

Incidence of skin and respiratory diseases among Danish hairdressing apprentices

Majken H. Foss-Skiftesvik^{1,2}, Lone Winther³, Claus R. Johnsen³, Claus Zachariae³ and Jeanne D. Johansen¹

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

²Department of Dermatology and Allergy, Research Centre for Hairdressers and Beauticians, Copenhagen University Hospital Gentofte, 2900 Hellerup, Denmark, and ³Department of Dermatology and Allergy, Copenhagen University Hospital Gentofte, 2900 Hellerup, Denmark

doi:10.1111/cod.12744

Summary

Background. Hairdressing is one of the professions with the highest risk of occupational skin and respiratory diseases. The incidence of these diseases in hairdressing apprentices has been studied only sparsely.

Objective. To determine the incidence of skin and respiratory diseases in hairdressing apprentices, and to explore whether hairdressing apprentices leave the trade during training because of these diseases.

Methods. A 3-year follow-up questionnaire study was conducted among 248 hairdressing apprentices and a control group comprising 816 young adults from the general population.

Results. The incidence rate ratios (IRRs) for contact urticaria (IRR 4.7, 95%CI: 2.6–8.6), hand eczema (IRR 1.7, 95%CI: 1.1–2.6) and rhinitis symptoms (IRR 1.6, 95%CI: 1.2–2.2) were significantly increased in the hairdressing apprentices, whereas wheezing was similar between groups. During the follow-up period, 21.8% of the hairdressing apprentices had left the trade, and 70.3% of these had left because of health complaints. The most frequently reported reasons for leaving were musculoskeletal pain (47.4%) and skin diseases (47.4%), followed by respiratory symptoms (23.7%).

Conclusions. Hairdressing apprentices are at increased risk for contact urticaria, hand eczema and rhinitis symptoms compared with the general population, and a substantial proportion leave the trade because of these diseases, causing a 'healthy worker survivor effect.'

Key words: contact urticaria; epidemiology; hairdressing apprentices; hand eczema; incidence; occupational; rhinitis symptoms; wheezing.

Correspondence: Majken Hougaard Foss-Skiftesvik, Department of Dermatology and Allergy, Research Centre for Hairdressers and Beauticians/National Allergy Research Centre, Copenhagen University Hospital Gentofte, Kildegårdsvej 28, Section 20A, DK-2900 Hellerup, Denmark. Tel: +45 38 67 73 03; Fax: +45 39 67 71 18. E-mail: mhou0016@regionh.dk

Conflicts of interest: There are no actual or potential competing financial interests for any of the authors.

Accepted for publication 10 November 2016

Hairdressers are exposed to various allergenic and irritant substances on a daily basis (1, 2). The hands and the respiratory tract are particularly exposed. Hence, hairdressers are at risk of suffering from occupational skin and respiratory diseases such as hand eczema, contact urticaria, asthma, and rhinitis. Various types of epidemiological study have assessed the occurrence of these diseases in hairdressers. Registry studies have identified hairdressing as being among the occupations with the highest risk of occupational hand eczema (3–5), contact urticaria (6, 7),

rhinitis (8), and asthma (9–12). In these registry studies, the primary focus is on diagnosed cases of disease, and thereby conservative risk estimates of the actual occurrence are given. Several cross-sectional studies investigating the occurrence of self-reported disease have also been conducted among hairdressers (13–18). These studies report higher estimates of disease frequency. However, the cross-sectional design entails the risk of a healthy worker effect if sensitive individuals have already left the trade and are therefore not included in the sample. Prospective studies examining the incidence of new cases of diseases are usually the preferred approach for studying the cause of disease, because they use all of the available information on the studied population. Such studies are, however, rare among hairdressing apprentices (19–21). A healthy worker effect has already been suggested to exist in hairdressers in relation to both skin and respiratory diseases, as a result of a ‘healthy hire effect’ (22), as newly started hairdressing apprentice have less hand eczema and atopic dermatitis (23), fewer symptoms and better lung function (21) than control groups. Whether sensitive individuals discontinue training because of skin and respiratory diseases, resulting in a ‘healthy survivor effect’ (22), has not been examined in hairdressing apprentices. The aims of this study were to examine the incidence of skin and respiratory diseases in hairdressing apprentices, and to explore whether hairdressing apprentices leave the trade during training because of these diseases.

