Infection and Drug Resistance

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REVIEW

Beauty Salons are Key Potential Sources of Disease Spread

This article was published in the following Dove Press journal:
Infection and Drug Resistance

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Abstract: Beauty salons can do marvel prettiness for their customers; however, they are also considered as major health concern. They are a reason for the spread of viral, fungal and bacterial diseases. Many research isolated pathogenic bacteria and fungi from beauty salons products and tools. In this review we aim to increase the public's awareness of the potential for disease transmission through the common tools and products used in beauty salons. Furthermore, heighten salons' standards of care in sterilizing beauty tools and products and storing them properly.

Keywords: beauty salon, bacterial infection, cosmetic product, salons' tools, viral diseases

Introduction

The concept of a salon is linked to beauty, an establishment dealing with cosmetic products and tools to improve the appearance of one's hair, face, and body. Cosmetics are generally mixtures of chemical compounds derived from natural (such as coconut oil) or synthetic sources. In the United States, the Food and Drug Administration (FDA), which regulates the cosmetics industry, defines cosmetics as

> Intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body's structure or functions. (Sources of Cosmetic Products & Ingredients)[1]

Salons provide a wide range of services including hairdressing, nail care (manicures and pedicures), hair removal by waxing and threading, mud baths, and many other services. However, they are also considered a major health concern.[2,3] The health risks associated with beauty salons vary depending on the products and tools used, the nature of the business, and the service providers themselves.[4] Salons can contribute to and cause the spread of viral, fungal, and bacterial infections.[3,5] Among the diseases that can be transmitted in beauty salons are hepatitis B

& C, herpes, AIDS, skin and eye infections, hair lice, and chronic fungal diseases.[2,6–12]

The ingredients in cosmetic products and the materials used in the tools make the salon an ideal environment for the proliferation of microbes, thus contributing to the spread of various diseases.[2,3] Cosmetics fulfill all of the requirements for microbial growth;[13,14] the ingredients of most beauty products include sugar, starch, protein, amino acids, organic acids, acids, alkalis, salts, paraffin, fatty acids, alcohols, esters, moisturizers, colors and dyes, preservatives, antioxidants

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DovePress
http://doi.org/10.2147/IDR.S303461

fragrances, and essential oils. In addition, most of these ingredients are water soluble, which is an essential factor for the growth of microorganisms.[13] Cosmetics that contain a high-water content are at a higher risk of contamination, which can lead to an alteration in the composition of the product and/or constitute a threat to the health of the consumer (Sources of the chemistry of cosmetics; Australian Academy of Science).[15–17]

Here, we review the literature that examines the microbial contamination of salon products and tools, the standard hygienic and sterilization practices used in salons, and the risks of disease spread through these businesses.

Literature Review

Salon Hygiene

Salons tend to use chemical and physical methods to sterilize tools and equipment, such as chemical reagents, boiling water, autoclaving, chemical reagents, quartz bead sterilization, and UV light (Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization).[18] The method of using hot water sterilization involves placing the tools in boiling water for a period of no less than 3–5 min. While this method is relatively fast, it has been shown to be insufficient for killing all microorganisms.[19] Autoclaving is the most reliable way to kill all microbes, although it is not ideal for sterilizing electrical equipment, and the process of sterilization requires a relatively long time. Chemical disinfectants are effective in killing microbes or at least slowing their growth; however, most of these chemicals are hazardous and need to be used with caution (Sources of Proper Sanitation Protocols Can Make or Break Your Salon).[20] Currently, most salons use barbicide solution as a disinfectant, which is highly toxic to humans (Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization).[18]

Some salons use a quartz sterilizer or a UV sterilizer. The quartz sterilizer uses a process that consists of heating air through quartz beads for a period of 5–15 s at 250 °C (482 °F). This type of sterilizer accommodates a large number of tools, but the shape and structure of the tools may change after a period of time. The UV sterilizer is the safest method for tools and brushes that cannot be sterilized at high temperatures; the only disadvantage is that it accommodates very few tools (Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization)[18]. After cleaning and sterilizing, the tools must be stored properly in cool, dry places to reduce the risk of any growth of bacteria and fungi remaining on tools and therefore, the spread of disease. Brushes should be stored in makeup bags and metal and wooden tools should be stored in closed plastic containers (Sources of Salon Hygiene, Proper Practices for Sanitation, Disinfection, and Sterilization).[18]

