

Occupational skin diseases in hairdressing apprentices – has anything changed?

Majken G. Hougaard¹, Lone Winther², Heidi Søsted¹, Claus Zachariae² and Jeanne D. Johansen¹

¹National Allergy Research Centre, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, 2900 Hellerup, Denmark and

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

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Summary

Background. Hairdressers are at risk for occupational skin diseases. Since 2008, an educational programme has been conducted in Danish hairdressing schools to prevent occupational skin diseases. Its effect is unknown.

Objective. To examine the current frequency of self-reported hand eczema and contact urticaria in Danish hairdressing apprentices as compared with controls, and to determine the occurrence of hand eczema and contact urticaria in hairdressing apprentices with different durations of exposure to the trade.

Methods. This was a cross-sectional, web-based questionnaire study conducted among 504 hairdressing apprentices and a control group of 1400 adolescents from the general population.

Results. Hand eczema was significantly more prevalent in the hairdressing apprentices than in controls (34.5% versus 18.8%, $p < 0.001$). The incidence rate of hand eczema among hairdressing apprentices was 98 cases/1000 person-years. Contact urticaria was also more prevalent in the hairdressing apprentices (7.3% versus 4.2%, $p = 0.006$). Both diseases increased with increasing duration of exposure to the trade.

Conclusion. Despite educational efforts to prevent occupational skin diseases in the hairdressing schools, Danish apprentices are still at increased risk for hand eczema and contact urticaria. Both diseases develop after only a few years of work in hairdressing. Further preventive strategies are warranted.

Key words: contact urticaria; hairdressing apprentices; hand eczema; web-based questionnaire.

Hairdressers have daily exposure to various chemicals and allergens, and are consequently at risk for occupational skin diseases. In Danish hairdressers, a lifetime prevalence of hand eczema of 42–44% has been reported (1, 2). Hairdressing apprentices seem to have

a particularly high (3) risk, with a reported lifetime prevalence of 27–58% (4–6).

Common hairdressing allergens in Denmark include *p*-phenylenediamine and toluene-2,5-diamine in hair dyes, and persulfates in bleaching products. Additionally, glyceryl monothioglycolate (GMTG) in permanent wave solutions (7, 8) is a frequent cause of contact dermatitis in hairdressers. Although the withdrawal of GMTG in some European countries has resulted in a reduction in GMTG allergy in these countries (9), GMTG is still used in permanent wave solutions in Denmark. In addition to the heavy allergen exposure, hairdressing apprentices frequently perform wet work, which strongly predisposes them to the development of irritant contact dermatitis.

Correspondence: Majken Gabriel Hougaard, National Allergy Research Centre, Department of Dermato-Allergology, Copenhagen University Hospital Gentofte, Niels Andersens Vej 65, 2900 Hellerup, Denmark. Tel.: (+45) 39777312; Fax: (+45) 39 77 71 18. E-mail: majken.gabriel.hougaard@regionh.dk

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Since 2008, an education programme has been conducted in Danish hairdressing schools in order to prevent hand eczema. Whether it has had an effect is unknown.

In addition to hand eczema, hairdressers are at risk of developing contact urticaria (10–14). The causal agents may be persulfates, natural rubber latex proteins, hydrolysed wheat protein (15), or hair dye ingredients (16). According to Australian findings, hairdressers have one of the highest frequencies of occupational contact urticaria (12). However, few studies on contact urticaria in hairdressers have been published, and studies on contact urticaria in hairdressing apprentices have never been performed.

The objectives of this study were to examine the current prevalence and incidence of hand eczema in Danish hairdressing apprentices, and thereby evaluate whether hairdressing apprentices are still at significant risk of developing hand eczema after the introduction of the educational programme in 2008. We also investigated whether self-reported contact urticaria was more prevalent in hairdressing apprentices than in adolescents from the general population. Finally, we determined the occurrence of hand eczema and contact urticaria in hairdressing apprentices with different durations of exposure to the trade.

Materials and Methods

A cross-sectional, case–control questionnaire study was conducted among all hairdressing apprentices in Denmark and a control group comprising adolescents from the general population.

