

ORIGINAL ARTICLE

Prevention of hand eczema among Danish hairdressing apprentices: an intervention study

Anne Bregnhøj,¹ Torkil Menné,² Jeanne Duus Johansen,³ Heidi Søsted¹

► An additional appendix is published online only. To view this file please visit the journal online (<http://oem.bmj.com/content/early/recent>).

¹Research Centre for Hairdressers and Beauticians, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, Hellerup, Denmark

²Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, Hellerup, Denmark

³National Allergy Research Centre, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, Hellerup, Denmark

Correspondence to

Dr Anne Bregnhøj, Research Centre for Hairdressers and Beauticians, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, Niels Andersens vej 65, Hellerup DK-2900, Denmark; annbre03@geh.regionh.dk

Accepted 18 November 2011

ABSTRACT

Objectives To investigate whether an evidence-based intervention could reduce the incidence of hand eczema in a cohort of Danish hairdressing apprentices during their training, as hairdressing apprentices are known to have a high risk of developing hand eczema.

Methods This study was a clinically controlled, prospective intervention study. Within 2 weeks of starting their training, 502 hairdressing apprentices were enrolled in the study on occupational hand eczema.

Approximately half of the apprentices were assigned to an intervention group and received an evidence-based training program developed for this study and delivered by teachers specially trained in the prevention of hand eczema; the other half received normal training and served as a control group. All apprentices completed self-administered questionnaires including questions regarding hand eczema, use of gloves and degree of wet work, and were all clinically examined for hand eczema three times during the 18-month study period. The three examinations were scheduled as school visits and consisted of a baseline examination and two follow-up examinations approximately 8 and 18 months later.

Results More apprentices from the intervention group used gloves during wet work procedures and significantly fewer developed hand eczema compared with apprentices from the control group ($p=0.04$). A logistic regression model showed that atopic dermatitis had a significant influence on the development of hand eczema in the cohort irrespective of the intervention.

Conclusions We were able to increase the use of gloves and reduce the incidence of hand eczema in hairdressing apprentices by implementing a training program in hairdressing schools.

INTRODUCTION

Occupational hand eczema is one of the most frequent work related diseases in Denmark, as in many other countries, and is caused by either allergic and/or irritant contact dermatitis.^{1,2} Hairdressers belong to a high-risk occupation with an elevated incidence of occupational hand eczema.^{1,3-6} Hairdressing apprentices seem to be at particularly high risk,⁷⁻¹¹ with an average onset at the age of 19–21 years^{7,11} and an estimated 1-year prevalence of 37%.⁴ In comparison, trained hairdressers in Copenhagen had an estimated 1-year prevalence of hand eczema of 20% as shown in a previous Danish study,⁴ while young people from the general population in Sweden and Denmark had a 1-year prevalence of 9%–10%.^{12,13} There is a high staff turnover in the profession. In Denmark hairdressers work an average of 8.4 years in the

What this paper adds

- Hairdressing apprentices have a high incidence of occupational hand eczema.
- A high percentage of hairdressers leave the profession with one of the main reasons being hand eczema.
- An effective approach to reduce the incidence of hand eczema in a cohort of hairdressing apprentices has been developed, implemented and evaluated.
- Atopic dermatitis is confirmed as a risk factor for occupational hand eczema.

profession (including their training period), with one of the main reasons for leaving being hand eczema.^{14,15} Similar results have been shown in a Finnish study.¹⁵ As occupational contact dermatitis among hairdressers and hairdressing apprentices has severe personal and socioeconomic consequences,^{16,17} it seemed relevant to examine preventive strategies among hairdressing apprentices.

Previous intervention studies on occupational hand eczema have shown that evidence-based education is an effective tool to reduce incidence.¹⁸⁻²³ The training program developed for this study consisted of oral presentations, written information and practical training, all of which were presented by specially trained and dedicated supervisors who also served as teachers.

In Denmark hairdressing apprentices undergo a 4-year training program consisting of dedicated school periods and periods in salons.

It is important to evaluate the effect of any intervention with a validated instrument. To our knowledge this is the first controlled intervention study among hairdressing apprentices. The aim of this study was to investigate whether evidence-based education in the prevention of hand eczema among hairdressing apprentices could reduce the incidence of hand eczema using a controlled design.

MATERIALS AND METHODS

We conducted an intervention study in a cohort of Danish hairdressing apprentices which included two follow-up examinations. The data presented are based on self-administered questionnaires.

All apprentices gave informed consent and the Committee on Biomedical Research Ethics of Copenhagen and Frederiksberg approved the

Workplace

protocol (H-B-2007–096). The study was conducted from August 2008 to July 2010.

Study design

This study was a clinically controlled, prospective intervention study, with an initial baseline examination and two follow-up examinations conducted approximately 8 and 18 months after enrolment in the study. On all three occasions the hairdressing apprentices completed a self-administered questionnaire and were clinically examined for hand eczema.

The Danish training program for hairdressing apprentices

The Danish hairdressing program lasts 4 years and comprises periods in school providing a combination of theory and practice, and periods in salons consisting of mixed practical hairdressing procedures. Although most apprentices were examined during the school periods, a few were examined while they were working in the salons.

