programme conducted in three Danish hospitals.

Participants We included 258 out of 397 (65%) health-care workers with self-reported hand eczema within the past year from 2269 surveyed health-care workers. Of the included participants, 8 were excluded from the trial due to pregnancy (n=2), oral use of corticosteroids (n=1), and loss before entry (n=1) and at follow-up (n=4).

Interventions The experimental group received education in skin care and individual counselling based on patch and prick testing and exposure assessment plus treatment as usual if needed. The control group received no intervention or treatment as usual if needed.

Main outcome measures The primary outcome was change in clinical severity measured by Hand Eczema Severity Index (HECSI-score) from onset to five months follow-up. Secondary outcomes were change in the Dermatology Life Quality Index (DLQI), self-evaluated severity, skin protective behaviour and knowledge of hand eczema from onset to follow-up.

Results A total of 123 participants were randomised to the experimental group and 132 to the control group. Follow-up data were available for 247 of 255 participants (97%). The HECSI-score decreased significantly in the experimental group (mean change of -2.98
points from entry to follow-up (from 9.08 to 6.10), 95% CI (-1.59 to -4.36), P<0.001) compared with no significant change in the control group (-0.188 (from 9.50 to 9.69), 95% CI -1.73 to 1.36, P=0.81). The absolute difference in mean HECSI-score between the groups at follow-up was 3.03, 95% CI (1.01 to 5.06), P=0.003. The DLQI decreased significantly in the experimental group (mean change of -0.81 points (from 2.84 to 2.03), 95% CI (-0.30 to -1.31), P=0.002 compared with an insignificant increase in the control group (-0.02 (2.84 to 2.86), 95% CI (-0.50 to 0.45), P=0.92). The absolute difference in mean DLQI-score between the groups at follow-up was 0.87, 95% CI (0.18 to 1.55), P=0.014. Self-evaluated severity and skin protective behaviour by terms of hand washings, use of moisturisers and wearing of protective gloves all improved significantly in the experimental group compared with the control group whereas knowledge of hand eczema did not change significantly.

**Conclusion** This is the first randomised clinical trial which finds that a secondary preventive programme of skin care education and individual counselling based on allergy test is effective in health-care workers with hand eczema. Implementation of preventive programmes in the health-care sector is extremely important since health-care workers constitute the majority of occupational hand eczema which is related to high societal costs by terms of increased sick leave, rehabilitation and early retirement.

**Trial registration and funding** The trial was registered in ClinicalTrials.Gov, NCT01012453 and approved by the Danish Research Ethics Committee System for Region Zealand, registration number SJ 126. The trial was funded by Region Zealand’s Research Fund and The Danish Working Environment Research Fund.
INTRODUCTION

Hand eczema is a common problem among health-care workers. In 2007, almost one third of the health-care workers in a Danish hospital reported hand eczema during the past year. In 2009, skin diseases accounted for one third of the recognized occupational diseases in Denmark, and the societal costs related to the disease are extensive. Preventive programmes have been introduced in certain work places and are known to be effective as primary prevention for wet work occupations, i.e., health-care workers, hairdressers, gutcleaners and cheese dairy workers. In contrast, the evidence for secondary prevention programmes is more limited, perhaps due to the complexity of the necessary intervention. Multidisciplinary intervention programmes with several clinic visits have been introduced in secondary prevention of hand eczema in health-care workers. However, these programmes have not been introduced based on randomised clinical trials.

The aim of the present Hand Eczema Trial (HET) trial is to evaluate the effect of a simple secondary preventive programme consisting of skin care education and individual counselling regarding work related and domestic exposures and contact allergies among health-care workers. The HET trial represents the first individually randomised and observer-blinded trial on secondary prevention of health-care workers.

METHODS

The randomisation of participants took place between October 2009 and February 2010 in three geographically closely situated hospitals in Denmark. Informed written consent was obtained from each participant. The trial was registered in ClinicalTrials.Gov, NCT01012453, and it was approved by the Danish Research Ethics Committee System for
Region Zealand, registration number SJ 126. A detailed description of the trial design is published elsewhere\textsuperscript{15}.

**Trial participants**
The trial participants were identified from a survey of 3,181 health-care workers in the three hospitals, and the inclusion criteria was an affirmative answer to the formerly validated question “Have you had hand eczema during the past twelve months?”. Exclusion criteria were pregnancy, systemic use of immunosuppressive drugs or retinoids, psoriatic lesions on the hands, any serious medical condition that could influence the results, and lack of informed written consent.

**Survey**
In March 2009, a self-administered questionnaire was distributed to all nurses, physicians, nursing aids and laboratory technicians in the three hospitals; 3,181 individuals in all. The questionnaire investigated the prevalence of hand eczema and its relation to exposures and risk factors, hospital wards, duty hours and professions. Measures on self-evaluated disease severity were obtained by use of a validated photographic guide and knowledge of skin protection was measured by use of a multiple choice test\textsuperscript{16}. Domestic exposures and allergic and atopic dispositions were also explored. 2,274 responded to the questionnaire (71%) and among the respondents, 21% reported hand eczema within the past year.

**Design**
All included participants were clinically examined at entry into the trial, and information about baseline variables were obtained by a nurse just before randomisation. The examination included scoring of severity, self-reported severity assessment (by use of a photographic guide), quality of life, number of eruptions during the past three months, questions on preventive measures (use of protective gloves, moisturisers and disinfectants) and knowledge of hand eczema. Immediately after the examination, all participants were randomised individually to the experimental group or to the control group (no intervention or treatment as usual). The participants in the experimental group were subsequently patch and prick tested, and three days later, reading of the patch test and individual counselling was done by a trained physician (see details later). Experimental participants were offered ‘treatment as usual’ if needed. The participants in the control group received no further treatment in the trial, but were offered ‘treatment as usual’ if needed, and no restrictions were given regarding past or future management of hand eczema.

At follow-up after 5 months, all participants were clinically examined and the outcome measures were obtained by the same nurse as at onset in an observer-blinded fashion. According to the protocol, follow-up was supposed to take place 6 months from entry. However, the follow-up time was 5 months due to logistic and seasonal reasons. Firstly, the inclusion lasted longer than expected, and secondly, we wanted to evade the possibility of an improving effect of increased UV-radiation and humidity on eczema during summertime. Figure 1 shows the trial flow chart.

