BEAUTY and its BEAST

UNMASKING THE IMPACTS OF TOXIC CHEMICALS ON SALON WORKERS

WOMEN'S VOICES FOR THE EARTH
OUR HEALTH. OUR FUTURE. TOXIC FREE.

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EXECUTIVE SUMMARY

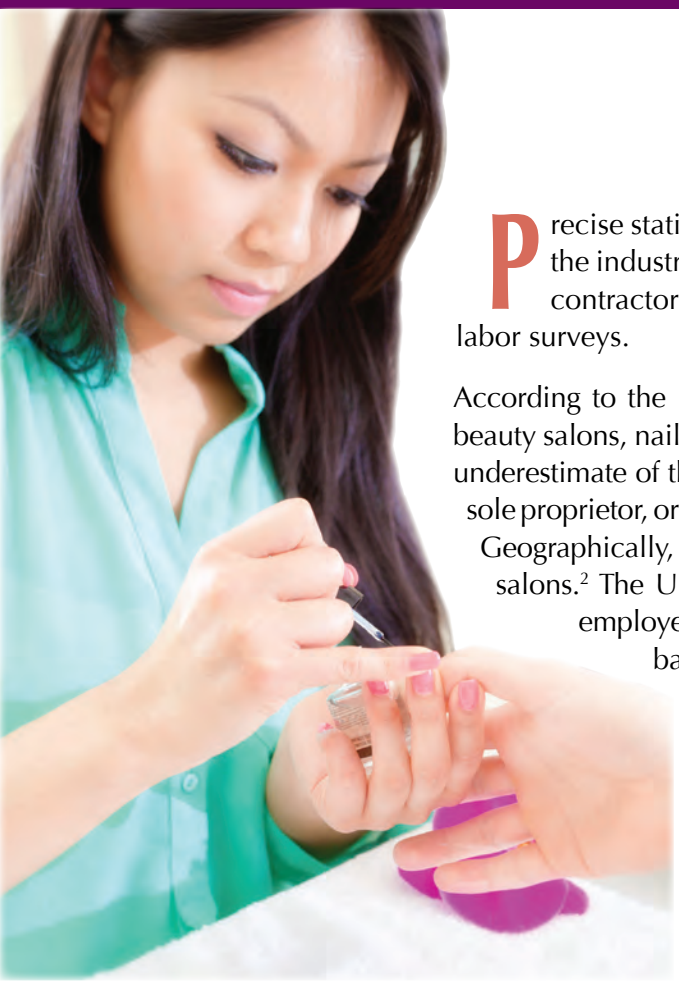
Salon workers, a population dominated by women, are exposed to a myriad of chemicals of concern everyday in their workplaces. Hair sprays, permanent waves, acrylic nail application, and numerous other salon products contain ingredients associated with asthma, dermatitis, neurological symptoms and even cancer. Salon workers absorb these chemicals through their skin and breathe them in as fumes build up in the air of the salon over the course of the workday. Research shows that salon workers are at greater risk for certain health problems compared to other occupations. This report will highlight the results of decades of research on the beauty care workforce, demonstrating the disproportionate incidence of cancers, neurological diseases, immune diseases, birth defects, reproductive disorders, skin diseases, asthma, and breathing problems in this population. Clearly, action is needed to improve conditions for salon workers and to help create and ensure healthier workplaces in the future. Recommendations for salon workers, salon owners, salon product manufacturers, and researchers, as well as long-term policy solutions, are presented in this report as options for improving the health and safety of salon workers.

RESEARCH FINDINGS SUMMARY

Hair and nail salon workers are at greater risk of the following health issues:

- Dermatitis and other skin conditions
- Decreased lung function and asthma
- Breast cancer, lung cancer, cancer of the larynx, bladder cancer, and multiple myeloma
- Miscarriage
- Having babies born with cleft palate and other birth defects
- Depression
- Alzheimer's disease, presenile dementia, motor neuron disease
- Lupus and primary biliary cirrhosis

SALON WORKER DEMOGRAPHICS



Precise statistics on the salon workforce are difficult to obtain given the nature of the industry, with its many small, independently owned salons and independent contractors, both of which may get undercounted in census efforts and other labor surveys.

According to the U.S. Census Bureau, 94,819 businesses in the U.S. are classified as beauty salons, nail salons, or barbershops by the U.S. Census Bureau, but this is likely an underestimate of the true number of establishments.[1] (Salons owned and operated by a sole proprietor, or which are unincorporated, are generally excluded from these statistics.) Geographically, California and New York are the two states with the largest number of salons.[2] The U.S. Bureau of Labor Statistics estimates there are 1.2 million people employed in this sector working as hairdressers, hairstylists, cosmetologists, barbers, nail salon workers, and other beauty and personal care workers. With the exception of the smaller barber workforce (who are largely men), salon workers are predominately women: 94.8% of hairstylists and hairdressers and 85.1% of other personal appearance workers are female. 12.8% of the workforce is Black or African American, 5.2% is Asian, and 14.6% is Hispanic or Latina.[3] For the category of "miscellaneous personal appearance workers," which includes nail salon workers, 6.1% are Black or African American, 56.7% are Asian, and 7.8% are Hispanic or Latina.[4]

NAILS Magazine also reports industry statistics specifically for the nail salon workforce, drawing on a combination of sources including magazine subscription sales and industry specific surveys. Their statistics indicate a much higher number of nail salon workers than is reflected by the U.S. Bureau of Labor Statistics. According to *NAILS Magazine*, there are approximately 364,247 nail salon workers employed in 48,930 nail salons nationally. These nail salon workers are 97% female with 61% being of reproductive age (<45 years old). 51% are Vietnamese, 40% Caucasian, 5% Black or African American, 3% Hispanic or Latina, and 1% other nationalities.[5]

Salon jobs tend to be low-wage jobs with the Bureau of Labor Statistics reporting median hourly wages in 2011 for hairdressers, hairstylists, and cosmetologists, including tips and commission, at just $10.91.[6] Similarly, surveys of nail salon workers have shown that most tend to earn less than $18,200 per year.[7] Many salon workers are contractors renting booths in a salon, or misclassified as contractors (when they should be classified as employees) and thus do not have many of the same benefits or rights of being an employee, such as health care, sick leave, or job security. Nail salon workers are a largely immigrant population, commonly with limited English fluency skills, which makes it difficult to access safety information, or navigate the regulatory environment.

HARMFUL CHEMICALS TO AVOID IN SALON PRODUCTS

The chemicals on this list can be avoided by using currently available salon products containing safer alternatives.

CHEMICAL NAME	FOUND IN THESE PRODUCTS	SYMPTOMS OF EXPOSURE	POTENTIAL LONG TERM EFFECTS
Dibutyl Phthalate	Nail polish	Nausea, dizziness, eye and skin irritation	Reproductive toxin, birth defects
Formaldehyde or methylene glycol	Nail hardener, nail polish, keratin hair straighteners	Breathing problems, coughing, wheezing, skin rashes, eye, nose, throat irritation	Cancer, dermatitis
Toluene	Nail polish, nail glue, hair dye, wig glue/hairpiece bonding	Dizziness, headaches, skin rashes, eye, nose, throat irritation	Liver damage, kidney damage, birth defects, pregnancy loss
Methyl Methacrylate (MMA)	Artificial nails	Breathing problems, chest tightness, eye, nose, throat irritation, headaches, confusion	Loss of smell, reproductive toxin, asthma, allergic reaction
Cyclopentasiloxane or cyclomethicone	Flat iron sprays, thermal protection sprays	Under the high heat of a flat iron, cyclopentasiloxane creates formaldehyde. Formaldehyde leads to breathing problems, coughing, wheezing, skin rashes, eye, nose, throat irritation	Formaldehyde exposure may cause cancer, dermatitis
Styrene	Hair extension glue, lace wig glue	Vision problems, trouble concentrating, tiredness	Cancer
Trichlorethylene	Hair extension glue, lace wig glue	Dizziness, headache, confusion, nausea, eye and skin irritation	Liver damage, kidney damage, dermatitis, double vision
1,4 Dioxane	Hair extension glue, lace wig glue	Eye and nose irritation	Cancer, liver damage, kidney damage
2-butoxyethanol or Ethylene glycol monobutyl ether	Disinfectants, cleaners	Headache, eye and nose irritation	Reproductive toxin

BE MINDFUL OF THESE HARMFUL CHEMICALS

The following list of chemicals are those known to be harmful to health, but which may be difficult to avoid due to a lack of safer available alternatives.