Intervention

The intervention was based on educating teachers in the training schools. Four schools were assigned to the intervention group and six schools served as controls. Each intervention school provided between two and five supervisors for the project. These supervisors underwent a 2-day course of special training in skin physiology, allergy and eczema, prevention of hand eczema among hairdressers and optimisation of workplace procedures, and were responsible for the training of the apprentices in the schools. In cooperation with the supervisors from the intervention schools, we developed an evidence-based training program, primarily based on a special skin protection program for hairdressers (box 1). The training program consisted of a number of oral presentations, a pamphlet, group work exercises, practical training and glove size measurement. This approach has been successfully evaluated in previous intervention studies.^{18–23} Examples of lipid rich moisturisers and protective gloves were given to the intervention group as examples of proper protective measures. Accelerator free nitrile gloves were recommended. The intervention was planned, implemented and evaluated according to the model described by Goldenhar *et al*.³⁷

The intervention schools and the control schools were chosen so that different geographical areas of Denmark and different school sizes would be represented in each group, and partly because some training on skin protection had already been implemented in a number of the schools. There were no major

differences between control schools and intervention schools. Hairdressing schools in Denmark operate individually but have a common curriculum.

The questionnaire

Questions concerning hand eczema were adapted from the Nordic Occupational Skin Questionnaire (NOSQ-2002), and have been validated in different occupations and geographical areas.^{38–39} Self-reported hand eczema has also been validated in this cohort, using clinical examination as the gold standard, and good agreement and high predictive values were obtained.⁴⁰ The following questions were asked: “Have you ever had hand eczema?”, “Have you ever had eczema on your wrists or forearms?” and “When did you last have eczema on your hands, wrists or forearms?”. Atopic dermatitis was defined using the UK Working Party’s diagnostic criteria.^{41–44} Finally, specific questions concerning procedures in hairdressing, the use of gloves and the amount of wet work were developed specially for this study (see online supplementary appendix 1).

The development of the questionnaire included pilot testing in 19 skilled hairdressers.

Clinical examination

Objective signs and severity of hand eczema were assessed by a trained medical doctor (AB) using the Hand Eczema Severity Index (HECSI), which is a validated scoring system with high inter- and intraobserver reliability and used to determine the presence, severity and localisation of hand eczema.⁴⁵ The HECSI score ranges from 0 to 360, where 0 is no eczema and 360 is most severe eczema. Each apprentice completed the questionnaire before their hands were examined later on the same day so that they were unaware of the examination result when answering the questions. Additionally, all apprentices were examined for flexural eczema at enrolment in the study to fulfil all minor diagnostic criteria of the UK Working Party.

Data from the clinical examinations are presented in a former publication.⁴⁰ These data were mainly used to validate self-reported hand eczema in this cohort.

Study population

A total of 502 hairdressing apprentices were enrolled in this study within 2 weeks of starting training. Enrolment was conducted in August 2008 (n=382) and in January 2009 (n=120).

The apprentices were recruited from all 10 hairdressing schools in Denmark, with each school providing from eight to 103 subjects. All new apprentices present on the day of enrolment were invited to participate. Subsequently, several apprentices dropped out or were excluded (figure 1), as described below.

The mean age of the apprentices was 17.5 years and the majority were female (95.2%). The participation rate was 99.8% at inclusion (502 of 503 hairdressing apprentices present on the day of enrolment). All completed the questionnaire and only one failed to have their hands examined. At the first follow-up, data were collected from 294 of the 321 apprentices still being trained at that time (91.6%); for three trainees we only obtained HECSI scores but no questionnaire. At the second follow-up, the participation rate was 99.6% (283 of 284 hairdressing apprentices still in training); all completed the questionnaire but 21 did not complete the clinical examination. The missing data were mainly due to sick leave or time off on the day of the examination.

The apprentices in the intervention group were aware that they had been selected for the intervention, which could have

Box 1 Special skin protection program for hairdressers

Use gloves when you wash, dye, bleach, and perm^{10–24}
Cut before you dye the hair^{25–26}
Mix in a separate, ventilated cabinet²⁷
Disposable gloves must be clean, new, and dry²⁸
Never reuse disposable gloves²⁸
Use cotton gloves underneath protective gloves²⁹
Use gloves for as long as necessary, but as shortly as possible^{29–30}
Use an unscented, lipid rich moisturizer^{31–33}
Do not wear rings when you work³⁴
Use gloves when doing wet work in your spare time³⁵
Use warm gloves outside when it's cold³⁶

meant that they self-reported a higher frequency of hand eczema as they were probably more aware of the signs and symptoms of the condition. On the other hand, participating in this study could have increased the focus on preventive measures in the control schools thereby decreasing the frequency of hand eczema in this group.

Exclusions

During the study, 105 apprentices were excluded for different reasons including: changing from an intervention school to a control school or vice versa (2 cases), moving from school apprenticeship to salon apprenticeship (with no formal school classes) (9 cases), and ceasing training due to failure to qualify as an apprentice (94 cases). None of the apprentices were excluded due to skin diseases or other health issues.

Study dropouts

A total of 113 of the apprentices included in the study were eligible to continue their hairdressing apprenticeship but decided to change career for various reasons. This group is referred to as dropouts. They were all contacted by phone and if contact was not established, a letter was sent. All were asked whether they had experienced hand eczema during hairdressing training, and if so, was hand eczema the main reason for changing career. A response rate of 74.3% (84 of the 113 dropouts) was obtained.

