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## Disinfectant Susceptibility of Bacteria Isolated from Salon Tools in Ishaka Town, Bushenyi District, Uganda

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### ABSTRACT

Bacterial infections are on rising especially resistant strains which cause increase of economic burden to both patients and healthcare providers. Salons shops are recently reported as one of the route for transmitting bacterial pathogens including resistance strains and this was linked to the lack of awareness of salons shop operators on biosafety practices in salons. This study determined prevalence and disinfectant susceptibility patterns of bacteria isolated from salon tools in Ishaka town, Bushenyi District, Uganda. Twenty-five (25) Salon owners/ Head operators were enrolled in this study to determine the level of awareness about the biosafety practice of salons operation using semi-structured questionnaire. Additionally, total of 125 swab samples were collected from different salons tools (combs, brushes, scissors, clippers and shaving machines) and processed using standard Microbiological methods for isolation of bacteria. The isolated bacteria were identified using standard phenotypic methods including analytical profile index (API). Susceptibility patterns of the isolated bacteria to disinfectant were determined using agar well diffusion method. Results obtained from this study showed that a significant number of salon operators ( $p \leq 0.05$ ) were aware about the important of disinfectant usage, disinfect tool(s) after use and washing hands /tools after use. Among the 125 swabbed samples collected from the salons, 78 (65.5%) were contaminated with different bacterial species. Clippers were found to have higher (25.6%) contamination among the salon tools from which samples were collected. Of all the tested disinfectants, most resistance was shown with Sodium hypochloride 1%. In conclusion, this study showed that, majority of the salon operators were aware about the biosafety practice of salon operation despite the higher contaminations of salons tools.

**Keywords:** Disinfectant, Susceptibility, Bacteria isolated and Salon tools.

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### INTRODUCTION

Infections can be spread through different ways including direct contact with bodily fluids from contaminated blood, pus, sores, cuts or grazes [1; 2]. Therefore, beauty salons which is defined as a place where your hair, face, and body can be given special treatments to improve their appearance ,it may pose also potential health risks to their clients and service providers such as skin infections on the scalp, face and neck or sometimes injuries [3; 4]. Therefore, bacteria skin infections can be acquired from different inanimate objects depending on the nature of the service sought, tools and equipment used, health status of the clients and service providers as well as the infection control procedures implemented [1]. Beauty salons are considered as one of the dangerous places for transmission of diseases, they

may pose potential health risks to their clients and service providers such as skin infections on the scalp, face and neck or sometimes injuries [3; 4]. Some bacteria, viruses and fungi especially yeasts have been isolated from manicure, pedicure, hairdressing and barbering equipment and tools used in salons [5; 6; 7; 3; 8]. Studies done in United states of America by [9; 7] on manicure and pedicure tools used on hands and feet of customers who acquired those services showed that they were contaminated by *Streptococcus sp.*, *Enterococcus sp.*, *Micrococcus sp.*, *Bacillus sp.*, *Enterobacter sp.*, *Klebsiella sp.*, *Acinetobacter sp.*, *Citrobacter sp.*, and *Escherichia coli*. Other studies on some tools also isolated; other bacteria such as *Mycobacterium fortuitum*, *Mycobacterium chelonae* and *Mycobacterium mageritense* [10; 11; 12; 8] Similarly studies done on

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in-use tools in hairdressing and barbering, showed contamination by bacteria like *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Staphylococcus epidermidis*, *Streptococcus sp*, *Enterococcus sp* and *Enterobacteria* [13; 14; 3].

Furthermore, the proper use of disinfectants can help contain and prevent the spread of harmful bacteria and viruses. Disinfectants are antimicrobial agents that are applied to the surface of non-living objects to destroy microorganisms that are living on the objects. However, studies have revealed resistance of some microorganisms on different type of disinfectants. A study done by [15], on different disinfectants revealed that, among 27 bacteria isolates used, all strains were susceptible to sodium hypochlorite, glutaraldehyde and to the association quaternary ammonium - formaldehyde - ethyl alcohol disinfectants. However, the susceptibility of strains to phenol and to one quaternary ammonium compound (QAC) was variable. Only eight (08) strains (one MRSA strain, two *S. epidermidis* strains, *E. cloacae*, *P. mirabilis*, *S. marcescens* and two strains of *P. aeruginosa* (38% of all drug resistant strains identified)) were resistant to the quaternary ammonium and phenol compounds, while of the six antibiotic susceptible strains demonstrated only two (33%) strains (*Proteus mirabilis* and *Staphylococcus epidermidis* strains) were resistant to the QAC and phenolic compounds, respectively. However, a number of