Methods

The study was conducted as a 3-year follow-up questionnaire study among hairdressing apprentices and a comparable reference group comprising young adults from the general population (referred to as the population controls). The study population is described in detail in previous publications (24, 25). The baseline study was conducted between April and July 2013 as a web-based questionnaire study among 504 hairdressing apprentices and 1400 population controls in Denmark. In the baseline study, personal registration numbers and e-mail addresses of individual participants were documented. For the follow-up study in 2016, the current addresses of participants were obtained through the Danish Research Services (Forsker Service, Statens Serum Institute, Copenhagen) by use of their personal registration numbers. The follow-up study was conducted between April and June 2016. Participants first received an invitation e-mail, and then received two reminders, with a link to the web-based questionnaire. Non-responders subsequently received a paper questionnaire and a pre-paid return envelope by post. One postal reminder was issued.

Questionnaire

The questionnaire contained questions concerning respiratory symptoms, asthma, rhinitis, urticaria on the hands, contact urticaria, hand eczema, smoking habits, occupational exposures, and education level. Questions were adopted from the Nordic Occupational Skin Questionnaire 2002 (26) and the European Community Respiratory Health Survey (27). For details concerning the definition of wheezing, rhinitis symptoms, hand eczema, urticaria on the hands, wrist, or forearms, and contact urticaria, see previous studies (24, 25). To determine incident cases of disease since baseline, the following questions were used: (i) Have you had wheezing or whistling in your chest at any time since the last survey? (ii) Have you, since the last survey, had a problem with sneezing or a runny or blocked nose when you did not have a cold or the flu? (iii) Have you had hand eczema since the last survey? (iv) Have you, since the last survey, had itchy wheals appearing and disappearing rapidly (within hours) on your hands, wrists, or forearms (urticaria or nettle rash)? (v) 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?

To examine discontinuation of the job, the hairdressing apprentices were asked the following questions: (i) Are you still a hairdressing apprentice? (ii) Did you leave training because of, or partly because of, disease? (iii) Which disease? (You can tick off one or more of the following): asthma, allergy symptoms related to the nose and/or eyes, hand eczema, nettle rash, depression/stress, pain in muscles or joints, other.

Ever smokers were defined as participants giving an affirmative answer to the following question: Have you ever smoked for as long as a year? (Yes means at least 20 cigarettes in a life-time or at least one cigarette per day for 1 year). Atopic dermatitis was defined according to the UK Working Party’s diagnostic criteria (28), as the presence of one major criterion and at least two of four minor criteria. The highest completed education level of participants was classified according to the Danish International Standard Classification of Education 2015 (ISCED-15) (29). A higher ISCED number indicated a higher education level, except for ISCED 90, which refers to ‘Not given or no education.’ For example, ISCED 20 refers to lower secondary education, and ISCED 80 refers to a doctoral degree or equivalent education.

Data management and statistics

The distribution of the web-based questionnaire by e-mail and the subsequent entry of responses were performed

with the online questionnaire tool ENALYZER SURVEY SOLUTIONS (30). The questionnaire was answered electronically by 741 respondents, and 323 answered the paper questionnaire. The answers obtained by paper questionnaires were subsequently entered into ENALYZER, and the full dataset was finally drawn from ENALYZER as a spreadsheet file. The statistical program IBM® SPSS™ version 19 (SPSS, Chicago, IL, USA) was used for the statistical analyses. A χ^2 test was used for binary data, and independent samples *t*-tests were used for normally distributed continuous variables. A two-sided *p*-value of <0.05 was considered to be statistically significant.