Statistical analysis

For comparison of categorical variables, for example, the use of gloves in different tasks, the χ^2 test was used, and according to the Bonferroni correction, a p value <0.003 was considered significant. Paired quantitative data were analysed by comparing means with the Wilcoxon signed rank test, and the Mann–Whitney test was used for independent data. Time spend wearing gloves in the salons was evaluated by a χ^2 for trend test. A backward stepwise logistic regression model was performed to evaluate risk factors for the development of hand eczema. Finally, OR and CIs for the development of hand eczema during the study were calculated.

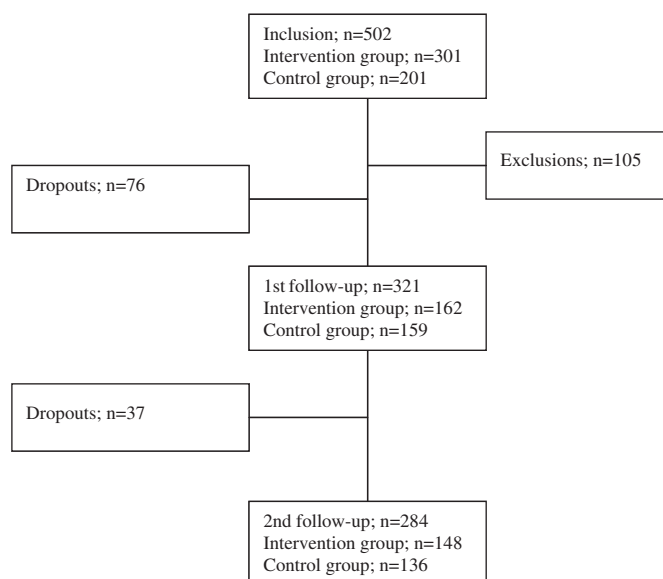


Figure 1 Study flow diagram.

All statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Inc) for Windows (release V.18.0).

RESULTS

Data collected from both cohorts are compared in tables 1–3. The demographic characteristics of the two groups did not differ significantly (table 1).

Hairdressing training in Denmark varies by school, as reflected by the fact that during the study, the apprentices from the intervention group worked in salons for an average of 32.5 weeks compared with 27.5 weeks for the apprentices from the control group ($p=0.01$). Consequently, the apprentices from the control group spent more weeks in school, with an average of 32 weeks compared with 30 weeks for the intervention group ($p=0.001$). On the day of the final follow-up, more apprentices from the intervention group were working in salons (20.4%) compared with the control group (14.7%; $p=0.03$).

Apprentices from the intervention group used gloves more often than the control group, particularly when shampooing and when handling bleaching products (table 2). Although the

Table 1 Demographic characteristics of the cohort and development of eczema

	Intervention group	Control group	p Value
Age (years)*			
Range	15–32	15–38	0.2
Mean	17.8	17.7	
Median	17	17	
Sex†			
Male	6.6 (13/196)	3.5 (7/201)	0.2
Female	93.4 (183/196)	96.5 (194/201)	
Atopic dermatitis* †	10.2 (20/196)	8.0 (16/201)	0.4
Hand eczema			
Lifetime prevalence			
At enrolment	9.2 (18/196)	7.0 (14/201)	0.4
Point prevalence			
At enrolment	1.5 (3/196)	3.0 (5/201)	0.3
2nd follow-up	4.8 (7/147)	5.9 (8/136)	0.5
1-year prevalence			
At enrolment	7.7 (15/196)	6.0 (12/201)	0.5
2nd follow-up	20.4 (30/147)	29.4 (40/136)	0.07
During training			
1st follow-up	11.0 (16/145)	19.2 (28/146)	0.05
2nd follow-up	20.4 (30/147)	29.4 (40/136)	0.07
2nd follow-up and dropouts	19.4 (35/180)	28.3 (53/187)	0.04
Eczema on wrists or forearms			
During training			
1st follow-up	4.1 (6/145)	5.5 (8/146)	0.6
2nd follow-up	8.2 (12/147)	8.1 (11/136)	0.9
Hand eczema and eczema on wrists or forearms			
During training			
1st follow-up	18.6 (27/145)	28.1 (41/146)	0.06
2nd follow-up	21.8 (32/147)	33.8 (46/136)	0.02
2nd follow-up and dropouts	20.5 (37/180)	31.5 (59/187)	0.02

Values are % (n/total) unless otherwise stated. Data are based on questionnaires at enrolment, and the 1st and 2nd follow-ups (after exclusions as detailed in the Materials and methods section). Self-reported hand eczema has previously been validated in this cohort.⁴⁰ The χ^2 test was used for the comparison of frequencies and the Mann–Whitney test for comparison of means in the two independent groups.

$p<0.05$ was considered significant; significant results are shown in bold (comparison of the intervention group and control groups).

*Atopic dermatitis measured using the UK Working Party's diagnostic criteria including the minor criterion 'visible flexural eczema'.

†Measured at enrolment.

