

## Evaluation of Common Health Hazards among Cosmetologists: Focus on Manicurists

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### ABSTRACT

Nail salons utilize large quantities of chemicals. Salon workers come in contact with over 20 regularly used chemicals each day. The number of nail salons in Nigeria is growing at a rapid pace and each year the industry earns billions. Three main chemicals have recently come under fire for being hazardous to workers health. Named the “toxic trio,” toluene, phthalates, and formaldehyde have been thoroughly investigated by many organizations and found to be hazardous to manicurists’ health. Ingredients in products used in hair and nail salons include endocrine disrupting compounds (EDCs) like parabens and phthalates. EDCs can mimic or block endogenous endocrine function, with wide-ranging health implications, including reproductive effects. Many of the chemicals contained, emitted or formed from the use of nail products are also known or suspected respiratory irritants and sensitizing agents, including volatile organic compounds (VOCs) like formaldehyde in hair straighteners and nail polishes, ammonia in hair dyes, persulfates in bleaches, and phthalates added for fragrance or as solvents. Several studies indicate that women in this occupational group may disproportionately suffer from adverse respiratory, reproductive and dermatological effects.

Keywords: Health, hazards, cosmetologists, focus and manicurists.

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### INTRODUCTION

Ingredients in nail care products contain chemicals with far-reaching health implications. Following exposure from occupational, environmental and lifestyle sources, it has been reported that metals could accumulate in the body organs due to their long half-life [1]. and some of these metals may interfere with the metabolism of essential nutrients of similar oxidation states such as calcium and zinc [2] as well as other biological processes of the body [3]. Some cosmetics contain compounds such as lead, cadmium, beryllium, nickel, arsenic, mercury [4], selenium, thalium, chromium, paraben, diethanolamine, triethanolamine, poly (vinylpyrrolidone) copolymers, petrolatum, propylene glycol, stearylalkonium chloride, biotionol, hexachlorophene, halogenated salicyl anilides, vinyl chloride, zirconium complexes, chloroform, methylene chloride, chlorofluorocarbon propellants,

diazolidinyl urea, triazolidinyl urea, sodium lauryl [5], which have been shown to have harmful effects on human organs, resulting in conditions like photo contact sensitization, cancer, benign and malignant tumours of the lungs, contact dermatitis, potent allergen and skin irritation, skin granulomas, hepatocellular carcinomas, mental disorder, hyperpigmentation, violent cough, eczema, headaches, dizziness, rashes, reproductive dysfunction, endocrine disruption [6]. Despite the impending risk of adverse effects among nail salon workers, very few studies have evaluated the chemical exposures and health outcome among individuals working in the cosmetology industry. In this review, the author intends to examine literature on nail salon workers exposures with focus on the reproductive, respiratory, and dermatological effects on the individual(s). Some of the identified chemical compounds are reviewed below.

### Parabens

For protecting cosmetics from microbial contamination, preservatives are used. The most commonly used preservative in cosmetics are parabens. Around 75 to 90 per cent of cosmetics contain parabens (typically at very low levels). Parabens easily permeate the skin and are suspected of interfering with hormone function (endocrine disruption). They mimic oestrogens, the primary female sex hormone. They may also interfere with male reproductive functions. Various studies indicate that methylparaben applied on the skin reacts with other chemicals, leading to increased skin

aging and DNA damage [7]. Certain foods, such as barley, strawberries, carrots, onions currents, and vanilla, also contain Parabens [8] Parabens in foods are metabolized when eaten, making them less strongly estrogenic. On the other side when applied to the skin and absorbed into the body, parabens in cosmetics bypass the metabolic process and enter the blood stream and body organs intact. It has been determined that women are exposed to 50 mg per day of parabens from cosmetics [8]. They are associated with cancer and neurotoxicity among other adverse health effects.

### DEA (Cocamide DEA and Lauramide DEA)

DEA (diethanolamine) related ingredients are used to make cosmetics creamy or sudsy, or as a pH adjuster to reduce the acidity of other ingredients. They are found in shampoos, soaps and cleansers. DEA reacts with nitrites in cosmetics to form nitrosamines. Nitrites are occasionally added to products as anti-corrosive agents or can be present as contaminants [9]. The degradation of some chemicals used as preservatives in cosmetics can release nitrites when the product is exposed to air. During experiments conducted in laboratory, exposure to high doses of DEA-related ingredients has been shown to cause liver cancers and precancerous changes in skin and thyroid. These chemicals may also cause mild to moderate skin and eye irritation. Cocamide DEA is found to be hazardous to the environment because of its acute toxicity to aquatic organisms and can cause bioaccumulation [9]. Cocamide-DEA was listed under carcinogenic toxicant in June 2012. The substance is generally used as a foaming agent in soaps, shampoos, hair dye, cosmetics and household cleaning formulas. Cocamide DEA works as a surfactant, which means it

