Limiting Respiratory Hazards for Hairstylists

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Abstract: Introduction and Background: In spite of regulatory improvements in workplace practices in the United States, hairstylists continue to be exposed to workplace hazards. The predominant hazard is exposure to harmful chemical products that can lead to skin and breathing complications. Much has been accomplished in European countries to mitigate chemical exposures in that setting. However, American hair salons need more stringent guidance and oversight. Methods: Results from a pilot study of ten hairstylists in the Little Rock area are presented here. Potential respiratory hazards are explored by evaluating daily activities, chemical product usage, use of personal protective equipment (PPE), and adequacy of salon ventilation. Although, this is a small study it offers insight into workplace conditions and regulatory needs. Results: Researchers found that face masks, described as cumbersome, were rarely worn and that only two of the ten salons had exhaust fans. Impact on Industry: This paper aims to provide awareness and guidance for hair salons and hairstylists on preventing inhalation hazards, through recommendations on ventilation, respirators, and design of a suitable safety manual.

Key words: hairstylists, videotaping, occupational exposure, inhalation exposure, respirators

INTRODUCTION

More than 500,000 hairstylists work in the United States. The general hazards for this occupation are similar to other occupations and include fire, electrical shock, ergonomics, slips, trips and falls, stress, injury from work tools, and hazardous substances. Newer identified hazards include electric and electromagnetic fields, illumination, humidity and temperature. Some hazards, such as fire and electrical, carry low risk in this occupation and are readily prevented by following standard precautions. Other hazards carry more daily risk and require more effort and planning to prevent such as stress, ergonomics, and exposure to hazardous chemicals. Because hair-stylist routinely perform a number of chemical treatments on clients each day, the most immediate and common hazard for hairstylists is their exposure to potentially hazardous chemicals, leading reportedly to contact dermatitis and respiratory illnesses[1-4]. Presented here is a preliminary assessment of detailed personal activity patterns, product usage, and workplace practices for ten hair-stylists within a 15 mile radius of the metropolitan area of Little Rock. Awareness and guidance for hair salons and hairstylists on preventing inhalation hazards is provided through recommendations on ventilation, respirators., education, training, and design of a suitable safety manual.

Background: There are a number of reasons why occupational exposure to hair care chemicals remains a risk despite seemingly safer chemical products. First, although some ingredients in hair products may have changed, usage has increased considerably since the 1980s. Therefore, beauticians may be performing more chemical treatments daily. Second, hairstylists may be using less-studied chemical products, based on the increasing magnitude of product ingredients on the market and lack of governmental oversight. Thirdly, product usage may be deemed safe by manufactures based on recommended and/or assumed ventilation characteristics and proper personal protective measure not necessarily being achieved in the workplace. Fourthly, response to even low levels of environmental contaminants may be greatly enhanced by the growing obesity and poor diet trends in America and the associated health susceptibilities [5]. Lastly, although some studies have found that air concentrations for harmful chemicals have not been exceeded in this occupational setting, the multitude of chemicals present create a situation in which synergistic and cumulative effects need to be addressed.

Therefore, a systematic, complete and detailed analysis of personal exposures and contributing factors is needed [6], especially for American hairstylists who are largely understudied in comparison to their
European and Asian counterparts. Table 1 highlights a variety of chemical ingredients found in hair care products that may aggravate or trigger occupational asthma and other respiratory problems. Respiratory complications in hair-stylists is believed to be predominantly caused by exposure to persulfate salts, which are in hair bleaches and are used as accelerants to speed up the bleaching process. Exposure to persulfates occurs through inhalation mainly when mixing the bleaching powders with an oxidizing agent such as hydrogen peroxide. Phenylene Diamine can also cause asthma, especially when it comes in a powder form and must be prepared; the exposure to the dust acts like an irritant. Author, Brown (1987) has written an extensive document on hazardous chemicals found in hair care products, beyond those related to respiratory health effects.

MATERIAL AND METHODS

A number of instruments were used to conduct a preliminary assessment of personal activity patterns, product usage, and workplace practices for the ten hairstylists. Hairstylists completed a one-hour questionnaire, and a five-day diary between the fall of 2005 and the winter of 2006. In addition, corresponding salon owners completed a one-hour questionnaire and allowed researchers to conduct a salon survey of the establishments in which the hairstylists work. The hairstylists also participated in a two season, Phase 1 and Phase 2, videotaping session where 8-24 hours of video-footage of work activities were collected on each hair-stylist from fall 2005 to fall 2006. Figure 1 illustrates the recruiting process and data collection methods. The Arkansas Board of Cosmetology list 2844 registered salons throughout the state of Arkansas for 2005; 351 are found in the surrounding Little Rock, Arkansas metropolitan area. The 10 salons were recruited randomly from these 351 salons via telephone and then an in person meeting was arranged. Hairstylists in the salon were handed pamphlets explaining the study and the first hairstylist to volunteer within the salon was enrolled. A participation compensation of $50 was given to the salon owner and a compensation of $100 was given to the hair-stylists. Assigned alphanumeric codes (e.g., HS99) were used on all instruments and videotapes collected to protect identity as mandated through the UAMS institutional Review Board.

