Original Research Article

Microorganisms associated with Barbers Clippers in Rivers State University and its Environs, Nigeria.

ABSTRACT

This study was carried out to isolate and identify microorganisms that are associated with barbers' clippers in some barbers' shops in Rivers State University and its environment. A total of thirty (30) samples were collected from the various barbing salons both within and around Rivers State University. Sterile swab sticks were used to obtain samples from the surface of the barbers' clippers and were immediately sealed to prevent contamination. Identification of the microorganisms after culturing was done using Gram staining technique and biochemical tests. Antibiotic susceptibility test was also carried out on the isolated bacteria using disc diffusion method. The result revealed that bacteria were present on the barbers' clippers. The bacteria isolated were *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus epidermis*, and *Klebsiella pneumonia*. *Staphylococcus aureus* was the most prevalent bacteria isolate while *Klebsiella pneumonia* and *Staphylococcus epidermis* were the least prevalent bacteria isolates, but there were no fungi isolates after fourteen days incubation. The antibiotic susceptibility test showed that *Staphylococcus aureus* was susceptible to ciproflox, erythromycin, levofloxacin, gentamycin and streptomycin; *Staphylococcus epidermis* was susceptible to most of the antibiotics but resistant to amoxil and norfloxacin; *Klebsiella pneumonia* was susceptible to gentamycin, streptomycin and nalidixic acid; while *Escherichia coli* was resistant to all antibiotics. This study has shown that barbers' clippers harbor bacterial organisms which can be potential pathogens and may promote the spread of infection to human. It is therefore recommended that barbers must properly sterilize their clippers before use on customers, to reduce the spread of infection.

Keywords: Microorganisms, Barbers, clippers, antibiotic susceptibility, infection.

1. INTRODUCTION

Barbers are important professional, as they own and manage individual shops in the community. The establishment of barbing salons in our locality have been on the increase, as majority are owned and controlled by people without adequate training and knowledge on infection procedures. Some researchers have shown that there is the possibility of customers returning home with one infection or the other despite the aesthetics in the barbing industry [1]. Barbing shops are personal service establishments, and such service may pose potential health concerns to their clients, including the risk of infections and sometimes injury [2, 3]. These health risks vary depending on the nature of service, tools, equipment used (knives, blades, clippers, brushes and combs), the health status of the clients and service providers as well as the implementation of infection control procedures. Infection can occur during hair barbing procedures since items such as razor, scissors, combs, and clippers can accidentally penetrate the skin and cause injuries, as the incurred injuries from these tools are clearly associated with bacteria, viral and fungal infection risks [4]. These infections can be transmitted to other clients if proper infection control procedures are not implemented, because blood and other body fluids are not supposed to be visible on instruments, equipment or working surfaces as they aid the transmission of infecting agents. It has been noted that there are areas of the body that fungal infections especially *Tinea capitis* and ringworm from the barbering salon equipment affect easily that makes it to spread faster, and they are the skin, scalp, face and neck [5]. Microorganisms are continually been introduced into the environment and could therefore, be easily spread between clients and

operators by contact with unwashed hands, and contact with blood and other body fluid soiled equipment [6].

The human hair is one part of the human body that is always exposed to environmental pollutants. The equipment used by barbers are always prune to contamination after usage on customers hairs, and they are always subjected to very poor sterilization methods which includes disinfecting with non-strong disinfectants and use of flaming with lighter. Some of the materials such as the brushes, coverups on clients clothing are never sterilized, while some are sterilized, but the sterilization efficacy is questionable since customers still get infected after salon visits [7]. Studies have revealed that there are factors that affect disease transmission, which are personal hygiene, overcrowding, and low socioeconomic status, too, shed hairs are known to harbor infectious fungal agents for long period since their rate of degradation lasts for up to a year, and the rate of eradication of disease is difficult due to asymptomatic carriers and barbering operations are still under little or no scrutiny despite the possible risk of spreading infectious diseases [8, 9]. Fungal infections have become important clinical condition that deserves public attention because some of them are potentially harmful to human health. Keratinophilic fungi are usually isolated from the soil and the keratinous tissues of the human body such as the skin, hair and nails.

Bacteria are known to reside in the hair follicles, and about 85% of the population are found in the superficial layer of the skin and hair follicles [10]. Barbers' shops are classified as personal services establishments and may pose potential health concerns to their clients including the risk of infection and sometimes injury. These health risks vary depending on the nature of service, tools and equipment used, the health status of the clients and service providers as well as the infection control procedures. The equipment used may clearly be associated with bacteria and fungi infection risks as the human hair is also a reservoir of bacteria including *Staphylococcus intermedius* and coagulase negative *Staphylococci* and *Staphylococcus aureus* [11].