The study was approved by the Danish Data Protection Agency.

The Danish training programme for hairdressing apprentices

Hairdressing training in Denmark is provided by 10 governmentally supported vocational schools distributed evenly throughout the country. Apprenticeship takes 4 years: 60 weeks in the schools, and 148 weeks working in different hairdressing salons. Exposure to hair dyes, hair bleaches, permanent wave solutions and styling products starts within the first weeks of apprenticeship. Since 2008, several lessons have been given during the first 20 weeks of apprenticeship about chemistry and protective measures against occupational skin diseases.

Study population

All 10 vocational schools in Denmark were invited to participate in the questionnaire study; eight participated. Contact information on 1128 hairdressing

apprentices was collected. We included apprentices at all levels of apprenticeship, including apprentices who had recently graduated (within 1 year). Both hairdressing apprentices training in schools and hairdressing apprentices currently training in salons were included.

For the control group, contact information on 2701 persons of similar age, sex and post code was obtained from the Danish Research Services (Statens Serum Institut, Copenhagen, Denmark).

In April–July 2013, 3829 invitation letters and two reminders for a web-based questionnaire (Enalyzer Survey Solutions) were sent by post to cases and controls. To increase the participation rate, participants were automatically enrolled in a prize draw.

Questionnaire

The web-based questionnaire contained 99 questions, of which approximately half concerned atopic dermatitis, hand eczema, contact urticaria, smoking status, education, and work. Questions on atopic dermatitis were based on the UK Working Party's criteria (17). Questions from the Nordic Occupational Skin Questionnaire (NOSQ) (18) were used to identify hand eczema and urticaria.

Definitions of outcome variables

Hand eczema was defined by an affirmative answer to the question: 'Have you ever had hand eczema?'

Incident hand eczema was defined as hand eczema with onset at the same time as starting current education or work or later.

Urticaria on the hands, wrists or forearms was defined as an affirmative answer to the question: 'Have you ever had itchy wheals appearing and disappearing rapidly (within hours) on your hands, wrists or forearms (urticaria or nettle rash)?'

Contact urticaria was defined as an affirmative answer to the question: 'Have these itchy wheals (urticaria) on your hands, wrists or forearms been caused by skin contact with rubber gloves, hair dyes, cosmetics or the like?'

Covariates

Atopic dermatitis was defined, according to the UK Working Party's diagnostic criteria (17), as the presence of one major criterion and two or more minor criteria.

Personal smoking status was recorded according to ECRHS III (19), and defined as never smoker, ex-smoker, and current smoker. Cigarettes/day were calculated for current smokers.

Hairdressing school takes 4 years in Denmark. For level of apprenticeship, the apprentices were grouped according to their current year of apprenticeship.

Statistical analysis

The statistical program IBM SPSS™ version 19 (SPSS Inc., Chicago, IL, USA) was used for statistical analysis. A chi-squared test was used for binary data, and a *t*-test was used for normally distributed continuous data. A two-sided *p*-value of ≤ 0.05 was considered to be statistically significant.

Binary logistic regression analyses were performed to study the development of hand eczema and contact urticaria in hairdressing apprentices at different levels of apprenticeship. Adjustment was made for age, sex, atopic dermatitis, and smoking status. Associations were expressed as odds ratios (ORs) and their accompanying 95% confidence interval (CIs). Hairdressing apprentices who had dropped out of hairdressing school were not included in regression analyses.

Results

Of the 3829 invited persons (1128 hairdressing apprentices and 2701 controls), 1908 successfully completed the questionnaire (505 hairdressing apprentices and 1403 controls). Controls with previous exposure to hairdressing work were excluded from the study. One respondent from the case group was excluded because of a

language barrier. This left 1904 respondents for analyses.

The overall participation rate was 49.8% (1904/3825). There were no major differences in age, sex or geographical distribution between responders and non-responders.

The participation rate was significantly lower for cases than for controls (Table 1). Both groups consisted mainly of females. The median age was 22 years in both groups. The geographical distribution of cases and control was similar (results not given). Current smoking was significantly more common in hairdressing apprentices than in controls.