### Study Design

This was a cross-sectional study (because was observational study which analyzed data from a representative subset, at a specific point in time), where salons were selected using a purposive sampling strategy (also known as subjective). Therefore, samples were collected from salon service operators' tools such as combs, brushes, scissors, clippers and shaving machines purposively. ID codes were used to protect the privacy of salons. Information about how disinfectants are used on the tools and disinfectants used were also collected; after which samples were analyzed in the

factors may affect effectiveness of disinfectants among which are the concentration used, application method, contact time of the disinfectant and the safety considerations for operators to apply disinfectants [16; 17; 18]. Uganda National Bureau of Standard UNBS (2008) recommends testing for effectiveness of these disinfectants, since the role of salon in the spread of such infections in Uganda has not yet been elucidated, hence a need to explore the effectiveness of the commonly used disinfectants and Identify the genes associated with disinfectant resistance.

### Aim of the study

The aim of this study was to determine disinfectant susceptibility of bacteria isolated from salon tools in Ishaka town, Bushenyi District, Uganda

### Specific Objectives

1. To assess the level of awareness about biosafety practices among salon operators in Ishaka town.
2. To determine the susceptibility patterns of the bacterial isolated from salon tools to the commonly used disinfectants.

### Research Questions

1. What is the salon operators' level of awareness on biosafety practices for salons?
2. What are the susceptibility patterns of the bacterial isolated from salon tools to the commonly used disinfectants? Justification/significance of the study

## METHODOLOGY

lab to determine the prevalence of bacterial contamination. This was followed by the determination of major bacteria contaminants. From the bacteria identified, all species identified were represented for the tested commonly used disinfectants. From the resistant *Staphylococcus aureus* isolates, disinfectant resistant genes (QAC) were determined and confirmed through sequencing using Sanger sequencing method.

### Study area

The study was carried out on selected beauty salons in Ishaka town division located in Ishaka municipality, Bushenyi

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district, Uganda. Ishaka town has a human population of 41,217 according to the population census 2014 [19]. Ishaka municipality has 20 villages including 4 villages which Ishaka town division covers. This study was conducted on beauty salons selected in 4 villages (Cell A, Cell B, Cell C and Cell D).

#### Sample size

The minimum sample size was determined by [20] formula which states as:

$$S = \frac{3.84 * 27 * 0.5(1-0.5)}{(0.05)^2 (27-1) + 3.84 * 0.5(1-0.5)} = \frac{25.92}{1.02525} = 25 \text{ Salons.}$$

Twenty-five (25) minimum numbers of salons were used during this study.

#### Sampling strategy

The convenience sampling method was used to select Ishaka town out of other towns of Bushenyi district. Convenience sampling also known as availability sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility and proximity to the researcher. Ishaka town division has 27 beauty salons where 8 are barbershops, 9 are women salons only and 10 are Unisex beauty salons. From these salons, a total of 25 salons were selected purposively. The simple random sampling method which is a sampling technique where every item in the population has an even chance and likelihood of being selected in the sample was used to select 25 Beauty salons. Furthermore, swab samples were taken from tools such as Scissors, Brushes, Combs, Clippers and Shaving Machine selected purposively. The choice of selected tools was in accordance with literature which has shown that the tools selected for this study are the most commonly contaminated [21]. Furthermore, 25 salon operators were selected purposively from the selected salons participated in this study to obtain qualitative data such as their Knowledge, attitude and practice with respect to biosafety while carrying out their daily activities (like daily cleanliness practice used daily, how they disinfect equipment and tools used and infection controls measures implemented).

$$S = \frac{X^2 NP (1-P)}{d^2(N-1) + X^2 P (1-P)} \text{ Where;}$$

S= required sample size;

X<sup>2</sup> = the table value of chi-square for 1 degree of freedom at the desired confidence level (1.96\*1.96=3.841);

N = the population size (27 saloons listed from pilot study);

P=the population proportion (assumed to be 0.50 since this would provide the maximum sample size);

d=the degree of accuracy expressed as a proportion (5%=0.05).