The incidence rates (IRs) were calculated as the number of new cases of wheezing, rhinitis symptoms, hand eczema, urticaria on the hands, wrists, or forearms, and contact urticaria, since the baseline study, per person-year of observation. The population at risk for hand eczema and urticaria was defined as participants who had never had hand eczema or urticaria at baseline. The population at risk for rhinitis symptoms was defined as participants who had never had nasal allergies, including hay fever, at baseline, and the population at risk for wheezing was defined as participants who had never had asthma at baseline. As the follow-up study was conducted exactly 3 years after baseline, all participants were considered to have been observed for 3 years. Hairdressing apprentices who had left the trade were not included in calculations of IRs. IR ratios (IRRs) with 95% confidence intervals (95% CIs) were calculated with the online calculator OPENEPI. Adjustment for smoking and atopic dermatitis could not be performed, owing to small sample sizes.

Results

Results from the baseline study in 2013 have been presented elsewhere (24, 25). In the follow-up study, an overall response rate of 55.9% (1064/1904) was obtained after two e-mail reminders and one postal reminder. The response was significantly lower in hairdressing apprentices than in population controls [49.2% (248/504) versus 58.2% (816/1400), $p < 0.001$]. The main characteristics of responders are summarized in Table 1. Both hairdressing apprentices and population controls consisted mainly of females, with a mean age of 25 years. Atopic dermatitis was similarly common in the two groups (36.3% versus 35.5%, $p < 0.82$), but smoking was significantly more prevalent among hairdressing apprentices (35.9% versus 25.4%, $p < 0.001$). The distribution of highest completed education level in the two groups is shown in Table 1. The majority (85.5%) of the

participants who were hairdressing apprentices at baseline were currently in the category DISCED 30, meaning that they had graduated from hairdressing schools, which corresponds to an upper secondary education. More than half (56.1%) of the population controls also belonged to the category DISCED 30, but many (39.3%) had attained higher education levels. Occupational exposure for >2 h a day to wet work, rubber gloves, cleaning agents and chemicals fumes was significantly more common among the hairdressing apprentices ($p < 0.001$) (Table 1).

Non-responders

As the invitation e-mail and letter contained information concerning the purpose of the study, we wanted to investigate whether a selection bias had been introduced, in the sense that persons with pre-existing skin or respiratory diseases at baseline would be more inclined to complete the follow-up questionnaire. Table 2 shows a comparison of the baseline lifetime prevalence of diseases between responders and non-responders to the follow-up study. No significant selection bias could be detected, but the hairdressing apprentices who responded to the follow-up questionnaire tended to have a higher baseline prevalence of hand eczema (38.3% versus 30.9%, $p = 0.08$).

Discontinuation of hairdressing

Of the 248 participants who were hairdressing apprentices at baseline, 78.2% (194) were still active in the hairdressing trade at follow-up; 53 were still training, and 141 were working as trained hairdressers. Hence, 54 (21.8%) had left the trade (Table 1), of whom 38 (70.4%) reported leaving because of, or partly because of, disease. Six left before finishing their apprenticeships, and 32 left after completing their apprenticeships. The reasons most frequently reported as causes for leaving were musculoskeletal pain and skin diseases (hand eczema or urticaria), which were both reported by 47.4% (18/38). The next most common reason for leaving was the presence of respiratory symptoms (rhinoconjunctivitis symptoms or asthma), which was reported by 23.7 (9/38)% (Table 3).