CHEMICAL NAME	FOUND IN THESE PRODUCTS	SYMPTOMS OF EXPOSURE	POTENTIAL LONG TERM EFFECTS
Quaternary Ammonium Compounds or "dimethyl benzyl ammonium chloride"	Disinfectants and cleaners	Skin, eye and nose irritation	Asthma
P-phenylenediamine	Hair dyes, black henna tattoos	Skin irritation	Dermatitis
Glyceryl thioglycolate	Permanent wave solutions, "acid perms"	Skin irritation	Dermatitis
Ammonium persulfate	Hair bleach	Eye, skin and nose irritation, coughing, shortness of breath	Asthma, dermatitis
Ethyl methacrylate	Artificial nails	Eye and skin irritation, rashes on eyelids, face or neck, difficulty concentrating, coughing, shortness of breath	Asthma
Acetone	Nail polish remover, hairspray	Eye, skin and throat irritation, dizziness	Eye, skin and throat irritation, dizziness
Acetonitrile	Nail glue remover	Eye, skin and throat irritation, face flush, chest tightness, nausea	Weakness, exhaustion
Butyl acetate, ethyl acetate or isopropyl acetate	Nail polish, nail polish remover, wig glue/ hairpiece bonding	Eye, skin and throat irritation, headaches, dizziness	Eye, skin and throat irritation, dermatitis
Methacrylic acid	Nail primer, eyelash glue	Skin burns, eye, nose and throat irritation	Kidney damage, dermatitis, reproductive toxin

Note: These lists are not exhaustive. More research is needed.

ADVERSE HEALTH OUTCOMES EXPERIENCED BY SALON WORKERS

Skin Conditions

Skin conditions including dermatitis, eczema, and rashes, particularly affecting the hands are the most common work-related health effects seen among salon workers. Some surveys have found upwards of 60% of salon workers reporting these skin conditions.[8,9,10] Comparative studies show that salon workers, particularly hairdressers, are two to three times more likely to suffer from skin conditions than people in other occupations such as office workers.[11] Salon work involves considerable exposure of the hands to numerous irritating and sensitizing chemicals. In addition, tasks such as hair shampooing are classified as "wet work" in which the hands are wet for long periods of time, while also in contact with other chemicals. Long periods of exposure to moisture reduce the skin's natural barrier, allowing greater absorption of chemicals, and increasing the chance of irritation to the skin. Salon chemicals commonly associated with causing skin conditions include hair dyes and bleaches, permanent wave solutions, fragrances, and acrylates associated with acrylic nails.[12,13,14,15,16]

Some surveys have found upwards of 60% of salon workers reporting these skin conditions.

While in some workers the severity of work-related skin conditions develops over time, skin symptoms often occur soon after entering the workforce. Numerous studies of cosmetology students and trainees have found that suffering from skin problems begins early in their careers. A study of hairdressing students in Australia found 58% already reported having skin problems on their hands.[17] 40% of Swedish hairdressers and over 70% of Danish hairdressing apprentices reported that their hand eczema began during their vocational training.[18,19]

The consequences of hand dermatitis and other skin conditions can be severe in some cases. An Australian study of hairdressers involved clinical skin examinations of their hands. Experienced hairdressers were more likely to have moderate to severe skin conditions (8.1%) versus trainee hairdressers, of whom 4.7% already showed moderate to severe symptoms.[20] Overall, 29% of participants were classified as having skin impairments on the day they were examined.

Several studies document worsened quality of life due to skin problems. A Swedish study of hand eczema patients found that 70% reported experiencing disturbances to their social and emotional lives due to their skin condition, and over half of patients described conditions of frequent itching.[21] A Finnish study found over 12% of hairdressers reporting that their hand eczema made their work considerably more difficult.[22] These impacts often lead to salon workers

choosing to leave the industry early. In a study of Danish hairdressers with hand eczema, 45.5% reported that their skin condition was the main reason for leaving their job.[23] In another study, 50% of hairdressers surveyed in the United Kingdom reported knowing of a colleague who had left their job due to their work-related skin problems.[24] Leaving a job due to hand eczema was also reported three times more often for Swedish hairdressers than for people in other occupations.[25] Frequently however, hand dermatitis and similar conditions are merely thought of as "part of the job," and are suffered silently by salon workers.[26,27]

Skin conditions have been found to be significantly underreported to occupational health authorities by salon workers.[28] One illuminating study found that upon examination by a dermatology specialist, 34% of hairdressers who showed signs of skin problems self-reported that they thought their hands were "normal" that day.[29] Many salon workers' skin symptoms can and should be prevented (or at least experienced with less severity). Improved training, employment of best practices, and safer products are needed to reduce the impacts to the salon worker population.

Respiratory Conditions/Breathing Problems

The second most common kinds of health effects experienced by salon workers are breathing problems such as asthma, chronic bronchitis, reduced lung function, cough, and nasal symptoms. Salon products contain numerous chemicals that off-gas and can build up in the air of a salon. Many of these chemicals can be lung irritants and allergens. Breathing all day in workplaces with impaired air quality takes its toll on salon workers. Many salons lack adequate ventilation, which can compound the problem.

Occupational asthma has been well documented among salon workers. One study of over 20,000 people in Northern Europe found that hairdressers had one of the highest risks of new-onset asthma compared to workers of other professions.[30] A study in Colorado documented that 9.3% of cosmetologists surveyed had physician-diagnosed asthma, and that doing work in hairstyling or applying artificial nails significantly increased the risk of being diagnosed with asthma.[31] Manicurists applying artificial nails were also found to have a three-fold increased risk of exacerbation of their asthma at work.[32] Other occupational asthma case studies have also been reported recently for both cosmetologists and nail salon workers, associated with exposure to fragrances, artificial nails and glues, hair bleaching and dyes in the workplace.[33,34,35,36,37] However, more research is clearly needed in this area,

A study of medical centers in 15 U.S. states found that hairdressers were four times more likely to be diagnosed with idiopathic pulmonary fibrosis, an unexplained fatal chronic lung disease.

as other occupational health studies have not found excess risks of asthma among salon workers compared to other professions.[38,39]

Salon workers have been shown to be at greater risk for other chronic lung diseases as well as various breathing problems. A study of medical centers in 15 U.S. states found that hairdressers were four times more likely to be diagnosed with idiopathic pulmonary fibrosis, an unexplained fatal chronic lung disease.[40] A study in Finland found that hairdressers were also more than four times more likely to suffer from chronic bronchitis than a control group of supermarket saleswomen.[41] Similarly these hairdressers had 70% increased chance of chronic nasal symptoms like sneezing or runny nose, 40% greater chance of coughing, and 50% greater chance of shortness of breath. The researchers in this study concluded that "Allergenic and irritative chemicals in hairdressing are likely candidates explaining the difference found between the hairdressers and controls."[42] In a follow-up study, hairdressers particularly reported nasal symptoms and shortness of breath as factors compromising their ability to work.[43] Another study of hairdressers in the United Kingdom found that hairdressers were 13 times more likely to suffer from work-related cough and five times more likely to suffer from work-related nasal symptoms than a control population.[44] A survey of Norwegian hairdressers reported significantly more nasal and respiratory symptoms associated with exposure to hair dyes, permanent solutions, and hair bleaches than a control group of office workers.[45] A Greek study of hairdressers documented significantly decreased lung function among hairdressers compared to office workers.[46]

Nail salon workers who apply acrylic nails appear to be particularly at risk. One study found that workers regularly applying acrylic-nail chemicals experienced both decreased lung function and increased airway inflammation. A more intense workday (i.e., longer hours applying acrylic nails) led to worsened lung function. Lung function was also found to be worse among workers who had spent the most years in the nail salon industry.

Nail salon workers have also been found to experience respiratory symptoms. A study of Boston-area Vietnamese nail salon workers reported breathing problems and nasal symptoms were commonly associated with their work.[47] A study of nail salon workers in South Korea found similar results in that they were significantly more likely to suffer from nasal or throat irritation and cough than a comparative population of office workers.[48] Nail salon workers who apply acrylic nails appear to be particularly at risk. One study found that workers regularly applying acrylic-nail chemicals experienced both decreased lung function and increased airway inflammation.[49] A more intense workday (i.e., longer hours applying acrylic nails) led to worsened lung function. Lung function was also found to be worse among workers who had spent the most years in the nail salon industry.[50]

A common factor found in these studies was that many of the respiratory symptoms among both hair and nail salon workers were only associated with their work environments and appeared to improve considerably during vacations or other days away from the salon.[51,52,53]

Reproductive Disorders and Birth Defects

As a predominantly female profession, the potential for reproductive harm from salon work is a prominent concern. Research suggests that salon workers actively seek health advice about the chemicals they work with when they are pregnant.[67] Anecdotal evidence indicates that salon workers have a tendency to leave their jobs during pregnancy due to their health concerns about exposures.[68] While the scientific data are limited, due in

WHAT'S THAT SMELL IN SALONS ANYWAY?