helps soaps and shampoos to lather and foam. If a surfactant is too strong it can strip away your body's natural oils, leaving your skin dried out. If this natural protection against microbes and other environmental factors is not there your skin might get flaky and itchy. Your skin also becomes more prone to infection. Other examples of strong surfactants that can cause dry skin include sulfates, commonly sodium laureth sulfate and sodium lauryl sulfate, and betaines (usually cocamidopropyl betaine). Apart from drying your skin out (which we all know is bad enough), Cocamide DEA has been implicated in much more serious and long-term health risks. Cocamide DEA can complex with preservatives to form very dangerous chemicals called nitrosamines. One such example is called NDELA, a compound that has been shown to cause cancer in rats. NDELA is readily absorbed through the skin, especially when it's applied to large areas of your body. They're usually found in less expensive skin care products, but nothing is more valuable than your health.

### Di butyl Phthalate (DBP)

DBP is mainly used in cosmetics for nails as a solvent for dyes and as a plasticizer that prevents nail polishes from becoming hard and brittle. It has been shown to cause developmental defects, changes in the prostate and testes and reduces

sperm counts [10]. It has also been found that it acts as a suspected endocrine disruptor on the fact that it interferes with hormone function, and may cause harm to the unborn child and worsen infertility. Various researches reveal that

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exposure to phthalates may cause serious health effects such as liver and kidney failure in young children when products containing phthalates are ingested for extended periods [11]. It has been found that phthalates

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reduce sperm count in men and reproductive defects in the developing male foetus (when the mother is exposed during pregnancy), among other health effects.

### **The Toxic Trio**

The chemicals of greatest concern in nail products have been referred to as The Toxic Trio. Chemicals found in products that are used in nail salons that have endocrine-disrupting effects can be categorized as volatile solvents - including formaldehyde and toluene - or

as semi-volatile solvents, including phthalates [12]. While these solvents are the major concerns, many other volatile compounds are found in nail salon products, raising questions about the combined or synergistic effects of a mix of exposures.

### **Toluene**

Toluene, a known endocrine disrupting chemical [13], is a colourless liquid. It acts as a solvent and is used in many nail products to reinforce colour and to form a smooth finish on the nail. It has a sweet, pungent, benzene-like odour [14] and is rapidly absorbed when inhaled. Although most research has focused on the inhalation of toluene, it can also pass through the skin and into the bloodstream. Workplace studies have demonstrated that toluene has reproductive effects - including an increased risk of spontaneous abortions [13]. It is also an irritant to the eyes, nose and throat and at high exposures can be

toxic to the kidneys and liver. It can be transmitted through the placenta to a fetus as well as to a baby through breast milk [15]. Taking note of some of these associations, a Public Health Statement from the United States Agency for Toxic Substances and Disease Registry warns that "low to moderate, day-after-day exposure in the workplace can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure is stopped. A person may experience some hearing and color vision loss after long-term daily exposure to toluene in the workplace.

### **Phthalates**

Phthalates are a group of chemicals with demonstrated endocrine-disrupting properties in animals. These chemicals are used primarily to make plastics softer and more flexible and are found in a wide range of products - from children's toys to shower curtains. They are also used in nail polish, perfumes, and skin moisturizers, and can also be found in the outer coating on medicines and in the tubing used in medical devices. There are a number of different phthalate formulations, and the most common in cosmetics are dibutyl phthalates (DBP)

[16]. Phthalates are incorporated into nail products as solvents and plasticizers and to strengthen the longevity of a polish application (i.e. to hold colour and to prevent chipping). Animal research has found particular problems in the male offspring of exposed mammals. When exposure to phthalates occurs during the phase of fetal development when sexual differentiation happens, malformations of the reproductive tract can occur [17, 18]. Phthalates are also known to trigger asthma (ChemHAT.org).