Incidence of skin and respiratory diseases in hairdressing apprentices

Among the 1467 participants who had never had hand eczema at baseline (330 hairdressing apprentices and 1137 population controls), 813 (153 hairdressing apprentices and 660 population controls) completed

Table 1. Main characteristics of participants

	Hairdressing apprentices (n = 248)	Population controls (n = 816)	p-value
Mean age, years (SD)	25 (4.0)	25 (4.3)	0.88
Female, % (n)	96.4 (239)	96.3 (786)	0.97
Ever smoked, % (n)	35.9 (89)	25.4 (207)	0.001
Atopic dermatitis, % (n)	36.3 (90)	35.5 (289)	0.82
Highest completed education, % (n)			
DISCED 90	0	0.9 (7)	
DISCED 20	13.7 (34)	3.7 (30)	
DISCED 30	85.5 (212)	56.1 (458)	
DISCED 50	0.4 (1)	5.9 (48)	
DISCED 60	0.4 (1)	21.4 (175)	
DISCED 70	0	11.5 (94)	
DISCED 80	0	0.5 (4)	
Exposures > 2 h/day, % (n)			
Wet work	63.7 (158)	15.2 (124)	<0.001
Rubber gloves	56.5 (140)	13.6 (111)	<0.001
Cleaning agents	8.5 (21)	4.0 (33)	<0.001
Dusts	6.5 (16)	5.3 (43)	0.70
Chemical fumes	66.5 (165)	1.1 (9)	<0.001
Completed training, % (n)	75.8 (188)		
Active hairdressers, % (n)	56.8 (141)		
Ex-hairdresser, % (n)	19.0 (47)		
Still training, % (n)	21.4 (53)		
Maternity leave, % (n)	0.4 (1)		
Fourth year of training, % (n)	19.8 (49)		
Third year of training, % (n)	0.8 (2)		
Second year of training, % (n)	0.4 (1)		
Dropped out during training, % (n)	2.8 (7)		

DISCED, Danish International Standard Classification of Education; SD, standard deviation. A lower DISCED number indicates a lower education level. DISCED 90 refers to 'Not given or no education.'

Table 2. Comparison of the reported lifetime prevalence of diseases at baseline between responders and non-responders to the 3-year follow-up questionnaire

	Hairdressing apprentices (n = 504)			Population controls (n = 1400)		
	Responders (n = 248)	Non-responders (n = 256)	p-value	Responders (n = 816)	Non-responders (n = 584)	p-value
Asthma, % (n)	16.9 (42)	17.6 (45)	0.85	17.9 (146)	16.1 (95)	0.38
Allergic rhinitis, % (n)	36.3 (90)	35.2 (90)	0.79	34.1 (278)	32.9 (192)	0.64
Hand eczema, % (n)	38.3 (95)	30.9 (79)	0.08	19.1 (156)	18.3 (107)	0.71
Urticaria on hands, wrists, or forearms, % (n)	21.0 (52)	25.4 (65)	0.24	25.2 (206)	22.9 (134)	0.32
Contact urticaria ^a , % (n)	6.5 (16)	8.2 (21)	0.45	4.0 (33)	4.5 (26)	0.71
Atopic dermatitis, % (n)	36.3 (90)	30.9 (79)	0.20	35.4 (289)	31.7 (185)	0.15

^aContact urticaria caused by skin contact with rubber gloves, hair dyes, cosmetics or the like.

the follow-up questionnaire 3 years later. However, 25 of the hairdressing apprentices had left the trade during follow-up, leaving 128 hairdressing apprentices for analysis of IRs. At follow-up, 106 new cases of hand eczema were reported (26 hairdressing apprentices and 80 population controls), giving calculated IRs of 68 cases/1000 person-years among hairdressing apprentices and 40 cases/1000 person-years among controls. The IRs for wheezing, rhinitis symptoms, urticaria on the hands, wrists or forearms and contact urticaria

were calculated in the same manner. The results are shown in Table 4. The IRRs for rhinitis symptoms (1.6, 95%CI: 1.2–2.2), hand eczema (1.7, 95%CI: 1.1–2.6), urticaria on the hands, wrists or forearms (1.85, 95%CI: 1.2–2.8) and contact urticaria (4.7, 95%CI: 2.6–8.6) were significantly increased in the hairdressing apprentices (Table 4), whereas the incidence of wheezing was similar in the two groups (0.95, 95%CI: 0.6–1.5), with a cumulative incidence of 15.4% versus 16.3%, respectively ($p = 0.79$).