A limited number of studies have conducted indoor air monitoring in salons to better characterize the potentially hazardous chemicals found in the air that salon workers and their clients breathe. Both hair and nail salon products are made from numerous chemicals which off-gas into the air of the salon when used. In most cases, the levels of chemicals detected have not been found to exceed regulatory occupational health guidelines. Yet, many authorities consider those occupational guidelines to be outdated and not necessarily protective of worker health.[54] The data from air monitoring studies have routinely shown, however, that certain chemicals tend to be present in salon air at disproportionately higher levels than other workplaces (such as offices) or homes. Several air monitoring studies of hair salons have found elevated levels of ethanol, isopropanol, ammonia, toluene, and similar volatile organic compounds (VOCs), thioglycolates, persulfates, as well as fragrance ingredients such as pinene, limonene, and eucalyptol. [55,56,57,58] In addition to the nuisance of strong chemical odors, most of these chemicals cause irritation to eyes, lungs, and throat at a minimum, and some can lead to other health effects, including cancer, at higher levels and prolonged exposure. Research is needed to better understand the potential synergistic or additive effects of multiple simultaneous exposures in a salon.

Chemicals detected in hair and nail salons include acetone, butyl acetate, ethyl acetate, methyl methacrylate, ethanol, isopropanol, ammonia, toluene, thioglycolates, persulfates, as well as fragrance ingredients such as pinene, limonene, and eucalyptol.

In nail salons, a different set of chemicals are detected, reflecting the components of nail products, which differ from hair products. Studies of nail salons often detect acetone, toluene, butyl acetate, ethyl acetate, and methyl methacrylate at elevated levels.[59,60,61,62,63,64] Some studies have noted that the peaks in chemical levels occur while certain salon services such as perms, hair bleaching, or acrylic nails are being performed. The quality of ventilation in salons also appears to impact monitoring levels, which can vary considerably from salon to salon. One notable study which measured total volatile organic compounds (TVOCs) in nail salons found both a minimum level of 61 ppb TVOCs in one salon and a maximum of 38,000 ppb TVOCs in another. This means one salon had 600 times the levels of chemicals in the air than the other. Quality of ventilation was a key factor: better ventilated salons were found to have lower levels of TVOCs. By comparison, the researchers noted that the average concentration of TVOCs in homes is 337 ppb.[65] Another study of "local exhaust ventilation" technology in nail salons found that nail tables with built in local exhaust had the potential to reduce hazardous exposures to salon workers by more than 50%.[66] Improving air quality in salons, though product reformulation to reduce volatile chemicals and more rigorous ventilation standards, should be a priority for improved health and well-being for beauty workers' health and their customers' as well.

part to the complexities of conducting reproductive health research, there are valid reasons for concern. Toxic solvents and endocrine-disrupting chemicals that have been associated with adverse reproductive outcomes, such as pregnancy problems and birth defects, are commonly found in salon products.[69,70] This fact has driven some research to investigate whether salon workers are disproportionately experiencing reproductive harm from their everyday work. Thus far, the preliminary results have been mixed with some studies documenting higher risks among salon workers and others seeing no correlations.[71] For example, a French study found that women exposed to organic solvents during pregnancy (such as hairdressers) showed an increased risk of giving birth to a baby with an oral cleft.[72] Similarly a European registry study found a five-fold increase in risk of cleft palate in babies born to hairdressers.[73] A Danish study found a moderate increase in hypospadias, a penis abnormality, in baby boys born to mothers most likely exposed to endocrine-disrupting chemicals (such as hairdressers).[74] Researchers in France found an increased risk in oral clefts, urinary tract malformations, and male genital tract malformations in children born to mothers whose occupations (including hairdressing) involved exposure to glycol ethers and solvents.[75] In Sweden, hairdressers were found to have a slight increased risk of having infants born with a major malformation.[76]

A European registry study found a five-fold increase in risk of cleft palate in babies born to hairdressers.

Research has also examined the increased risks of adverse pregnancy and other reproductive outcomes among salon workers. A survey of cosmetologists in North Carolina found a slightly increased risk of miscarriage in women who worked full time during their pregnancy.[77] The survey also noted that those women who had been in cosmetology school during pregnancy had twice the risk of miscarriage. Elevated risks of miscarriage were also seen for cosmetologists working in salons where nail sculpturing took place, as well as in salons that used formaldehyde and alcohol-based disinfectants.[78] A Finnish study found that hairdressers had increased risks of preterm delivery and low birth weight babies compared to teachers.[79] Similarly, a Swedish study found that hairdressers were more likely to give birth to babies that were small for gestational age. A study in New York found a slightly increased risk in cosmetologists giving birth to low birth weight babies when compared to realtors.[80] Frequent permanent waving and hair spraying by those hairdressers further increased this risk.[81] Further studies on this group of cosmetologists also revealed that they were twice as likely as realtors to experience postpartum hemorrhage and twice as likely to require newborn intubation.[82] Caucasian hairdressers surveyed in the Baltimore area were found to have a significantly higher rate of premature ovarian failure, a condition that involves early onset of menopause.[83]

The research on reproductive harm to salon workers is still in its early stages and needs further investigation. There are several studies, for example, that have not found any associations with increased reproductive harm among

salon workers.[84,85,86] Inconsistencies in the data demonstrate the complexity of this kind of research. However, thus far, the body of data justifies the need for greater research in defining the risks to women of reproductive age and to discover and promote preventive strategies.

Cancer

Cancer-causing chemicals are found in salon products, raising the concern that occupational exposure to these chemicals may increase the risk of cancer in salon workers. While the evidence is limited, some studies have found that hairdressers are more likely to experience certain cancers. In 2010, the International Agency for Research on Cancer (IARC) published an evaluation of studies on cancer risks associated with dyes and colorants. With respect to hair dyes especially, the IARC concluded that "occupational exposures as a hairdresser or barber are probably carcinogenic to humans."[90] A study conducted in New York found that beauticians were at three times greater risk of breast cancer than women of other occupations.[91] Other breast cancer studies, however, have found inconsistent results.[92] A meta-analysis of other types of cancer did find several associations with greater risks of cancers among hairdressers. Specifically, the analysis noted an increased risk of lung, larynx, and bladder cancers, and multiple myeloma in hairdressers compared to other occupations.[93] These preliminary results are concerning, given the chronic exposure of salon workers to cancer causing chemicals. Clearly, additional research is needed to better understand the exposures and develop preventative strategies.

With respect to hair dyes especially, the IARC concluded that "occupational exposures as a hairdresser or barber are probably carcinogenic to humans."

Depression

Depression in salon workers was examined in a single occupational health study conducted in Baltimore, MD. Cosmetologists surveyed in the study were found to be at increased risk of depression compared to workers in other professions. The risks were found to be greatest for salon workers who had worked longer than 20 years in the industry. Increased risks

DATA GAPS ON HEALTH EFFECTS OF ETHNIC HAIR CARE

One under-researched sector of the salon products market is those products specifically targeted for use with the African-American population. There are several chemicals of concern used in these products: from highly corrosive ingredients in hair relaxers, such as lye, to potentially endocrine-disrupting ingredients such as placenta in hair treatments, and toxic solvents and adhesives in hair glues and removers. The caustic chemicals in hair relaxers have been known to lead to scalp lesions and burns as well as hair loss in product users.[87] Preliminary research has linked use of placenta-containing hair oils and other products with earlier age of menarche in African-American teens as well as increased risk of fibroids in women.[88,89] There is a lack of research, however, on potential impacts to salon workers using these products both on themselves and on their clients. Research is needed to examine the impacts on this population of salon workers in order to establish more protective measures and help determine safer products.

BRAZILIAN BLOWOUT AND OTHER HAIR STRAIGHTENERS: A CASE STUDY OF REGULATORY WEAKNESSES

In recent years, professional hair straighteners containing formaldehyde, such as Brazilian Blowout, have been in the spotlight as a prime example of an under-regulated salon product known to pose serious health hazards. A professional hair straightener is a salon product that is designed to straighten curly or frizzy hair for a period of up to three months and is applied by a stylist with the use of a flat iron.

Brazilian Blowout and several other leading brands of hair straightening products have been found to contain high levels of formaldehyde (also referred to as methylene glycol). While formaldehyde is very effective at straightening hair, formaldehyde gas is released during application of the product (when the hot flat iron contacts the product on a client's hair). Formaldehyde gas is a dangerous pollutant that can be severely irritating to the eyes, nose and throat, and long-term exposure to formaldehyde in the workplace has been associated with an increased risk of cancer.