Randomisation
Randomisation was performed individually and centrally via telephone to the Copenhagen Trial Unit (CTU). For allocation concealment, a computer generated allocation sequence with a block size of 10 was used. The block size was unknown to the clinical investigators. The randomisation was stratified according to hospital (the three hospitals involved), profession (physicians compared with nurses, nursing aids, and biotechnicians) and severity of hand eczema (HECSI < 8 at entry compared with HECSI ≥ 8 at entry).

**Blinding**

Outcome measurements were obtained by a trained nurse who was blinded with respect to treatment allocation. It was not possible to blind the participants or the physician with respect to treatment allocation. Data entry was performed by the blinded nurse using double data entry, and the statistical analyses of the data were performed by the unblinded physician.

**Outcomes**

The *primary outcome* was defined as the difference in Hand Eczema Severity Index (HECSI) at entry compared with follow-up. The HECSI scoring system is validated and grades the intensity of erythema, induration, papules, vesicles, fissures, scaling and oedema for five areas of each hand (fingertips, fingers (except the tips), palms, back of hands, wrists) on a scale from 0-3 with the score values for each of the areas added up. The extent of affected skin of each area is graded from 0-4. The intensity and extent are multiplied and the total score ranges from 0-360\(^7\).
The secondary outcomes were the difference in Dermatology Life Quality Index (DLQI) from entry to follow-up, the difference in self-evaluated disease severity (by use of a validated photographic guide) from entry to follow-up, the differences in number of eruptions during the past three months, skin protective behaviour (preventive measures) and knowledge of skin protection from entry to follow-up (see definitions later). The DLQI scoring system is a validated dermatology-specific quality of life instrument. It is a 10-item questionnaire with a total score ranging between 0 and 30 points calculated by summing the score of each question. The higher the score, the more the quality of life is impaired. Self-evaluated disease severity was measured by use of a validated photographic guide. Skin protective behaviour (preventive measures) was measured as instances of daily hand washing and hand disinfection and use of protective gloves and moisturisers at work and at home. Knowledge of skin protection was measured as the total number of points achieved in a repeated multiple choice questionnaire with four questions on skin protection. A maximum score of 10 was obtained if all answers were correct. The minimum score was 0 points.

**Experimental group**

At entry, the participants in the experimental group were patch tested (T.R.U.E. TEST® standard series panel 1 and 2 supplemented by chlorhexidine digluconate 0.5%, primin 0.01%, sesquiterpene lactone mix 0.1%, budesonide 0.01%, tixocortol pivalate 0.1%, hydroxyisohexyl-3-cyclohexene carboxaldehyde 5%, methylidibromo glutaronitrile 0.5% and fragrance mix II 14%) and prick tested (ALK-Abello Soluprick® standard series, chlorhexidine 0.5%, latex). The patch test was removed by the participants after 48 hours. One day after removal, reading was done by a trained physician, and hand eczema was
subtyped according to allergic, atopic or irritant aetiology. In all participants, however, irritancy was considered evident due to the extensive exposure to water, detergents and occlusive gloves in the hospital environment. A history of work-related and domestic exposures was obtained. Instructions in avoidance of relevant allergens, as well as in general skin protection at work and at home were given. The participants demonstrated application of a fluorescent emollient on their hands, and UV-light was used to detect if the application was appropriate. Hand washing was observed by the physician, and the participants were recommended to use cold or lukewarm water, to wet the hands before application of the detergent and to dry the hands carefully. Wearing of rings was discouraged. Participants were instructed according to a skin protection programme by the physician, and a written version of the instruction was handed out. The participants were encouraged to replace hand washings with disinfectants when hands were not visibly dirty (according to the recommendations for the workplace), to use a fat moisturiser free of fragrances at least three times during the working hours; upon arrival, before lunch and before leaving, and also at bedtime. Use of protective gloves was recommended for wet work, while handling medications, cleaning and cooking (handling of vegetables, raw meet and fish). When the use of protective gloves was expected to exceed five minutes, it was recommended to wear cotton gloves underneath. The time spent on reading of the patch test and individual counselling was 20 to 30 minutes per participant.

If participants in the experimental group had severe hand eczema which needed medical treatment, they were advised to consult their general practitioner or dermatologist for further treatment. One participant in the experimental group was prescribed topical corticosteroids, and one was advised to visit the general practitioner or a dermatologist.
Control group

No intervention was given to the participants in the control group. If participants in the control group had severe hand eczema which needed medical treatment, they were advised to consult their general practitioner or dermatologist for further treatment. Two participants in the control group were prescribed topical corticosteroids, and one was advised to visit the general practitioner or a dermatologist.

Sample size estimation

The superiority trial was planned to include a minimum of 262 participants. The sample size calculation was based on the expected mean difference of 4 in HECSI score between the experimental group and the control group at follow-up (10 versus 14). The alpha error level was 5% and the beta error level was 20%. With the standard deviation of 13 on the HESCI score, the sample size calculation was 131 each intervention group.

Statistics

All statistics were calculated using PASW statistics 18 version 18.0.0 (SPSS Inc., Chicago, IL, U.S.A.). Unpaired t-test was used when comparing unpaired data and paired t-test for paired data. A two sided P-level < 0.05 was considered significant.

RESULTS

397 health-care workers with self-reported hand eczema during the past year were invited to participate in the trial. Of these, 255 (64%) participated. The 142 health-care workers
who did not participate in the trial were contacted by email and telephone and asked about reasons for not participating, and 102 (72%) responded. No wish to participate was reported by 66 of 102 (65%), pregnancy by 15 (15%), change of job or having moved by 13 (13%), lack of time by 4 (4%), immunosuppressive drugs 3 (3%), one was on long term sick leave, and one had died. A total of 123 were randomised to the experimental group (I) and 132 were randomised to the control group (C) figure 1 (flow chart of the trial).

Characteristics of the experimental group and the control group
The two groups were randomised according to hospital, profession and clinical scoring of severity. Descriptive data of the two groups at entry of the trial is shown in table 1.

Discontinuation
Follow-up data were available for 247 of the 255 (97%) participants. In the experimental group, 122 of 123 participants received the intervention as planned (one did not show up for the intervention). At follow-up, two were excluded due to pregnancy, and one did not show up. In the control group, one was excluded due to systemic use of corticosteroids and three participants did not show up at follow-up.