The 60-90 minute (mixed categorical and non-categorical) questionnaires were administered in person to the salon owners and hairstylists, and covered questions on demographics, personal care, work practices, personal protective equipment, product usage, safety training, general health, workplace ergonomics, and risk perception. Hair-stylists were given a 5-day workday diary to document the number of clients, treatments performed, types of products and personal protective equipment used. Salon surveys allowed us to make detailed sketches of the various salon layouts (e.g., location of work rooms, mixing rooms, and bathrooms). Where possible, researchers also noted location of vents, exhaust hoods, windows, and doors. Collected video-footage ultimately varied from 8-24 hours per hair-stylist over four to twelve days for each hairstylist due to variability of client appointments and comfort with the camera. Footage was collected by a researcher on 2-hour mini-Digital video tapes (DV) using a Panasonic Model PV-GS31 camcorder and later transferred to DVD (Digital Video Disc) with sound removed to protect private conversations. Macro-activity data (e.g., number of clients, treatments performed) was entered into Excel log sheets for each hairstylist from the DVD Tapes.

RESULTS AND DISCUSSION

Demographics: Table 2 shows the main demographics for this study which included four African American hairstylists, five Caucasian hairstylists and one Asian hairstylist (one male and 9 female hairstylist). Weekly hours of work and annual income varied from 22 to 55 hours and $17, 000 to $73, 000, respectively, for the hairstylists. Three of our hair-stylist had been in this business for over 20 years, one for between 15 to 20 years, one for between 12 to 15 years, one for between 9 to 11 years, one for between 6 to 8 years and two for only 0-2 years. The hair-stylists worked an average of eight hours per day from Tuesday through Saturday, but weekly variations to this schedule were observed. Salons varied from having one hairstylist to having 8 hairstylists, which potentially affects the total amount of contaminants present.

Factors Affecting Inhalation Exposure: Figure 2 is an illustration of the occupational factors that can affect a hair-stylist's chemical exposure (i.e., the contact/exposure duration, and frequency) with potentially harmful ingredients found in hair care products. As such, we present our findings from this pilot study in relation to those occupational factors as determined through the questionnaires, survey, diaries, and videotapes. A holistic determination of the health effects of chemical exposure, however, depend on other personal biological, genetic, behavioral, and environmental factors at home and at work, not discussed here.

Chemical Usage: In this study, there were high standard deviations that often surpassed the means in the types of client treatments, number of client treatments and, therefore, the volume of products used by the hair-stylists, illustrating the high variability.
Table 1: Potentially Harsh Ingredients Found in Hair Products

Hair Dyes and Bleaches
3-nitro-p-hydroxyethylaminophenol, 2,4-toluene diamine, m-phenylene diamine, henna, benzidine, metal sulfides (e.g. sodium hydrosulfite), p-phenylene diamine, o-nitro-p-phenylene diamine, 4-amino-o-phenylene diamine, 4-amino-2-nitrophenol, 2,4-diaminoanisole, glyceryl monothioglycolate, hydrogen peroxide, lead acetate, silver nitrate, glycerin, aminoanthraquinone, ammonia, and ammonium persulfate

Shampoos, Conditioners, Hairsprays
ethylene diaminetetraacetic acid (EDTA), cetethyl morpholinium, ethosulfate, benzophenone-4, budesonide, tixocortol-21-pivalate, zinc pyridinetione, lavender oil (geraniol, linalool, linalyl-acetate), quaternium-15, ethanol, glutaraldehyde, guanidine hydroxide, formaldehyde, paraben, sodium lauryl sulphate, polyvinyl pyrrolidone and zinc pyrithione.