Workplace

Table 2 Use of gloves in the cohort at the final follow-up

	Intervention group (n=147), % (n)	Control group (n=136), % (n)	p Value
Shampooing, school	70.7 (104)	46.3 (63)	<0.001
Shampooing, salon	48.9 (72)	29.6 (40)	0.001
Hair dyeing, school	100 (147)	98.5 (134)	0.1
Hair dyeing, salon	97.8 (144)	98.5 (134)	0.6
Rinsing hair dye, school	90.5 (133)	85.3 (116)	0.2
Rinsing hair dye, salon	85.6 (126)	74.8 (102)	0.02
Eye-brow dye, school	13.6 (20)	2.2 (3)	<0.001
Eye-brow dye, salon	5.0 (7)	0.7 (1)	0.04
Bleaching, school	89.8 (132)	77.2 (105)	0.002
Bleaching, salon	86.3 (127)	78.5 (107)	0.09
Rinsing bleach, school	83.0 (122)	72.1 (98)	0.03
Rinsing bleach, salon	76.3 (112)	68.1 (93)	0.1
Permanent dye, school	63.9 (94)	52.9 (72)	0.06
Permanent dye, salon	46.0 (68)	39.3 (54)	0.3
Rinsing permanent dye, school	81.0 (119)	72.8 (99)	0.1
Rinsing permanent dye, salon	72.7 (107)	64.4 (88)	0.1

The percentages and numbers of apprentices in each group who always used gloves for specific procedures in the schools and salons are shown.

The χ^2 test was used for comparisons.

A p value <0.003 was considered to be significant according to the Bonferroni correction; significant results are shown in bold.

No missing answers were recorded.

frequency of glove use decreased when apprentices from the intervention group were working in the salons, they still used gloves more often than the control group during these periods. Gloves were not reused in any of the schools but were reused in some salons. At the final follow-up, gloves were reused by 14.3% of the intervention group and 21.3% of the control group ($p=0.1$). Of those who reused gloves at the final follow-up, 61.9% of the intervention group versus 58.6% of the control group ($p=0.8$) turned them inside out. No differences in the types of gloves were detected between the two groups while working in the salons, but in the schools more apprentices from the intervention group (95.9%) than the control group (75.0%) used nitrile gloves at the final follow-up ($p<0.001$).

The apprentices from the intervention group used gloves for more hours per day, and fewer reported wet hands for 2 h or more per day (table 3).

As shown in detail in table 1, apprentices from the intervention group reported significantly less eczema than those from the control group. At the final follow-up, 19.4% of the appren-

tices from the intervention group versus 28.3% of the apprentices from the control group had experienced hand eczema during their training (including dropouts) ($p=0.04$). The OR of getting hand eczema during the study period for the control group was 1.65 (95% CI 1.02 to 2.67). The majority of the affected apprentices (70.0% in the intervention group and 80.0% in the control group) stated that their condition began while they were working in the salons ($p=0.3$). The severity of hand eczema was clearly related to occupation, as 76.9% stated that their work aggravated their symptoms and 59.0% that their symptoms improved during holidays (with no statistical difference between the two groups).

There was a 21.4% incidence of hand eczema among dropouts (15.2% in the intervention group and 25.5% in the control group; $p=0.3$). There was no correlation between hand eczema and atopic dermatitis among the dropouts ($p=0.13$), but significantly more of those who changed career because of hand eczema were classified with atopic dermatitis compared with the other dropouts ($p=0.04$). Overall, 12% of dropouts in the intervention group and 9.8% in the control group stated that hand eczema was the main cause of their changing career ($p=0.7$).

Of those who experienced hand eczema during the study, 40.6% from the intervention group versus 19.6% from the control group ($p=0.04$) had consulted their general practitioner, and 15.6% versus 10.8% ($p=0.2$) a dermatologist. Only a minority of apprentices with hand eczema, and only apprentices from the intervention group (9.4% vs 0.0%, $p=0.04$) had their condition reported to the Board of Occupational Health.

A logistic regression model showed that atopic dermatitis and belonging to the control group were risk factors for the development of hand eczema in the cohort (table 4). Sex, age and weeks spent in the salons had no influence on the development of hand eczema.

DISCUSSION

This was a controlled intervention study with the intention of preventing occupational hand eczema in a cohort of Danish hairdressing apprentices. To our knowledge this is the first published intervention study in such a cohort. The main finding was that we were able to increase the use of gloves and reduce the incidence of hand eczema in an intervention group by educating teachers and thereby the apprentices in the training schools. Furthermore, atopic dermatitis was also found to be a risk factor for developing hand eczema in the cohort irrespective of intervention.

Previous intervention studies in high-risk occupations have also reduced the frequency of hand eczema. The majority of intervention studies have been conducted in cohorts with high-risk occupational exposures and already substantially affected by hand eczema.^{18 19 21 22} This study is one of the few intervention studies so far to concentrate on primary prevention of hand eczema. The main focus of the intervention was the provision of evidence-based education including a skin protection program, optimisation of workplace procedures and practical training, with high involvement by dedicated supervisors. All levels of the organisations involved in training hairdressers in Denmark were informed and took part in the process: the Danish Hairdressers' and Beauticians' Union, and school heads, teachers and apprentices. The approach chosen in this study was based on previous intervention studies showing a substantial effect on the prevalence of hand eczema in other occupational settings. Held *et al* were able to improve behaviour and reduce clinical skin

Table 3 Time with glove use and wet work per day in the salons at the final follow-up

	Intervention group (n=127), % (n)	Control group (n=134), % (n)	p Value
Glove use			
Never	0.0 (0)	0.0 (0)	NT
<0.5 h	3.9 (5)	11.9 (16)	0.02
0.5–1 h	19.7 (25)	23.1 (31)	0.5
1–2 h	23.6 (30)	26.9 (36)	0.5
2–3 h	30.7 (39)	24.6 (33)	0.3
3–4 h	11.8 (15)	7.5 (10)	0.2
>4 h	10.2 (13)	6.0 (8)	0.2
χ^2 for trend			0.002
Wet work			
2 h or more	50.4 (64)	67.9 (91)	0.004

The χ^2 test was used for the comparison.

