

Personal use of Hair Dyes and Temporary Black Tattoos in Copenhagen Hairdressers

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Background: Hairdressers are occupationally and personally exposed to hair dye substances and adverse reactions from the skin are well known. Currently, little is known about personal exposure to hair dye ingredients and temporary black tattoos.

Objectives: To investigate hairdressers' professional and personal risk exposures and to compare the frequency of temporary tattoos among hairdressers and subjects from the general population.

Methods: A questionnaire was sent to 1679 Copenhagen hairdressers and 1063 (63.3%) responded; 3471 subjects from the general population in Copenhagen were asked about temporary black tattoos.

Results: Of the female hairdressers, 38.3% had coloured hair within the previous week. Adverse skin reactions to own hair dye were reported in 29.5%. In the hairdresser population, no significant association was observed between self-reported adverse skin reactions to hair dye and having had a temporary black tattoo when adjusted for sex, age, and atopy. A total of 19.0% of hairdressers (43.5% of apprentices) and 6.3% of participants from the general population had ever had a temporary black tattoo performed at one point. There were no differences in frequency of eczema after temporary tattooing between hairdressers and subjects in the general population. Almost all hairdressers (99.2%) used gloves for hair colouring, 51% for high/low lighting, 39.6% for perming and 21.1% used gloves for shampooing.

Conclusions: In conclusion, skin reactions to hair colour are frequent among Copenhagen hairdressers. Temporary black tattoos were more frequent among hairdressers than in a sample of the general population and increased with decreasing age.

Keywords: adverse reaction; hairdresser; hair dye; questionnaire; semi-permanent tattoo; temporary tattoo

INTRODUCTION

Hairdressers are intensively exposed to wet work and chemical substances in ingredients from hair colours, permanent wave, and bleaching products (Iorizzo *et al.*, 2002). In the general population, 74.9% of women and 18.4% of men reported that they had dyed

their hair at one point in their life. It is generally believed that hairdressers have a more intense exposure to hair dye ingredients through their personal hair dyeing habits than do subjects from the general population (Søsted *et al.*, 2005) since apprentices in Denmark often use each other when practising hair dyeing and since hairdressers often change their hair colour to inspire their customers. Furthermore, hairdressers have a significant occupational dermal exposure (Lind *et al.*, 2005; Hueber-Becker *et al.*, 2007). Since hairdressers

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have a substantial exposure to hair dye chemicals, they may have a higher frequency of skin reactions from hair dyeing compared with that of the general population. *p*-phenylenediamine (PPD) or PPD-related substances are strong sensitizing aromatic amines, which are often used in hair dyes. PPD may also be included in temporary black tattoos (Avnstorpe *et al.*, 2002). The use of temporary black tattoos and hair dyeing has recently become fashionable, not only among adult women but also among adult men, teenagers, and children. Temporary black tattoos often cause primary allergy if a subject is later exposed to hair dyeing, and severe skin allergic symptoms may develop (Le Coz *et al.*, 2000; Brancaccio *et al.*, 2002; Søstede *et al.*, 2002; Baron *et al.*, 2003; Søstede *et al.*, 2006). We investigated hairdressers' personal use of hair dyes, exposure to temporary black tattoos, and the adverse effects related to these exposures. We elucidated hairdressers' personal risk behaviour through their use of temporary black tattoos and hair dye reactions and their occupational risk behaviour by reporting their use of protective gloves. In addition, we compared the frequency of temporary black tattoos among hairdressers and subjects from the general population.

MATERIALS AND METHODS

The hairdresser population

The study was performed in collaboration with the Danish Hairdressers' and Beauticians' Union (employees) and the Danish Hairdresser Association (owner of the salons), who gave access to their member register. Permission was obtained from the Danish data protection agency.

The questionnaire was posted to 1679 hairdressers in January 2007. A reminder was sent one month later. In 21 cases, the correct address could not be retrieved. In total, 63.3% (1063 of 1679) returned a completed questionnaire: 847 were hairdressers, 87 were apprentices in a salon, 23 were teachers at the hairdresser school, 9 were administrative staff, and 90 had miscellaneous work. For 11 persons, the answer about employment was missing. Of the respondents, five were <18 years and nine were >70 years; these respondents were excluded. Only those currently working as hairdresser and aged 18–70 years were included, giving a sample of 908 individuals, see Table 1. A questionnaire was developed based on questions used in the general population (Søstede *et al.*, 2005). It comprised 38 questions pertaining to hairdressers' use of hair dyes and temporary black tattoos, adverse reactions, and working habits. Question included 'Has a doctor ever told you that you have atopic dermatitis?'