#### Sample collection and storage

Moisten sterile swabs with 0.85% normal saline were collected from salon tools such as combs, brushes, scissors, clippers and shaving machines. It was done by moving a pre moistened sterile swab two to three times, over the surface which gets in contact with the skin of customers or salon providers. The swabs collected were inserted into sterile 5 ml tubes containing 2 ml of Stuart transport medium. After taking sample, each tube was covered appropriately to avoid contamination and labeled, then were carried out in a cool box. The samples were transported to the Microbiology Laboratory, Kampala International University -Western Campus promptly. Samples were processed immediately when taken to the Microbiology Laboratory, Kampala International University -Western Campus and those that were not processed were stored at 2<sup>o</sup>-8<sup>o</sup>C and processed the next day [21].

#### Data collection

Both qualitative and quantitative data were collected in this study and the data collection methods are described below as per the objective.

#### Assessing the level of awareness about biosafety practices among Salon owners/ Head operators in Ishaka town.

Data were collected from Salon owners/ Head operators using semi-structured questionnaire in order to generate useful information which helped to explain the

quantitative data obtained. Information sought includes; knowledge, attitude and practice with respect to biosafety and socio-demographic information. Professional ethics were upheld at all the stages, including sample collection, processing and reporting results which will be in accordance with approved Standard operation procedures. All the equipment in the laboratory, such as autoclave, microscope, incubator, etc, were used following the manufacturer's operating guidelines. Each test was done in duplicates, in order to minimize errors. Negative control was used in order to get precise and reliable results. For Polymerase Chain Reaction, some measures were taken in order to avoid contamination such as decontamination of surfaces, changing gloves, lab coats and testing of primer on positive and negative controls to avoid positive results.

#### **Data analysis**

The raw data was entered in excel after being edited and cleaned in case of any obvious errors. The data from objective 1 and 3 were then analyzed using statistical package for social sciences (SPSS) version 21 software. For prevalence of commonly bacteria contaminated beauty salon tools were presented in form of frequencies and percentages with their corresponding 95% confidence interval and *P-value* comparison among tools, it was done using Chi-square.

#### **Ethical considerations**

In order to make sure that the study is conducted ethically, several specific issues were addressed.

#### **Institutional consent**

Ethical clearance was sought from the Research Ethics Committee of KIU-WC (*ref* No.: SF201813; Nr UG-REC-023/201813).

#### **Salon owners' approval**

Permission to collect sample from tools and qualitative data from salon owners/Senior salon service providers was sought from salon owners of the selected salons and approval was obtained.

#### **Informed consent**

The salon owners of selected salons were informed of the study, using the best locally understood language. The purpose of the study, methods, possible risk(s)

and benefits of participation were clearly spelt out. Involvement in the research was voluntary and participants were free to opt out at any time without penalty or loss of potential advantages. Individuals willing to be part of the study were requested to fill out and sign a pertinent Consent form, administered by the researcher, and in the presence of a witness.

#### **Privacy and confidentiality**

Privacy of participants was insured by protecting individual identity and information. For example, all data collected was used without names of the participants and kept safely and confidentially. Salon facilities were protected by using Identification Number to protect their anonymity.

#### **Justice in selection**

The salons were selected equitably and fairly by using simple random sampling technique, where we listed all 27 salons' names on a piece of paper and choose 25 salons needed in this study randomly in order to give all salons an equal opportunity to be involved. Besides, justice was involved in the application of fairness to individuals in choosing interviewees to participate in this study. Every respondent was given equal opportunity to participate in the study. No particular priority was given to anyone.

#### **Respect for rights of respondents**

Each respondent had an entitlement to his/her opinion, response and comments. The researcher ensured that each and every response provided during the course of the study is respected.

