WORK-RELATED SYMPTOMS DUE TO CHEMICAL USE AMONG HAIRDRESSERS IN BANGKOK, THAILAND

Ann Jirapongsuwan[1], Pornkaew Luengumporn[2], Surintorn Kalampakorn[1], and Sara Arphorn [1]

[1]Faculty of Public Health, Mahidol University, Bangkok;
[2]Public Health Center 30, Health Department, Bangkok Metropolitan Administration, Bangkok, Thailand

Abstract. Hairdressers are exposed to various work related chemicals contained in hair products that may affect their health. We conducted a cross-sectional survey of symptoms reported by hairdressers in Bangkok, Thailand and their associated factors in order to guide prevention efforts. We calculated 380 subjects were need for the study. Subjects were selected by stratified random sampling to be recruited for the study. Inclusion criteria were hairdressers with at least one-year experience in this career and were willing to participate in the study. The exclusion criterion was hairdressers who were current smokers. Each subject was asked to complete a questionnaire that asked about demographics, symptoms and potential associated factors. The questionnaire had a reliability coefficient range of 0.7-0.8. Logistic regression analysis was used to identify factors associated with symptoms. A total of 380 subjects were included in the study; 80.3% were female; the average subject was aged 38 years. Sixty-eight point seven percent of subjects had worked as a hairdresser for 1-10 years. Ninety-six point eight percent had no respiratory symptoms prior to beginning work as a hairdresser. Ninety-seven point nine percent had no chemical protection training. Sixty point three percent had a poor level of preventive behavior when using hair products. Thirty-nine point five percent reported having health symptoms in the previous three months. Forty-nine point five percent of these episodes were respiratory symptoms that included nasal irritation, rhinorrhea, cough and dyspnea. Eighteen point seven percent had skin symptoms, including rash, erythema and edema. Sixteen point nine percent had eye irritation. Factors significantly associated with symptoms included having a previous medical condition, exposure to hair dyes, exposure to hair straightening solutions, frequency of hair dying, duration of hair shampooing, duration of hair dying, using preventive measures with hair products, and using general exhaust ventilation. Hairdressers in Bangkok, Thailand frequently have symptoms caused by chemical exposure in their work. Preventive measures need to be used consistently. Further studies are needed to determine the most effective methods for reducing symptoms and their efficiencies.

Keywords: hairdressers, occupational health, work-related symptoms, chemical use, worker health

Correspondence: Ann Jirapongsuwan, Faculty of Public Health, Mahidol University, 420/1 Ratchawithi Road, Ratchathewi, Bangkok 10400, Thailand. Tel/Fax: +66 (0) 686 4308939.
E-mail: ann.jir@mahidol.ac.th

INTRODUCTION

The hairdressing business is a small enterprise where typically no employment contracts are made with employees. As a result, most hairdressers are informal workers lacking proper labor protection. Most have no minimum wage guarantee or benefit, such as sick leave or health insurance (Arphorn *et al*, 2014). Limited support is available to help workers safeguard their health in the workplace. A previous study (Bradshaw *et al*, 2011) found chemical exposure at work among hair dressers had adverse health effects. High concentrations of chemical substances have been discovered at some hairdressing salons (Tsigonia *et al*, 2010). Chemicals found in the workplace of hairdressers have been reported to include volatile solvents, cetrimonium chloride, betaine monohydrate, ammonia compounds, cyanoacrylates, formaldehyde, methacrylate and nitrosamines (Takkouche *et al*, 2009; Victoria *et al*, 2013). These chemicals have been found in hair dyes, bleaching agents, permanent wave solutions, shampoos, hair conditioners and hair styling products (Ferreira, 2013; Deschamps *et al*, 2014). The health effects caused by exposure to these chemicals may have acute or chronic health effects (Lysdal *et al*, 2012; Nemer *et al*, 2013). Contact with these chemicals in hair products is usually of short duration but occurs repeatedly in hairdressers. Some chemicals enter the body through the skin and some through the airways.