Table 1. Characteristics of participants in the hairdresser survey stratified by sex and age group

Sex	<i>N</i> = 923
Women	821 (88.9%)
Men	102 (11.1%)
Age (years)	<i>N</i> = 908 ^a
18–24	154 (16.9%)
25–34	287 (31.6%)
35–70	467 (51.4%)

Only participants who were currently working in a salon (*N* = 923) were selected for analysis.

^aFifteen cases were excluded due to high or low or missing age.

Questions included 'Have you ever had a henna tattoo (a temporary black tattoo that is painted on the skin and that disappears after 2–3 weeks)?' and 'If yes, have you had eczema at this site?' Eczema was defined as 'redness, scaling, and itching'.

Hand eczema, atopic dermatitis, patch test results, contact to healthcare services, sick leave, and reports on industrial injury to the Board of Occupational Health (DK) are the subject of a separate paper (Hansen and Søstede 2009).

The general population

From June 2006 to May 2008, a cross-sectional study was performed in the general population in Copenhagen, the capital of Denmark. A random sample of 7 931 subjects aged 18–69 years was obtained from the Danish Central Personal Register, Ministry of Internal Affairs. All were adults born in Denmark with Danish citizenship. A total of 3471 (43.7%) subjects participated in a general health examination and 3460 were patch tested. The participation rate was higher among older age groups than among younger age groups for both sexes (Thyssen *et al.*, 2009). The Ethics Committee of Copenhagen County approved the study (KA-20060011). Written informed consent form was obtained from all participants before the beginning of the study.

Statistical analysis

Comparison of prevalence estimates were performed using the chi-square tests. Furthermore, in the hairdresser population, a logistic regression analysis was done with 'reaction to hair dye ever' as the dependent response variable and with 'sex', 'age group', 'atopic dermatitis', and 'temporary black tattoo ever' as the explanatory variables. In a mix of the two populations (hairdresser/general), a logistic regression analysis was performed with 'temporary black tattoos ever' as the dependent variable and

‘age group’, ‘sex’, and ‘population, hairdresser versus general’ as the explanatory variable. Another logistic regression analysis was performed with ‘reaction to tattoo ever’ as the dependent variable and ‘population, hairdresser versus general’ and ‘age group’ as the explanatory variable. Statistical analysis was performed with SPSS version 17.0 for Windows (SPSS, Chicago, IL, USA). Frequencies and 95% confidence intervals (CIs) were calculated. Associations were presented as odds ratios (ORs) with 95% CIs and *P*-values.

RESULTS

The hairdresser population

Of the 923 participants, 821 (88.9%) were women. The median age was 35 years, 18–70 years for both men and women. Details of the respondents’ sex and age are given in Table 1. Among the hairdressers and apprentices included, 66.0% (605 of 916) had >10 years experience as a hairdresser.

Personal risk behaviours

Of the participants, 98.9% of the women and 69.7% of the men had ever dyed or bleached their own hair (Table 2); 38.3% of the women and 9.1%

of the men had coloured hair within the last week. Of those ever having dyed their own hair, 28.7% reported eczema following hair dyeing and 7.8% reported angio-oedema-type reactions (table 3). Among both sexes of all ages, 29.5% (254 of 862) reported either one or both types of reaction.

A logistic regression analysis showed that ‘a reaction to hair dye ever’ was associated to an age <35 years; 18–24 years OR: 3.2 (CI: 2.1–4.8); and an age between 25–34 years OR: 2.7 (CI: 1.9–3.9), while ‘being a woman’, OR: 1.0 (CI: 0.6–1.9); ‘atopic dermatitis’ OR: 1.0 (CI: 0.2–1.8); and ‘tattoo ever’ OR: 1.1 (CI: 0.8–1.6) were not significantly related to ‘a reaction to hair dye ever’.

When a chi-square test was done with out correction for age, sex, and atopy, we saw a significance connection between ‘a reaction to hair dye ever’ and ‘tattoo ever’ OR: 2.5 (CI: 1.2–5.0) in the oldest age group containing persons between 35 and 70 years, whereas there was no connection to see in the younger age groups 18–24 years OR: 0.7 (CI: 0.4–1.4) and 25–34 years OR: 1.0 (CI: 0.6–1.7).