#### **Protection of research personnel and environment**

Protective wear, including gloves and laboratory coats, was used to protect research personnel against the test organism. Inoculation of samples was carried out in a safety cabinet to prevent environmental contamination and infection to research personnel. All plates and any disposable materials used were properly disposed of or burnt after being autoclaved. Reusable glass wares were autoclaved so as to prevent the risk of infection; any washing was done in a sink; and the runoff disposed of in a septic tank. The surfaces of the working

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benches were decontaminated with disinfectants.

#### **Determination of susceptibility pattern of the bacterial isolated from salon tools to the commonly used disinfectants**

Disinfectants susceptibility test was done in order to verify whether disinfectants commonly used are sensitive to bacteria identified. In this study, disinfectants susceptibility test was performed using well diffusion method as described by [16] with some modification. A sterile cork borer was used to bore 5 holes (each having a diameter of 6 mm height and 4mm of depth) on the agar, where three holes of them were for three different disinfectants to tests (see table 3) and other two wells were one for control negative (distilled water) and another for control positive which was Amoxicillin 0.1% (v/v).

The bacteria inoculums were standardized with 0.5 MacCfarland standard solutions. The inoculation was done by using sterile swab soaked in the standardized bacterial then swab was

used to inoculate on the surface of Mueller-Hinton agar (MHA) plates containing holes.

The disinfectants to test were prepared and 100 µl of each disinfectant were filled into the wells without allowing overflow. In this experiment, each plate was inoculated with one organism identified and were having 5 wells [three (3) containing disinfectants to test and one (1) containing distilled water as negative control and lastly another one (1) contained amoxicillin 0.1mg/ml prepared solution used as positive control]. The use-dilution concentrations were performed in agreement with manufacturer's recommendations with consideration of concentration recommended by Uganda National bureau of standard (UNBS). Therefore, the plates were incubated at 37°C for 24hours. Inhibition zones were observed after incubation period and were interpreted based on absence or presence of inhibition zone [International Clinical Laboratory Standard guidelines (ICLS, 2016)].

**Table 1: Disinfectants used in this study**

No.	Disinfectants with their commercial names	Made by	Dilution used
1	Sodium Hypochlorite 3%, Commercial name is JIK (also called household bleach)	Orbit Chemical industries Ltd. (Nairobi/Kenya)	1 % as recommended by UNBS.
2	Surgical spirit BP	Kwality Afro-Asia Ltd. (Kampala/Uganda)	No dilution used as recommended by manufacture, it's ready to use.
3	Methylated spirit (Commercial name is Tripple seven)	Zadu Industries Ltd.	No dilution used as recommended by manufacture, it's ready to use.

## **RESULTS**

### **Participants demographic characteristics**

Data was collected from 25 participants who included salon owners and service providers the response rate was 100%. Of the participants respondent's gender; there were slightly more male 60% were male while 40% were females. The average age of the respondents was 25±0.6 years. Majority of the respondents (64%) had secondary school level education while

36% had no formal education. Fifty-two percent (52%) of the respondents had Barbershops within Ishaka town Among the 25 salons visited in this study, 13(52%) were Barbershops, 6(24%) were Hairdressing/Women salon and 6(24%) were unisex salon. The rest of the details are shown in Table 2.

**Table 2: Participants demographic characteristic**

Characteristics	Frequencies n (%)	<i>P-value</i>
<b>Sex</b>		
Male	15(60)	
Female	10(40)	<b>0.05*</b>
<b>Education</b>		
None	3(12.0)	
Primary	6(24.0)	
Secondary	16(64.0)	0.89
<b>Location</b>		
Outside town	14(56.0)	
In town	11(44.0)	0.42
<b>Type of saloon</b>		
Barbershop	13(52.0)	
Hairdressing/Ladies salon	6(24.0)	<b>0.013*</b>
Unisex Salon	6(24.0)	