About 35% of service providers use UV sterilization and about 20% use quartz beads to sanitize their tools. However, the use of an ultrasonic cleaner was reported by only 1% of providers. None of these described methods have been proven adequate in reaching a satisfactory level of sterilization by themselves, and a combination of approaches should be used.[21]

Risks

Cosmetic products and tools are a favorable environment for the multiplication of microbes, which contribute to and cause the spread of viral, fungal, and bacterial infections.[2,5] Numerous factors contribute to this problem. First, the ingredients of most beauty products, such as organic and inorganic compounds, moisturizers, basic minerals, and growth factors, provide an environment conducive to the multiplication of microbes. Second, the dates of production and expiration are not marked on cosmetics; consequently, the reduction in effectiveness of the preservatives in the cosmetics over time is unknown.[15] Third, cosmetics are not manufactured under sanitary conditions and are frequently shared in beauty salons.[22] Fourth, the regular tools used in cosmetic salons such as razors, scissors, clippers, and nail care tools can accidentally penetrate the skin, which may lead to health problems ranging from inflamed skin to hepatitis.[23] Service providers themselves are susceptible to transferring infections among their customers if they suffer from serious medical problems.[4,10,24] Accordingly, several studies have been undertaken to determine if the transmission of viruses, bacteria, ring worm, or fungi is associated with cosmetic procedures in beauty salons.[2]

Some bacterial species in the *Staphylococcus, Streptococcus*, and *Pseudomonas* genera are of major concern because they are associated with many common diseases and can cause respiratory problems and chronic diseases owing to their toxicity.[15,25–27] A real-life case was reported of an individual who acquired a methicillin-resistant *Staphylococcus aureus* (MRSA) infection after visiting a hairdresser in London, UK.[12] In 2006, in Rivers State, Nigeria, unhygienic tools contributed to

HIV infections and hepatitis, which are both blood-borne diseases.[28] *S. aureus* in other studies has been shown to cause outbreaks among salon customers in the United States.[29]

Unfortunately, most makeup brushes and other cosmetics objects, even after being thoroughly disinfected, still pose a risk in terms of bacterial transmission and infection each time they come in contact with cracks in the skin.[2,4,10,12] Four bacterial species are considered by pharmacopeia in the United States as indicators of contaminated cosmetics: *Pseudomonas aeruginosa, Staphylococcus aureus, Salmonella* spp., and *Escherichia coli.*

Microorganisms Isolated from Salon Tools

Several literature reports document the existence of a variety of microorganisms isolated from beauty tools used in salons such as nail care tools, sharpeners, sponges, combs, makeup brushes, hair stretchers, rollers, and hairpins (Table 1).[6,30] Researchers collected samples from clippers, clipper steps, combs, and brushes from 40 different beauty salons in Taraba State, Nigeria, in 2020. The samples were cultured on nutrient agar, mannitol salt agar, MacConkey agar, and Sabouraud dextrose agar. All samples contained pathogenic bacteria, including species of *Staphylococcus, Bacillus*, and *Streptococcus*. In addition to bacteria, pathogenic fungi in the following genera were also found: *Aspergillus, Trichophyton, Malassezia, Mucor*, and *Microsporum*. The highest microbial content in this study was measured on clippers, as these tools received the lowest level of sterilization practice among all of the tested tools.[31] In 2019, at the University of Al-Qadisiyah, College of Biotechnology in Iraq, six bacterial species were isolated from combs, brushes, rollers, hairpins, scissors, razors, dryers, and laundry tools from beauty salons in the campus. Based on the molecular and biochemical