HECSI score
A significant decrease in HECSI score was found in the experimental group with a mean change of 2.98 points from entry to follow-up (P<0.001). In the control group, the mean HECSI-score did not change significantly (table 2). The absolute difference in the mean HECSI-score between the two groups after 5 months was significantly higher in the experimental group compared with the control group (P=0.003) (table 2).
To investigate if the primary outcome was unaffected by the 8 dropouts (4 in the experimental group and 4 in the control group) we conducted a sensitivity analysis by performing imputation. A worse-best scenario was created with four extra participants in the experimental group with worsening of hand eczema at follow-up (2 points increase in HECSI), and with four extra participants in the control group with improvement of hand eczema at follow-up (2 points decrease in HECSI). The absolute difference in the mean HECSI-score between the two groups after 5 months was still significantly higher in the experimental group compared with the control group (P=0.05).

**DLQI score**

The DLQI-score decreased significantly in the experimental group from entry to follow-up (P=0.002). In the control group, the DLQI did not change significantly (table 2). The absolute difference in DLQI-score at follow-up was significantly higher in the experimental group compared with the control group (P=0.014) (table 2).

**Self-evaluated disease**

A significant decrease from entry to follow-up in severity score was found in the experimental group (P<0.001). In the control group, the severity-score did not change significantly (table 2). The absolute difference in severity-score at follow-up was significantly higher in the experimental group compared with the control group (P=0.003) (table 2).

**Number of eruptions during the past three months**
Number of eruptions proved to be an inadequate outcome measure in our trial, since 41 participants reported "constant hand eczema" in stead of quoting a number of eruptions, making it impossible to calculate any differences.

**Skin preventive measures at work**

**Hand washing**
A decrease in instances of hand washings from entry to follow-up was found in the experimental group (P<0.001). In the control group, the mean instances of hand washings did not change significantly (table 2). The absolute difference in instances of hand washings at follow-up was statistically significantly higher in the experimental group compared with the control group (P=0.001) (table 2).

**Disinfectants at work**
The use of disinfectants increased significantly from entry to follow-up in the experimental group (P=0.004). In the control group, the use of local disinfectants did not change significantly (table 2). The absolute difference in use of disinfectants between the two groups at follow-up was insignificantly higher in the experimental group compared with the control group (P=0.187) (table 2).

**Protective gloves at work**
The use of protective gloves at work did not change significantly in any of the groups from entry to follow-up. At follow-up, a significantly higher rate of participants in the intervention group (7.4%) reported wearing cotton gloves compared with participants in the control
group (1.6%) (P=0.025). No significant difference in use of protective gloves at work was found between the groups (table 2).

**Moisturisers at work**

The use of moisturisers at work improved statistically significantly in both groups from entry to follow-up (table 2). The absolute difference in use of moisturisers at work between the two groups after 5 months was statistically significantly higher in the experimental group compared with the control group (P=0.023) (table 2).

**Skin preventive measures at home**

Off work, the participants in the experimental group increased statistically significantly in the use of moisturisers (P=0.034), protective gloves during cooking (P<0.001) and cleaning (P=0.008), and cotton gloves (P<0.001) compared with the participants in the control group (table 2). No significant differences in instances of hand washings at home were found between the two groups (table 2).

**Knowledge of skin protection**

In the experimental group, there was no significant change in knowledge of hand eczema from entry to follow-up, but the participants in the control group deteriorated/decreased significantly in knowledge (P=0.001) (table 2). There was no absolute significant difference between the two groups regarding change in knowledge of hand eczema at follow-up (table 2).
DISCUSSION

Principal findings
In the present randomised clinical trial with blinded outcome assessment of health-care workers with hand eczema, a simple intervention of skin care education and individual counselling with respect to exposures at work and at home and contact allergies, was found to have a statistically significantly positive effect on the primary as well as several secondary outcome measures after 5 months follow-up. The participants in the experimental group improved significantly in objective hand eczema severity and self-evaluated quality of life, and severity and preventive measures. Since hand eczema is a common occupational disease in health-care workers, these findings are of utmost importance and provide us with a step towards a solution of how to handle and prevent hand eczema in health-care workers.

Interpretation of results
The participants in the experimental group improved significantly in severity of hand eczema (33% improvement), quality of life (30% improvement) and self-evaluated severity (17% improvement) at follow-up, whereas the participants in the control group did not change significantly. The participants in the experimental group improved significantly in skin protective behaviour (preventive measures) at work reflected by decreasing instances of hand washing (17% improvement) and increasing use of disinfectants (8% improvement) and moisturisers (51% improvement). At home, they improved significantly in wearing of protective gloves while cooking (20% improvement) and cleaning (30% improvement), as well as in increasing their use of moisturisers (6% improvement). Cotton
gloves worn underneath protective gloves were used significantly more often in the participants in the experimental group than in the control group at follow-up.

**Strengths**

This is the first randomised trial which finds that skin care education and individual counselling regarding hand eczema improves the symptoms significantly in health-care workers with hand eczema within the last year. The strengths of the trial include the centrally and individually performed randomisation, the observer-blinded assessment of the primary outcome and the very high completion (97%) with only few participants lost to follow-up^{22-25}.

The randomisation was stratified according to profession, hospital and HECSI-score at entry which ensured balance between the experimental group and the control group according to these factors. The intervention was simple in design and included patch and prick testing. Counselling was performed individually and was not only restricted to exposures at work but also domestically.

**Potential weaknesses**

A number of potential participants (n=66) did not want to participate and a number were excluded for various reasons. We are of course unable to know if these groups would have responded differently to the preventive measures. Our sample size calculation estimated that we should include a total of 262 participants, but we only succeeded in including 255 participants. Critics could therefore argue that our comparison were very late interim analyses requiring more strict P values to declare
significant difference. However, the observed differences were highly statistically significant and are not likely to change by inclusion of seven extra participants. Moreover, eight patients dropped out. A worst-best imputation demonstrated that even under such extreme assumptions the prevention lead to a significant improvement compared with the control intervention.

In all three hospitals, a risk of information bias was present. To prevent information bias among the participants, those in the experimental group were individually requested not to share information with others.

Eczema is known to fluctuate with seasonal changes. Improvement is usually seen during summer and autumn due to higher levels of humidity and UV radiation. Entry data in the trial were achieved from late October 2009 to early February 2010, and follow-up data were achieved from March to May 2010. 81% of the participants were included in the trial in 2009, and 19% in 2010. Seasonal changes were therefore not considered to influence the outcomes of the trial significantly.