**Key:** \*Statistically significant

#### **Level of awareness about biosafety practices among salon operators**

Based on information obtained from respondents about disinfectants uses, majority of the respondents (88%) were aware about the importance of using disinfectant. Eighty-four (84.0%) percent of respondents acknowledged the purchase of disinfectants from supermarkets and knew the important of using the different tools in salon. All the studied participants (100%) agreed on cleaning of tool(s) after use. Fifty-two (52%) and Ninety-two (92%) of participants were not aware about biosafety guideline and usage of Methylated Spirit and Sodium hypochloride (JIK) respectively, the eighty-four (84%) of the respondents were un-aware of biosafety guidelines and usage of Surgical Spirit and Sodium hypochloride (JIK) combination in salons

shops, so were for those who were un-aware of biosafety guideline and usage of Surgical spirit & shampoo/savlon combination. Use of after shave as disinfectants on tools was not known by 92% of respondents. Majority of the participants (96%) were un-aware of the use of heat on clipper as a disinfectant but were aware of the washing hands /tools after shaving to prevent infections transmission. Disinfecting of the shaving machines before using was known by 54% of the participants. Most of the studied participant 80%, 92%, 100% and 96% were aware of the disinfecting the Clippers, Scissors, Combs and Brushes respectively before use. The rest of the details are shown in Table 3.

**Table 3: Level of awareness on biosafety practices used in beauty salons**

Variable	Frequency (Percentage)	p value
<b>Disinfectants usage</b>		
Yes	22 (88)	0.006*
No	3 (12)	
<b>Source of disinfectant</b>		
Pharmacy	4 (16)	0.03*
Supermarkets	21 (84)	
<b>Important of having more than one tool in use</b>		
Yes	21 (84)	0.03*
No	4 (16)	
<b>Cleaning instruments after use</b>		
Agree	25 (100)	0.001*
Disagree	0 (0)	
<b>Use of Methylated Spirit</b>		
Yes	12 (48)	0.02*
No	13 (52)	
<b>Use of Sodium hypochloride (JIK) only</b>		
Yes	2 (8)	0.006*
No	23 (92)	
<b>Use of Surgical Spirit and Sodium hypochloride JIK</b>		
Yes	4 (16)	0.03*
No	21 (84)	
<b>Use of Surgical spirit &amp; shampoo/savlon</b>		
Yes	4 (16)	0.03*
No	21 (84)	
<b>Usage of after shave as disinfectants on tools</b>		
Yes	2 (8)	0.006*
No	23 (92)	
<b>Usage of heat on clipper as a Disinfectant</b>		
Yes	1(4)	0.004*
No	24 (96)	
<b>Importance of washing hands /tools</b>		
Yes	24 (96)	0.004*
No	1(4)	

**The following tools must be disinfected before use**

<b>Shaving machine</b>			
Yes	14 (56)	0.71	
No	11(44)		
<b>Clipper disinfection before use Yes</b>			
Yes	20 (80)	0.047*	
No	5 (20)		
<b>Scissor disinfection before use</b>			
Yes	23 (92)	0.006*	
No	2 (8)		
<b>Combs disinfection before use</b>			
Yes	25 (100)	0.001*	
No	0 (0)		
<b>Brushes disinfection before use</b>			
Yes	24 (96)	0.004*	
No	1 (4)		

**Key:** \* Statistically significant.

**Susceptibility of isolated bacteria to commonly used disinfectants**

Out of the 137 bacterial isolates subjected to disinfectant susceptibility tests, 37 (27.0%) were resistant to Sodium hypochloride 1%, 22(16.0 %) to Surgical spirit BP while 4 (2.9%) were resistant to Methylated spirit (Table 4). The distribution of resistance according to the bacterial species showed that, *Serratia liquefaciens*, *Serratia marcescens* and *Staphylococcus sciuri* were 100% resistant to Sodium hypochloride while *Staphylococcus epidermidis* showed low

resistance (3.6%). Similarly, *Serratia liquefaciens* showed high resistant (87.5%) to Surgical spirit BP among the bacteria tested while *Serratia marcescens* and *Staphylococcus sciuri* showed no resistance (0.0%) to this disinfectant. *Serratia marcescens* was found to be the most resistant bacterial to Methylated spirit while *Staphylococcus epidermidis*, *Staphylococcus Xylosus*, *Enterobacter aerogenes* and *Staphylococcus sciuri* showed no resistance (0.0%).