Several studies have reported hairdressers are at high risk for some health problems (Slater *et al*, 2000; Figueiredo *et al*, 2008; Bradshaw *et al*, 2011). Health consequences reported to be associated with these chemicals in hair products include occupational asthma, rhinitis, hypersensitivity pneumonitis and reduced lung function (Slater *et al*, 2000; Figueiredo *et al*, 2008; Hashemi *et al*, 2010; Bradshaw *et al*, 2011; Herin *et al*, 2012). Hairdressing has also been reported to be associated with skin problems such as contact dermatitis (O'Connell *et al*, 2010). Development of hypersensitivity to these chemicals has also been reported to occur (Valks *et al*, 2005). Health problems due to exposure to these chemicals for the reproductive system have been reported to include menstrual disorders and subfertility problems (Ronda *et al*, 2009; Peters *et al*, 2010). The International Agency for Research on Cancer stated that chemicals contained in hair products are potentially carcinogenic (Peters *et al*, 2010). Studies have reported hairdressers are significantly more likely to develop cancer of the lungs, larynx and bladder (Czene *et al*, 2003; Takkouche *et al*, 2009).

Studies from Bangkok, Thailand have reported a high incidence of hand contact dermatitis and asthma among hairdressers (Sajung, 2012; Luengumporn *et al*, 2014). A survey by the Thai Ministry of Public Health reported 34% of salons had poor ventilation in the workplace; 56.3% of workers never received health checkups, 60.4% of hairdressers continued to work when sick and 40% of hairdressers were not given personal protective equipment, such as masks, by the salons (The Sanitation Division, 2010). In Thailand, most hairdressing salons are self-employed businesses and not registered with the Ministry of Commerce (Department of Business Development, 2004). Hairdressers are not required to have licenses or professional registration, resulting in a lack of appropriate safety training. Hairdressers rarely receive occupational health examinations and are neglected by the authorities.

Most diseases, injuries and other

health conditions experienced by workers are multifactorial. Evidence supporting the interaction between occupational factors and personal factors among health of workers is frequently combined to enhance management of occupational illness and injury (Schulte *et al*, 2012). To achieve a healthy working life, a comprehensive preventive approach is required. To help develop such an approach, understanding the associated factors is important to improve worker health. In Thailand, little is known about effect on health of the association between personal and occupational factors among hairdressers. The purpose of the present study was to investigate work-related symptoms of hairdressers in Bangkok, Thailand and their associated factors. These results can inform health intervention planning to reduce workplace hazards for hairdressers.

MATERIALS AND METHODS

We conducted a cross-sectional descriptive study of hairdressers in Bangkok, Thailand during August to September, 2013. We calculate the total number of subjects needed for the study was 380 using the formula for single proportion estimation (Daniel, 2010). A stratified random sampling technique was used to select the area of Bangkok from which to recruit study subjects. One subject was chosen from each selected salon for the study. Inclusion criteria were hairdressers with at least 1 year of experience in their career who were willing to participate in the study. The exclusion criterion was hairdressers who smoked cigarettes. Written informed consent was obtained from each study subject prior to participation.

Study instrument

A questionnaire was developed by the researchers and asked about subject sex, age, marital status, education level, income, pre-existing medical conditions and work-related symptoms during the previous 3 months. Subjects who reported at least one symptom were considered to have a work-related symptom. Subjects were also asked about occupational factors. These included work experience, hair product exposure, training in chemical health protection, size of the business, work duration, number of customers daily, types of services provided, personal protective equipment provided, frequency and duration of chemical exposure, perceptions about chemicals in hair products, perceived severity of the effects of those chemicals, perceived vulnerability to the effects of those chemicals, perceived efficacy of protective behaviors practiced. Content validity was examined by five experts working in occupational and environmental health. A Cronbach's alpha coefficient had a range of 0.76-0.83 among 30 hairdressers similar to the study subjects.

Ethical considerations

This study was approved by the Ethics Committee for Research on Human Subjects, Faculty of Public Health, Mahidol University (Ref. No. MUPH 2012-175).

Data analysis

The data collected were analyzed using Statistical Package for the Social Sciences (SPSS) version 18.0, for Windows (IBM, Armonk, NY). Descriptive statistics were used for all variables. Logistic regression analysis was used to analyze associations between independent variables and worked-related symptoms. Significance was set at $p<0.05$.

RESULTS

Personal factors

A total of 380 subjects were included in the study, 80.3% female. The average

age of the subjects was 38 years. Seventy-four point three percent of subjects had a secondary school education. Fifty-five percent of subjects were married. The average monthly income of subjects was THB 18,300 (USD 610). Seventeen point nine percent of subjects reported having a pre-existing medical condition; of these, 39.7% had an allergic disease such as asthma.