Table 1 The Most Common Microbes That Have Been Isolated in Beauty Salons

Microbes	Source of Isolation	Reference
Staphylococcus sp., *Streptococcus* sp., *Bacillus* sp., *Aspergillus* sp., *Trichophyton* sp., *Malassezia* sp., *Mucor* sp., and *Microsporum* sp.	Cosmetic tools	[31]
Staphylococcus, Bacillus, Aspergillus, Penicillium, Microsporum	Brushes and combs	[23]
Staphylococcus aureus, Staphylococcus epidermidis, Streptococcus sp., *Micrococcus* sp., *Enterococcus* and *Enterobacter*	Cosmetic tools	[6]
Staphylococcus sp., *Streptococcus* sp., *Enterococcus, Candida albicans*	Wax, lipstick, eyeliner, mascara, and foundation	[36]
Staphylococcus aureus, Candida albicans	Lipstick, mascara, and eyeliner	[37]
Escherichia coli, Proteus vulgaris, Streptococcus viridans, Corynebacterium sp.	Brushes and combs	[32]
Bacillus, Staphylococcus, Escherichia coli, Aspergillus, Penicillium, Salmonella,	Cosmetic powders and eyeliners	[5]
Staphylococcus, Pseudomonas, Bacillus, Enterococcus, Aspergillus, Cladosporium, Rhizopus	Hairdryers, combs, and brushes	[33]
Staphylococcus, Aspergillus, Streptococcus	Combs, Brushes, and Hairdryers	[3]
Bacillus, Staphylococcus, Escherichia coli, Aspergillus, Penicillium, Salmonella	Brushes and combs	[39]
Saprophytic fungi, dermatophytes	Hairbrushes	[10]
Streptococcus, Staphylococcus, Escherichia coli, Enterobacter, Pseudomonas, Aspergillus, Penicillium	Combs, brushes, hair stretchers, rollers, and hairpins	[2]
Staphylococcus aureus, Pseudomonas aeruginosa, yeast, and fungus	Cosmetics products and tools	[35]
Bacillus, Staphylococcus aureus, Escherichia coli	Cosmetic creams	[15]
Candida, Penicillium, Micrococcus, Staphylococcus	Nail care tools	[40]
Pseudomonas aeruginosa, Enterobacter gergoviae, Candida parapsilosis, Aspergillus flavus, mould	Facial creams and hand and body lotions	[25]

characteristics of the isolated bacteria, they were identified as *S. aureus*, which was the most dominant species in all samples, *S. epidermidis, Streptococcus* spp., *Micrococcus* spp., *Enterococcus* spp., and *Enterobacter* spp.[6] In the same year at the university, bacteria and fungi were isolated on nutrient agar and potato dextrose agar from combs and brushes used in public beauty salons in three campuses in Nigeria. The bacterial isolates were identified as *Staphylococcus aureus*, and species of *Bacillus, Micrococcus, Serratia, Citrobacter, Proteus*, and *Shigella*, and fungi such as *Aspergillus flavus, Penicillium* spp., *Trichophyton* spp., and *Microsporum* spp.[23] It can be concluded from this study that beauty salons can be considered a hazard when the hygiene standard is far from the expected, especially when it is combined with high moisture and dust content. Another study investigated the microbial content in a beauty blender when it was not cleaned at all or when it was dropped on the floor and reused without cleaning. The results revealed the presence of both *S. aureus* and *E. coli*.[30]

In 2018, hair samples were collected from salon tools from ten different salons within the Benin metropolis, Edo State, Nigeria. All samples were inoculated on nutrient agar. The bacterial isolates obtained from salon tools included *E. coli, Proteus vulgaris, Streptococcus viridian*, and *Corynebacterium* sp.[32] In Kamyaran city, Iran, in the summer of 2015, bacteria and fungi were isolated from hair dressings used in beauty salons using a variety of selective microbial media. The contaminating microorganisms were identified as *Staphylococcus aureus, S. epidermis, Klebsiella pneumoniae, Pseudomonas aeruginosa*, and species of *Bacillus, Micrococcus, Enterococcus*, and *Enterobacter*, and the fungal species *Aspergillus flavus, A. fumigates, Alternaria* spp., *Cladosporium* spp., *Geotrichum candidum, Rhizopus nigricans, R. arrhizus, Trichophyton* spp., *Mucor* spp., *Candida albicans*, and *Penicillium* spp.[33]

In Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria, samples from combs, brushes, and hairdryers were collected from two hairdressing salons inside the campus to investigate the role of salons in spreading diseases. The samples were inoculated on nutrient agar, MacConkey agar, and mannitol agar and showed the presence of bacterial species in the genera *Streptococcus* and *Micrococcus*, as well as *Staphylococcus aureus*, and a few species of fungi in the genera *Aspergillus, Mucor*, and *Rhizopus*.[3] The same theory, the role of salons in spreading diseases, was tested by Enemuor and colleague at Kogi State University, Anyigba. They collected samples from combs, brushes, hair stretchers, rollers, and hairpins from six hairdressing salons. The samples were then cultured on a variety of selective and general media, revealing the presence of five bacterial and six possible pathogenic fungal species. The dominant bacterial species across all six salons was *S. aureus*, followed by *S. epidermidis*. This study considered the presence of the pathogenic fungus *Trichophyton* as an indicator of the probability of contamination by more risky microorganisms.[2] Even though the sample size in this study was very small, it highlighted a series of problems regarding the acceptable hygiene level that needs to be enforced in salons.

In another interesting study by Baqer et al (2014), sponges and mascara were tested to evaluate microbial contamination. The results revealed the existence of normal flora, such as *S. epidermidis*, and the dominance of *S. aureus* and other Enterobacteriaceae family members including *E. coli, Shigella*, and *P. aeruginosa*. Each of these species is known for their ability to cause nosocomial infections in health centers and the community. This study also employed a natural sterilization method using the supernatant of *Lactobacillus*, which has antimicrobial activity and can control the growth of microbes living in beauty sponges and eyelash mascara.[34]

In 2015, fungal species were detected in hair brush samples from beauty salons in Jatinangor, Indonesia, using two different culture media, Sabouraud agar with chloramphenicol and Sabouraud agar with chloramphenicol and cycloheximide. The majority of fungi in this study was saprophytic fungi, including species in the following genera: *Aspergillus, Fonsecaea, Penicillium, Cephalosporium, Mucor, Rhodotorula, Gliocaldium, Phialophora, Rhizopus*, and the species Mycelia sterilia. The existing fungi were highly affected by the salon practice used in washing brushes. When required care was neglected, examination revealed the presence of a small percentage of dermatophyte species. When brushes were cleaned once a week with a common detergent, *Candida* spp. were detected, and when the brushes were never washed, *Trichophyton* spp. and *Malassezia* spp. were detected.[10]

In 2012, Naz isolated and detected numerous human pathogens from 100 samples of beauty salon tools including blusher brushes, face sponges, and wax. The samples were inoculated on mannitol salt agar, cetrimide agar for bacterial detection, and potato dextrose agar for fungal tests. Most of the wax samples, all brushes, and beauty

sponges were contaminated with *S. aureus*. *Pseudomonas aeruginosa* contaminated 75% of the samples, while less than 50% of the samples were contaminated by yeast and other fungi.[35]

Most of the research on assessing the role of salon tools in the spread of diseases found that these tools either were never stylized or were not cleaned between customers. Even when hygienic practices were employed, acceptable levels of sterilization were rarely applied.

Microorganisms Isolated from Cosmetics Products

In addition to all of the studies investigating pathogenic microorganisms contaminating cosmetic tools, the literature is replete with reports on the isolation of microbes from cosmetic products in beauty salons, including lipstick, mascara, eye shadow, foundation, blusher, eyeliner, facial creams, and hand and body lotions (Table 1). All of these products are considered an ideal environment for microbial proliferation due to their rich favorable ingredients.

In one study in 2018 at the University of Raparin, Iraq, over 120 moistened cotton swab samples were collected from ten different hair and beauty salons to define the presence of microorganisms in lipstick, eyeliner, mascara, and foundation. The study found more bacterial growth than fungal growth. The bacterial species included *Staphylococcus* spp., *Streptococcus* spp., and *Enterococcus* spp. The fungal specie was *Candida albicans*, which is considered a natural constituent of gut flora, but when it transforms far from its original site it can cause several chronic infections.[36]