Of the individuals with skin reaction to own hair dye, 11.9% (30 of 252) had subsequently been in contact with healthcare services.

Almost 40% (39.4%) of young female hairdressers (18–24 years) had ever had a semi-permanent

Table 2. Hairdresser’s personal use of hair dyes

	Sex ^a <i>N</i> = 908			Age group ^a		
	Women, <i>n</i> = 804 (%)	Men, <i>n</i> = 99 (%)	Total, <i>n</i> = 903 (%)	18–24 years, <i>n</i> = 152 (%)	25–34 years, <i>n</i> = 287 (%)	35–70 years, <i>n</i> = 464 (%)
Have ever dyed or bleached their own hair (<i>n</i> = 918)	795 (98.9)	69 (69.7)	864 (95.7)	151 (99.3)	286 (99.7)	427 (92.0)
Coloured own hair within the previous 12 months (<i>n</i> = 918)	447 (55.6)	25 (25.3)	472 (52.3)	89 (58.6)	171 (59.6)	212 (45.7)
Coloured own hair within the previous week (<i>n</i> = 918)	308 (38.3)	9 (9.1)	317 (35.1)	56 (36.8)	97 (33.8)	164 (35.3)
Never coloured own hair (<i>n</i> = 918)	9 (1.1)	30 (30.3)	39 (4.3)	1 (0.7)	1 (0.3)	37 (8)

^aFifteen cases are missing by age; five cases did not answer the question concerning hair dye.

Table 3. Hairdresser’s adverse reactions to hair dyes

	Sex			Age group		
	Women, <i>n</i> = 794 (%)	Men, <i>n</i> = 68 (%)	Total, <i>N</i> = 862 ^a (%)	18–24 years, <i>n</i> = 151 (%)	25–34 years, <i>n</i> = 286 (%)	35–70 years, <i>n</i> = 425 (%)
Have ever had itching, scaling, and redness following own hair colour (<i>n</i> = 862)	228 (28.7)	19 (27.9)	247 (28.7)	61 (40.4)	109 (38.1)	77 (18.1)
Have ever had oedema of face or neck following own hair colour (<i>n</i> = 862)	65 (8.2)	2 (2.9)	67 (7.8)	17 (11.3)	29 (10.1)	21 (4.9)

^aEight hundred and sixty-four persons have ever dyed their hair; two cases answer were missing.

tattoo (Table 4); among apprentices, 43.5% (37/85) had ever had a semi-permanent tattoo and of these, five individuals were <18 years. For both men and women and among all ages, 19.0% had ever had a temporary black tattoo (Table 5) and of these, 3.5% had had eczema at the tattoo site, a sign of sensitization to black dye (Table 6).

The median age for the first tattoo was 19 years (7–55 years; mean age 22 years). Only six persons had had a ‘reaction at the tattoo site’ (mean age 21 years), they had all coloured their hair and three of them reported ‘ever reaction on hair dyes’.

Professional risk behaviours

Of all the individuals who dyed hair in a salon, 52.5% (468 of 892) mixed the dyes under the local exhaust ventilator and 11.3% (101 of 892) mixed hair dyes in a separate mixing cupboard. The re-

maining 36.2% (323 of 892) mix the colour elsewhere. Of those working as hairdressers, 98.2% (903 of 920) performed hair dyeing in the salon; 100.0% of apprentices dyed hair in the salon. Almost all (99.2%) used gloves for hair colouring, 51% for high/low lighting, 39.6% for perming, and 21.1% used gloves for shampooing.

General population

One-third (33.3%) of young women (18–24 years) in the general population reported having a temporary black tattoo at one point (table 4). Among men and women of all ages, 6.3% had had a temporary black tattoo (Table 5).