Occupational factors

Sixty-eight point seven percent of subjects had worked for 1-10 years as hairdressers. Ninety-six point eight of subjects reported no symptoms prior to starting work as a hairdresser. Ninety-seven point nine percent had no chemical protection training. Sixty-six point three percent worked in a salon with <4 hairstyling chairs and 87.4% worked in a salon with 1-5 hairdressers. Sixty-three point two percent worked 9-12 hours daily. Forty-six point eight percent worked 6 days a week.

Ninety-eight point seven percent of subjects reported their salon had aprons, 95.5% had gloves and 93.2% had masks. Fifty-two point four percent of subjects stated their salon had a chemical wash basin. Eighty-five point five percent of subjects reported their salons had fans, 80.8% had air conditioning and 73.7% had general exhaust ventilation.

Fifty-six point three percent of subjects were concerned the chemical in hair products were strong. Fifty-four point seven percent of subjects perceived the protective behaviors were effective and 62.6% of subjects felt they had adequate self-efficacy in carrying out protective behaviors. Fifty-four point seven percent of subjects had a poor level of perceived vulnerability to the effects of the chemicals contained in the hair products. Sixty point three percent of subjects had poor protective behavior against exposure to chemicals contained in hair products.

Work-related symptoms

Thirty-nine point five percent of subjects complained of health symptoms during the previous three months, of whom 49.5% complained of respiratory symptoms, 18.7% complained of skin problems, 16.9% complained of eye symptoms and 14.9% complained of headaches and/or dizziness (Table 1).

Subjects who reported health symptoms stated the hair products which provoked these symptoms were permanent wave solutions (36.7%), hair dyes and bleaching powder (34.7%), hair straightening solutions (26.7%) and shampoo (13.3%) (Table 2).

Factors associated with work-related symptoms

On multiple logistic regression analysis (Table 3) the factors significantly associated with work-related symptoms were: having a pre-existing medical condition [adjusted Odd Ratio (aOR) = 5.38; 95% Confidence Interval (CI): 1.98-4.62], exposure to hair dyes (aOR = 9.27; 95%CI: 3.23-6.69), exposure to hair straightening solutions (aOR = 15.14; 95% CI: 4.03-9.64), frequency of hair dying (aOR = 4.64; 95%CI: 1.44-4.94), duration of hair shampooing (aOR = 2.80; 95%CI: 1.07-7.27), duration of hair dying (aOR = 2.72; 95%CI: 1.22-6.11), preventive behaviors practiced while using hair products (aOR = 6.38; 95%CI: 2.77-4.69) and using general exhaust ventilation (aOR = 6.84; 95%CI: 3.06-5.32).

DISCUSSION

Hairdressers are exposed to a variety of chemicals at work due to hair product exposure (Mounier-Geyssant *et al*, 2006;

Table 1
Symptoms of study subjects after exposure to hair products (n=380).

Symptoms	n (%)
None	230 (60.5)
Having symptoms	150 (39.5)
Overall respiratory	249 (49.5)
Nasal irritation	98 (39.4)
Rhinorrhea	60 (24.1)
Cough	47 (18.9)
Dyspnea	44 (17.7)
Overall skin	94 (18.7)
Itching	47 (50.0)
Rash	34 (36.2)
Erythema or edema	13 (13.8)
Overall eye	85 (16.9)
Eye irritation	54 (63.5)
Watery eyes	31 (36.5)
Overall nervous system	75 (14.9)
Headaches	50 (66.7)
Dizziness	25 (33.3)

Table 2
Hair products causing health symptoms among study subjects (n=150).

Hair products	n (%)
Permanent wave solutions	55 (36.7)
Hair dyes and bleaching powder	52 (34.7)
Hair straightening solutions	40 (26.7)
Shampoo	20 (13.3)
Multiple use products	141 (94.0)

Ronda *et al*, 2009) causing adverse health effects (Bradshaw *et al*, 2011). In our study, a relatively large proportion of study subjects had symptoms, especially respiratory symptoms and skin problems. Our finding (39.5%) are similar to studies from Turkey (35%) (Mandiracioglu *et al*, 2009) and the United Kingdom (41%) (Bradshaw *et al*, 2011). Our findings suggest symptoms are due to work exposure. One study reported hairdressers began to experience symptoms about one year after beginning work at a salon (Parra *et al*, 1992). The respondents in our study reported the average of 10 years working at the salons. Further studies are needed evaluating time to onset of symptoms based on use of personal protective equipment.