### **Formaldehyde**

Formaldehyde, a known carcinogen 22, is commonly used as a preservative. In nail products, it functions as a nail hardener and for creating a smooth finish on the nail. It is an eye, nose, and throat irritant and can lead to coughing and wheezing. Repeated exposure can lead to a skin

condition known as dermatitis. McNary & Jackson [19] studied the amount of formaldehyde and toluene exposure experienced by professional nail technicians and their customers during applications using products with either of these chemicals. They found that "neither

workers nor consumers are at any additional risk from exposure to formaldehyde or toluene in cosmetic nail products beyond daily exposure from commercial products in a work setting and in the home". Other researchers [20] who examined the risks of spontaneous abortions among cosmetologists found associations between these events and "the number of hours worked per day in

cosmetology, the number of chemical services performed per week, the use of formaldehyde-based disinfectants, and work in salons where nail sculpturing was performed by other employees." They did caution, however, that including some variables about which they lacked information in the analyses might alter their findings.

### **Common Health Hazards associated with Nail Workers**

#### **Air quality and respiratory issues**

Many products used in nail salon contain chemicals that are very volatile, meaning that they evaporate into the air at room temperature, and can subsequently be inhaled by nail salon workers and customers. In addition, a considerable amount of dust is produced when artificial nails are filed and this, if left airborne, can be inhaled by staff and customers. Certain chemicals of concern in nail salons (e.g. methyl methacrylate and formaldehyde) also enter the body primarily through inhalation. Respiratory problems are exacerbated by inadequate ventilation in salons [21, 22, 23, 24]. Exposure to irritants in the work setting can bring on a respiratory illness where it did not previously exist and/or exacerbate symptoms in someone already ill [2]. These conditions include asthma and Reactive Airway Dysfunction Syndrome (RADS). Because workers in nail salons tend to work in the industry for many years, their continued exposure to irritants is of special concern because

continued exposure can exacerbate a respiratory condition. Unfortunately, there are no data available on the number of workers who develop symptoms or who leave the industry because their respiratory illness was getting worse. However, a report from the Lung Association of Ontario notes, that "the costs of unmanaged work-related asthma are high for both employers and employees." Roelofs et al [8] studied Vietnamese nail salon workers in the Boston area and found that breathing problems and nasal symptoms were not uncommon. In a study by Reutman et al [12] the authors examined lung function and a marker of airway inflammation, i.e., exhaled nitric oxide, studying nail technicians and control participants in a pilot health assessment. Job latency, acrylic gel contact (specifically methyl methacrylates and ethyl methacrylates) hours and current smoking were all associated with airway inflammation.

#### **Dermatological Effect**

Exposure to a range of chemicals used in nail salon products can lead to skin irritation and skin diseases such as irritant contact dermatitis (ICD), allergic contact dermatitis (ACD), urticaria (hives) and angioedema (like hives but where swelling occurs under the skin). These chemicals include formaldehyde (found in some polishes) and acetone and alcohol (used in nail polish removers). Acrylates (methyl methacrylates and ethyl methacrylates) used in the creation of acrylic nails, have also been linked to ACD when there is direct contact with the

substance [5]. More recently, there has been concern about the potential harms of UV lamps used in salons to dry polishes and harden acrylic nails, especially the harms for clients. The wattage used in these lamps can vary significantly, with different wattages producing different amounts of UV radiation. In one study of Korean nail salon workers compared with a matched control group of office workers [2], 92% of salon workers complained of eye irritation, significantly higher than the control group.

### Reproductive Problems

Research has been done on the health issues relating to chemical exposures for nail salon workers in pregnancy and on the problems in the offspring of women who work in nail salons. Major concern has focused on chemicals used in nail salon products that are endocrine disruptors; animal research has established a clear link to reproductive problems in the offspring of animals exposed in utero. For example, two studies found that the levels of dibutyl phthalate, a chemical of key concern in nail salon products, were higher in the blood of nail salon workers than in members of the general population [14]. A study by [10] found that women exposed

to solvents used in products common in hair salons - and which are also used in nail salons - had offspring with higher rates of birth defects than expected, with these problems including oral clefts, urinary malformations and male genital malformations. As well, studies by Savitz and Shy [20], and [9] have found that cosmetologists are at higher risk for having spontaneous abortions (miscarriages) and low birth weight babies. The work of [9] also showed that cosmetologists were twice as likely as a comparator group (realtors) to experience postpartum hemorrhage and for their newborns to require intubation.

### CONCLUSION/RECOMMENDATION

Nail workers are exposed to many chemicals with severe adverse effects. Hence, while it is not possible to completely eliminate potentially harmful chemicals in the nail salons, they can at least be controlled. Similarly, whereas more research is needed in these settings,

safe work practices such as the use of PPE, proper ventilation, and using less harmful alternatives, if available, should be encouraged as it would help to ameliorate exposures and lessen the risk of long-term health effects

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