$p<0.05$ was considered to be significant; significant results are shown in bold.

NT, Not tested.

Table 4 The relationship between potential risk factors and prevalence of hand eczema at the final follow-up, including dropouts

	Total, % (n/total)	Hand eczema, % (n/total)	Crude OR (95% CI)	Adjusted OR (95% CI)	Final model OR* (95% CI)
Intervention					
Control group	51.0 (187/367)	60.2 (53/88)	1.00	1.00	1.00
Intervention group	49.0 (180/367)	39.8 (35/88)	0.61 (0.38 to 0.99)	0.62 (0.35 to 1.09)	0.59 (0.36 to 0.95)
Atopic dermatitis					
No	90.5 (332/367)	87.5 (74/88)	1.00	1.00	1.00
Yes	9.5 (35/367)	15.9 (14/88)	2.32 (1.13 to 4.79)	2.16 (0.87 to 5.35)	2.47 (1.19 to 5.14)
Sex					
Female	95.6 (351/367)	97.7 (86/88)	1.00	1.00	
Male	4.4 (16/367)	2.3 (2/88)	0.44 (0.09 to 1.98)	0.48 (0.06 to 3.96)	
Weeks in salon					
0–20	26.3 (72/274)	27.5 (19/69)	1.00	1.00	
21–40	49.3 (135/274)	47.8 (33/69)	0.90 (0.47 to 1.74)	0.87 (0.44 to 1.70)	
>40	24.4 (67/274)	24.6 (17/69)	0.95 (0.44 to 2.03)	0.98 (0.45 to 2.16)	
Age (years)					
15–17	67.0 (246/367)	62.5 (55/88)	1.00	1.00	
18–24	29.7 (109/367)	32.9 (29/88)	1.26 (0.75 to 2.11)	1.41 (0.77 to 2.59)	
>25	3.3 (12/367)	4.6 (4/88)	1.74 (0.50 to 5.98)	2.19 (0.49 to 9.73)	

Logistic regression analysis with the outcome OR of hand eczema at the final follow-up.

*The final model is based on the adjusted model, analysed using backward stepwise logistic regression.

symptoms in different wet-work occupations,^{18 19} and the group of Flyvholm *et al* significantly reduced the prevalence of hand eczema among both gut cleaners and cheese dairy workers following the implementation of skin protection programs.^{21–23}

Only a few reports have described the use of protective gloves in high-risk occupations including hairdressing. In this study, a relatively high percentage of apprentices from the intervention group wore gloves when shampooing customers' hair in the schools (70.7%) compared with apprentices from the control group (46.3%) ($p<0.001$). When apprentices from the intervention and control groups were working in the salons, the use of gloves when shampooing hair decreased to 48.9% and 29.6% ($p=0.001$), respectively. When applying hair dye to customers' hair, nearly all apprentices from the intervention and control groups used gloves in both the schools and the salons (97.8% and 98.5% in the salons, respectively; $p=0.6$). For comparison, 90.2% of Australian hairdressing apprentices used gloves when dyeing customers' hair, while only 6.3% wore gloves when shampooing hair.⁴⁶ Similar results have been found in the UK: 9% of apprentices wore gloves when shampooing and approximately 95% when dyeing hair.⁴⁷ In a German study, 18.5% of hairdressing apprentices wore gloves regularly when shampooing and 87.1% when colouring hair.⁸ These results indicate that preventive strategies focusing on glove use in wet-work procedures have already been successfully implemented in hairdressing schools in Denmark. It seems to be generally accepted that gloves should be worn when applying hair dye both in Denmark and in other countries. The results also indicate difficulties in maintaining good practice in salons, probably because salons are busier, and because the salon owners have different attitudes towards the use of gloves. The decreasing trend of glove use in the salons compared with the schools and the relatively high frequency of glove reuse, and especially turning reused gloves inside out, is of great concern. Further education of trained hairdressers and especially salon owners is required to eliminate this problem.

It is widely accepted that exposure to wet work for 2 h or more is a risk factor for irritant contact dermatitis in the hairdressing profession.¹⁰ A German observational study found that

hairdressers were exposed to wet work, defined as having wet hands or wearing protective gloves, for an average of 2 h and 17 min in an 8 h shift.⁴⁸ Fewer apprentices in the intervention group in the present study reported wet hands for 2 h or more per day compared with the control group ($p=0.004$) while working in the salons (table 3). The duration and frequency of wet work seems to be difficult to estimate in questionnaires. Jungbauer *et al* showed that the duration of wet work was overestimated by a factor of 2 compared with the duration assessed by observation, while almost double the frequency of wet work was detected by observation compared with a questionnaire in a cohort of nurses.⁴⁹ Based on these observations, the duration and frequency of wet work reported in questionnaires should be interpreted with caution.