Respiratory and skin symptoms were the most commonly reported symptoms among our study subjects, similar to the findings of other studies (Valks *et al*, 2005; Takkouche *et al*, 2009; Hashemi *et al*, 2010; O'Connell, 2010; Bradshaw *et al*, 2011; Ferreira, 2013). Hair products emit chemicals in gaseous form that remain in the work environment may be inhaled as well as absorb through the skin by hairdressers (Hashemi *et al*, 2010). In our study, permanent wave solutions, hair dyes and bleaching powder were reported as the most irritating chemicals by study subjects, similar to the finding of other studies (Ameille *et al*, 2003; Hashemi *et al*, 2010). Studies evaluating the clinical and immunological effects of hair products on hairdressers found hair products exposure was significantly associated with respiratory and skin conditions (Parra *et al*, 1992; Almaguer and Malkin, 1998).

In our study, the personal factor of having previous medical condition with asthma prior to beginning work as a hairdresser was associated with work-related symptoms. Similar to previous studies that health symptoms among hairdressers was associated with having an allergic history (Mounier-Geyssant *et al*, 2006; Madiracioglu *et al*, 2009). Chemical irritants from hair products can trigger attacks in persons with allergic disease (Youakim, 2001). Therefore, hairdressers with such health problem should be informed about the risks involved in this occupation and protection measure must be performed.

Table 3
Factors associated with work-related symptoms on multiple logistic regression analysis (n=380).

Factors	Crude Odds Ratio	95% Confidence Interval	Adjusted Odds Ratio	95% Confidence Interval
Having a previous medical condition				
No	1		1	
Yes	0.24	0.14-0.42	5.38	1.98-4.62
Exposure to hair dyes and bleaching powder				
No	1		1	
Yes	9.70	6.99-12.22	9.27	3.23-6.69
Exposure to hair straightening products				
No	1		1	
Yes	14.37	5.70-10.76	15.14	4.03-9.64
Frequency of hair dying (times/month)				
1-55	1		1	
> 55	1.88	1.23-2.88	4.64	1.44-4.94
Duration of hair shampooing (min/time)				
1-15	1		1	
> 15	2.17	1.29-3.66	2.80	1.07-7.27
Duration of hair dying				
1-40	1		1	
> 40	2.38	1.56-3.62	2.72	1.22-6.11
Preventive behaviors when using hair products				
Good	1		1	
Poor	6.06	3.67-5.01	6.38	2.77-4.69
Using general exhaust ventilation				
Yes	1		1	
No	6.71	4.21-6.72	6.84	3.06-5.32

Concerning occupational factors, being exposed to hair dyes and straightening solutions was associated with work-related symptoms of subjects. Hairdressers could be exposed to persulfates and ammonia during hair dying, and cause airway irritation (Mounier-Geyssant *et al*, 2006; Ronda *et al*, 2009). A study of hairdressers in Iran found that hair dyes and bleaching powder were reported as the most irritating chemical for respiratory symptoms (Hashemi *et al*, 2010). In hair straightening solutions, one of the most typical substances is formaldehyde which caused skin irritation (US Department of Labor, Occupational Safety and Health Administration, 2015). Our study also found the association between frequency and duration of hair dying, similar to a study in Norway (Hollund *et al*, 2001). The longer period of time of exposure to hair dying solutions, the higher risk of work-related symptoms. Therefore, hair product exposure preventive measure and health surveillance particularly respiratory and skin problems for workers in salons should be concerned.

In our study, a large proportion of study subjects had poor preventive behaviors, similar to a previous study (Lid *et al*, 2005). Two-thirds of subjects used exhaust ventilation, but the percentage of subjects with symptoms was high. Previous studies have found using exhaust ventilation can remove indoor air pollutants in hairdressing salons (Mounier-Geyssant *et al*, 2006; Ronda *et al*, 2009; Hashemi *et al*, 2010). The work-related symptoms in our study may caused by multifactorial included personal and occupational factors which was perhaps a result in high proportion of having symptoms of study subjects. To be better explanation regarding ventilation concern, an appropriate ventilation device, workplace chemical concentration and the personal exposure to chemical in hair products should be investigated for further study.

There were some limitations in our study. Data was gathered by self-reporting without a clinical examination making it subject to recall bias. Further studies are needed to explore specific exposure and changes in health over time. Exposure levels need to be measured and physical examinations with pulmonary function testing performed.

In summary, the proportion of subjects with symptoms due to exposure to hair care products was relatively high and personal protective behavior was relatively low. Preventive programs need to be created and tested to determine if symptoms can be reduced by implementing these preventive programs.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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