Of the hairdressing apprentices, 18.1% were first-year apprentices, 20.0% were second-year apprentices, 20.2% were third-year apprentices, 21.6% were fourth-year apprentices, 19.0% had recently graduated, and 5 (1%) had dropped out of school since their information was provided by the schools.

Occurrence of hand eczema

The prevalence of hand eczema was significantly higher in hairdressing apprentices across all groups (34.5%) than in controls (18.8%) ($p < 0.001$) (Table 2). Hairdressing apprentices were older than controls at the onset of hand eczema (18 versus 15 years, $p < 0.001$). Among the participants reporting hand eczema, hairdressing apprentices had a significantly higher proportion of incident hand eczema (Table 2). The incidence of hand eczema was 98 cases/1000 person-years.

Table 1. Main characteristics of participants

	Hairdressing apprentices (n = 504)	Controls (n = 1400)	OR (95% CI)*	<i>p</i> -value
Participation rate, % (no.)	44.7 (504/1127)	51.9 (1400/2698)	0.75 (0.65–0.86)	< 0.001
Female, % (no.)	94.6 (477/504)	95.7 (1340/1400)	0.79 (0.50–1.26)	0.323
Age (years), mean (SD)	22 years (3.8)	22 years (4.1)	–	0.545
Never-smoker, % (no.)	56.5 (285/504)	71.6 (1002/1400)	0.52 (0.42–0.64)	< 0.001
Current smoker, % (no.)	28.4 (143/504)	17.2 (241/1400)	1.91 (1.50–2.42)	< 0.001
Ex-smoker, % (no.)	15.1 (76/504)	11.2 (157/1400)	1.41 (1.05–1.89)	0.023
Cigarettes/day, mean (SD)	10.04 (5.6)	9.45 (6.3)	–	0.353
Level of apprenticeship				
None, no. (%)	–	1400 (100)		
First year, % (no.)	18.1 (91)	0		
Second year, % (no.)	20.0 (101)	0		
Third year, % (no.)	20.2 (102)	0		
Fourth year, % (no.)	21.6 (109)	0		
Recently graduated, % (no.)	19.0 (96)	0		
Dropped out, % (no.)	1.0 (5)	0		

CI, confidence interval; OR, odds ratio; SD, standard deviation.

Bold type indicates statistical significance.

*Crude OR for cases as compared with controls.

Table 2. Hand eczema and urticaria in hairdressing apprentices as compared with controls

	Hairdressing apprentices (n = 504)	Controls (n = 1400)	Crude OR (95% CI)	p-value
Hand eczema	34.5 (174/504)	18.8 (263/1400)	2.3 (1.8–2.9)	< 0.001
Incident hand eczema	78.2 (136/174)	24.0 (63/263)	11.4 (7.2–18.0)	< 0.001
Age at onset of hand eczema (years), mean (SD)	18 (4.7)	15 (6.3)	–	< 0.001
Urticaria on hands, wrists, or forearms	23.2 (117/504)	24.3 (340/1400)	0.9 (0.7–1.2)	0.63
Contact urticaria	7.3 (37/504)	4.2 (59/1400)	1.8 (1.2–2.8)	0.006

CI, confidence interval; OR, odds ratio; SD, standard deviation.

Values are % (n/N) unless otherwise stated.

Bold type indicates statistical significance.

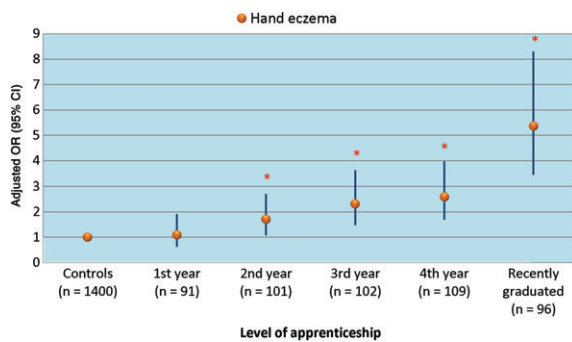


Fig. 1. The association between hand eczema and level of apprenticeship was studied with a binary regression analysis. Adjustment was performed for sex, age, level of apprenticeship, atopic dermatitis, and smoking status. Results are expressed as adjusted odds ratios (ORs) with accompanying 95% confidence intervals (CIs). ORs marked with an asterisk are statistically significantly different from controls.