The intervention group in this study reported significantly less hand eczema compared with the control group. During the 18-month study period, the apprentices (including dropouts) reported an incidence of hand eczema of 19.4% (intervention group) versus 28.3% (control group) ($p=0.04$) (table 1), and the OR for hand eczema during the study period was 1.65 for the control group compared to the intervention group. The incidence of hand eczema in the control group correlates well with the findings from other studies on occupational hand eczema among hairdressing apprentices. In several studies, the life-time prevalence of hand eczema in hairdressing apprentices has been estimated to be 27.2%–58%.^{4 5 50 51} In Germany, Uter *et al* found an incidence of hand eczema in a prospectively followed cohort of hairdressing apprentices of 43.3% over 3 years.⁹ For comparison, the 1-year prevalence of hand eczema in general populations of young people in Sweden and Denmark is estimated to be 9%–10%.^{12 13} Uter *et al* also found that hand eczema was the reason for ceasing training in 30.1% of drop-outs,^{9 10} which is higher than the rate found in this study.

The role of atopic dermatitis as a risk factor for developing hand eczema in high-risk occupations is debated^{5 10} but was found to be a risk factor in this study.

This study is based on questionnaires and clinical examinations with a high participation rate. The question concerning self-reported hand eczema has been previously validated in this

Workplace

cohort using clinical hand examination as the gold standard,⁴⁰ thus showing that the self-reported prevalence of hand eczema in this study design is a valid assessment method, with a sensitivity of 70.3% and a specificity of 99.8%. In addition, atopic dermatitis was diagnosed according to all minor diagnostic criteria of the UK Working Party.^{41–44} This was possible because all apprentices were clinically examined for flexural eczema at enrolment. These procedures have probably resulted in a more precise estimate of atopic dermatitis than in many other studies, including a previous study of our own¹³ where clinical examinations were not performed. All clinical examinations were carried out by one observer, which eliminates any interobserver variability.

During the study, the intervention group on average spent significantly more time in the salons, and thereby experienced high exposure conditions, than in the schools. This could have biased the results towards a higher incidence of hand eczema in the intervention group and affected the outcome of the intervention. In addition, significantly more apprentices from the intervention group were examined in the salons at the second follow-up, which could have increased the point prevalence in that group, as they typically experienced a flare-up of their symptoms during highly exposed periods.

This study also has some limitations. The non-randomised and non-blinded design could have impacted on the incidence of self-reported hand eczema. In order to minimise possible confounding by the non-blinded design, the apprentices were instructed to answer the questionnaire in light of their own experience. As shown in a previous publication, self-reporting of hand eczema is a valid method in this study design.⁴⁰ The non-randomised design was chosen for practical reasons, primarily because some of the schools were already planning or providing training on preventive measures. There were no differences between the intervention schools and the control schools at enrolment regarding the age of the apprentices, sex distribution, prevalence of atopic dermatitis, body mass index, smoking habits, alcohol consumption or point, 1-year and life-time prevalences of hand eczema or of eczema on wrists and forearms. The two groups were considered appropriate for comparison.

We conclude that evidence-based education is an effective approach for the prevention of occupational hand eczema among hairdressing apprentices. We recommend offering hairdressing apprentices more training on the prevention of occupational hand eczema. This is a cheap and fairly easy way to prevent a condition which has a substantial impact on the individual and on society. It would be interesting to follow the cohort further to evaluate the long-term effects of this intervention.

Funding This study was supported by the Danish Hairdressers' and Beauticians' Union, the Danish Hairdresser Association, the Danish Working Environment Research Fund and the Aage Bangs Foundation.

Competing interests None.

Ethics approval The Committee on Biomedical Research Ethics of Copenhagen and Frederiksberg approved this study (H-B-2007–096).