In 2010, stylists in Oregon and California were among the first to report to occupational health authorities the problems they were having with Brazilian Blowout, including difficulty breathing, nose bleeds, and eye irritation. The U.S. Food and Drug Administration (FDA) has also received numerous complaints from customers and salon workers about similar symptoms, as well as rashes, fainting, and hair loss, associated with use of the product. As a result, in 2011, the federal Occupational Safety and Health Administration (OSHA) issued a hazard alert against the use of hair straighteners containing formaldehyde.[94] The FDA also sent a warning letter in 2011 to the makers of Brazilian Blowout and began an investigation into hair smoothing products that emit formaldehyde.

However, the FDA's ongoing investigation has yet to result in any further actions on these products. Additionally, the Cosmetics Ingredient Review, an industry-funded panel of scientists tasked with reviewing the safety of cosmetic products, declared that formaldehyde was unsafe as used in hair smoothing products.[95] Numerous other countries, including Canada, Australia, and members of the European Union, have banned many of these products due to safety concerns.[96] Unfortunately, in the U.S., regulatory authority and will are weak, which allows these potentially cancer-causing products to continue to be sold to salons without restriction.

were also associated with salon workers who worked with cleaning products in the salon and those who texturized hair. The researchers proposed that these salon workers might have been exposed to chemicals associated with depression, but that further research is needed to determine which chemicals are problematic, and to better assess exposures to these chemicals in the salon.[97]

Alzheimer's Disease and other neurotoxic effects

Salon work commonly involves the use of solvents and other volatile chemicals associated with neurotoxic effects. Not surprisingly, salon workers have been found to suffer from neurological symptoms and diseases at disproportionate rates. For example, headaches and dizziness are two symptoms commonly experienced by salon workers. In a study of Vietnamese nail salon workers in Boston, MA, 44% reported experiencing headaches, which dissipated when they were away from the salon. Similarly, 28% reported lightheadedness or difficulty concentrating while at work.[98] In a South Korean study, 82% of nail salon workers reported commonly experiencing headaches at work compared to 37% of a control group of office workers. This study also found that these nail salon workers were being exposed to airborne levels of acetone, toluene, butyl acetate, and methyl methacrylate, which exceeded the South Korean government's Occupational Exposure Limits for these chemicals.[99] A study of U.S. death certificate information revealed that hairdressers had significantly increased risks of dying from three neurological conditions: Alzheimer's disease, presenile dementia, and motor neuron disease compared to other workers in other occupations.[100] Neurological impacts of exposures in the salon are of great concern, and worthy of additional research and examination.

Salon workers have been found to suffer from neurological symptoms and diseases at disproportionate rates. For example, headaches and dizziness are two symptoms commonly experienced by salon workers.

Immune Disorders

While limited data exist on immune disorders in salon workers, two studies have found increased risks in nail salon workers and those who apply nail polish frequently. An occupational health study in Canada found that nail salon workers who applied nail polish regularly had ten times the risk of lupus than other occupations.[101] A U.S. study found that frequent application of nail polish increased the risk of primary biliary cirrhosis, an autoimmune disease that primarily affects women.[102] Researchers of both studies highlighted the potential role chemical exposures may play in causation of these diseases.

Heart disease

Cardiovascular function may also be affected by occupational exposures in salons. Researchers in Taiwan demonstrated increased oxidative stress and reduced heart rate variability in hairdressers associated with exposures to volatile organic compounds in the air of their salons. When these hairdressers were monitored on non-working days away from the salon, their cardiovascular health was greatly improved, indicating that workday exposures were the likely cause of their symptoms.[103]

Lack of Regulation of Ingredients in Products

By law, all cosmetic products (including salon products) sold in the United States must be free of poisonous or deleterious substances that might harm users under conditions of normal use.[104] However, the legal tools available to enforce the law are extremely limited. While the Food and Drug Administration (FDA) has regulatory authority over cosmetics, the FDA admits that it "does not review or approve nail products and other cosmetics before they go on the market." The Food, Drug and Cosmetics act contains no provisions that require evidence of the safety of ingredients in cosmetics products prior to their marketing. The FDA also recognizes the fact that it lacks the ability to require a recall of harmful products, and that recalls are voluntary company actions. These legal loopholes make it difficult to prevent cosmetic products containing harmful chemicals from being marketed, even when there is evidence of harm from the product. In addition, there is no requirement that ingredients in salon products be disclosed.

Lack of Regulation of Health and Safety in Salons

While federal occupational safety laws exist, there is inadequate capacity to enforce occupational safety and health in salons from the federal level. Instead, health and safety rules and regulations in salons are often promulgated by the state cosmetology and barbering boards. These regulations vary from state to state but rarely are specific enough to address toxic chemical exposures in salons. For example, there are very few regulations establishing minimum ventilation requirements in salons. And often, the capacity to enforce regulations is also limited, given the large number of individual establishments.

RECOMMENDATIONS

In the long term, salon safety is largely a matter of manufacturer responsibility, to create and produce effective salon products that do not result in impaired air quality in the salon and adverse health outcomes among workers. Currently however, salon owners and workers face limited options for healthier products. In order to protect their health from the impacts of available salon products, they require alternative strategies and preventative actions. Below we offer strategies for salon workers and owners to better protect their health, as well as long-term goals for manufacturers and policymakers to ensure healthier salons.

Salon Worker Protections and Preventive Actions

Use less toxic products in the nail salon when possible, including the following:

- Nail polishes free of dibutyl phthalates, toluene, and formaldehyde
- Nail polish removers free of butyl acetate, methyl acetate, or ethyl acetate
- Nail polish thinners free of toluene or methyl ethyl ketone

Use less toxic products in the hair salon when possible, including the following:

- Hair sprays labeled as "low VOC formulas"
- Pump spray products rather than aerosols (to reduce inhalation risk)
- Hair straighteners free of formaldehyde or methylene glycol

Use personal protective equipment on a daily basis:

- Wear neoprene or nitrile gloves to protect the skin on your hands.
- Do not reuse disposable gloves.
- Where necessary, use respirators with organic carbon chemical cartridges, or N95 respirator dust masks.

Ensure proper handling, storage, and disposal of salon products:

- Close containers of salon products when not in use.
- Place any trash soaked in chemicals in a trash can with a tight lid.
- Dispose of hazardous waste appropriately.

Order services performed to reduce exposure, for example, cut client's hair before applying hair dye to reduce the exposure of your hands to hair dye.

Use fewer products and smaller amounts of each product when performing services.

Wash your hands before and after performing services to remove any chemical residue.

Consider limiting the salon services offered, especially if certain services already lead to symptoms.

Salon Owner Solutions

Ensure adequate ventilation in the salon:

- Open doors and windows when possible.
- Install a ventilation system with external exhaust and ability to make multiple air changes per hour.
- Exhaust particularly sensitizing and irritating exposures away from the salon workers breathing zone.
- Install nail tables with a built-in local exhaust fan.
- Stock less toxic products in the salon (for examples see above).

Consider limiting services performed at the salon to exclude services most commonly causing symptoms in workers or clients.

Ensure appropriate occupational health and safety training for workers on preventive measures.

Seek "Green Salon" or "Healthy Salon" certification (where available).

Review the California DTSC Greener Nail Salon checklist for additional ways to green your salon.

See a list of web resources for salon workers and owners at www.womensvoices.org/salons.

Salon Product Manufacturer Solutions

- Disclose all ingredients in salon products and facilitate access to Safety Data Sheet information.
- Provide product safety information in multiple languages, according to salon demographics.
- Employ green chemistry to reformulate products that contain the most problematic chemicals.
- Design products for safe use in commonly found salon environments, such as under-ventilated salons, salons located in homes, etc.