In barbers' shops there is frequent use of blades often without proper sterilization and the clients' face, skull and skin can be scratched or cut by sharp equipment during shaving and shaping of the hair [12]. In several countries shared shaving equipment in barbershops is commonly practiced. Accidental scratch by sharp equipment in barbershops may create opportunity for microorganisms, mainly HIV and other blood borne pathogens, to enter into the body causing serious health problems to the clients [13]. It is believed that any service with the potential to cause skin abrasion can be associated with infections which can be transmitted to other clients if proper infection control procedures are not implemented [14].

The establishment of barbing saloons in Rivers State is steadily on the increase because their establishment is not regulated, as there is a steady increase in the establishment of new ones. Background knowledge on infectious disease control which should be a prerequisite for saloon operators is lacking to the majority of these saloon owners and operators. Known for its aesthetic

activity, research however shows the possibility of it making its patrons feel sick by the acquisition of contagious diseases after visiting the saloon [1]. All individuals (male and female) have approximately 300,000 hairs on their scalp with a growth rate of approximately half an inch per month. Therefore, there should be monthly visits to the barbing saloon for a haircut. The advent of electric clippers for barbing operations replaced the traditional use of razor blades and other sharp objects following technological advancement [15]. The inappropriate disinfection or sterilization methods used in many barbing saloons and the re-use of barbing equipment has heightened the concern regarding communicable diseases associated with the scalp. The use of kerosene, diesel, ethanol, fuel, and other cleaning agents for the sterilization of clippers, combs, and brushes is common practice among barbers in Nigeria. Bacterial infections such as impetigo-like lesions have been reported to be infections associated with barbing operations.

Opportunistic pathogens are usually present in non-living cornified layers of the skin and its appendages [16]. Host resistance and the inoculum size are major determinants in the establishment of a microbial infection during barbing. Although, the severity of the infection depends mostly on the immunologic status of the host. Many bacteria species live as normal flora of the skin and mucous membranes of humans with *Staphylococcus aureus* being one of the most important and pathogenic species. Some other bacteria species including *S. epidermidis*, are considered commensals, or normal residents of the skin surface. Even though they are harmless in most individuals, the bacteria are capable of causing various infections of the skin and other organs, abrasions on the skin are a predisposing factor for these infections [17].

The scalp, like the skin, is prone to infections from many different types of infectious agents. Fungal and bacterial infections are by far the most common, and the scalp is in fact more at risk of infection most times. A combination of factors like unwashed hair, over reactive oil glands, harsh hair treatments, perspiration and may other factors increase the risk of infections of fungal organisms such as dermatophytes(ringworm) and yeasts, bacterial organisms such as scalp folliculitis (associated with scalp acne) and others. The aim of this study is to detect microorganisms associated with barbing tools and equipment and their sterility. The result of the work has shown that barbers' equipment is not free from microorganisms irrespective of the method used for sterilization.

2. MATERIALS AND METHODS

2.1 Study Area

This research work is a cross-sectional study that was carried out around Rivers State University and its environs. The samples were obtained from the Rivers State University Shopping Complex Barbering Saloons, the University Main gate, the Agip Road Barbing Saloons and other Saloons located in Diobu area (Back gate). Most of the samples involved in this study were collected from the male gender who frequent the different barbing saloons regularly. The study area is Rivers State University and its Environs and are located within the Port Harcourt Metropolis

with over 1 million population within Latitudes $4^{O}43'07''$ and $4^{O}54'32''$N and Longitudes $6^{O}56'04''$ and $7^{O}03'20''$E.