Straighteners (e.g., relaxers)
potassium hydroxide, sodium hydroxide, lithium hydroxide, ammonium persulfate, hydrogen peroxide, potassium persulfate, and sodium persulfate

Permanent Waves Solutions and Neutralizers
ethanol, ammonium persulfate, hydrogen peroxide, ammonium thioglycolate, glyceryl monothioglycolate, thioglycolic acid, potassium persulfate, sodium perborate, sodium bromate, potassium bromate, borax, ammonia, mercaptans, calcium hydroxide, guanidine carbonate, glutaraldehyde, and N-vinyl-2-pyrrolidone (PVP)

Fig. 1: Recruiting Process and Data Collection Methods

Fig. 2: Occupational Factors Affecting Chemical Exposure

Table 2: Hair-Stylist and Salon Owner Demographics

<table>
<thead>
<tr>
<th>Measures</th>
<th>Min</th>
<th>Median</th>
<th>Max</th>
<th>Mean</th>
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<tr>
<td>Age</td>
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<td>35</td>
<td>50</td>
<td>36</td>
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<td>Annual Income-$</td>
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<td>27 000</td>
<td>73 000</td>
<td>33 000</td>
</tr>
<tr>
<td>Hours worked (daily/weekly)</td>
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<td>8/38</td>
<td>11/55</td>
<td>8/38</td>
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<tr>
<td>Age</td>
<td>30</td>
<td>35</td>
<td>50</td>
<td>34</td>
</tr>
<tr>
<td>Annual Income-$ (n=7)</td>
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<td>35 000</td>
<td>55 000</td>
<td>40 000</td>
</tr>
<tr>
<td>Number of HairStylists'/Salon</td>
<td>1</td>
<td>2</td>
<td>8</td>
<td>4</td>
</tr>
</tbody>
</table>

Note: a: three salon owners refused to give income, b: includes the salon owner. Three of the ten hair stylists in this study were also salon owners, giving overlapping data
among the ten hair-stylists (Table 3). This will result in significant variations in the types and the magnitude of chemical exposures experienced by these hair-stylists, mostly likely indicative of the occupation in general. Ethnic variations were also observed. The Caucasians and the one Asian hairstylist in this study rarely performed relaxer treatments. In addition, on average, the four African-American hair-stylists applied less shampoo, hair conditioner creams, conditioners, spritz, and gels compared to their Caucasian and Asian counterparts in this study (not shown here). Larger studies should explore all these variations and the resultant effect on concentrations of volatile organics for personal inhalation exposure.

Streaking, hair dying, and relaxing are potentially some of the harshest chemical treatments hair-stylists perform, and we found application times to be as high as 90-minutes per client for these (Table 3). Hydrogen peroxide, persulfate salts and paraphenylenediamine are some of the ingredients found in dyes and streaking products and are suspected of causing airway and dermal hypersensitivity [9]. Relaxers have a high pH, and most of the conditioning ingredients (i.e., fatty alcohols) are unstable and slowly break down releasing ammonia over time [10]. This can be a harsh irritant for the lungs.

Ventilation: One of the most revealing factors of this study was the lack of adequate ventilation. Only two of the ten salons had exhaust fans and only one used their exhaust fans. Lack of exhaust fans was a function of salons housed in buildings not specifically designed for that purpose. When used, exhaust fans can help lower exposure levels to chemicals [11]. If salons are interested in appropriately designing their ventilation systems, they should visit the ANSI/ASHRAE Standard 62.1-2004 on “Ventilation for Acceptable Indoor Air Quality”, where the “Ventilation Rate Procedure” should be used to determine the minimum outdoor air intake flow for a ventilation system in a typical building. Additionally, the standards recommend that beauty and nail salons also have minimum exhaust ventilation at 0.60 cfm/ft², where exhaust makeup air may come from outdoor, re-circulated and/or transfer air. Given the lack of exhaust fans in the salons we studied, the issue of conformity to minimum ventilation requirements needs to be further explored in this occupational setting. Researchers must keep in mind that salons generate a multitude of chemicals that may have the same toxicological endpoint. Therefore, further research is needed to determine if even the minimum ventilation requirements are enough to protect against adverse health effects in this setting.

Respirator Usage: From the videotapes we observed that none of the hairstylists wore respirators during harsh treatments, even though one hairstylist claimed to have worn a respirator occasionally. The use of respirators for hair stylists may prove challenging. Their job is such that they routinely converse with their clients during treatment and engage in other activities such as answering phones and drinking or eating. If hairstylists commit to wearing respirators, some of these activities would have to be curtailed. The most popular and easy to use respirator is the disposable filtering facepiece N95 variety, considered 95% effective in filtering airborne particles. These are often worn by workers in nail salons, and protect against the inhalation of liquid and solid particles. For the hair salon setting this may provide protection against harmful particulates found hair sprays and powders. These respirators do not protect against volatile organics, however. The best recommendation for this purpose is a half-mask, chemical cartridge respirator with cartridges containing activated carbon or other materials for absorbing volatile organic compounds. There are many different volatile compounds found in hair care products, however, and the standard organic vapor respirator may not be appropriate for potential hazards. Additionally, chemical cartridge respirators are more cumbersome to wear than the filtering facepiece disposable masks. In general, because of the reluctance of hairstylists to use respirators and the difficulty in selecting a respirator that protects against all inhalation hazards in this setting, good ventilation is seen as the best option to protect both the hairstylists and client.