Policy Recommendations

FEDERAL LEGISLATION

Pass strong and comprehensive federal cosmetics policy to ensure safer cosmetic and salon products, including the following provisions:

- Phase out of ingredients linked to cancer, birth defects, and developmental harm
- Creation of a health-based safety standard that includes protections for children, the elderly, workers, and other vulnerable populations
- Elimination of labeling loopholes by requiring full ingredient disclosure on product labels and company websites, including salon products and the constituent ingredients of fragrance
- Worker access to information about unsafe chemicals in personal care products
- Adequate funding to the FDA Office of Cosmetics and Colors so it has the resources it needs to provide effective oversight of the cosmetics industry
- Support further research on worker exposure and setting of preventive standards

ESTABLISH LOCAL HEALTHY SALON RECOGNITION PROGRAMS

San Francisco, CA, was the first city in the country to establish a healthy nail salon recognition program that provides public acknowledgement of nail salons that, among other criteria, use nail polishes free from dibutyl phthalate (DBP), toluene, and formaldehyde; use nitrile gloves when performing nail services; properly ventilate the salon; and use safer nail polish removers and thinners. Since this program was established,

several other cities in California have adopted similar programs including the City of Santa Monica, San Mateo County, and Alameda County. An air monitoring study conducted of salons participating in the salon recognition program versus salons not participating in the program showed a decrease in toluene exposure (although not statistically significant) and an increase of knowledge about the presence of DBP.[105] The adoption of such programs has the potential to reduce salon workers exposure to toxic chemicals, increase their knowledge of practices to create healthier workplaces, and drive manufacturers toward the creation of safer products.

Healthy Salon Recognition programs recognize salons that use less toxic products and best practices.

FEDERAL AGENCY RECOMMENDATIONS

There are steps federal agencies can take using their existing authority to reduce salon workers exposure to harmful chemicals.

The Food and Drug Administration (FDA) is the agency that regulates cosmetic and salon products. Although the agency does not require premarket safety approval of salon products, the agency has the authority to take action if a product does prove to be adulterated or misbranded. Although the agency does not have the authority to issue a mandatory recall of products, it can ban or restrict the use of harmful substances in a product through a rulemaking process to classify a harmful chemical as poisonous or deleterious. To improve the health of salon workers the FDA should do the following:

- Request a voluntary recall of the Brazilian Blowout Solution and Acai Professional Smoothing Solution and other brands of hair straighteners that contain formaldehyde (according to Regulatory Procedures Manual, 7-5-2 " FDA Requested Recall").
- Classify toluene and dibutyl phthalate as poisonous and deleterious substances.

The Environmental Protection Agency (EPA) does not regulate salons directly, but salons do fall under the agencies purview from a pollution prevention standpoint. The agency also runs the Integrated Risk Information System (IRIS), which produces human health assessments based on evaluations of health effects that may result from exposure to environmental contaminants. Health assessments may be used, by policymakers or other agencies, to help shape regulatory decisions over certain chemicals.

To improve the health of salon workers the EPA should do the following:

- Develop inhalation (RfC) and oral reference values (RfD) for ethyl methacrylate (EMA) and methyl methacrylate (MMA) that are based current scientific information. MMA has IRIS reference values that are based on 1964 studies. There are no

IRIS reference values for EMA. The existing reference values are not based on protecting against reported and documented health impact such as occupational asthma.

The Occupational Safety and Health Administration (OSHA) is a regulatory agency that establishes and enforces standards for workplace safety. For example, the agency enforces permissible exposure limits for chemicals workers may be exposed to in salon or in manufacturing facilities of these products. The agency also provides resources, training, education, and assistance to promote workplace safety. To improve the health of salon workers, OSHA should do the following:

- ☞ Update the Permissible Exposure Limits (PELs) for key chemicals of concern commonly found in nail and hair salon products to protect against chronic health hazards, including cancer, reproductive and developmental toxicity, and asthma.
  - Specifically, the 8-hour exposure limit for toluene should be revised from 200 ppm to 0.5 ppm to protect against spontaneous abortions and to be as protective as environmental standards for the public. In the alternative, the limit should be reduced to at least 10 ppm, which has been adopted by the California Occupational Safety and Health Standards Board to protect against chronic nervous system damage.
  - The limit for DBP should also be reduced from its current 5 mg/m3 to 0.01 mg/m3 to protect against developmental and reproductive toxicity.
  - To protect against asthma, OSHA should reduce the PEL for methyl methacrylate and develop a PEL for ethyl methacrylate. Notations such as DSEN should be added to indicate that the chemicals are skin sensitizers.
- ☞ OSHA should consider the effect of long-term and continuous exposures, as well as frequent non-continuous high exposures, on the health of women of childbearing age.

Research Recommendations

Additional scientific research on hazardous exposures to salon workers is needed to better understand potential impacts and to devise preventive strategies. Specifically, data gaps identified in this report which need further attention include the following:

- Research on effective preventive strategies to reduce exposures to toxic salon chemicals until safer alternatives are readily available
- Research in green chemistry to develop safer salon products
- Research on the impacts of multiple chemical exposures experienced in a salon
- Research to better characterize salon worker exposures to specific chemicals of concern, including breathing zone assessments of air pollutants, and dermal uptake of chemicals in salon products
- Epidemiological research to assess the health outcomes associated with salon exposures to specific chemicals of concern
- Research to examine and better characterize the unique exposures of hairdressers that work with African-American clients, including research on hair straightening, application and removal of hair extensions, and use of products containing placenta
- Epidemiological research to assess the health outcomes experienced by hairdressers that work with African-American clients
- Research on individual sensitivity and genetic sensitivity to salon chemicals and salon environments

Conclusion

Salons can be a hazardous place to work given the multiple daily exposures to chemicals of concern. Fortunately, this situation is not inevitable. Best practices, including using less toxic products, improved ventilation, and appropriate protective equipment, can significantly decrease the chance of adverse health impacts of salon work. Over the long term, development of less toxic products is paramount to ensure a healthier workplace. Currently, many salon workers pay too high a price with their health for their jobs. Salon workers should be able to enjoy their work without paying a toll on their health. Collectively, manufacturers, lawmakers, government agencies, salon owners and workers all play an important role in making salons healthier places to work.

END NOTES

1 U.S Census Bureau (2011) Statistics of U.S. Businesses (SUSB) Number of Firms, Number of Establishments, Employment, and Annual Payroll by Enterprise Employment Size for the United States, All Industries: 2011. Available at: www.census.gov/econ/susb/index.html

2 U.S Census Bureau (2012) 2012 County Business Patterns (NAICS), Industry Code Comparison 81211/Hair, Nail, and Skin Care Services Available at: www.census.gov/econ/cbp/

3 Bureau of Labor Statistics (2013) Current Population Survey, Household Data Annual Averages. Table 11. Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity. Bureau of Labor Statistics, U.S. Department of Labor, Available at www.bls.gov/cps/cpsaat11.pdf

4 Bureau of Labor Statistics (2013) Current Population Survey, Household Data Annual Averages. Table 11. Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity. Bureau of Labor Statistics, U.S. Department of Labor, Available at www.bls.gov/cps/cpsaat11.pdf

5 *NAILS Magazine* (2014) *NAILS Magazine* 2013-2014 Industry statistics. Available at: issuu.com/bobit_nails/docs/bb2013-14stats_web/1?e=2524612/5794031

6 Bureau of Labor Statistics (2014) Occupational Outlook Handbook, 2014-15 Edition, Barbers, Hairdressers, and Cosmetologists. Bureau of Labor Statistics, U.S. Department of Labor, Available at www.bls.gov/ooh/personal-care-and-service/barbers-hairdressers-and-cosmetologists.htm (visited July 31, 2014).

7 California Healthy Nail Salon Collaborative (2010) Framing a proactive research agenda to advance worker health and safety in the nail salon and cosmetology communities. Convening report. 2010. Available at: : www.cahealthynailsalons.org/resourcestim-hi%E1%BB%83u-them/publications-and-media-2/

8 Lysdal SH., Sosted H. and Johansen JD. (2011) Do hairdressers in Denmark have their hand eczema reported as an occupational disease? Results from a register-based questionnaire study. Contact Dermatitis. Vol. 66, pp: 72-78. 2011.

9 Bradshaw L., Harris-Roberts J., Bowen J., Rahman S. and Fishwick D. (2011) Self-reported work-related symptoms in hairdressers. Occupational Medicine. Vol. 61, pp:328-334. 2011.

10 Roberts H., Frowen K., Sim M. and Nixon R. (2006) Prevalence of atopy in a population of hairdressing students and practicing hairdressers in Melbourne, Australia. Australasian Journal of Dermatology. Vol. 47, pp:172-177. 2006.

11 Lind ML, Albin M., Brisman J., Kronholm Diab K., Lillienberg L., Mikoczy Z., Nielsen J., Rylander L., Toren K. and Meding B. (2007) Incidence of hand eczema in female Swedish hairdressers. Occupational and Environmental Medicine. Vol 64, pp: 191-195. 2007.

12 Lind ML, Albin M., Brisman J., Kronholm Diab K., Lillienberg L., Mikoczy Z., Nielsen J., Rylander L., Toren K. and Meding B. (2007) Incidence of hand eczema in female Swedish hairdressers. Occupational and Environmental Medicine. Vol 64, pp: 191-195. 2007.