Table 3. Reported reasons for leaving the hairdressing trade. Multiple reasons possible

	Hairdressing apprentices (n = 6)	Trained hairdressers (n = 32)	Total (n = 38)
Asthma, % (n)	0 (0)	3.1 (1)	2.6 (1)
Allergy symptoms in nose/eyes, % (n)	0 (0)	25.0 (8)	21.1 (8)
Hand eczema, % (n)	66.7 (4)	37.5 (12)	42.1 (16)
Urticaria, % (n)	0 (0)	6.3 (2)	5.3 (2)
Depression/stress, % (n)	16.7 (1)	15.6 (5)	15.8 (6)
Musculoskeletal pain, % (n)	16.7 (1)	53.1 (17)	47.4 (18)

Discussion

To the best of our knowledge, this is the first study to investigate the incidence of urticaria and rhinitis symptoms in hairdressing apprentices. Interestingly, we found significantly increased IRRs in the hairdressing apprentices for rhinitis symptoms, hand eczema, urticaria on the hands, wrists, or forearms, and contact urticaria caused by rubber gloves, hair dyes, cosmetics or the like, whereas an increased risk of wheezing could not be detected. As the incidence of rhinitis symptoms has not been investigated in hairdressing apprentices before, comparison with similar studies is not possible. However, a large-scale retrospective questionnaire study (31) conducted among trained Swedish hairdressers and women from the general population also found a significantly increased incidence of nasal blockage in the hairdressers (17.3 versus 11.4 cases/1000 person-years, IRR 1.5, 95%CI: 1.3–1.8). In addition, several cross-sectional studies have reported a higher prevalence of rhinitis symptoms in trained hairdressers than in different control groups (32–34).

In contrast to an increased incidence of rhinitis symptoms, we could not detect an increased risk of wheezing in the hairdressing apprentices. Our findings are in agreement with a previous prospective study in hairdressing apprentices (21), which reported a similar cumulative incidence of wheezing in hairdressing apprentices and office apprentices (10.0% versus 11.5%, $p=0.66$). In conclusion, although hairdressing is among the professions with the highest risk of occupational asthma, an increased incidence of wheezing cannot be detected during training. We did, however, detect an increased risk of rhinitis symptoms, which are generally considered to constitute a risk factor for asthma. It appears that respiratory symptoms can be induced by excessive exposure to hairdressing products, and that upper respiratory tract

symptoms develop sooner than lower respiratory tract symptoms.

Epidemiological data on contact urticaria in hairdressers are sparse (35, 36), and the only existing data on its occurrence in hairdressing apprentices derive from our baseline study, in which a prevalence of 7.3% was found (24). Interestingly, the incidence of urticaria on the hands, wrists or forearms was as high as that of hand eczema in both hairdressing apprentices and population controls. The fact that many of the symptoms of urticaria have a substantial degree of overlap with symptoms of hand eczema might have given rise to misclassification, partly explaining this high incidence. Nevertheless, urticaria on the hands, wrists or forearms and contact urticaria caused by exposure to hairdressing products seem to be problems for a substantial proportion of hairdressing apprentices, and further attention should be paid to this. Symptoms of contact urticaria are usually mild, limited to small areas of the skin, and of short duration. The relevant diagnostic tests, that is, the open application test and the prick test, are rarely performed (37), so contact urticaria is probably underdiagnosed.