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

1. **Skoet R**, Olsen J, Mathiesen B, *et al*. A survey of occupational hand eczema in Denmark. *Contact Dermatitis* 2004;**51**:159–66.
2. **Agner T**. Hand eczema. In: Johansen JD, Frosch PJ, Lepiottevin J-P, 5 eds. *Contact Dermatitis*. Heidelberg, Germany: Springer-Verlag, 2011:395–406.
3. **Lind ML**, Albin M, Brisman J, *et al*. Incidence of hand eczema in female Swedish hairdressers. *Occup Environ Med* 2007;**64**:191–5.
4. **Hansen HS**, Sosted H. Hand eczema in Copenhagen hairdressers—prevalence and under-reporting to occupational registers. *Contact Dermatitis* 2009;**61**:361–3.
5. **Roberts H**, Frowen K, Sim M, *et al*. Prevalence of atopy in a population of hairdressing students and practising hairdressers in Melbourne, Australia. *Australas J Dermatol* 2006;**47**:172–7.
6. **Holm JO**, Veierod MB. An epidemiological study of hand eczema. I. Prevalence and cumulative prevalence among hairdressers compared with a control group of teachers. *Acta Derm Venereol Suppl (Stockh)* 1994;**187**:8–11.
7. **Diepgen TL**, Coenraads PJ. The epidemiology of occupational contact dermatitis. *Int Arch Occup Environ Health* 1999;**72**:496–506.
8. **Uter W**, Gefeller O, Schwanitz HJ. Occupational dermatitis in hairdressing apprentices. Early-onset irritant skin damage. *Curr Probl Dermatol* 1995;**23**:49–55.
9. **Uter W**, Pfahlerberg A, Gefeller O, *et al*. Prevalence and incidence of hand dermatitis in hairdressing apprentices: results of the POSH study. Prevention of occupational skin disease in hairdressers. *Int Arch Occup Environ Health* 1998;**71**:487–92.
10. **Uter W**, Pfahlerberg A, Gefeller O, *et al*. Hand dermatitis in a prospectively-followed cohort of hairdressing apprentices: final results of the POSH study. Prevention of occupational skin disease in hairdressers. *Contact Dermatitis* 1999;**41**:280–6.
11. **Valks R**, Conde-Salazar L, Malfaito J, *et al*. Contact dermatitis in hairdressers, 10 years later: patch-test results in 300 hairdressers (1994 to 2003) and comparison with previous study. *Dermatitis* 2005;**16**:28–31.
12. **Yngveson M**, Svensson A, Isacson A. Prevalence of self-reported hand dermatitis in upper secondary school pupils. *Acta Derm Venereol* 1998;**78**:371–4.
13. **Bregnhøj A**, Sosted H, Menné T, *et al*. Healthy worker effect in hairdressing apprentices. *Contact Dermatitis* 2011;**64**:80–4.
14. **Lysdahl SH**, Sosted H, Andersen KE, *et al*. Hand Eczema in hairdressers: a Danish register-based study of the prevalence of hand eczema and its career consequences. *A Contact Dermatitis*. 2011;**65**(3):151–8.
15. **Leino T**, Tuomi K, Paakkulainen H, *et al*. Health reasons for leaving the profession as determined among Finnish hairdressers in 1980–1995. *Int Arch Occup Environ Health* 1999;**72**:56–9.
16. **Danish National Board of Health**. *Forebyggelse af kontakteksem*. Report 2001.
17. **Diepgen TL**. The costs of skin disease. *Eur J Dermatol* 2006;**16**:456–60.
18. **Held E**, Wolff C, Gyntelberg F, *et al*. Prevention of work-related skin problems in student auxiliary nurses: an intervention study. *Contact Dermatitis* 2001;**44**:297–303.
19. **Held E**, Mygind K, Wolff C, *et al*. Prevention of work related skin problems: an intervention study in wet work employees. *Occup Environ Med* 2002;**59**:556–61.
20. **Agner T**, Held E. Skin protection programmes. *Contact Dermatitis* 2002;**47**:253–6.
21. **Flyvholm MA**, Mygind K, Sell L, *et al*. A randomised controlled intervention study on prevention of work related skin problems among gut cleaners in swine slaughterhouses. *Occup Environ Med* 2005;**62**:642–9.
22. **Mygind K**, Borg V, Flyvholm MA, *et al*. A study of the implementation process of an intervention to prevent work-related skin problems in wet-work occupations. *Int Arch Occup Environ Health* 2006;**79**:66–74.
23. **Sell L**, Flyvholm MA, Lindhard G, *et al*. Implementation of an occupational skin disease prevention programme in Danish cheese dairies. *Contact Dermatitis* 2005;**53**:155–61.
24. **Uter W**, Lessmann H, Geier J, *et al*. Contact allergy to ingredients of hair cosmetics in female hairdressers and clients—an 8-year analysis of IVDK data. *Contact Dermatitis* 2003;**49**:236–40.
25. **Hueber-Becker F**, Nohynek GJ, Dufour EK, *et al*. Occupational exposure of hairdressers to [14C]-para-phenylenediamine-containing oxidative hair dyes: a mass balance study. *Food Chem Toxicol* 2007;**45**:160–9.
26. **Lind ML**, Boman A, Sollenberg J, *et al*. Occupational dermal exposure to permanent hair dyes among hairdressers. *Ann Occup Hyg* 2005;**49**:473–80.
27. **Moscatto G**, Pignatti P, Yacoub MR, *et al*. Occupational asthma and occupational rhinitis in hairdressers. *Chest* 2005;**128**:3590–8.
28. **Lind ML**, Johnsson S, Meding B, *et al*. Permeability of hair dye compounds p-phenylenediamine, toluene-2,5-diaminesulfate and resorcinol through protective gloves in hairdressing. *Ann Occup Hyg* 2007;**51**:479–85.
29. **Ramsing DW**, Agner T. Effect of glove occlusion on human skin (II). Long-term experimental exposure. *Contact Dermatitis* 1996;**34**:258–62.
30. **Ramsing DW**, Agner T. Effect of glove occlusion on human skin. (I). short-term experimental exposure. *Contact Dermatitis* 1996;**34**:1–5.
31. **Held E**, Agner T. Comparison between 2 test models in evaluating the effect of a moisturizer on irritated human skin. *Contact Dermatitis* 1999;**40**:261–8.
32. **Held E**, Johansen JD, Agner T, *et al*. Contact allergy to cosmetics: testing with patients' own products. *Contact Dermatitis* 1999;**40**:310–15.
33. **Held E**, Agner T. Effect of moisturizers on skin susceptibility to irritants. *Acta Derm Venereol* 2001;**81**:104–7.
34. **Hansen KS**. Occupational dermatoses in hospital cleaning women. *Contact Dermatitis* 1983;**9**:343–51.
35. **Nilsson E**, Mikaelsson B, Andersson S. Atopy, occupation and domestic work as risk factors for hand eczema in hospital workers. *Contact Dermatitis* 1985;**13**:216–23.
36. **Agner T**, Serup J. Seasonal variation of skin resistance to irritants. *Br J Dermatol* 1989;**121**:323–8.
37. **Goldenhar LM**, LaMontagne AD, Katz T, *et al*. The intervention research process in occupational safety and health: an overview from the National Occupational Research Agenda Intervention Effectiveness Research team. *J Occup Environ Med* 2001;**43**:616–22.