13 Kwok C., Money A., Carder M., Turner S., Agius R., Orton D. and Wilkinson M. (2014) Cases of occupational dermatitis and asthma in beauticians that were reported to The Health and Occupation Research (THOR) network from 1996 to 2011. Clinical and Experimental Dermatology. Vol. 39, pp:590-595. 2014.

14 Cravo M., Cardoso JC., Goncalo M. and Figueiredo A. (2008) Allergic contact dermatitis from photobonded acrylic gel nails: a review of four cases. Contact Dermatitis. Vol. 59, pp:250-251. 2008.

15 Lee HS. And Lin YW. (2009) Permeation of hair dye ingredients p-phenylenediamine and aminophenol isomers, through protective gloves. Annals of Occupational Hygiene. Vol. 53, No. 3, pp:289-296. 2009.

16 Uter, W., Schnuch, A., Geier, J., Pfahlberg, A. and Gefeller, O. (2001) Association between occupation and contact allergy to the fragrance mix: a multifactorial analysis of national surveillance data. Occupational and Environmental Medicine. Vol. 58, pp:392-398. 2001.

17 Roberts H., Frowen K., Sim M. and Nixon R. (2006) Prevalence of atopy in a population of hairdressing students and practicing hairdressers in Melbourne, Australia. Australasian Journal of Dermatology. Vol. 47, pp:172-177. 2006.

18 Lind ML, Albin M., Brisman J., Kronholm Diab K., Lillienberg L., Mikoczy Z., Nielsen J., Rylander L., Toren K. and Meding B. (2007) Incidence of hand eczema in female Swedish hairdressers. Occupational and Environmental Medicine. Vol 64, pp: 191-195. 2007.

19 Lysdal SH., Sosted H. and Johansen JD. (2011) Do hairdressers in Denmark have their hand eczema reported as an occupational disease? Results from a register-based questionnaire study. Contact Dermatitis. Vol. 66, pp: 72-78. 2011.

20 Roberts H., Frowen K., Sim M. and Nixon R. (2006) Prevalence of atopy in a population of hairdressing students and practicing hairdressers in Melbourne, Australia. Australasian Journal of Dermatology. Vol. 47, pp:172-177. 2006.

21 Meding, B. and Swanbeck G.(1990) Consequence of having hand eczema. Contact Dermatitis. Vol. 23, No.1, pp:6-14. (1990)

22 Leino, T., Tammilehto, L., Hytonen, M., Sala, E. Paakkulainen, H. and Kanerva, L. (1998) Occupational skin and respiratory diseases among hairdressers. Scandinavian Journal of Work, Environment & Health. Vol. 24, No. 5, pp: 398-406. 1998.

23 Lysdal SH., Sosted H., Andersen KE. And Johansen JD. (2011) Hand eczema in hairdressers: a Danish register-based study of the prevalence of hand eczema and its career consequences. Contact Dermatitis. Vol. 65, pp:151-158. 2011.

24 Bradshaw L., Harris-Roberts J., Bowen J., Rahman S. and Fishwick D. (2011) Self-reported work-related symptoms in hairdressers. Occupational Medicine. Vol. 61, pp:328-334. 2011.

25 Lind ML, Albin M., Brisman J., Kronholm Diab K., Lillienberg L., Mikoczy Z., Nielsen J., Rylander L., Toren K. and Meding B. (2007) Incidence of hand eczema in female Swedish hairdressers. Occupational and Environmental Medicine. Vol 64, pp: 191-195. 2007.

26 Lysdal SH., Sosted H. and Johansen JD. (2011) Do hairdressers in Denmark have their hand eczema reported as an occupational disease? Results from a register-based questionnaire study. Contact Dermatitis. Vol. 66, pp: 72-78. 2011.

27 Leino, T., Tammilehto, L., Hytonen, M., Sala, E. Paakkulainen, H. and Kanerva, L. (1998) Occupational skin and respiratory diseases among hairdressers. Scandinavian Journal of Work, Environment & Health. Vol. 24, No. 5, pp: 398-406. 1998.

28 Lysdal SH., Sosted H. and Johansen JD. (2011) Do hairdressers in Denmark have their hand eczema reported as an occupational disease? Results from a register-based questionnaire study. Contact Dermatitis. Vol. 66, pp: 72-78. 2011.

29 Roberts H., Frowen K., Sim M. and Nixon R. (2006) Prevalence of atopy in a population of hairdressing students and practicing hairdressers in Melbourne, Australia. Australasian Journal of Dermatology. Vol. 47, pp:172-177. 2006.

30 Lillenberg L., Andersson E., Janson C., Dahlman-Hoglund A. and Forsberg, B. (2013) Occupational Exposure and New-onset Asthma in a Population-based Study in Northern Europe (RHINE). Annals of Occupational Hygiene. Vol 57, No. 4, pp:482-492. 2013

31 Kreiss K., Esfahani RS., Antao V., Odencrantz J., Lezotte DC. and Hoffman RE. (2006) Risk factors for asthma among cosmetology professionals in Colorado. Journal of Occupational and Environmental Medicine. Vol. 48, pp:1062-1069. 2006.

32 Kreiss K., Esfahani RS., Antao V., Odencrantz J., Lezotte DC. and Hoffman RE. (2006) Risk factors for asthma among cosmetology professionals in Colorado. Journal of Occupational and Environmental Medicine. Vol. 48, pp:1062-1069. 2006.

33 Kwok C., Money A., Carder M., Turner S., Agius R., Orton D. and Wilkinson M. (2014) Cases of occupational dermatitis and asthma in beauticians that were reported to The Health and Occupation Research (THOR) network from 1996 to 2011. Clinical and Experimental Dermatology. Vol. 39, pp:590-595. 2014.

34 Quirce, S., Fernandez-Hieto, M., del Pozo, V., Sastre, B. and Sastre J. (2008) Occupational asthma and rhinitis caused by eugenol in a hairdresser. Allergy. Vol. 63. pp: 137-8. 2008.

35 Kreiss K., Esfahani RS., Antao VC., Odencrantz J., Lezotte DC. and Hoffman RE. (2006) Risk factors for asthma among cosmetology professionals in Colorado. Journal of Occupational and Environmental Medicine. Vol. 48, No. 10, pp: 1062-1069. October 2006.

36 Leino, T., Tammilehto, L., Hytonen, M., Sala, E. Paakkulainen, H. and Kanerva, L. (1998) Occupational skin and respiratory diseases among hairdressers. Scandinavian Journal of Work, Environment & Health. Vol. 24, No. 5, pp: 398-406. 1998.

37 Blainey A, Ollier S, Cundell D, Smith RE and Davies RJ. (1986) Occupational asthma in a hairdressing salon. Thorax. Vol. 41, pp 42-50 1986.

38 Bradshaw L., Harris-Roberts J., Bowen J., Rahman S. and Fishwick D. (2011) Self-reported work-related symptoms in hairdressers. Occupational Medicine. Vol. 61, pp:328-334. 2011.

39 Leino T., Tammilehto L, Luukkonen R, and Nordman H. (1997) Self reported respiratory symptoms and diseases among hairdressers. Occupational and Environmental Medicine. Vol. 54, pp: 452-455. 1997.

40 Baumgartner KB., Samet JA., Coultas DB., Stidley CA., Hunt WC., Colby TV., Waldron JA. and collaborating centers (2000) Occupational and environmental risk factors for idiopathic pulmonary fibrosis: A multicenter case-control study. American Journal of Epidemiology. Vol. 152, No. 4, pp: 307-315. 2000.

41 Leino T., Tammilehto L, Luukkonen R, and Nordman H. (1997) Self reported respiratory symptoms and diseases among hairdressers. Occupational and Environmental Medicine. Vol. 54, pp: 452-455. 1997.

42 Leino T., Tammilehto L, Luukkonen R, and Nordman H. (1997) Self reported respiratory symptoms and diseases among hairdressers. Occupational and Environmental Medicine. Vol. 54, pp: 452-455. 1997.

43 Leino, T., Tammilehto, L., Hytonen, M., Sala, E. Paakkulainen, H. and Kanerva, L. (1998) Occupational skin and respiratory diseases among hairdressers. Scandinavian Journal of Work, Environment & Health. Vol. 24, No. 5, pp: 398-406. 1998.

44 Bradshaw L., Harris-Roberts J., Bowen J., Rahman S. and Fishwick D. (2011) Self-reported work-related symptoms in hairdressers. Occupational Medicine. Vol. 61, pp:328-334. 2011.