We report an IR for hand eczema of 68 cases/1000 person-years among the hairdressing apprentices, and an increased IRR as compared with young adults from the general population. In the 1990s, two prospective studies also examined the incidence of hand eczema in hairdressing apprentices (19, 20). The apprentices were included soon after they began training, and were followed with questionnaire and clinical examinations until the end of training. Both studies found high IRs of hand eczema (151 and 328 cases/1000 person-years), and a peak incidence was reported during the second quarter of training (572 cases/1000 person-years) (20). The higher IRs in these studies are probably partly attributable to the fact that they followed hairdressing apprentices from the beginning of training, whereas we followed hairdressing apprentices across all levels. However, the lower incidence in our study could also suggest an improvement in work habits and the use of protective measures during the last 20–30 years.

In this 3-year prospective questionnaire study, we found that more than 1 in 5 of the hairdressing apprentices leave the trade, and that the majority reported leaving because of, or partly because of, health complaint(s). The reasons most frequently reported as causes for leaving the trade were musculoskeletal pain and skin diseases, followed by respiratory symptoms. A large-scale study conducted among trained hairdressers reported an even higher discontinuation rate of 44.3% among trained hairdressers after they had finished hairdressing school (13). In this group, musculoskeletal pain was the

Table 4. Crude incidence rates and incidence rate ratios (IRRs) with 95% CIs of disease in hairdressing apprentices and population controls

	Hairdressing apprentices			Population controls			IRR (95%CI)
	Cases	Person-years	Incidence (/1000 person-years)	Cases	Person-years	Incidence (/1000 person-years)	
Wheezing	25	486	51	109	2007	54	1.0 (0.6–1.5)
Rhinitis symptoms	59	381	154	155	1611	96	1.6 (1.2–2.2)
Hand eczema	26	384	68	80	1974	40	1.7 (1.1–2.6)
Urticaria on hands, wrists, or forearms	31	459	68	66	1821	37	1.9 (1.2–2.8)
Contact urticaria ^a	23	543	42	21	2349	9	4.7 (2.6–8.6)

CI, confidence interval.

^aContact urticaria caused by skin contact with rubber gloves, hair dyes, cosmetics or the like.

main cause for leaving (41.9%), followed by hand eczema (23.1%). In a Finnish study, hand eczema and asthma were the top reasons for leaving the trade, followed by musculoskeletal pain and rhinitis (38). In conclusion, the existence of a 'healthy worker survivor effect' with regard to skin and respiratory diseases is supported both by the findings in our study and by studies among trained hairdressers. Although it was not the main focus of this study, musculoskeletal pain proved to be a substantial health complaint in hairdressing apprentices, and the hairdressing schools should increase the focus on prevention of musculoskeletal pain by teaching the apprentices about healthy working postures and habits.

A relatively low response of 55.9% in our study gives rise to concern about selection bias. A particular concern is whether individuals with diseases were more likely to complete the follow-up questionnaire, which would result in overestimation of IRs. However, comparison of the baseline prevalence of disease between responders and non-responders showed similar occurrences of disease in the two groups. Another concern was that ex-hairdressers would be less inclined to complete the questionnaire, resulting in false low discontinuation rates and wrong estimates of reasons for leaving the

trade. However, our dropout rate was similar to that in data available from Statistics Denmark (39), showing discontinuation rates of 22–28% among hairdressing apprentices in the years 2013, 2014, and 2015 (39).

In conclusion, the novel finding of a significantly increased incidence of self-reported rhinitis symptoms, urticaria on the hands, wrists or forearms and contact urticaria among hairdressing apprentices as compared with young adults from the general population should encourage greater attention to these diseases in the hairdressing trade. Reducing the occurrence of these diseases, along with hand eczema and musculoskeletal pain, is an important step in improving working conditions for hairdressers and hairdressing apprentices.

Acknowledgements

Funding provided by The Health Foundation, Kongelig Hofbundtmager Aage Bangs Fond, the Beckett Fund, the Danish Hairdressers' and Beauticians' Union, the Danish Hairdressers' Association, Torben and Alice Frimodt's Fund, the Director Jacob Madsen and Wife Olga Madsen's Fund, Carl and Ellen Hertz's grant for Danish Medical and Natural Sciences and Else and Mogens Wedell-Wedellsborgs Fund is gratefully acknowledged.