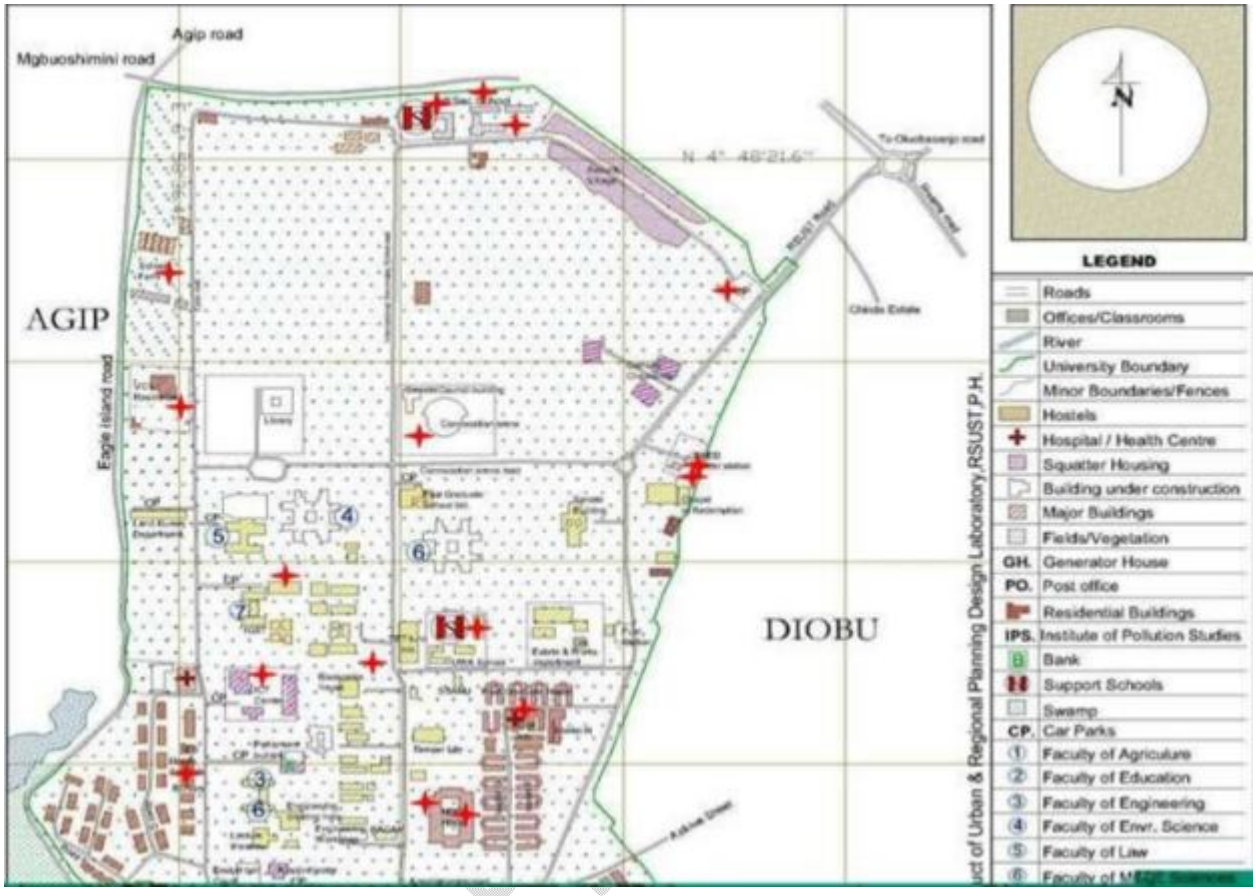

Figure 1: Map of Rivers State University and its Environs [18].

2.2 Study Population

A total of Thirty (30) Barbering shops were selected for this study after they have been identified and located. The selected areas and barbering shops were visited and the individuals briefed on the purpose of the research as dates were fixed for sample collection.

2.3 Eligibility of Subjects

2.3.1 Inclusion Criteria for Test Samples

Only those willing to provide at least written consent were included in the study and the barbers must be within Rivers State University Campus and its environs.

2.3.2 Exclusion Criteria for Test Samples

The following individuals were excluded as subjects for the study. People not residing around Rivers State University and Individuals who did not consent to the study.

2.3.3 Sample Collection Methodology

The samples were collected from each client using a labeled wet sterile swab stick from the combs, clippers and brushes, and transported immediately using cold chain to the Microbiology Laboratory in the Department of Medical Laboratory Science in the University for culture and they were treated using standard method of culturing [2]. The samples were collected from three different locations with barbing saloons in the Rivers State University particularly at the University Main gate, Back gate and Shopping Complex and Environs.

2.3 Preparation of Media

The media used were Nutrient, Chocolate, MacConkey and Sabouraud Dextrose Agar and they were prepared according to the manufacturer's specification by weighing out the required weight and dissolving it in the required volume of water in conical flask and were autoclaved at the temperature of $121^{O}C$ for 15minutes after which each media was poured into different culture plates and were allowed to stand and set. The culture plates were dried using a hot air oven before the samples were cultured on them.

2.4 Inoculation

Nine culture plates were prepared from each of the culture media, as a swabbed stick was aseptically inoculated on each plate in order to uniformly spread the samples on the plates using streak plate technique. The plates were incubated at $37^{O}C$ for 24hours for bacteria and 5-7 days for fungi at room temperature. The isolates were sub-cultured to have a pure strain of the organism used for biochemical test. The identification of the isolates were subjected to Gram staining and other biochemical tests which were catalase, coagulase and others.