Training and Education: All of the hair-stylists received at least the standard one year of training at a cosmetology school, with a few receiving additional training through workshops and seminars. Training in other countries, such as Taiwan, can be as long as three years [12]. Questionnaires, however, revealed that none of the hair stylists received information during their training on the potential of hair products to cause or trigger respiratory problems and on the importance of proper ventilation or use of personal protective equipment. This highlights the needs for cosmetology schools to access their training curriculum and provide specific education related to chemical exposure, implementation of PPE and protective practices. Hairstylists would also greatly benefit from everyday working documents (e.g., brochures, and educational videos) that provide a list of steps for reducing personal exposure to harsh chemicals.

Safety Manual and Other Hazards: It is the recommendation of the Occupational and Health Administration (OSHA) that every business with over one employee have a safety manual. A safety manual should provide the following information on every likely hazard that might be encountered in a particular
business: a description of the hazard, precautions to prevent an injury due to that hazard, and steps to minimize the effects of an injury should it occur. A safety manual for a hair salon should be appropriately tailored to address possible hazards in that setting. One obvious hazard is chemical exposure that can lead to respiratory and dermal injuries for the hairdressers and for the clients, and the necessary precautions to take (including ventilation and protective equipment). For chemical hazards, the manual should also discuss the importance of obtaining material safety data sheets (MSDSs) for each chemical used in the salon through distributors and suppliers, and tips on how to read and understand these MSDSs. The OSHA Hazards Communication Standards (Hazcom, OSHA Standards: 1910.1200) in fact recommends that every employee has a hazards communication program covering the use of MSDSs. Safety manual for salons should also discuss and address other important hazards, for example; flammable materials, ergonomics, electrical shock hazards, workplace violence, workplace substance abuse, and slips, trips and falls. Hairstylists are encouraged to visit their state cosmetology boards that provide additional rules and regulations for hair salons when they obtain licenses. In terms of safety, however, these state regulations address predominantly sanitation and chemical burns for clients. There will be variations in each salon’s safety manual coverage due to salon differences in size, location, layout and practices that lead to varying hazards.

Study Limitations: Some limitations of the study include its small sample size and the introduction of errors in averages. There is also the possible introduction of selection bias in that those who responded had existing health condition or concerns.

Summary: This pilot study explored the occupational inhalation hazards for hairdressers and highlighted some contributing factors that may affect the magnitude and duration of inhalation exposure. These include but are not limited to: number and types of client treatments, volume of product usage, type of products used, personal protective equipment and practices, and ventilation. Some main findings are that salon owners need to improve ventilation with installation of more exhaust fans, and even the ability to open windows for natural ventilation. Hairstylists should also be encouraged to wear comfortable single-use respirators during harsh treatments. Researchers recommend that hairdressers receive early education on occupational factors affecting their health in cosmetology school and that responsible parties in the United States (e.g., Occupational Safety and Health Administration (OSHA), State Cosmetology Review Board) provide more oversight for this occupational setting.

Impact on Industry: This paper aims to provide awareness and guidance for hair salons and hairdressers on preventing inhalation hazards. Recommendations include proper ventilation and the use of appropriate respirators in this setting. Ideas for designing a suitable safety manual is also provided. Many of the European countries (e.g., Norway, France, Denmark, England, Switzerland, and Holland) have placed more emphasis on laws, research, and movements to aid beauticians, making it incumbent on responsible parties in the United States (e.g., Occupational Safety and Health Administration (OSHA), Food and Drug Administration (FDA) and State Cosmetology Review Boards) to evaluate issues regarding chemical exposure and the other health risks in this occupational setting 

Author Contributions: "Alesia C. Ferguson and Evita Asumugha contributed to the design of the study, collection of data and interpretation of results. Evita Asumugha was largely responsible for videotaped data collection and preparation of questionnaires and surveys. Alesia Ferguson was largely responsible for study ideas, oversight and manuscript preparation. Dr. Tom Rimmer contributed to the design of the project and research on ventilation requirements.
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REFERENCE