References

- 1 Lysdal S H, Johansen J D, Flyvholm M A, Søsted H. A quantification of occupational skin exposures and the use of protective gloves among hairdressers in Denmark. *Contact Dermatitis* 2012; **66**: 323–334.
- 2 Leino T, Saarinen L, Henriks-Eckerm M, Paakkulainen H. Working conditions and health in hairdressing salons. *Appl Occup Environ Hyg* 1999; **14**: 26–33.
- 3 Schwensen J F, Friis U F, Menné T, Johansen J D. One thousand cases of severe occupational contact dermatitis. *Contact Dermatitis* 2013; **68**: 259–268.
- 4 Skoet R, Olsen J, Mathiesen B et al. A survey of occupational hand eczema in Denmark. *Contact Dermatitis* 2004; **51**: 159–166.
- 5 Dickel H, Kuss O, Blesius C R et al. Occupational skin diseases in Northern Bavaria between 1990 and 1999: a population-based study. *Br J Dermatol* 2001; **145**: 453–462.
- 6 Bensefa-Colas L, Telle-Lamberton M, Faye S et al. Occupational contact urticaria: lessons from the French National Network for Occupational Disease Vigilance and Prevention (RNV3P). *Br J Dermatol* 2015; **173**: 1453–1461.
- 7 Williams J D, Lee A Y, Matheson M C et al. Occupational contact urticaria: Australian data. *Br J Dermatol* 2008; **159**: 125–131.
- 8 Hytönen M, Kanerva L, Malmberg H et al. The risk of occupational rhinitis. *Int Arch Occup Environ Health* 1997; **69**: 487–490.
- 9 Dulon M, Peters C, Wendeler D, Nienhaus A. Trends in occupational airway diseases in German hairdressers: frequency and causes. *Am J Ind Med* 2011; **54**: 486–493.
- 10 Orriols R, Isidro I, Abu-Shams K et al. Reported occupational respiratory diseases in three Spanish regions. *Am J Ind Med* 2010; **53**: 922–930.
- 11 Latza U, Baur X. Occupational obstructive airway diseases in Germany: frequency