2.5 Biochemical Test

2.5.1 Gram Staining

A smear was made of each of the test organism and was allowed to air dry. On this was covered with crystal violet solution and allowed to act for 30 seconds. The stain was poured off holding the slide at an angle downward and iodine solution was poured over the slide and this served as a mordant and was allowed for about 30secs. The crystal violet and iodine mixture were decolorized with alcohol and washed off with water until the colour stopped to come out. Safranin was applied for 1-2 minutes, and it was washed off with water, as the slide was dried

between blotting paper. All the prepared smears were examined under the microscope using the oil immersion objective (x100 objective) [13].

The biochemical tests were carried out for the identification of the isolated bacteria and they were catalase, oxidase, coagulase, indole and others.

2.5.2 Catalase Test

This test distinguishes bacteria that has the ability to produce catalase enzyme from the ones that cannot produce this enzyme as they have the ability to hydrolyze hydrogen peroxide to water and hydrogen.

Procedure: Two drops of 3% hydrogen peroxide were placed on a clean grease free microscope slide. A sterile wire loop was used to pick a bacteria colony from the culture medium and emulsified in the 3% hydrogen peroxide on the microscope slide. Observation for the presence or absence of gas evolution was carried out and results were recorded. This was repeated for the rest of the isolates obtained as catalase positive organism showed the evolution of gas[13].

2.5.3 Oxidase Test

A small part of filter paper was soaked in 1% Kovács reagent and was allowed to dry. A sterile loop was used to pick an isolated colony from a fresh sub-cultured (18- to 24hour) bacteria plate and was rubbed onto the treated filter paper. This was observed for color change, as an oxidase positive color changes to dark purple within 5 to 10 seconds. This was done for the isolates that were Gram negative and the results were recorded accordingly[13].

2.5.4 Coagulase Test

A zero point five **(**0.5ml) of normal saline was dropped on a clean slide labeled with sample numbers, test (T) and control (C). The test organism using a sterile wire loop were picked and emulsified in the normal saline on the labeled slide, after which a drop of plasma was placed on the emulsified saline, dropped corresponding to the test, it was then properly mixed and rocked gently for about 10secs. If positive, macroscopic clumping would be observed. If negative, no clumping was observed. This test will be done to distinguish *Staphylococcus aureus* (pathogenic) from non-pathogenic *Staphylococci* and the results were recorded[13].

2.5.5 Indole Test

Four (4ml) millilitres of sterile peptone water was drawn with a sterile pipette and discharged into a clean test tube, and the test organism was inoculated into it, and incubated for 24hours at 37^{O}C. A drop of Kovac's reagent was added to it and the reaction was observed. A red ring formation at the surface of the tube was an indication of a positive test while yellow indicative of a negative result and the results were recorded[13].

2.5.6 Motility Test

The motility test is used to determine if the bacteria is motile or non- motile by moving away from the line of inoculation. A semi solid agar medium was prepared in a test tube. The medium was inoculated with a straight wire loop, making a single stab down at the center of the tube to about half of the depth of the medium. It was incubated at 37^{O}C for 24hours, if a bacterium was motile, there will be growth going out away from the stab line, and test is positive. This test was done to know if an organism is motile or not[13].

2.6.7 Sugar Fermentation Test

Five (5ml) millilitres of distilled water was pipetted and discharged separately into two sets of test tubes. Phenol red was added into each test tube to give red colour. Glucose and Lactose were added into each test tube with phenol red indicator. A sterile wire loop was used to pick the colony of the isolates into each of the test tube containing glucose and lactose. It was covered with cotton wool and incubated at 37^{O}C for 3days[13].

2.6 Antimicrobial Susceptibility Testing

Many bacteria are resistant to commonly used antibiotics, this means that the drugs can't kill the bacteria, sensitivity analysis is a useful tool to help quickly determine if bacteria are resistant to certain drugs. The Kirby-Bauer agar diffusion method is well documented and is the standardized method for determining antimicrobial susceptibility.

2.6.1 Procedure: White filter paper disks (6 mm in diameter) were impregnated with known amounts of antimicrobial agents. Each disk was coded with the name and the concentration of the agent. The concentrations of 10µg of Ampicillin was indicated on the disk by AM-10. The impregnated disks were picked and placed on an inoculated Mueller Hinton Agar or Nutrient Agar, the antibiotics diffused through the agar and was incubated for 16-24 hours. The diameter of the visible zone of inhibition was measured and compared to reference values, there should be sufficient bacteria to form a visible lawn of growth where it is not inhibited by the drug. The results were interpreted qualitatively as Resistant, Intermediate or Susceptible[13].