Similar microbes were found in studies conducted in the same year at Benghazi University, Libya. That study analyzed microbial contamination of 25 facial cosmetics including samples of kohl, eyeliners, and lipsticks. Bacterial and fungal contaminants, such as *Staphylococcus aureus* and *Candida albicans*, respectively, were found.[37] More cosmetic products have investigated earlier in ten beauty salons in different regions of Tabriz city, Iran. Scientists collected 52 samples from skin and eye cosmetics, such as cream, mascara, powder, and eyeliner from All samples were inoculated on cetrimide agar, Levine eosin methylene blue agar, Baird Parker agar, and Sabouraud dextrose chloramphenicol agar. All cosmetics were found to be contaminated with bacteria, fungi, and yeast, and the most dominant species were associated with the following genera: *Streptococcus, Pseudomonas, Bacillus, Staphylococcus, Acinetobacter, Salmonella, Klebsiella, Citrobacter, Rhodotorul*, and *Candida*, as well as *E. coli*.[5] Among all of the samples used in this study, the powder had the highest contamination level, which might be due to exposure to air and the frequent use of the same powder pad. Besides powder, mascara also had a high contamination level, most likely due to its high moisture content, which contributes to ocular infection.[22]

The number of people who use and share a cosmetic product greatly affects the microbial contamination rate. In a study by Skowron et al,[38] samples including cream, lotion, and face and hair masks were divided into three groups. The first group of products were used by one person, the second group was used by a group of people, and the last group of products was expired and utilized by public. The microbial content in personally used products was much lower than that of publicly used products, and the expired products exhibited the highest microbial contamination. The majority of microorganisms detected in this study were considered microflora and few pathogenic organisms were detected, such as *P. aeruginosa* and *C. albicans*.[38]

Although many microbes detected in cosmetic products are not necessarily pathogenic, they may still pose a risk when considering the overall microbiome. It has been shown that organisms in the normal flora can threaten human life when they transfer from one person to another, which is common in salons. It was found that the higher the moisture percentage in the beauty product, the higher the microbial count. In addition, leaving the cosmetics tools or products uncovered, exposed them to the air, dust, and airborne microorganisms, which may increase microbial contamination.

Closing

A review of several studies clearly showed that more bacterial species, especially Gram-negative bacteria, were isolated from cosmetic products in beauty salons. The main reason for this is likely due to the preservative used in cosmetic product being more effective in inhibiting fungal growth than bacterial growth.[41]

Some microbes isolated from cosmetic products and tools are considered as significant threats to public health. *S. aureus, P. aeruginosa* and *K. pneumoniae* are ubiquitous in the environment, and are related to nosocomial infections, causing severe infections in plants, humans,

and other animals. Bacteria related to nosocomial infection microbes are rarely and poorly controlled by antibiotics.[42] In addition to infections acquired from hospitals, food-borne diseases are another issue caused by microbes found on salon instruments and products. The most common food-borne microorganisms, such as *E. coli, Bacillus* sp., *Salmonella* sp., and *Yersinia* sp. are widely found in salons. Both *Bacillus cereus* and *E. coli* can cause food poisoning, as they are agents that secrete toxins into food, triggering gastrointestinal illness. *Salmonella* spp. and *Shigella dysenteriae* spread via contaminated food and food handlers, are known to cause food-borne sickness, and are highly resistant to certain antibiotics.[43]

The findings of these studies may have been limited by the variable types of microorganisms present in the collected samples. In addition, the approaches used may not have been conducive to isolating all types of contaminating organisms; some organisms may require special conditions to grow on agar plates, or tissue culture propagation in the case of viruses and other parasites.

There is a need to increase the public's awareness of the potential for disease transmission through the common tools and products used in beauty salons. Accordingly, based on the findings and recommendations of the studies reviewed here, we aim to heighten salon standards of care used in sterilizing beauty tools and products, and storing them properly. In addition, we highly recommend the use of individual cosmetic kits. All of these recommendations, if employed, should contribute significantly to a reduction in the spread of infection and disease through beauty salons. In term of awareness, the International Organization for Standardization provided guidelines that should be taken into account in the field of cosmetic manufacturing, from manufacturing to the usage by customers, until waste disposal.

Disclosure

The authors report no conflicts of interest for this work.

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