45 Hollund BE, Moen B, Lygre SH, Florvaag E and Omenaas E. (2001) Prevalence of airway symptoms among hairdressers in Bergen, Norway. Occupational and Environmental Medicine. Vol. 58, pp:780-785. 2001.

46 Skoufi GI., Nena E., Kostikas K., Lialios GA., Constantinidis TC., Daniil Z. and Gourgoulianis K. (2013) Work-related Respiratory Symptoms and Airway Disease in Hairdressers. International Journal of Occupational and Environmental Medicine. Vol. 4, No. 2, pp:53–60. April 2013.

47 Roelofs C., Azaroff LS., Holcroft C., Nguyen H. and Doan T. (2008) Results from a community-based occupational health survey of Vietnamese-American nail salon workers. Journal of Immigrant and Minority Health. Vol. 10, No. 4, pp: 353-361. August 2008.

48 Park S., Gwak S. and Choi S. (2014) Assessment of Occupational Symptoms and Chemical Exposures for Nail Salon Technicians in Daegu City, Korea. Journal of Preventive Medicine and Public Health. Vol. 47, pp: 169-176. 2014.

49 Reutman SR., Rohs AM., Clark JC., Johnson BC., Sammons DL., Toennis CA., Robertson SA., MacKenzie BA. And Lockey JE. (2009) A pilot respiratory health assessment of nail technicians: Symptoms, lung function and airway inflammation. American Journal of Industrial Medicine. Vol. 52, pp: 868-875. 2009.

50 Reutman SR., Rohs AM., Clark JC., Johnson BC., Sammons DL., Toennis CA., Robertson SA., MacKenzie BA. And Lockey JE. (2009) A pilot respiratory health assessment of nail technicians: Symptoms, lung function and airway inflammation. American Journal of Industrial Medicine. Vol. 52, pp: 868-875. 2009.

51 Roelofs C., Azaroff LS., Holcroft C., Nguyen H. and Doan T. (2008) Results from a community-based occupational health survey of Vietnamese-American nail salon workers. Journal of Immigrant and Minority Health. Vol. 10, No. 4, pp: 353-361. August 2008.

52 Kronholm Diab K., Jonsson AG., Axmon A. and Nielsen J. (2014) Work-related airway symptoms, nasal reactivity and health-related quality of life in female hairdressers: a follow-up study during exposure. International Archives of Occupational and Environment Health. Vol.87, pp: 61-71. January 2014.

53 Skoufi GI., Nena E., Kostikas K., Lialios GA., Constantinidis TC., Daniil Z. and Gourgoulianis K. (2013) Work-related Respiratory Symptoms and Airway Disease in Hairdressers. International Journal of Occupational and Environmental Medicine. Vol. 4, No. 2, pp:53–60. April 2013.

54 Occupational Safety and Health Administration (OSHA) (2014) Permissible Exposure Levels - Annotated Tables. U.S. Department of Labor. Available at: https://www.osha.gov/dsg/annotated-pels/

55 Tsigonia A., Lagoudi A., Chandrinou S., Linos A., Evlogias N. and Alexopoulos EC. (2010) Indoor air in beauty salons and occupational health exposure of cosmetologists to chemical substances. International Journal of Environmental Research and Public Health. Vol. 7, pp:314-324. 2010.

56 Hollund BE and Moen BE. (1998) Chemical Exposure in Hairdresser Salons: Effect of Local Exhaust Ventilation. Annals of Occupational Hygiene., Vol. 42, No.4, pp: 277-281. 1998.

57 Oikawa D., Takeuchi W., Murata S., Takahashi K. and Sekine Y. (2012) Measurement of Concentrations of Thioglycolic Acid, Dithioglycolic Acid and Ammonia in Indoor Air of a Beauty Salon. Journal of Occupational Health. Vol. 54, pp: 370-375. 2012.

58 Leino T., Kähkönen E., Saarinen L., Henriks-Eckerman ML. and Paakkulainen H. (1999) Working conditions and health in hairdressing salons. Applied Occupational and Environmental Hygiene. Vol. 14, No. 1, pp: 26-33. January 1999.

59 Park S., Gwak S. and Choi S. (2014) Assessment of Occupational Symptoms and Chemical Exposures for Nail Salon Technicians in Daegu City, Korea. Journal of Preventive Medicine and Public Health. Vol. 47, pp: 169-176. 2014.

60 Eklund BM., Burkes S., Morris P. and Mosconi L. (2008) Spatial and temporal variability in VOC levels within a commercial retail building. Indoor Air. Vol. 18, pp: 365-374.

61 Alaves VM., Sleeth DK., Thiese MS. And Larson RR. (2013) Characterization of indoor air contaminants in a randomly selected set of commercial nail salons in Salt Lake County, Utah USA. International Journal of Environmental Health Research. Vol. 23, No. 5, pp: 419-433. 2013.

62 Henriks-Eckerman ML. and Korva M. (2012) Case study: Exposure to airborne methacrylates in nail salons. Journal of Occupational and Environmental Hygiene. Vol. 9, pp: D146-D150. 2012.

63 Goldin LJ, Ansher L., Berlin A., Cheng J., Kanopkin D., Khazan A., Kisivuli M., Lortie M., Bunker Peterson E., Pohl L., Porter S., Zeng V., Skogstrom T., Fragala MA., Myatt TA., Stewart JH. and Allen JG. (2014) Indoor Air Quality Survey of Nail Salons in Boston. Journal of Immigrant Minority Health. Vol. 16, pp:508-514. 2014.

64 Quach T., Varshavsky J., Von Behren J., Garcia E., Tong M., Nguyen T., Tran A., Gunier, R. and Reynolds, P. (2012) Reducing Chemical Exposures in Nail Salons through Owner and Worker Trainings: An Exploratory Intervention Study. American Journal of Industrial Medicine. Vol. 56, pp: 806-817. 2013.

65 Goldin LJ, Ansher L., Berlin A., Cheng J., Kanopkin D., Khazan A., Kisivuli M., Lortie M., Bunker Peterson E., Pohl L., Porter S., Zeng V., Skogstrom T., Fragala MA., Myatt TA., Stewart JH. and Allen JG. (2014) Indoor Air Quality Survey of Nail Salons in Boston. Journal of Immigrant Minority Health. Vol. 16, pp:508-514. 2014.

66 Marlow DA., Looney T. and Reutman S. (2012) An evaluation of local exhaust ventilation systems for controlling hazardous exposures in nail salons. Centers for Disease Control. Division of Applied Research and Technology. Engineering and Physical Hazards Branch, EPHB Report No. 005-164. September 2012.

67 Wright C. and Quint J. (1989) Analysis of Pregnancy-Related Calls to an Occupational Hazard Hot Line. Western Journal of Medicine. Vol. 151,No. 6, December 1989. pp 670-675.

68 National Asian Pacific American Women's Forum (2006) "The Nail Salon Industry: The Impact of Environmental Toxins on API Women's Reproductive Health". May 2006

69 Morales-Suarez-Varela MM., Toft GV., Jensen MS., Ramlau-Hansen C., Kaerlev L., Thulstrup AM., Llopis-Gonzalez A., Olsen J. and Bonde JP. (2011) Parental occupational exposure to endocrine disrupting chemicals and male genital malformations: A study in the Danish national birth cohort study. Environmental Health. Vol. 10, No. 3, pp:1-9. 2011. Accessible at: www.ehjournal.net/content/10/1/3

70 Chevrier C., Dananche B., Bahuau M., Nelva A., Herman C., Francannet C., Robert-Gnansia E. and Cordier S. (2006) Occupational exposure to organic solvent mixtures during pregnancy and the risk of non-syndromic oral clefts. Occupational and Environmental Medicine. Vol. 63, pp:617-623.

71 Peters C., Halring M., Dulon M., Schalblon A., Torres Costa J., and Nienhaus A. (2010) Fertility Disorders and Pregnancy Complications in Hairdressers – A Systematic Review. Journal of Occupational Medicine and Toxicology. Vol. 5, No. 24. 2010.

72 Chevrier C., Dananche B., Bahuau M., Nelva A., Herman C., Francannet C., Robert-Gnansia E. and Cordier S. (2006) Occupational exposure to organic solvent mixtures during pregnancy and the risk of non-syndromic oral clefts. Occupational and Environmental Medicine. Vol. 63, pp:617-623.

73 Lorente C., Cordier S., Bergeret A., De Walle HEK., Goujard J., Ayme S., Knill-Jones R., Calzolari E. and Bianchi F. (2000) Maternal Occupational Risk Factors for Oral Clefts. Scandinavian Journal of Work, Environment and Health. Vol. 26, No.2, pp:137-145. 2000.