The trial was not monitored by an external authority. However, double data entry was performed by the observer-blinded investigator, and 50% of the data was monitored and checked for errors by an unblinded coinvestigator. The statistical analyses were performed unblinded for treatment allocation.

**Meaning of the study**
Standardised secondary prevention programmes for occupational hand eczema are implemented in some workplaces, but they are not sufficiently scientifically evaluated. In Germany, secondary individual prevention courses are established in cooperation with the Accident Prevention and Insurance Association in the Health and Welfare services and are assumed to be effective \(^{14,26,27}\). However, these programmes have never been evaluated in a randomised setting. Our trial is the first to provide high level evidence, to suggest that secondary prevention is effective in health-care workers with mild to moderate hand eczema. This is an important finding since many health-care workers are affected, and the consequences of hand eczema constitute a major impact in life \(^{12,28-31}\). Similar studies investigating the effect of a similar programme in other workplaces (i.e., among hairdressers, cleaners and kitchen assistants) with more severe eczema would be interesting in the future. However, regarding hand eczema in health-care workers, our data together with data from previous observational studies, strongly suggest the efficacy of preventive programmes.

Implementation of a preventive programme as used in the present trial in the health-care sector is considered to be cost-effective. In addition to the time spent on patch and prick testing, only one clinic visit of approximately 30 minutes at a trained dermatologist was used. Effectiveness in terms of less sick leave, less need of rehabilitation and fewer awarded disability pensions was not investigated in the present trial. Future studies with focus on these outcomes are needed to evaluate the cost-effectiveness of preventive programmes.

**Conclusion**
Our trial provides evidence that a secondary preventive programme of skin care education, and individual counselling based on allergy testing is effective and should be implemented in the health-care sector in the future. Hopefully this would improve not just the prevalence and severity of hand eczema and quality of life but also socio-economic relations in terms of less sick leave and rehabilitation in the health-care sector.
Invited to participate in survey 
n=3181

Did not participate in survey 
n=912

Participants in survey 
n=2269

No hand eczema 
n=1444

Participants with hand eczema within the last year = 397 
invited to participate in the hand eczema trial 
n=397

Participants excluded 
n=142

Participants included 
n=255

T=0
- Disease severity (HECSI)
- Self evaluated disease severity
- Number of eruptions
- Quality of life (DLQI)
- Skin protective behaviour
- Knowledge on skin protection

Randomisation

Experimental group 
n=123

Control group 
n=132

T=0
- patch test
- prick test
n=123

T=0 + three days
- subtype the HE diagnosis and interpret the patch test.
- demonstrate hand washing
- demonstrate appliance of emollients
- individual, thorough counselling
- skin care programme
n=122

T=5 months (follow-up)
- clinical examination
- quality of life
- knowledge of skin protection and skin protective behaviour
n=119

T=5 months (follow-up)
- clinical examination
- quality of life
- knowledge of skin protection and skin protective behaviour
n=128
<table>
<thead>
<tr>
<th>Score definitions</th>
<th>Experimental group</th>
<th>Control group</th>
<th>Mean score</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HECSI score</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>8.94</td>
<td>9.51</td>
</tr>
<tr>
<td>DLQI score</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>2.87</td>
<td>3.13</td>
</tr>
<tr>
<td>Self-evaluated disease severity</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>1.69</td>
<td>0.84</td>
</tr>
<tr>
<td>Hand disinfections at work</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>4.80</td>
<td>1.41</td>
</tr>
<tr>
<td>Hand washings at work</td>
<td>E: n=122</td>
<td>C: n=132</td>
<td>4.0</td>
<td>1.39</td>
</tr>
<tr>
<td>Moisturisers at work</td>
<td>E: n=122</td>
<td>C: n=132</td>
<td>2.13</td>
<td>0.91</td>
</tr>
<tr>
<td>Protective gloves at work</td>
<td>E: n=110</td>
<td>C: n=113</td>
<td>2.16</td>
<td>0.88</td>
</tr>
<tr>
<td>Protective gloves while wet work</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>2.38</td>
<td>0.75</td>
</tr>
<tr>
<td>Protective gloves while cooking</td>
<td>E: n=112</td>
<td>C: n=129</td>
<td>1.13</td>
<td>0.41</td>
</tr>
<tr>
<td>Protective gloves while Cleaning</td>
<td>E: n=113</td>
<td>C: n=128</td>
<td>1.40</td>
<td>0.69</td>
</tr>
<tr>
<td>Hand washings at home</td>
<td>E: n=122</td>
<td>C: n=132</td>
<td>2.03</td>
<td>0.86</td>
</tr>
<tr>
<td>Moisturisers at home</td>
<td>E: n=122</td>
<td>C: n=132</td>
<td>1.86</td>
<td>0.35</td>
</tr>
<tr>
<td>Knowledge of hand eczema and skin protection</td>
<td>E: n=123</td>
<td>C: n=132</td>
<td>9.41</td>
<td>1.22</td>
</tr>
</tbody>
</table>

TABLE 1: Characteristics of the participants in the experimental group (E) and in the control group (C) at enrolment.
TABLE 2: Outcomes in relation to the experimental group (E) and the control group (C).
Paired samples test of means comparing data at t=0 and t= 5 months within each group, and independent samples t-test for equality of means between the intervention group and the control group.