Occurrence of urticaria

The prevalence of urticaria on the hands, wrists or forearms was similar in hairdressing apprentices and controls (Table 2). However, self-reported contact urticaria caused by skin contact with rubber chemicals, hair dyes, cosmetics or the like was significantly more prevalent in hairdressing apprentices, with a frequency of 7.3% as compared with 4.2% in controls ($p = 0.006$).

Effect of level of apprenticeship on hand eczema and contact urticaria

The prevalence of hand eczema increased with increasing level of apprenticeship: 18.7% of first-year apprentices, 29.7% of second-year apprentices, 33.3% of third-year apprentices, 36.7% of fourth-year apprentices, and 53.1% of recently graduated hairdressing apprentices ($p < 0.001$).

The risk of hand eczema increased with increasing level of apprenticeship (Fig. 1).

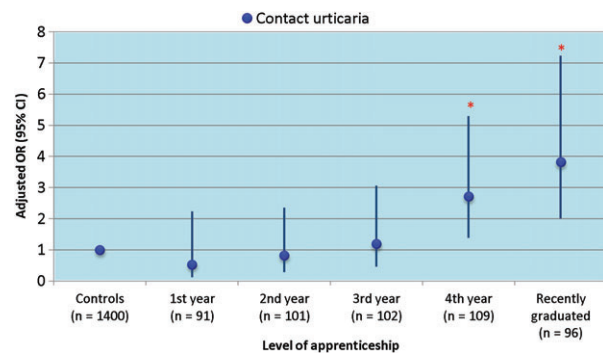


Fig. 2. The association between contact urticaria and level of apprenticeship was studied with a binary regression analysis. Adjustment was performed for sex, age, level of apprenticeship, atopic dermatitis, and smoking status. Results are expressed as adjusted odds ratios (ORs) with accompanying 95% confidence intervals (CIs). ORs marked with an asterisk are statistically significantly different from controls.

Apprentices in the second year of hairdressing school had almost twice as high an OR for hand eczema as adolescents from the general population (OR 1.7, 95% CI 1.07–2.70). Recently graduated hairdressers had a more than five times higher OR than controls (OR 5.34, 95% CI 3.44–8.30).

Neither age nor smoking was associated with an increased risk of hand eczema. Atopic dermatitis was a risk factor for hand eczema (OR 2.75, 95% CI 2.19–3.45).

The prevalence of contact urticaria also increased with increasing level of apprenticeship: 2.2% of first-year apprentices, 4.0% of second-year apprentices, 4.9% of third-year apprentices, 11.0% of fourth-year apprentices, and 14.6% of recently graduated hairdressing apprentices ($p < 0.001$).

The risk of contact urticaria increased with increasing level of apprenticeship (Fig. 2).

Apprentices in the fourth year of hairdressing school had an almost three times higher OR for contact urticaria than adolescents from the general population (OR 2.71, 95% CI 1.39–5.30). Recently graduated hairdressers had an almost four times higher OR than controls (OR 3.81, 95% CI 2.01–7.23).

Atopic dermatitis was a risk factor for contact urticaria (OR 2.69, 95% CI 1.77–4.11). Current smoking tended to increase the risk of contact urticaria (OR 1.57, 95% CI 0.97–2.53). Age was not associated with an increased risk of contact urticaria.

Discussion

Hand eczema is a well-recognized problem in hairdressing, and there have been several efforts to reduce its incidence. During 2008–2010, a clinically controlled prospective intervention study was conducted (20), and showed that the implementation of a training programme in Danish hairdressing schools resulted in a significantly reduced incidence of hand eczema in the intervention group as compared with controls. As a result, hairdressing schools in Denmark have, since then, provided several lessons on chemistry and protective measures in hairdressing during the first 20 weeks of apprenticeship. In spite of these efforts, we show that hand eczema is still a substantial problem for hairdressing apprentices in Denmark. In the first year of apprenticeship, the risk of hand eczema has increased, and in the second year of apprenticeship the OR has significantly increased to almost double that of adolescents from the general population. In 2009, 49.4% of hairdressing apprentices in Denmark had experienced hand eczema (1). This prevalence is comparable to our data on hairdressing apprentices in the third and fourth years of apprenticeship.