Hairdressers compared with general population

A regression analysis showed that ‘temporary black tattoo ever’ was significantly more common

Table 4. Lifetime prevalence of temporary black tattoo among hairdressers in comparison with subjects in the general population

Age (years)	Hairdressers, <i>N</i> = 908 ^a		General population, <i>N</i> = 3471 ^b	
	Male, <i>n</i> = 99 (%)	Female, <i>n</i> = 803 (%)	Male, <i>n</i> = 1536 (%)	Female, <i>n</i> = 1905 (%)
18–24	1/8 (12.5)	56/142 (39.4)	7/77 (9.1)	43/129 (33.3)
25–34	2/18 (11.1)	71/267 (26.6)	16/165 (9.7)	33/221 (14.9)
35–70	3/73 (4.1)	38/394 (9.6)	34/1294 (2.6)	83/1555 (5.3)
Total	6/99 (6.1)	165/803 (20.5)	57/1536 (3.7)	159/1905 (8.3)

^aSix persons answer were missing.

^bThirty persons answer were missing.

Table 5. Lifetime prevalence of temporary black tattoo in hairdressers in comparison with subjects in the general population

Age (years)	Hairdressers, <i>n</i> = 908 ^a (%)	General population, <i>n</i> = 3471 ^b (%)	Odds ratio (95% CI)	<i>P</i>
18–24	57/150 (38)	50/206 (24.3)	1.3 (0.8–2.1) ^c	0.279
25–34	73/285 (25.6)	49/386 (12.7)	2.0 (1.3–3.0) ^c	0.002
35–70	41/467 (8.8)	117/2849 (4.1)	1.9 (1.3–2.7) ^c	0.001
Total	171/902 (19.0)	216/3441 (6.3)	1.7 (1.3–2.2) ^d	<0.001

When a regression analysis was done in each age groups among the 18–24 years old ‘being a woman’ OR: 4.9 (95% CI: 2.2–11.0) *P* ≤ 0.001 was a significant risk factor for reporting ‘temporary black tattoo ever’.

^aSix persons with missing answers.

^bThirty persons with missing answers.

^cAdjusted for sex.

^dAdjusted for sex and age.

Table 6. Lifetime prevalence of reaction at temporary black tattoo site in different age groups of hairdressers in comparison with a random sample from the general population

Age (years)	Hairdressers, <i>n</i> = 171 (%)	General population, <i>n</i> = 215 ^a (%)	Odds ratio (95% CI)	<i>P</i>
18–24	0/57 (0.0)	1/50 (2.0)	—	—
25–34	5/73 (6.8)	1/49 (2.0)	3.5 (0.4–31.2)	0.257
35–70	1/41 (2.4)	3/116 ^a (2.6)	0.9 (0.1–9.3)	0.959
Total	6/171 (3.5)	5/215 (2.3)	1.5 (0.5–5.1)	0.491

One person did not answer the question. No men from either the general population or hairdressers reported eczema following a temporary black tattoo.

^aPerson with missing answer.

among 18- to 24-year-olds OR: 6.7 (CI: 5.0–8.9) $P \leq 0.001$ and 25- to 34-year-olds OR: 3.4 (CI: 2.6–4.4) $P < 0.001$ as compared to 35- to 70-year-olds. Furthermore, female sex OR: 2.4 (95% CI: 1.7–3.2) $P < 0.001$ and ‘being a hairdresser’ OR: 1.7 (95% CI: 1.3–2.2) $P < 0.001$ were significantly associated with ‘temporary black tattoos ever’.

Since no men had reported a skin reaction at the tattoo site, they were excluded from the following regression analysis. The regression analysis showed that ‘reaction to tattoo ever’ was not significantly related to ‘being a hairdresser’ OR 1.5 (95% CI: 0.5–5.1) $P = 0.491$, see Table 6.

DISCUSSION

This study showed that of organized Copenhagen hairdressers, 98.9% of the women and 69.7% of the men had ever dyed their own hair.

In a questionnaire study from 2005, Sørensen *et al.* found that of the Danish population, 74.9% of females and 18.4% of males had ever dyed their hair (Sørensen *et al.*, 2005). It was anticipated that hairdressers would dye their hair more often than subjects in the general population since being in the hairdressing business may necessitate changing hair colour and hairstyles. In total, 29.5% of the Copenhagen hairdressers reported that they had ever dyed or bleached their own hair and that they had a skin reaction with itching, scaling, and redness. In comparison, only 5.3% of the Danish population reported itching, scaling, and redness following dyeing their own hair (Sørensen *et al.*, 2005); 8.2% of the female hairdressers and 2.9% of the male hairdressers reported oedema of the face or neck after hair dyeing in comparison with 1.4% of Danish women and 1.3% of Danish men from the general population (Sørensen *et al.*, 2005). The higher frequency of hair dye reactions among hairdressers is most likely because of sensitization from occupational exposure to hair dye ingredients. The results show a low rate of use of gloves when mixing dyes and from cutting and styling newly dyed hair; additionally, hairdressers colour their hair more frequently than subjects from the general population.