<table>
<thead>
<tr>
<th>Score definitions</th>
<th>E: Experimental group</th>
<th>C: Control group</th>
<th>Mean scores at follow-up (t= 5 months)</th>
<th>Mean score diff. (paired)</th>
<th>Confidence intervals 95%</th>
<th>P-value, Paired samples test</th>
<th>P-value, T-test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HECSI score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–360 (0: no hand eczema)</td>
<td>E: n=119</td>
<td>C: n=128</td>
<td>6.10</td>
<td>2.98</td>
<td>-1.357 to 1.732</td>
<td>&lt;0.001</td>
<td>0.003</td>
</tr>
<tr>
<td><strong>DLQI score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–30 (0: no affection on life quality)</td>
<td>E: n=119</td>
<td>C: n=128</td>
<td>2.03</td>
<td>0.81</td>
<td>0.301 to 1.313</td>
<td>0.002</td>
<td>0.014</td>
</tr>
<tr>
<td><strong>Self - evaluated disease severity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: mild lesions</td>
<td>E: n=118</td>
<td>C: n=128</td>
<td>1.42</td>
<td>0.28</td>
<td>0.147 to 0.412</td>
<td>&lt;0.001</td>
<td>0.003</td>
</tr>
<tr>
<td>2: moderate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: severe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: very severe</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hand disinfections at work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: none</td>
<td>E: n=117</td>
<td>C: n=127</td>
<td>5.22</td>
<td>-0.40</td>
<td>-0.672 to -0.132</td>
<td>0.004</td>
<td>0.19</td>
</tr>
<tr>
<td>2: 1-5 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 6-10 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 11-15 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: 16-20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: &gt;20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hand washings at work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: none</td>
<td>E: n=116</td>
<td>C: n=127</td>
<td>3.34</td>
<td>0.66</td>
<td>0.418 to 0.910</td>
<td>&lt;0.001</td>
<td>0.001</td>
</tr>
<tr>
<td>2: 1-5 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 6-10 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 11-15 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: 16-20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6: &gt;20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moisturisers at work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: no use</td>
<td>E: n=106</td>
<td>C: n=120</td>
<td>3.19</td>
<td>-1.09</td>
<td>-1.296 to -0.874</td>
<td>&lt;0.001</td>
<td>0.023</td>
</tr>
<tr>
<td>2: not every day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 1-2 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: &gt;2 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective gloves at work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: &lt;½ hour per day</td>
<td>E: n=99</td>
<td>C: n=107</td>
<td>2.20</td>
<td>-0.08</td>
<td>-0.275 to 0.114</td>
<td>0.412</td>
<td>0.92</td>
</tr>
<tr>
<td>2: ½-2 hours per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 2-3 hours per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 3-5 hours per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: &gt;5 hours per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective gloves while wet work</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: seldom/never</td>
<td>E: n=119</td>
<td>C: n=126</td>
<td>2.53</td>
<td>-0.17</td>
<td>-0.298 to -0.038</td>
<td>0.012</td>
<td>0.015</td>
</tr>
<tr>
<td>2: sometimes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: mostly</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective gloves while cooking</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: no use</td>
<td>E: n=102</td>
<td>C: n=117</td>
<td>1.36</td>
<td>-0.23</td>
<td>-0.346 to -0.105</td>
<td>&lt;0.001</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>2: sometimes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Protective gloves while Cleaning</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: no use</td>
<td>E: n=102</td>
<td>C: n=113</td>
<td>1.88</td>
<td>-0.44</td>
<td>-0.622 to -0.261</td>
<td>&lt;0.001</td>
<td>0.008</td>
</tr>
<tr>
<td>2: sometimes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Hand washings at home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: 1-5 times per day</td>
<td>E: n=118</td>
<td>C: n=126</td>
<td>1.99</td>
<td>0.05</td>
<td>-0.126 to 0.227</td>
<td>0.56</td>
<td>0.93</td>
</tr>
<tr>
<td>2: 6-10 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3: 11-15 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4: 16-20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5: &gt;20 times per day</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Moisturisers at home</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1: no</td>
<td>E: n=118</td>
<td>C: n=126</td>
<td>1.98</td>
<td>-1.10</td>
<td>-0.177 to -0.044</td>
<td>0.001</td>
<td>0.034</td>
</tr>
<tr>
<td>2: yes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Knowledge of hand eczema and skin protection</strong></td>
<td>E: n=119</td>
<td>C: n=128</td>
<td>9.50</td>
<td>-0.11</td>
<td>-0.343 to 0.124</td>
<td>0.36</td>
<td>0.25</td>
</tr>
</tbody>
</table>
References


(2) The National Board of Industrial Injuries in Denmark, The National Board of Industrial Injuries in Denmark. 18-6-2010. www.ask.dk


Hænder på arbejde

Arbejdsbetinget håndeksem
hos sundhedspersonale


Såfremt du aldrig har haft håndeksem, skal du kun besvare første halvdel af skemaet!

Du kan vinde 5000 kroner ved at deltage i undersøgelsen.

Skemaet bedes returneret i vedlagte svarkuvert senest den 17.4. Det tager 10-15 minutter at besvare undersøgelsen.

Du kan også besvare undersøgelsen elektronisk ved at gå ind på: www.datafabrikken.dk

personlig kode:
1. Følgende spørgsmål (A-D) belyser din viden om håndeksem:

(Sæt kun et enkelt kryds ved hvert spørsmål)

A. Hvorfor får man håndeksem?

Håndeksem er altid medfødt og arveligt
Håndeksem får man, fordi hænderne er i kontakt med noget, der skader huden

B. Hvornår bør du anvende bomuldshandsker under beskyttelseshandsker (gummi eller plastikhandsker)?

Altid, når du anvender beskyttelseshandsker
Når du anvender beskyttelseshandsker i mere end 10 minutter

C. Hvornår bør du anvende hånddesinfektionsmiddel frem for sæbe og vand?

Altid
Når der er synligt snavs på hænderne
Når der ikke er synligt snavs på hænderne

D. Hvilken creme bør du benytte til hænderne for at forebygge eller behandle håndeksem?

En creme med højt indhold af vand
En creme med parfume og konserveringsmidler
En creme med højt indhold af fedtstof
2. Har du nogensinde modtaget information om, hvorledes håndeksem forebygges?

Nej ☐ Ja ☐

_Hvis nej, gå til spørgsmål 3_

_Hvis ja, hvornår modtog du sidst information om, hvorledes håndeksem forebygges?_

☐ Inden for det sidste år
☐ Mere end et år siden

_Hvis ja, hvor modtog du senest information om, hvorledes håndeksem forebygges?_

(Du må gerne sætte flere krydser)

☐ Din arbejdsplads
☐ Din praktiserende læge
☐ Din praktiserende hudlæge
☐ Internettet
☐ Andet ______________________ (Skriv her)

3. Bliver forebyggelse af håndeksem omtalt på din arbejdsplads?

Nej ☐ Ja ☐

_Hvis ja, har omtalen af håndeksem haft nogen betydning for måden, du behandler din hud på?_

Nej ☐ Ja ☐
4. Hvilken hudtype har du?