Our findings underline the need for further efforts to reduce hand eczema in hairdressing apprentices. Educating apprentices in the schools is a welcome effort; however, two-thirds of the apprenticeship is spent training in the salons, and this needs to be considered in any effective prevention strategy.

We report here an incidence of 98 cases/1000 person-years for hand eczema in Danish hairdressing apprentices. This incidence is much higher than that reported for trained Swedish hairdressers younger than 25 years (37.1 cases/1000 person-years) (21). However, it is much lower than that reported by Uter et al. in 1999 (343 cases/1000 person-years) among German hairdressing apprentices (6) and that reported by Smit et al. in 1994 (22) (328 cases/1000 person-years). Unfortunately, study methods vary between the four studies, which makes comparison of results difficult.

The questions used to examine self-reported hand eczema in this study have previously proven to be in good agreement with clinical examination, and are considered to constitute a valid method for estimating the prevalence of hand eczema, although they might underestimate the true prevalence (1, 23).

This is the first study to investigate contact urticaria in hairdressing apprentices. A previous study investigating contact urticaria in trained hairdressers reported a prevalence of 16% (24). This is comparable to our findings among apprentices in the fourth year of apprenticeship and recently graduated hairdressers. Contact urticaria in hairdressing apprentices has not been identified before, and further studies should be performed to substantiate the findings and investigate the consequences.

The association between hairdressers' occupational skin diseases and smoking remains controversial. In line with previous investigations (25, 26), we found that smoking is more common in hairdressing apprentices than in controls. Smoking seems to play a role in the development of contact urticaria, but was not associated with hand eczema.

The defective skin barrier seen in atopic dermatitis is hypothesized to predispose to allergic reactions of both type 1 (27) and type 4 (28). As expected, we found that atopic dermatitis was a strong risk factor for the development of hand eczema and contact urticaria in both hairdressing apprentices and controls. More precisely, the risk of hand eczema and contact urticaria increased almost threefold in participants with a history of atopic dermatitis. Knowledge of this strong association is important, as it enables career guidance for young people with concurrent atopic dermatitis and a desire to become hairdressers.

A majority of the questions used in this study were adopted from previously validated questionnaires. In order to make the question concerning contact urticaria more relevant for the hairdressing apprentices, it was slightly changed from the original version by the NOSQ: 'Have these itchy wheals (urticaria) on your hands, wrists or forearms been caused by skin contact with fruits, vegetables, rubber gloves, animals, etc.?' to 'Have these itchy wheals (urticaria) on your hands, wrists or forearms been caused by skin contact with rubber gloves, hair dyes, cosmetics or the like?' This modification of the question has potentially introduced a bias, as hairdressing apprentices inevitably have more exposure to rubber gloves, hair dyes, cosmetics or the like than adolescents from the general population. They might therefore have been more prone to answer 'yes' to this question.

In Denmark, internet access has been available to > 80% of the population since 2009 (29). Therefore, we believed that distribution of questionnaires via the

internet was suitable for the study. However, achieving a high response rate can be challenging in web-based questionnaire studies (29), so we tried to overcome this obstacle by enrolling respondents in a prize draw. This may also have limited the potential bias resulting from the fact that sick individuals are more prone to answer questionnaires on health. The response rate may be a limitation of the study. However, as the available demographic data do not differ between respondents and non-respondents, we see no immediate reason to believe that the two groups differ from each other.

Conclusion

In spite of efforts to prevent hand eczema by means of education in the hairdressing schools, hairdressing

apprentices are still at increased risk for hand eczema. Hairdressing also seems to increase the risk for contact urticaria. Both hand eczema and contact urticaria develop after only few years of work in the hairdressing trade. Further preventive strategies to reduce occupational skin diseases in hairdressing apprentices are warranted, especially in the hairdressing salons.

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