Temporary black tattoos often cause primary allergy if a subject is later exposed to hair dyeing, severe skin allergic symptoms may develop. A previous questionnaire study showed that among subjects in the Danish population who dyed their hair, 4.9% reported having a temporary black tattoo (Sørensen *et al.*, 2005). In this study, 6.3% of the general population had had a temporary tattoo. Among the Danish hairdressers who dyed their hair, 19.0% reported

having had a temporary black tattoo. In a British questionnaire study ($N = 4000$) from 2008, it was shown that 7% of adults and 14% of children (age not defined) had had a temporary tattoo (Orton 2008). In the present study, 24.3% of the persons in the general population <25 years reported having had a temporary tattoo; 19.0% of the total population of hairdressers had ever had a temporary black tattoo; and 43.5% of the apprentices had had one. Accordingly, we suggest that having a temporary tattoo is an increasing event as young people have higher life time prevalence than adults but an explanation could also be a recall bias because it can be hard to remember what one did many years ago. Recall bias might also have an influence in the older age group where we see a connection between ‘reaction on hair dye’ and ‘tattoo ever’, maybe the only older people that remember that they had a tattoo are almost only those who had had a reaction to own hair dye.

Hairdressers seem to have more temporary black tattoos than does the general population. There were no statistical differences in adverse reaction to own hair dyes between tattooed and non-tattooed individuals, who had coloured their hair, when corrected for age, sex, and atopy. This agrees with the conclusion of Sørensen (Sørensen *et al.*, 2005) that on a group basis having temporary black tattoos is not a statistically significant reason for skin reactions to hair dyes. The power in this part of the study is very limited since only six hairdressers witnessed reactions to ‘temporary black tattoos’. The reason why we did not find any differences in frequency of hair dye reactions between tattooed and non-tattooed may be that the occupational (and personal) exposure to hair dye ingredients from using hair dyes and working with hair dyes is so significant that the effect from the tattoos disappears. Pure henna as being used in Arabic countries is not traditionally used in Denmark, so we believe that the participants that have had a temporary black tattoo have been exposed to PPD (or derivatives of PPD) and because we defined a temporary black tattoo as a black skin painting that lasted for 2–3 weeks. Pure henna tattoos are red or brown and has to be repainted to last.

In the present study, nearly all the hairdressers (99.2%) used gloves for hair colouring, 51% for high/low lighting, 39.6% for perming, and 21.1% for shampooing. A British study showed that 98% of hairdresser (who experience symptoms) used gloves for colouring, 81% for perming, and 26% for shampooing (Sinclair and Green, 2006). A Swedish study showed that only 12% used gloves when mixing hair colour; however, when they did the colouring 92% used gloves and 25% used gloves for

high/low lighting (Lind *et al.*, 2005). As hairdressers can experience hand eczema, despite reporting wearing gloves, it seems relevant to investigate how often the gloves are changed and what kind of gloves are used.

In a Swedish study by Lind *et al.* (Lind *et al.*, 2005), it was found that the hair dye compounds are scattered in the hairdressing salon on telephones, hair dryers, scissors, and combs, which also can be expected in the Danish salons too since only 11.3% of the hairdressers in the present study reported mixing hair dyes in a separate mixing cupboard.

In a French study (Hueber-Becker *et al.*, 2007), it was shown that the hair dye PPD was excreted in the hairdressers urine after only a week of hair dyeing, and it was also shown that the maximal exposure to hair dyes is when the hairdresser cuts and styles newly dyed hair without wearing gloves (Hueber-Becker *et al.*, 2007).

In conclusion, skin reactions to hair colour are frequent among Copenhagen hairdressers. The Copenhagen hairdressers are exposed to hair dyes because they mix dyes, cut, and styles newly dyed hair with out gloves. The occupational exposure to hair dyes should be avoided by teaching hairdressers apprentices and teaching owner of salons the importance of glove use. Temporary black tattoos were more frequent among hairdressers than in a sample of the general population and increased with decreasing age. Temporary black tattoos should be avoided by consumers as well as hairdressers and the local authorities and hairdressing schools should take their responsibility in warning against this.

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