- and causes in an international comparison. *Am J Ind Med* 2005; **48**: 144–152.
- 12 Leira H L. Notified cases of occupational asthma in Norway: exposure and consequences for health and income. *Am J Ind Med* 2005; **48**: 359–364.
 - 13 Lysdal S H, Søsted H, Andersen K E, Johansen J D. Hand eczema in hairdressers: a Danish register-based study of the prevalence of hand eczema and its career consequences. *Contact Dermatitis* 2011; **65**: 151–158.
 - 14 Lind M L, Albin M, Brisman J et al. Incidence of hand eczema in female Swedish hairdressers. *Occup Environ Med* 2007; **64**: 191–195.
 - 15 Nemer M, Kristensen P, Nijem K et al. Respiratory function and chemical exposures among female hairdressers in Palestine. *Occup Med (Lond)* 2013; **63**: 73–76.
 - 16 Espuga M, Muñoz X, Plana E et al. Prevalence of possible occupational asthma in hairdressers working in hair salons for women. *Int Arch Allergy Immunol* 2011; **155**: 379–388.
 - 17 Albin M, Rylander L, Mikoczy Z et al. Incidence of asthma in female Swedish hairdressers. *Occup Environ Med* 2002; **59**: 119–123.
 - 18 Leino T, Tammilehto L, Hytönen M et al. Occupational skin and respiratory diseases among hairdressers. *Scand J Work Environ Health* 1998; **24**: 398–406.
 - 19 Uter W, Pfahlerberg A, Gefeller O, Schwanitz H J. 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**: 487–492.
 - 20 Smit H, van Rijssen A, Vandenbroucke J P, Coenraads P J. Susceptibility to and incidence of hand dermatitis in a cohort of apprentice hairdressers and nurses. *Scand J Work Environ Health* 1994; **20**: 113–121.
 - 21 Iwatsubo Y, Matrat M, Brochard P et al. Healthy worker effect and changes in respiratory symptoms and lung function in hairdressing apprentices. *Occup Environ Med* 2003; **60**: 831–840.
 - 22 Shah D. Healthy worker effect phenomenon. *Indian J Occup Environ Med* 2009; **13**: 77–79.
 - 23 Bregnhøj A, Søsted H, Menné T, Johansen J D. Healthy worker effect in hairdressing apprentices. *Contact Dermatitis* 2011; **64**: 80–84.
 - 24 Hougaard M G, Winther L, Søsted H et al. Occupational skin diseases in hairdressing apprentices – has anything changed? *Contact Dermatitis* 2014; **72**: 40–46.
 - 25 Foss-Skiftesvik M H, Winther L, Johnsen C R et al. High occurrence of rhinitis symptoms in hairdressing apprentices. *Clinl and Transl Allergy* 2016; **6**: 26.
 - 26 Susitaival P, Flyvholm M A, Meding B et al. Nordic Occupational Skin Questionnaire (NOSQ-2002): a new tool for surveying occupational skin diseases and exposure. *Contact Dermatitis* 2003; **49**: 70–76.
 - 27 ECRHS III questionnaire [Internet]. 2014 Available at: <http://www.ecrhs.org/Home.htm> (last accessed 23 December 2016).
 - 28 Williams H C, Burney P G, Pembroke A C, Hay R J. The UK Working Party's diagnostic criteria for atopic dermatitis. III. Independent hospital validation. *Br J Dermatol* 1994; **131**: 406–416.
 - 29 Danmarks Statistik. DISCED-15 [Internet]. Available at: <http://www.dst.dk/da/Statistik/dokumentation/Nomenklaturer/ny-uddannelsesklassifikation-DISCED-15> (last accessed 18 May 2016).
 - 30 Enalyzer Survey Solutions [Internet]. Available at: <https://www.enalyzer.com/>
 - 31 Brisman J, Albin M, Rylander L et al. The incidence of respiratory symptoms in female Swedish hairdressers. *Am J Ind Med* 2003; **44**: 673–678.
 - 32 Hassan O M, Bayomy H. Occupational respiratory and musculoskeletal symptoms among Egyptian female hairdressers. *J Community Health* 2015; **40**: 670–679.
 - 33 Bradshaw L, Harris-Roberts J, Bowen J et al. Self-reported work-related symptoms in hairdressers. *Occup Med (Lond)* 2011; **61**: 328–334.
 - 34 Leino T, Tammilehto L, Luukkainen R, Nordman H. Self reported respiratory symptoms and diseases among hairdressers. *Occup Environ Med* 1997; **54**: 452–455.
 - 35 Lyons G, Roberts H, Palmer A et al. Hairdressers presenting to an occupational dermatology clinic in Melbourne, Australia. *Contact Dermatitis* 2013; **68**: 300–306.
 - 36 Zorba E, Karpouzis A, Zorbas A et al. Occupational dermatoses by type of work in Greece. *Saf Health Work* 2013; **4**: 142–148.
 - 37 Aalto-Korte K, Suomalainen S. Contact urticaria syndrome: epidemiology and occupational relevance. In: *Contact Urticaria Syndrome*, Giménez-Arnau A M, Maibach H I (eds); Boca Raton, FL, CRC Press, Taylor and Francis Group, 2014: pp. 13–19.
 - 38 Leino T, Tuomi K, Paakkulainen H, Klockars M. Health reasons for leaving the profession as determined among Finnish hairdressers in 1980–1995. *Int Arch Occup Environ Health* 1999; **72**: 56–59.
 - 39 Statistics Denmark. [Internet] Available at: <http://www.danmarksstatistik.dk/en> (last accessed 3 August 2016).