_Sæt ring omkring den hudtype (1-6), der passer bedst på dig_

<table>
<thead>
<tr>
<th>Hudtype</th>
<th>Hudfarve</th>
<th>Ved udsættelse for sollys</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hvid</td>
<td>Bliver altid rød, aldrig brun</td>
</tr>
<tr>
<td>2</td>
<td>Hvid</td>
<td>Bliver altid rød, kan blive en smule brun</td>
</tr>
<tr>
<td>3</td>
<td>Lysebrun</td>
<td>Kan blive rød, bliver gradvist brun</td>
</tr>
<tr>
<td>4</td>
<td>Moderat brun</td>
<td>Bliver minimalt rød, bliver hurtigt brun</td>
</tr>
<tr>
<td>5</td>
<td>Mørkebrun</td>
<td>Bliver sjældent rød, bliver meget brun</td>
</tr>
<tr>
<td>6</td>
<td>Sort</td>
<td>Bliver aldrig rød, bliver dyb mørk brun/sort</td>
</tr>
</tbody>
</table>

(Kommentar: Etniske danskere har oftest hudtype 1,2,3 eller 4, etniske asiater har oftest hudtype 4 eller 5, etniske afrikanere har oftest hudtype 5 eller 6)

5. Har du nogensinde som barn (før 16 år) haft et kløende hududslæt, som varede mere end et døgn?

   Nej ☐   Ja ☐   Husker ikke ☐

   _Hvis nej eller husker ikke, gå til spørgsmål 8_

6. Hvor gammel var du, da du fik dette hududslæt første gang?

   Under 2 år ☐
   2-5 år ☐
   6-10 år ☐
   Over 10 år ☐
   Ved ikke ☐
7. **Har dette hudsulæt nogensinde siddet i hudfolder?** *(med hudfolder menes albuebøjninger, knæhaser, ankler, hals eller øjenomgivelser)*

   Nej ☐  Ja ☐

8. **Har du tendens til tør hud?**

   Nej ☐  Ja ☐

9. **Har du nogensinde fået at vide af en læge, at du har astma?**

   Nej ☐  Ja ☐

10. **Har du nogensinde fået at vide af en læge, at du har høfeber?**

    Nej ☐  Ja ☐
11. Er du tidligere blevet allergitestet med lappeprøve (plasterprøver) på ryggen?

Nej ☐               Ja ☐

_Hvis nej, gå til spørgsmål 12_

_Hvis ja, hvornår? _______ (Skriv årstal)_

_Hvis ja, fik du i forbindelse med din allergitest påvist allergi?_

Nej ☐               Ja ☐

_Hvis ja, hvilken allergi var der tale om?_
(Du må gerne sætte flere krydser)

Nikkel ☐
Krom ☐
Gummi ☐
Parfume ☐
Planter ☐
Konserveringssmiddel ☐
(f.eks. formaldehyd)

Ved ikke ☐
Andet ☐    __________________________
(Hvis andet skriv her)
12. Er du tidligere blevet allergitestet med en priktest på underarmen?

| Nej | Ja |

Hvis nej, gå til spørgsmål 13

Hvis ja, hvornår? (Årstal)

Hvis ja, fik du påvist allergi ved priktesten?

| Nej | Ja |

Hvis ja, hvilken allergi var der tale om?

(Du må gerne sætte flere krydser)

- Latex (naturgummi)
- Pollen
- Dyrehår
- Husstøv
- Fødemidler
- Ved ikke

Andre allergier: (Hvis andre allergier, skriv her)
13. Hvilken stillingsbetegnelse har du?

- Læge
- Sygeplejerske
- Sosu-assistent
- Sygehjælper
- Bioanalytiker

I hvor mange år har du arbejdet i denne stillingsbetegnelse?

_________

(Skriv antal år)

14. Hvornår begyndte din ansættelse på din nuværende afdeling?

Måned: __________
Årstal: __________

15. Hvor mange timer arbejder du ugentligt i din nuværende ansættelse?

Hele timer pr. uge: _____

16. Arbejder du overvejende i:

- Dagarbejde
- Aftenarbejde
- Natarbejde
Venligst angiv den procentvise fordeling af din arbejdstid (dag- aften- og natarbejde) i tabellen.

(Sæt krydser efter bedste skøn)

<table>
<thead>
<tr>
<th></th>
<th>Aldrig</th>
<th>&lt; 25% af tiden</th>
<th>25-50% af tiden</th>
<th>51-75% af tiden</th>
<th>76-100% af tiden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dagarbejde</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aftenarbejde</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Natarbejde</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Spørgsmål vedrørende bijob / frivilligt arbejde**

17. **Har du et regelmæssigt bijob eller frivilligt arbejde?**

   Nej ☐           Ja ☐

   *Hvis nej, gå til spørgsmål 18*

   **Hvis ja, hvilken type arbejde?**  

   ________________________________  *(Skriv her)*

   **Hvor mange timer ugentligt i gennemsnit?**  

   _____  *(Skriv her)*
I forbindelse med dit bijob / frivillige arbejde, hvor mange gange om ugen:

<table>
<thead>
<tr>
<th></th>
<th>Aldrig</th>
<th>1-5 gange ugentligt</th>
<th>6-10 gange ugentligt</th>
<th>11-20 gange ugentligt</th>
<th>21-30 gange ugentligt</th>
<th>31-50 gange ugentligt</th>
<th>Over 50 gange ugentligt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anvender du hånddesinfektionsmiddel i forbindelse med dit bijob / frivillige arbejde?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasker du hænder med vand og sæbe i forbindelse med dit bijob / frivillige arbejde?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Hvor mange timer ugentligt er dine hænder udsat for vand, når du er på dit bijob/frivillige arbejde?

- Ikke udsat for vand  
- Under 1 time ugentligt  
- 1 - 2 timer ugentligt  
- 2 - 3 timer ugentligt  
- 3 - 5 timer ugentligt  
- 5 – 10 timer ugentligt  
- Mere end 10 timer ugentligt
Følgende spørgsmål omhandler påvirkninger på din hovedarbejdsplads

18. **Hvor mange timer dagligt er dine hænder udsat for vand / vådt arbejde i løbet af din arbejdsdag?** *(Uden brug af handsker)*

   Sæt et enkelt kryds, hvor det passer bedst i gennemsnit

   - Ikke udsat for vand
   - Under ½ time dagligt
   - ½ - 2 timer dagligt
   - 2 - 3 timer dagligt
   - 3 – 5 timer dagligt
   - Mere end 5 timer dagligt

19. **Hvor mange gange i løbet af din arbejdsdag:**

<table>
<thead>
<tr>
<th></th>
<th>Aldrig</th>
<th>1-5 gange dagligt</th>
<th>6-10 gange dagligt</th>
<th>11-15 gange dagligt</th>
<th>15-20 gange dagligt</th>
<th>Over 20 gange dagligt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Anvender du hånddesinfektionsmiddel</strong> (f.eks. klorhexidin eller sprit) i forbindelse med dit hovedjob?</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Vasker du hænder med vand og sæbe i forbindelse med dit hovedjob?</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
20. Hvor hyppigt foretager du kirurgisk håndvask, når du er på arbejde?