3. RESULTS

3.1 Microorganisms Isolated from the Barber's Clippers

The result of the prevalence of bacteria on barbers' clippers from the different barbers' shop is presented in table 1. *Staphylococcus aureus* (70%) was the most widely distributed bacteria isolate while *Klebsiella pneumoniae* and *Staphylococcus epidermis* (6.67% each) were the least prevalent.

Table 1: Microorganisms Isolated from the Barber's clippers

Organism	Number Isolated	Frequency (%)
Staphylococcus aureus	21	70
Escherichia coli	5	16.66
Klebsiella Spp	2	6.67
Staphylococcus epidermis	2	6.67

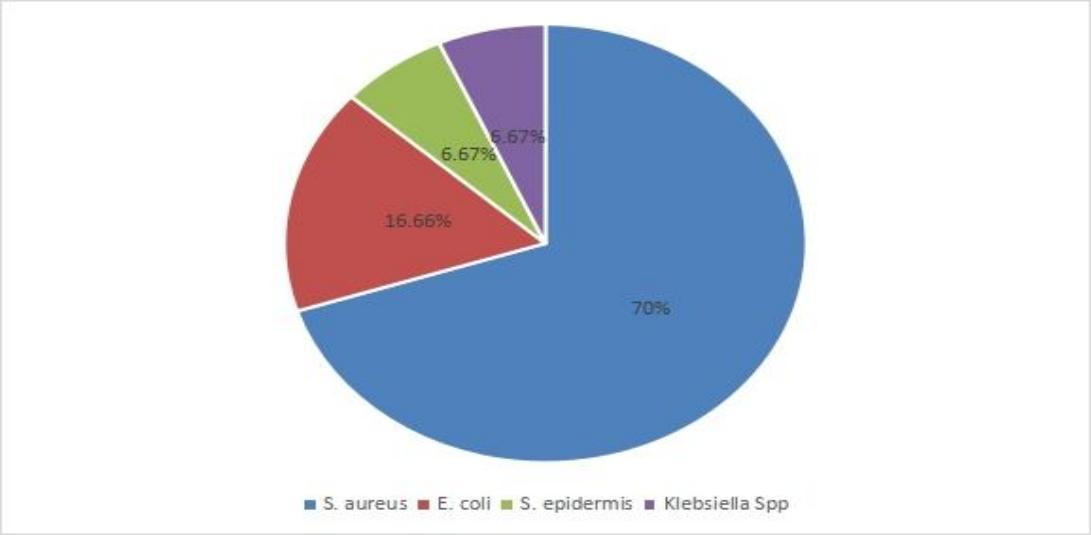

Figure 2: Percentage of Each Microbial Growth

3.2 Antibiotic Susceptibility Testing

The result for the antibiotic susceptibility pattern of Gram positive bacterial isolates from barbers' clippers is shown in Table 2. The results showed that *Staphylococcus aureus* was resistant to Ampiclox, Rifampicin, Amoxil, Norfloxacin, and Chloramphenicol; while *Staphylococcus epidermis* was resistant to Amoxil and Norfloxacin.

Table 2: Antibiotic Susceptibility Testing for Gram Positive Isolates

Isolate	Antibiotics									
	CPX	**E**	**LEV**	**CN**	**APX**	**RD**	**AML**	**S**	**NB**	**CH**
Staphylococcus aureus	S	S	S	S	R	R	R	S	R	R
Staphylococcus epidermis	S	S	S	S	S	S	R	S	R	S

Key:

CPX = Cciprofloxacin, E = Erythromycin, LEV= Levofloxacin, CN= Gentamycin APX= Ampiclox, RD= Rifampicin, AML= Amoxil, S= Streptomycin, NB= Norfloxacin, CH= Chloramphenicol.

The result for the antibiotic susceptibility pattern for Gram negative bacteria isolates from barbers' clippers is shown in Table 2. The results showed that *Klebsiella spp* was resistant to Tarivid, Reflacine, Ciprofloxacin, Augmentin, Ceporex, Septrin and Ampicillin, while *Escherichia coli* was resistant to all test antibiotics.