74 Morales-Suarez-Varela MM., Toft GV., Jensen MS., Ramlau-Hansen C., Kaerlev L., Thulstrup AM., Llopis-Gonzalez A., Olsen J. and Bonde JP. (2011) Parental occupational exposure to endocrine disrupting chemicals and male genital malformations: A study in the Danish national birth cohort study. Environmental Health. Vol. 10, No. 3, pp:1-9. 2011. Accessible at: www.ehjournal.net/content/10/1/3

75 Cordier S., Garlantezac, R., Labat, L., Rouget, F., Monfort, C, Bonvallot, N., Roig, B., Pulkkinen, J., Chevrier, C. and Multigner, L. (2012) Exposure During Pregnancy to Glycol Ethers and Chlorinated Solvents and the Risk of Congenital Malformations. Epidemiology. Vol. 23, No. 6, pp:806-812. November 2012.

76 Rylander L., Axmon A., Toren K. and Albin M. (2002) Reproductive outcome among female hairdressers. Occupational Environmental Medicine. Vol. 59, pp: 517-522. 2002.

77 John ME., Savitz DA. and Shy CM. (1994) Spontaneous abortions among cosmetologists. Epidemiology. Vol. 5, No. 2, pp:147-155. March 1994.

78 John ME., Savitz DA. and Shy CM. (1994) Spontaneous abortions among cosmetologists. Epidemiology. Vol. 5, No. 2, pp:147-155. March 1994.

79 Halliday-Bell JA., Gissler M. and Jaakkola J. (2009) Work as a hairdresser and cosmetologist and adverse pregnancy outcomes. Occupational Medicine. Vol. 59, pp:180-184. 2009.

80 Herdt-Losavio ML., Lin S., Druschel CM., Hwang SA., Mauer MP. and Carlson GA. (2009) The risk of having a low birth weight or preterm infant among cosmetologists in New York State. Maternal and Child Health Journal. Vol. 13, No. 1, pp:90-97. January 2009.

81 Rylander L., Axmon A., Toren K. and Albin M. (2002) Reproductive outcome among female hairdressers. Occupational Environmental Medicine. Vol. 59, pp: 517-522. 2002.

82 Herdt-Losavio ML., Lin S., Druschel CM., Hwang SA., Mauer MP. And Carlson GA. (2009) The risk of congenital malformations and other neonatal and maternal health outcomes among licensed cosmetologists. American Journal of Perinatology. Vol. 26, No. 9, pp: 625-631. October 2009.

83 Gallichio L., Miller S., Greene T., Zacur H. and Flaws JA. (2009) Premature ovarian failure among hairdressers. Human Reproduction. Vol. 24, No. 10, pp: 2636-2641. 2009.

84 Hougaard KS., Hannerz H., Bonde JP., Feveille H. and Burr H. (2006) The risk of infertility among hairdressers. Five-year follow-up of female hairdressers in a Danish national registry. Human Reproduction. Vol. 21, No. 12, pp:3122-3126. 2006.

85 Zhu JL., Vestergaard M., Hjollund NH. And Olsen J. (2006) Pregnancy outcomes among female hairdressers who participated in the Danish National Birth Cohort. Scandinavian Journal of Work, Environment and Health. Vol. 32, No. 1, pp:61-66. 2006.

86 Gallicchio L., Miller SR., Green T., Zacur H. and Flaws JA. (2010) Health outcomes of children born to cosmetologists compared to children of women in other occupations. Reproductive Toxicology. Vol. 29, No. 3, pp:361-365. June 2010.

87 Wise LA., Palmer JR., Reich D., Cozier YC. And Rosenberg L. (2012) Hair relaxer use and risk of uterine leiomyomata in African-American Women. American Journal of Epidemiology. Vol. 175, No.5, pp:432-440. 2012.

88 James-Todd T., Terry MB., Rich-Edwards J., Deierlein A. and Senie R. (2011) Childhood hair product use and earlier age at menarche in a racially diverse study population: A pilot study. Annals of Epidemiology. Vol. 21, No. 6, pp:461-465. June 2011.

89 Wise LA., Palmer JR., Reich D., Cozier YC. And Rosenberg L. (2012) Hair relaxer use and risk of uterine leiomyomata in African-American Women. American Journal of Epidemiology. Vol. 175, No.5, pp:432-440. 2012.

90 International Agency for Research on Cancer (IARC). (2010) IARC Monographs on the evaluation of carcinogenic risks to humans. Vol 99. Occupational exposures of hairdressers and barbers and personal use of hair colourants; some aromatic amines, organic dyes, and related exposures.

91 Koenig KL., Pasternack BS., Shore RE. and Strax P. (1991) Hair dye use and breast cancer: a case-control study among screening participants. American Journal of Epidemiology. Vol. 133, No. 10, pp:985-995. May 1991.

92 Goldberg MS. And Labreche F. (1996) Occupational risk factors for female breast cancer: A review. Occupational and Environmental Medicine. Vol. 53, No. 3, pp: 145-156. March 1996.

93 Takkouche, B., Regueira-Mendez, C. and Montes-Martinez, A. (2009) Risk of Cancer Among Hairdressers and Related Workers: A Meta-Analysis. International Journal of Epidemiology (2009); 38: 1512-1531.

94 Occupational Safety & Health Administration (OSHA) (2011) Hazard alert update: Hair smoothing products that could release formaldehyde. U.S. Department of Labor. Available at: https://www.osha.gov/SLTC/formaldehyde/hazard_alert.html

95 Boyer, IJ., Heldreth B., Bergfeld WF., Belsito DV., Hill RA., Klaasen CD., Liebler DC., Marks JG., Shank RC., Slaga TJ., Snyder PW. And Andersen FA. (2013) Amended safety assessment of formaldehyde and methylene glycol as used in cosmetics. International Journal of Toxicology. Vol. 32. Suppl. 4, pp: 5S-32S. 2013.

96 Women's Voices for the Earth (2014) Hair straightening products containing formaldehyde. Available at: www.womensvoices.org/avoid-toxic-chemicals/cosmetics-salons/hair-straightening-products-containing-formaldehyde/ 2014.

97 Gallicchio L., Miller SR., Greene T., Zacur H. and Flaws JA. (2011) Adverse health outcomes among cosmetologists and noncosmetologists in the Reproductive Outcomes of Salon Employees (ROSE) study. Journal of Toxicology and Environmental Health. Part A, Vol. 74, pp: 52-61. 2011.

98 Roelofs C., Azaroff LS., Holcroft C., Nguyen H. and Doan T. (2008) Results from a community-based occupational health survey of Vietnamese-American nail salon workers. Journal of Immigrant and Minority Health. Vol. 10, No. 4, pp: 353-361. August 2008.

99 Park S., Gwak S. and Choi S. (2014) Assessment of Occupational Symptoms and Chemical Exposures for Nail Salon Technicians in Daegu City, Korea. Journal of Preventive Medicine and Public Health. Vol. 47, pp: 169-176. 2014.

100 Park RM., Schulte PA., Bowman JD., Walker JT., Bondy SC, Yost MG., Touchstone JA. And Dosemeci M. (2005) Potential occupational risks for neurodegenerative diseases. American Journal of Industrial Medicine. Vol. 48, pp: 63-77. 2005.

101 Cooper GS, Wither J, Bernatsky S, Claudio JO, Clarke A, Rioux JD, CaNIOS GenES Investigators and Fortin PR. (2010) Occupational and Environmental Exposures and Risk of Systemic Lupus Erythematosus: Silica, Sunlight, Solvents. Rheumatology Vol. 49, No.11, pp:2172-2180. 2010.

102 Gershwin ME., Selmi C., Worman HJ, Gold EB., Watnik M., Utts J., Lindor KD., Kaplan MM., Vierling JM. And the USA PBC Epidemiology Group (2005) Risk factors and comorbidities in primary biliary cirrhosis: A controlled interview-based study of 1032 patients. Hepatology. Vol. 42, No. 5, pp: 1194-1202. November 2005.

103 Ma CM., Lin LY., Chen HW., Huang LC., Li JF. And Chuang KJ. (2010) Volatile organic compounds exposure and cardiovascular effects in hair salons. Occupational Medicine. Vol. 60, pp: 624-630. 2010.

104 21 U.S.C. § 361

105 Quach, T., E. Garcia, S. Sharma, M. Pierce, S. Bhatia, S. Tong-Argao, and K. Hoang. (2013) Evaluating a county-based Healthy nail Salon Recognition Program. Presented at 2013 Conference on Environment & Health, Basel, SWITZERLAND, August 19 - 23, 2013.

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