38. **Meding B**, Barregård L. Validity of self-reports of hand eczema. *Contact Dermatitis* 2001;**45**:99–103.
39. **Susitaival P**, Flyvholm MA, Meding B, *et al*. Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure. *Contact Dermatitis* 2003;**49**:70–6.
40. **Bregnhøj A**, Søsted H, Menné T, *et al*. Validation of self-reported hand eczema among Danish hairdressing apprentices. *Contact Dermatitis* 2011;**65**:146–50.
41. **Hanifin JM**, Rajka G. Diagnostic features of atopic dermatitis. *Acta Derm Venereol Suppl (Stockh)* 1980;**92**:44–7.
42. **Williams HC**, Burney PG, Hay RJ, *et al*. The U.K. Working Party's diagnostic criteria for atopic dermatitis. I. Derivation of a minimum set of discriminators for atopic dermatitis. *Br J Dermatol* 1994;**131**:383–96.
43. **Williams HC**, Burney PG, Pembroke AC, *et al*. The U.K. Working Party's diagnostic criteria for atopic dermatitis. III. Independent hospital validation. *Br J Dermatol* 1994;**131**:406–16.
44. **Williams HC**, Burney PG, Pembroke AC, *et al*. Validation of the U.K. diagnostic criteria for atopic dermatitis in a population setting. U.K. Diagnostic Criteria for Atopic Dermatitis Working Party. *Br J Dermatol* 1996;**135**:12–17.
45. **Held E**, Skoet R, Johansen JD, *et al*. The hand eczema severity index (HECSI): a scoring system for clinical assessment of hand eczema. A study of inter- and intraobserver reliability. *Br J Dermatol* 2005;**152**:302–7.
46. **Nixon R**, Roberts H, Frowen K, *et al*. Knowledge of skin hazards and the use of gloves by Australian hairdressing students and practising hairdressers. *Contact Dermatitis* 2006;**54**:112–16.
47. **Ling TC**, Coulson IH. What do trainee hairdressers know about hand dermatitis? *Contact Dermatitis* 2002;**47**:227–31.
48. **Kralj N**, Oertel C, Doench NM, *et al*. Duration of wet work in hairdressers. *Int Arch Occup Environ Health* 2011;**84**(1):29–34.
49. **Jungbauer FH**, Lensen GJ, Groothoff JW, *et al*. Exposure of the hands to wet work in nurses. *Contact Dermatitis* 2004;**50**:225–9.
50. **Majoie IM**, von Blomberg BM, Bruynzeel DP. Development of hand eczema in junior hairdressers: an 8-year follow-up study. *Contact Dermatitis* 1996;**34**:243–7.
51. **Holm JO**, Veierød MB. An epidemiological study of hand eczema. V. Prevalence among hairdresser trainees, compared with a general population of hairdressers. *Acta Derm Venereol Suppl (Stockh)* 1994;**187**:23–5.



Prevention of hand eczema among Danish hairdressing apprentices: an intervention study

Anne Bregnhøj, Torkil Menné, Jeanne Duus Johansen, et al.

Occup Environ Med published online January 20, 2012

doi: 10.1136/oemed-2011-100294

Updated information and services can be found at:
<http://oem.bmj.com/content/early/2012/01/20/oemed-2011-100294.full.html>

These include:

Data Supplement

"Supplementary Data"

<http://oem.bmj.com/content/suppl/2012/01/20/oemed-2011-100294.DC1.html>

References

This article cites 48 articles, 6 of which can be accessed free at:

<http://oem.bmj.com/content/early/2012/01/20/oemed-2011-100294.full.html#ref-list-1>

P<P

Published online January 20, 2012 in advance of the print journal.

Email alerting service

Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Notes

Advance online articles have been peer reviewed, accepted for publication, edited and typeset, but have not yet appeared in the paper journal. Advance online articles are citable and establish publication priority; they are indexed by PubMed from initial publication. Citations to Advance online articles must include the digital object identifier (DOIs) and date of initial publication.

To request permissions go to:
<http://group.bmj.com/group/rights-licensing/permissions>

To order reprints go to:
<http://journals.bmj.com/cgi/reprintform>

To subscribe to BMJ go to:
<http://group.bmj.com/subscribe/>

Appendix 1

Specific questions concerning hairdressing procedures, used in the questionnaire for 1st and 2nd follow-up.

- To which procedures do you always use gloves at the school / in the saloon? (Yes / no)

Shampooing

Hair dying

Rinse hair dye

Eyebrow dye

Bleaching

Rinse bleaching

Permanent

Rinse permanent

- How long time do you have wet hands on a regular day at work?

Including cutting wet hair, shampooing, dish wash, cleaning the saloon etc without gloves.

Never

Less than ½ hour per day

½ - 1 hour per day

More than 1 hour but less than 2 hours per day

2 – 3 hours per day

More than 3 hour but less than 4 hours per day

4 hours or more per day

- Do you reuse gloves? (yes / no)

- If yes, do you turn them inside out and reuse them?

Yes, always

Yes, more than half of the times

Yes, half of the times

Yes, less than half of the times

No, never

- How many hours, on a regular day, do you use gloves at work?

Never

Less than $\frac{1}{2}$ hour per day

$\frac{1}{2}$ - 1 hour per day

More than 1 hour but less than 2 hours per day

2 – 3 hours per day

More than 3 hour but less than 4 hours per day

4 hours or more per day