Table 3: Antibiotic Susceptibility for Gram Negative Isolates

Isolate	Antibiotics

	CPX	SXT	S	PN	CEP	OFX	NA	PEF	CN	AU
Klebsiella Spp	R	R	S	R	R	R	S	R	S	R
Escherichia coli	R	R	R	R	R	R	R	R	R	R

OFX = Tarivid; PEF= Reflacine; CPX= Ciprofloxacin; AU= Augmentin; CN= Gentamycin; S= Streptomycin; CEP = Ceporex; NA= Nalidixic Acid; SXT = Septrin; PN= Ampicillin

4. DISCUSSION, CONCLUSION AND RECOMMENDATION

4.1 Discussion

This study was conducted to isolate and identify microorganisms associated with the barber's clippers, and it has shown that there are bacteria found on clippers with the isolation of some bacteria. The different bacteria isolates from this study are as presented in table 1, and were *Staphylococcus aureus*, *Escherichia coli*, *Staphylococcus epidermis* and *Klebsiella spp*. The presence of these bacteria agrees with similar study by Eribo *et al*., [19], who isolated *Staphylococcus aureus*, *Klebsiella pneumonia, Escherichia coli*, and *Pseudomonas aeruginosa*, while, in another study by Mbajiuka *et al*., [14], they isolated *Staphylococcus aureus, Streptococcus spp.* and *Micrococcus spp* on the barber's tools. In the study by Enemour *et al*., [20] bacteria were also isolated from other tools used by the barbers such as combs, brushes, clippers and apron, and they include *Streptococcus spp, Staphylococcus aureus*, *Enterococcus spp, Staphylococcus epidermis,* and *Enterobacterium spp*. Their findings have shown that bacteria are associated with the different tools used by the barbers which agrees with this study, but however, bacteria such as *Pseudomonas aeruginosa, Streptococcus spp, Enterococcus spp*, and *Enterobacterium spp* were not found in the barber's clippers used in this study. Bacteria such as *Staphylococcus aureus* isolated from barbers' clipper including the ones found in this study has the ability to cause various pus-forming infections in humans such as boils, carbuncles, folliculitis, impetigo contagiosa and scalded-skin syndrome [14]. The prevalence of this bacteria on the clippers could probably be due to the use of non-potent disinfectants, sterilization technique and improper handling of barbering tools. Consequently, this study has revealed that the barbering procedures and tools, particularly in the study area present the risk of bacterial infections and a public health challenge.

In another study by Ebuara *et al.*, [21] *Staphylococcus aureus* and *Aspergillus spp* were the predominant organisms on the clippers, although *Streptococcus spp*, *Trichophyton spp*, and *Malasessa spp* were also isolated from the clippers. Of these organisms, only *Staphylococcus aureus* was isolated in this present study. The reason for this may be due to geographical differences, as some organisms are more prevalent in one area, and less prevalent in another, based on different conditions.

This present study was carried out in two different settings which are the Metropolitan and an educational settings, because it was conducted in a University campus and its' environs. Meanwhile, earlier study by Enemour *et al*., [20] and Mbajiuka *et al*., [14] were conducted in educational settings, while the study by Ebuara *et al*., [21] was conducted in a Metropolitan area. These different studies and the present study have shown that different bacteria isolates such as *Enterobacter spp*, *Bacillus spp*, *Pseudomonas aeruginosa*, and *Streptococcus spp* can be found on the barber's tools and these bacteria survived due to favourable conditions.

The Gram positive bacteria isolated from this study were *Staphylococcus aureus* and *Staphylococcus epidemis*. From the results of this study, *Staphylococcus aureus* was the most widely distributed bacterial isolate (70%). This finding corresponds with the research done by Eribo *et al*., [19] who also found *Staphylococcus aureus* as the most widely distributed bacteria in his study. While we found *Staphylococcus epidermis* in very small proportion (6.67%), and this also corresponds with other studies that have been conducted in other parts of the country.

The Gram negative bacteria isolated from this study were *Escherichia coli* and *Klebsiella pneumonia*. In our study, we found Escherichia coli (16.66%) was more prevalent than *Klebsiella pneumoniae* (6.67%), which is also in agreement with the findings of Eribo *et al.,* [19] and due to the presence of these bacteria, it is revealed that the current disinfection techniques used at each barbing salon were inadequate in preventing health risks among clients. It has been observed that sterilization techniques differ between service providers with 38% reporting the use of ultrasonic cleaners, all of which are not approved method of sterilization in many jurisdictions [22].

Sabouraud Dextrose Agar (SDA) was used for the isolation, cultivation, and maintenance of non-pathogenic and pathogenic species of fungi and yeasts. From this study, no fungi growth was observed on the SDA plates, and showed that no yeast or fungi was found. This may be due to the level of sterilization of the clippers by the barbers to eliminate the presence of fungi, especially if the presence of moisture is reduced by their techniques. This finding does not correspond with other studies that have been carried out in other parts of the country, especially the study by Ebuara *et al*., [21]. However, the study by Ebuara *et al*., [21] showed that the most contaminated of all barbing equipment are the combs and brushes, followed by the clipper step, and explained that this is so because most barbing shops do not employ any standard sterilization procedure on brushes, combs and clipper steps which on its own is grossly inadequate and insufficient to prevent microbial contamination. The barbing tools (combs, brushes, and aprons)

were also found to contain some microorganisms in the study by Enemour *et al*., [20] and Eribo *et al*., [19].