**Table 4: Disinfectants resistant bacterial isolates in Ishaka town, Uganda**

Organisms	Number examined	Types disinfectants tested		
		Surgical spirit BP	Methylated spirit 70%	Sodium Hypochlorite 1%
		Resistance n (%)	Resistance n (%)	Resistance n (%)
<i>Staphylococcus epidermidis</i>	55	2(3.6)	0(0.0)	2(3.6)
<i>Staphylococcus aureus</i>	52	8(15.3)	2(3.8)	9(17.3)
<i>Staphylococcus xylosus</i>	11	3(27.2)	0(0.0)	8 (72.7)
<i>Serratia liquefaciens</i>	8	7(87.5)	1(12.5)	8(100.0)
<i>Enterobacter aerogenes</i>	8	2(25.0)	0(0.0)	7(87.5)
<i>Serratia marcescens</i>	2	0(0.0)	1(50.0)	2(100.0)
<i>Staphylococcus sciuri</i>	1	0(0.0)	0(0.0)	1(100.0)
<b>Total</b>	<b>137</b>	<b>22(16.1)</b>	<b>4(2.9)</b>	<b>37(27.0)</b>

Table 5 show results on distribution of resistant bacterial isolates according to salon type showed that Barbershops had the highest distribution of resistant bacterial isolates 20 (41.7%), while Hairdressing/ladies salons had the lowest resistant bacterial isolates 5(14.3%). From the Barbershops salons it was observed that, *Serratia liquefaciens*, *Enterobacter aerogenes* and *Serratia liquefaciens* showed 100% resistance to the disinfectant while *Staphylococcus sciuri* had no resistance to the disinfectants tested. However, it was also observed that

*Serratia liquefaciens* from Hairdressing/ladies salons showed 100% resistant to the disinfectants tested while *Staphylococcus epidermidis*, *Staphylococcus xylosus*, *Enterobacter aerogenes*, *Serratia marcescens* and *Staphylococcus sciuri* showed no resistance to the disinfectant tested. In Unisex salons, *Serratia liquefaciens*, *Enterobacter aerogenes* and *Staphylococcus sciuri* showed 100% resistance to disinfectants tested while *Serratia marcescens* showed no resistance (Table 5).

**Table 5: Distribution of resistant Bacteria isolates based on type of salons from Ishaka town, Uganda**

Organisms	Types of disinfectant					
	Barbershops		Hairdressing/ladies salons		Unisex Salons	
	Number examined	Resistant n (%)	Number examined	Resistant n (%)	Number examined	Resistant n (%)
<i>Staphylococcus aureus</i>	12	5(41.6)	12	2(16.6)	28	2(7.1)
<i>Staphylococcus epidermidis</i>	21	1(4.7)	18	0(0)	16	1(6.25)
<i>Serratia liquefaciens</i>	3	3(100)	3	3(100)	2	2(100)
<i>Staphylococcus xylosus</i>	5	5(100)	2	0(0)	4	3(75)
<i>Enterobacter aerogenes</i>	5	4(80)	0	0(0)	3	3(100)
<i>Serratia marcescens</i>	2	2(100)	0	0(0)	0	0 (0)
<i>Staphylococcus sciuri</i>	0	0(0)	0	0(0)	1	1(100)
Total	48	20(41.7)	35	5(14.3)	54	12 (32)

## DISCUSSION

Salon shops have been reported as one of the routes for transmitting bacterial pathogens including resistance strains [22; 23] and this was linked to the lack of awareness of salons shops operators on biosafety practices in salons [23]. Literature have shown that, there is no established guideline on practices in salons in most African countries [21]. Resistance of these bacteria to disinfectant can lead to failure to fight both community and hospitals acquired infections. This study was therefore designed to determine disinfectant susceptibility of bacteria isolated from salon tools in Ishaka town, Bushenyi District of Uganda. The majority of the participant being aware of the usage of disinfectants in salons is in line with the findings of [2] from Rome, who reported that, more than 95% of the centers use more than one method of decontamination. This was contrary to the findings of [1] who reported higher percentage 58% (n=50) of barbers that were not aware of any health hazards associated with their profession from Kharian in Pakistan. The higher percentage of barbers who knew about usage of disinfectants in salons reported in this study is not surprising because most of the participants (64%) had secondary school certificate which is

consider as an ordinary level of education in Uganda. At that level, a student is expected to be able to read, write and understand common guideline or rules within the community. Understanding guideline on the usage of disinfectants in salons is very important, as careless use of salons equipment without disinfecting between one client to another can leads to the transmission of infectious diseases [23] within the community including resistant organisms.