(Sæt et enkelt kryds, hvor det passer bedst i gennemsnit)

- Aldrig
- 1-5 gange ugentligt
- 6-10 gange ugentligt
- Mere end 10 gange ugentligt

21. Anvender du regelmæssigt beskyttelseshandsker, når du er på arbejde?

- Nej
- Ja

Hvis nej, gå til spørgsmål 23

Hvor mange timer dagligt anvender du beskyttelseshandsker?

(Sæt et enkelt kryds, hvor det passer bedst i gennemsnit)

- Under ½ time dagligt
- ½ - 2 timer dagligt
- 2 - 3 timer dagligt
- 3 - 5 timer dagligt
- Over 5 timer dagligt
22. Hvilken type beskyttelseshåndsker anvender du på dit arbejde?

(Du må gerne sætte flere krydser)

Naturgummi / latex □
Syntetisk gummi (f.eks. nitril, neopren) □
Plastik (f.eks. vinyl, PVC, polyethylen) □
Bomuldshåndsker under gummi eller plastikhåndsker □
Ved ikke □

23. Er fugtighedscreme / håndcreme til rådighed for dig på din arbejdsplads?

Nej □       Ja □

24. Hvor ofte anvender du fugtighedscreme / håndcreme til hænderne, når du er på arbejde?

(Sæt et enkelt kryds, hvor det passer bedst i gennemsnit)

Anvender ikke □
Ikke hver dag □
1 - 2 gange dagligt □
Mere end 2 gange dagligt □
25. Venligst angiv dit daglige timeforbrug samt anfør, om du anvender beskyttelseshandsker ved nedenstående arbejdsaktiviteter
(Sæt kryds, hvor det passer bedst i gennemsnit)

<table>
<thead>
<tr>
<th>Dagligt timeforbrug på denne aktivitet</th>
<th>Handskebrug ved denne aktivitet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 timer</td>
<td>Under ½ time</td>
</tr>
<tr>
<td>Patientpleje, personlig hjælp</td>
<td></td>
</tr>
<tr>
<td>Medicinhåndtering</td>
<td></td>
</tr>
<tr>
<td>Blodprøvetagning</td>
<td></td>
</tr>
<tr>
<td>Kontakt med laboratoriereagenser</td>
<td></td>
</tr>
<tr>
<td>Kontakt med gummimaterialer / plast (feks. katetre, slanger, dræn)</td>
<td></td>
</tr>
<tr>
<td>Håndtering af fødevarer</td>
<td></td>
</tr>
<tr>
<td>Kontakt med rengøringsmidler</td>
<td></td>
</tr>
<tr>
<td>Kontakt med gips</td>
<td></td>
</tr>
</tbody>
</table>
26. **Hvor mange gange om dagen vasker du hænder, når du er kommet hjem fra arbejde?**

*(Sæt et enkelt kryds, hvor det passer bedst i gennemsnit)*

1   -  5 gange  
6   - 10 gange  
11 - 15 gange  
16 - 20 gange  
Over 20 gange  

27. **Anvender du regelmæssigt fugtighedscreme / håndcreme til hænderne i din fritid?**

Nej  
Ja  

**Hvis ja, hvor ofte?**

Ikke hver dag  
1-2 gange dagligt  
Mere end 2 gange dagligt  
Her følger nogle spørgsmål om rygning

28. Har du røget cigaretter, pibe, cigar eller cerutter inden for det seneste år?

Nej ☐ ☐
Ja ☐ ☐

Hvis nej, gå til spørgsmål 31

Hvis ja, hvornår røg du sidste gang?

I dag ☐
For 0-1 uge siden ☐
For 2-4 uger siden ☐
For 1-6 måneder siden ☐
For 6-12 måneder siden ☐

29. Hvad ryger / røg du?

Cigaretter ☐
Pibe ☐
Cigarrer ☐
Cerutter ☐

Hvor meget ryger / røg du?

_______ (antal cigaretter, pibestop, cigarer eller cerutter dagligt)

30. Hvor mange år har du røget regelmæssigt?

Antal hele år efter bedste skøn: __________
Her følger nogle spørgsmål om hverdags- og fritidsaktiviteter


<table>
<thead>
<tr>
<th>Dagligt timeforbrug på denne aktivitet</th>
<th>Handskebrug ved denne aktivitet?</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 timer</td>
<td>Nej</td>
</tr>
<tr>
<td>Under ½ time</td>
<td></td>
</tr>
<tr>
<td>Mellem ½ og 3 timer</td>
<td></td>
</tr>
<tr>
<td>Mellem 3 og 5 timer</td>
<td></td>
</tr>
<tr>
<td>Over 5 timer</td>
<td></td>
</tr>
<tr>
<td>Nej</td>
<td></td>
</tr>
<tr>
<td>Ja</td>
<td></td>
</tr>
<tr>
<td>Nogle gange</td>
<td></td>
</tr>
</tbody>
</table>

| Madlavning                             |                                  |
| Rengøring, opvask i hånden, eller håndvask af tøj |                                  |
| Passer børn under 4 år                |                                  |
32. **Venligst angiv dit daglige timeforbrug ved nedenstående hverdagsaktiviteter samt anfør, om du anvender beskyttelseshandsker derved.**

<table>
<thead>
<tr>
<th></th>
<th>Dagligt timeforbrug på denne aktivitet</th>
<th>Handskebrug ved denne aktivitet?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0 timer</td>
<td>Under ½ time</td>
</tr>
<tr>
<td><strong>Havearbejde/planter/jord (i sommerhalvåret)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Byggeri/renovering/istandsættelse</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bil- eller motor-reparationer</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

33. **Hvis du ser tilbage på det sidste år, hvad vil du så sige passer bedst som beskrivelse på din aktivitet i fritiden?**

(Sæt et enkelt kryds)

- Trænede hårdt og dyrkede konkurrenceidræt regelmæssigt og flere gange om ugen □

- Dyrkede motionsidræt eller tungt havearbejde mindst 4 timer om ugen □

- Spadserede, cyklede eller havde anden lettere motion mindst 4 timer om ugen (medregn også søndagsture, lettere havearbejde og cykling/gang til arbejde) □

- Læste, så fjernsyn eller havde anden stillesiddende beskæftigelse □
34. Dyrker du for tiden sport?