The antibiotic sensitivity test as performed in this study was to ascertain the effectiveness of antibiotics in the treatment of the infections transmitted by the barber's equipment. The bacterial isolates demonstrated slightly varied patterns of sensitivity to antibiotics which should be one of the reasons to maintain sanitary and hygienic conditions with the barbing equipment. The result for the antibiotic susceptibility pattern of Gram positive bacterial isolates from barbers' clippers showed that all isolates of *Staphylococcus aureus* were resistant to Ampiclox, Rifampicin, Amoxil, Norfloxacin, and Chloramphenicol; while *Staphylococcus epidermis* was resistant to Amoxil and Norfloxacin. The result for the antibiotic susceptibility pattern of Gram negative bacterial isolates from barbers' clippers showed that *Klebsiella* spp was resistant to Tarivid, Reflacine, Ciprofloxacin, Augmentin, Ceporex, Septrin and Ampicillin, while *Escherichia coli* was resistant to all test antibiotics. David *et al*., [23] suggested a way forward to controlling infection transfer in barbers' shop to include calling the attention of public health workers concerned to enforce sterilization of saloon equipment nationwide. Also, standard sterilization equipment such as UV sterilization chamber must be put in place in all saloons and sensitization of saloon customers of the related health hazards.

4.2 Conclusion

This study has demonstrated that barber clippers contain germs that may be harmful and may aid infection spread to humans. The use of ineffective disinfectants, incorrect sterilizing practices, and careless handling of barbering equipment may all be contributing factors to the presence of these germs on clippers. As a result, this research has shown that using barbering tools and techniques, particularly in the study area, increases the risk of bacterial infections. In order to prevent the transmission of illness, barbers must sanitize their hair clippers and other barbering equipment before using them on their clients.

4.3 Recommendation

Based on the outcome of this study, the following recommendations are suggested.
The government at Federal, State and Local levels should establish regulations, guidelines and best practices for salons operating in the country. There should be specific infection control practices and implementation of the practices and appropriate measures should be put in place to prevent the spread of infections via salons. All equipment must be cleaned (washed in hot soapy water) before disinfection or sterilization, to remove organic matter and other residue, which may cause a layer of build-up that prevent disinfection or sterilization. Equipment that comes into contact with the skin must be cleaned before reuse whether or not it looks dirty. Equipment should be thoroughly cleaned at least once a day and immediately. Equipment that comes into contact with the skin must be cleaned before reuse whether or not it looks dirty. Equipment should be thoroughly cleaned at least once a day and immediately after contamination with

blood. Fresh disinfection solution should be prepared daily and the container thoroughly cleaned before refilling.Bench top sterilizers and the most effective means of sterilizing equipment. This will go a long way to reduce microbiological and other potential hazards associated with the services of hair barbing.

Consent

As per international standard or university standard, Participants' written consent has been collected and preserved by the author(s).

Ethical Approval

The ethical approval for this study was obtained from the ethical committee of Rivers State University Teaching Hospital, Port Harcourt.

REFERENCES

[1] Kondo, M., Nakano, N. & Shiraki, Y. (2010). A chinese Japanese boy with black dot ringworm due to *Trichophyton violaceum*. *Journal of Dermatology,* 33(3), 165-168.

[2] Adeleye, I. A. & Osidipo, O. O. (2014). Isolation and characterization of microorganism from instrument used by Pedicurists operatin within Larger Metropolis, Nigeria. *West India Medical Journal,* 53(7), 413-415.

[3] Bam, P. & Chen. T. (2011). Infections associated with personal service establishments: Aesthetics. National collaborating Centre for environment health. 1-10.

[4] Stout, J. E., Gadowski, L. B., Rath, S., Alspaugh, J. A., Millar, M. B. & Cox, G. M. (2011). Pedicure associated rapidly growing mycobacterial infections and disease. *Journal of Clinical Infectious Diseases*, 53(9), 787-792.Vallarelli, A. F. A. (2014). Goya and *Tinea favosa*. *Brazilian Annals of Dermatology*, 89, 992–994.

[5] Amodio, E., Benedetto, M. A., Gennaro, L., Maida, C. M. & Romanu, N. (2010). Knowledge, attitudes and risk of HIV, HBV and HCV infections in hairdressings of Palermo city. *Europe Journal of Public Health*, 20(5), 33-437.