Obtaining disinfectants from supermarket by most of the participants could be due to the easy access or the disinfectants being sold at a cheaper price. But the implication of this is, some of the disinfectant in the super market could be of low standard or expired compare to the one bought in Pharmacies which could leads to in-effectiveness. This could lead to in appropriate decontamination of salons tools which increases the risk of spreading the infectious diseases including resistant organisms. This confirmed the report of [19], who reported that, there is an increase of purchase of over the counter medicine in Uganda which fuels the spread of resistant organisms within the community.

Majority of the participants responded to had more than one salon tools in their

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shops. This could reduce the risk of immediate transfer of contaminated equipment between one client to another. All participants interviewed (100%) responded to have clean or disinfect the instrument after used, this also showed a good level of hygiene practice by these studied participants. Furthermore, most of the respondents were aware of the guideline of usage of different disinfectants such as Methylated Spirit, Sodium hypochloride (JIK) only, Surgical Spirit and Sodium hypochloride, Surgical spirit & shampoo/savlon, after shave as disinfectants on tools and heat on clipper. This was contrary to the findings of [1] who reported that 90% (n=50) of barbers did not wash hands, 80% did not change the apron, 66% did not change towel during barbering services to different customers, which may be another way of transmitting resistant organisms from one client to another.

The results of this finding showed that, out of the three-disinfectant tested, bacteria showed higher resistant to Sodium Hypochlorite 1%. This was in line with findings of [24,25] who reported resistant of *E. coli* and *P. aeruginosa* to Sodium Hypochlorite 6% at 3000 $\mu$ g/disc, 3000, 5000 and 8000  $\mu$ g/disc. This was contrary to the findings of [16] also reported susceptibility of *P. aeruginosa*, *B. subtilis* to Sodium Hypochlorite with 17 and 15 zone of inhibition although they used 100% concentration. Among the all disinfectants tested, methylated spirit showed low resistant to all tested

The results of this study showed that, significant number of respondents ( $p \leq 0.05$ ) were aware about important of disinfectant usage, using different tools in the salons, disinfecting of tools before using, cleaning of tool(s) after used and washing hands /tools after shaving. However, significant number of respondent ( $p \leq 0.05$ ) were un-aware about important of biosafety guideline of usage

bacteria. This was in line with findings of [16] who reported susceptibility of methylated spirit against *P. aeruginosa* and *B. subtilis* with 20 and 22mm zone of inhibition. The lower resistant of methylated spirit found in this study could be link to the knowledge of salon operators as in this study its showed that most salons operators are knowledgeable about guideline designed by UNBS where it is recommend the usage of methylated spirit 70% as a disinfectant to use especially for basins and metal tools; this is also found during the study done by [16]. Proper cleaning of salons equipment using right concentration of disinfectant reduces the risk of developing resistant to these bacteria. This was contrary to the finding of [16] who reported 100% resistance of Methylated spirit at concentrations of 6.25%, 12.5% and 50% against *Bacillus subtilis* and *Pseudomonas aeruginosa* although the disinfectant (Methylated spirit) showed antibacterial activity at 100% concentrations.

The results of distribution of bacterial resistant base on salons type showed that Barbershops had the highest resistant bacteria 41.7% while Hairdressing/ladies salons had the least 14.3%. The higher resistant recorded from Barbershops than Hairdressing/ladies salons could be due the fact that, ladies take care of their hair than the men, in other words, ladies always make sure their hair is clean and used different kind of hair relaxers which may eliminate some of the bacteria associated with hair and skin infection.

## CONCLUSION

of different disinfectant and usage of heat on clipper as a disinfectant. Among 125 salons swabbed samples collected, 78 (65.5%) were contaminated with different bacterial species. clippers were found to have higher (25.6%) contamination among the salon tools studied. Sodium hypochloride 1% was the most resistant disinfectant among all disinfectant tested.

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