   Nej ☐       Ja ☐

Hvis ja, hvilke(n) sportsgren(e) ?

   (Skriv her)

35. Har du nogensinde haft håndeksem?

   Nej ☐       Ja ☐

36. Har du håndeksem for øjeblikket?

   Nej ☐       Ja ☐

37. Har du haft håndeksem inden for de seneste 12 måneder?

   Nej ☐       Ja ☐


Hvis du har svaret Ja til spørgsmål 35, bedes du venligst udfylde resten af spørgeskemaet, som omhandler håndeksem.
Spørgeskema til personer, der har eller har haft håndeksem

38. Hvor på hænderne er / var eksemet som regel lokaliseret?

(Sæt gerne flere krydser)

- Håndrygge
- Håndflader
- Fingerspidser
- Fingre (andre steder end fingerspidser)
- Håndled

39. Hvor hyppigt har du haft eksem på hænderne?

- Kun én gang og i mindre end 2 uger
- Kun én gang, men i to uger eller mere
- Flere gange
- Næsten hele tiden

40. Har du nogensinde haft håndeksem som barn (før 16 år)?

- Nej
- Ja

Hvis ja, gå til spørgsmål 42
41. Var dit erhverv det samme som nuværende, da håndeksemnet begyndte?
   Nej ☐   Ja ☐

   Hvis nej, hvad var dit erhverv?
   ___________________________________________________________________________
   (Skriv her)

42. Har du måttet skifte arbejdsplads pga. dit håndeksem?
   Nej ☐   Ja ☐

   Hvis ja, hvor mange gange?
   _____   (Antal gange)

   Hvis ja, har du skiftet arbejdsplads inden for de sidste 12 måneder pga. dit håndeksem?
   Nej ☐   Ja ☐

43. Har du overvejet at skifte arbejde pga. dit håndeksem?
   Nej ☐   Ja ☐

44. Er dine arbejdsopgaver blevet ændret pga. dit håndeksem?
   Nej ☐   Ja ☐
45. Hvad mener du selv var årsag til, at håndeksemet begyndte?

(Skriv her)

46. Hvilke af følgende påvirkninger på din arbejdsplads mener du forværer dit håndeksem?

(Sæt gerne flere krydser)

- Ingen
- Hyppig håndvask
- Huddesinektionsmidler (håndsprit)
- Lægemidler

(Skriv hvilke: ______________________)

- Gips
- Beskyttelseshandsker
- Gummimaterialer f.eks. katetre, slanger
- Rengøringsmidler
- Håndtering af madvarer
- Laboratoriereagenser

(Skriv hvilke: ______________________)

- Andet

(Skriv hvilke: ______________________)
47. Bliver dit håndeksem bedre, når du holder fri fra dit sædvanlige arbejde (f.eks. i weekender, ferier af 1 uges varighed eller længere perioder)?

(sæt gerne flere krydser)

Nej, mit håndeksem bedres ikke, når jeg holder fri ☐

Ja, mit håndeksem bliver bedre, når jeg holder fri i :
- weekenden ☐
- 1 uge ☐
- længere perioder ☐

48. Har du nogensinde været sygemeldt fra arbejdet pga. dit håndeksem?

Nej ☐
Ja ☐

Hvis ja, har du været sygemeldt inden for de seneste 12 måneder pga. dit håndeksem?

Nej ☐
Ja ☐

Hvis ja, hvor længe?

_________ (Antal uger efter bedste skøn)

49. Er dit håndeksem anmeldt som en arbejdsbetinget lidelse?

Nej ☐
Ja ☐
Ved ikke ☐

50. Har du som voksen søgt læge pga. håndeksem?

Nej ☐
Ja ☐
Hvilket år søgte du sidste gang læge pga. håndeksem?

_____________  (Skriv årstal efter bedste skøn)

51. Behandler du dit håndeksem?

Nej  ☐  Ja  ☐

Hvis ja, hvad behandler du dit håndeksem med?

(sæt gerne flere krydser)

Fugtighedscreme  ☐
Hormoncreme (binyrebarkhormon)  ☐
Lysbehandling  ☐
Antibiotika  ☐
Binyrebarkhormon tabletter  ☐
Anden behandling:  ____________________________  (Skriv her)

52. Får du forværring af dit håndeksem, når du har en infektion f.eks. foræblesse, influenza, halsbetændelse eller feber?

Nej  ☐  Ja  ☐  Ved ikke  ☐

53. Får du forværring af dit håndeksem, når du er stillet?

Nej  ☐  Ja  ☐  Ved ikke  ☐
54. Hvilke af følgende fritidsaktiviteter mener du medfører forværring af dit håndeksem? (Sæt gerne flere krydser)

- Ingen  
- Håndtering af fødevarer  
- Rengøring  
- Opvask  
- Tøjvask i hånden  
- Pasning af småbørn (bleskift m.m.)  
- Havearbejde  
- Istandsættelse/renovering af bolig m.m.  
- Reparation af biler, MC, motorer o.lign.  
- Andet

Skriv hvilke: ________________________________

55. Medfører sport forværring af dit håndeksem?

Nej  Ja

56. Medfører det forværring af dit håndeksem, når du har det varmt og sveder i hænderne?

Nej  Ja
Her følger et par spørgsmål om rygning og håndeksem

**57. Mener du, at rygning påvirker dit håndeksem?**

- Rygning forværremit håndeksem ☐
- Rygning har ingen betydning for mit håndeksem ☐
- Rygning gør mit håndeksem bedre ☐

**58. Er du holdt op med at ryge, eller har du haft rygepauser inden for det seneste år?**

- Nej ☐
- Ja ☐

_Hvis nej, gå til spørgsmål 59_

_Hvis ja, mener du, at rygeophøret / rygepausen har påvirket dit håndeksem, så det er:_

- Blevet bedre ☐
- Uforandret ☐
- Blevet værre ☐
59. Hvordan vurderer du sværhedsgraden af dit eksem?

Sæt venligst et kryds ud for den gruppe af billeder (A, B, C eller D), som ligner dit håndeksem mest, når det er værst.

Gruppe A □
Gruppe B

Gruppe C
Gruppe D

Tak for din besvarelse!