[6] De Souza, B. A. & Shibu, M. M. (2014). Infections and respiratory hazards of Naclsculpture plast. *Reconstructive Surgery*, 114(3), 1004-1008.

[7] Mase, K., Hasegawa, T., Horii, T., Hatakeyama, K., Kawano, Y., Yamashino, T. & Ohta, N. (2010). Firm adherence of *Staphylococcus aureus* and *Staphylococcus epidemidis* to human hair and effect of detergent treatment. *Journal of Microbiology & Immunology*, 44(8), 653-656.

[8] Pai, V. V., Hanumanthayya, K., Tophakhane, R. S., Nandihal, N. N. & Kikkeri, N. S. (2013). Clinical study of *Tinea capitis* in northern Karnataka: a 3years experience at a single institute. *Indian Journal of Dermatology*, 4(1), 23-26.

[9] Ayanbimpe, G. M., Taghir, H., Diya, A. & Wapwera, S. (2008). *Tinea capitis* among Primary School Children in Some Part of Central Nigeria. *Journal of Mycoses*, 51(4), 336-340.

[10] Lange-Asschenfeldt, B., Marenbach, D., Lang, C., patzelt, A., Ulrich, M., Maltusch, A., Terhorst, D., Stockfleth, E., Sterry, W. & Lademann, J. (2011). Distribution of bacteria in the epidermal layers and hair follicles of the human skin. *Journal of Skin pharmacology & Physiology*, 24(6), 305-311.

[11] Jape, U., Schroder, K., Zillikens, D. & Petzoldt, D. (2013). Tuft hair folliculitis associated with pemphigus vulgaris. *Journal of European Academy of Dermatology and Venereology*, 17(2), 223-236.

[12] Fantahu, B., Yeshambel, B., Belay, A., Desalegn, W., Feleke, M., Asegedech, B. & Andargachew, M. (2009). Efficacy evaluation and assessment of knowledge, attitude, and practice among barbers on proper sterilization and disinfection of sharp equipment regarding HIV transmission in Gondar and Bahir Dar towns, Northwest, Ethiopia. *BioMedical Central Journal*, 25(9), *1-28.*

[13] Cheesbrough, M. (2000). Laboratory practice in Tropical countries. Cambridge University Press, United Kingdom, 49-50.

[14] Mbajiuka, C.S., Obeagu, E.l., Ochei, K.C. & Iheke, S.O. (2014). Evaluation of Microbial Contamination of tools used in hair dressing salons in Michael Okpara University of Agriculture, Umudike, Abia State. *IOSR Journal of Dentistry and Medical Science*, 3(1), 22-27.

[15] Mackenzie, D. W. R., Loeffler, W., Mantovani, A. & Fujikura, T. (2005). Guidelines for the Diagnosis, Prevention and Control of Dermatophytosis in Man and Animals. World health Organization. Geneva, Switzerland.

[16] Kligman, A. M., Montagne, W., Ellia, R. A. & Silver, A. F. (2011). Advances in Biology of the skin, The Sebaceous Glands. Oxford. *Pergamon Press*, 110-124.

[17] Ryan, K. J. & Ray, C. G. (2014). An Introduction to Infectious Diseases, New York: McGraw Hill. *Sherris Medical Microbiology*, 5-7.

[18] Google. (2020). [Google Maps Rivers State University, Port Harcourt, Rivers State]. Retrieved December 4, 2020.

[19] Eribo, O. A., Ebiala, I. F., Oyedoh, P. O. & Oshodin, O. S. (2017). Bacteriological Assessment of Barbers Clipper in Barbers' Shops in Ugbowo, Benin City. *African Scientist*, *18*(4), 223–226.

[20] Enemour, S.C., Atabo, A.R. & Oguntibeju, O.O.O. (2012). Evaluation of microbial hazards in barbers' shops in a university setting. *Science Research Essay*, 7(9), 1100-1102.

[21] Ebuara, F.U., Imarenezor, E.P.K., Brown, S.T.C., Aso, R.E., Obasi, B.C. & Tyovenda, E.T. (2020). Isolation and identification of pathogenic microorganisms associated with barbers' equipment in Taraba state, Nigeria. *Trends in Science and Technology*, 5(1), 215-218.

[22] Rideout, K. (2010) *Comparison of Guidelines and Regulatory Frameworks for Personal Services Establishments*. Vancouver, BC: National Collaborating Centre for Environment Health. Available from: www.ncceh.ca. Accessed October 2, 2022.

[23] David, D.L., Edward, A., Zaruwa, M. & Addass, P.A. (2010). Barbing saloon associated fungal disease infection in Mubi, Adamawa State.Nigeria. *World Journal of Medical Science*, 5(1), 17-21.