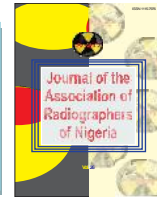




Contents lists available at

**Journal of Association of Radiographers of Nigeria**

Journal homepage: [www.jarn-xray.org](http://www.jarn-xray.org)



## **X-ray Equipments and Accessories as possible Vectors of Nosocomial Bacteria in Anambra State, Nigeria.**

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### **ARTICLE INFO**

#### **Article history**

Received July 26, 2012;  
Revised August 30, 2012;  
Accepted September 6, 2012;  
Available online, 2012

#### **Keywords:**

Nosocomial, Bacteria,  
infection, X-ray  
equipment, Culture

### **ABSTRACT**

**Background of Study:** Nosocomial infections have become a major challenge in health institutions, as they affect the quality of health care delivered. The radiology department is one of the mainstays of modern medicine. It is therefore necessary to assess its role in the spread of nosocomial infections.

**Aim:** To assess the presence and specie of nosocomial bacteria on x-ray equipments and accessories as well as their prevalence in public and private hospitals in Anambra state.

**Method:** Sterile swab sticks were used daily to swab the surfaces of selected x-ray equipments and accessories, at the close of work in public and private hospitals in Anambra State. MacConkey and Blood agar media were used to prepare the culture media. The prepared media were put in petri dishes and swab samples were inoculated onto the culture plates. Culture plates were then incubated for 24 hours, at a temperature of 37°C. Bacterial identification was done microscopically under bright light based on their colonial characteristics.

**Results:** Bacteria were isolated in 43/50 (86%) samples collected. Bacteria isolated were; *Staphylococcus aureus* (36.1%), *Pseudomonas aeruginosa* (22.7%), *Proteus spp* (7.2%), *Streptococcus* (13.4%), and *Coliform spp.* (20.6%). X-ray cassettes had the highest bacterial load followed by X-ray tube handles and couch.

**Conclusion:** Radiology equipment and accessories in Anambra State have high bacterial load and therefore are potential sources of nosocomial infection.

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## INTRODUCTION

Nosocomial infections are those acquired in the hospital by a patient who was admitted for a reason other than that infection<sup>1</sup>. It may also be seen as an infection occurring in a patient, in a hospital, or other health care facility; in whom the infection was not present or incubating at the time of admission. This includes infections acquired in the hospital but appearing after discharge; and also occupational infections among staff of the facility<sup>2</sup>. Nosocomial infections are increasingly becoming of great concern to health care providers and institutions, as they affect the quality of health care delivery<sup>3-5</sup>. Approximately about two million nosocomial infections occur annually in the United States of America<sup>6</sup>. This has resulted in considerable mortality, morbidity and cost in the population<sup>7-8</sup>. A healthcare environment increases the risk of infection for two primary reasons. First, it is likely that normally sterile body sites will become exposed, allowing pathogens to cause infections through contact with mucous membranes, non-intact skin and internal body areas. Secondly, the likelihood of a susceptible host is high because of the vulnerable health status of patients. The risk of nosocomial infection is therefore an unavoidable part of daily patient care<sup>9</sup>. The radiology department is considered one of the central areas for spread of nosocomial infections due to an appreciable number of patients who visit the department for various examinations<sup>10-13</sup>. The organisms causing most nosocomial infections may

come from the patient, contaminated instrument and the environment. In the radiology department, they are likely to be transmitted through contact with staff, equipment and accessories during positioning and hands on approach as well as droplet. Some of the infective organisms are airborne and others iatrogenic<sup>14-15</sup>. *Staphylococcus* and coliform colonies have been observed on x-ray couches and erect buck, cassettes, and intensifying screens<sup>11,16</sup>. Gram positive bacteria and fungi have also been isolated from anatomical markers<sup>17</sup>. Colonies of *K. Pneumonia*, *E. coli*, *micrococcus species*, *E. faecalis*, *S. Epidermidis*, *Staphylococcus species*, and *Streptococcus species*, *Klebsiella spp* have also been isolated from cassettes, barium preparation sites, lead rubber sheet and aprons, portable trays, wheel chairs and stretchers<sup>18-19</sup>. Surfaces touched by radiographers are also reported to be infected by *Klebsiella spp*.<sup>10</sup>. Hospital-acquired infections add to functional disability and emotional stress of the patient and in some cases, lead to disabling conditions that reduce the quality of life. Nosocomial infections are also one of the leading causes of death and their economic costs are considerable<sup>7</sup>. To prevent further infections, improve lifestyle and reduce cost, it is necessary to study possible sources of nosocomial infections in the X-ray department.

This study sought to assess the presence and specie of nosocomial bacteria on x-ray equipments and accessories as well as their prevalence in public and private hospitals in Anambra state, Nigeria.

## RESEARCH METHODOLOGY

About 50 swab samples were collected from X-ray departments of public and private hospitals in Anambra state of Nigeria (25 Public, 25 private) after close of work. Swab samples were collected from head and tail ends of X-ray couches, middle area of erect bucky and chest stands, X-ray tube head handles, exposure knobs, top surface of control consoles, middle area of X-ray cassettes, and inside surface of anatomical markers [Figure 1]. Swab samples were labelled and sent to a microbiology laboratory for culture and analysis. Culture media (MacConkey and Blood agar) were prepared according to manufacturer's instruction. MacConkey agar preparation was done by putting a weighted quantity of agar powder in a conical flask, adding

appropriate quantity of distilled water and stirring until homogeneity was achieved. The conical flask was covered with cotton wool and put in to the autoclave. It was then heated for 15 minutes at a temperature of 121<sup>0</sup>c to sterilize the medium. The media was afterward poured into petri dishes after cooling to 47<sup>0</sup>C. Culture plates were covered and allowed to set for inoculation of the samples. A similar procedure was also used for blood agar preparation. Aseptic procedure was then observed in inoculation of the swab samples. Culture plates were then incubated for 24 hours at a temperature of 37<sup>0</sup>c. The plates were later examined microscopically under bright light and organisms identified and isolated based on colonial characteristics. Data was analysed using simple frequency distribution.



Figure 1 Procedure for data collection with swabs on cassette (left), exposure button (middle) and anatomical marker (right)

Table 1: Overall Number of Samples Collected and the Number of Growth Recorded.

Samples.	Public Hospitals	Private Hospitals	Total (Percentage)
<b>Total Number of Samples</b>	25 samples	25 samples	50 samples (100%)
<b>Number of Samples with Growth</b>	24 samples (48%)	19 samples (38%)	43 samples (86%)
<b>Number of Samples without Growth</b>	1 sample (2%)	6 samples (12%)	7 samples (14%)

**RESULTS**

Results show an 86% (48%, public and 38%, private) bacterial growth for all hospitals studied. About 24/25 (96%) samples had bacterial growth in public

hospitals and 19/25 (76%) in private hospitals [Table1]. Bacteria isolated were *Staphylococcus aureus* 36.1%, *P. aeruginosa* 22.7%, *Coliform* 20.6%, *Streptococcus* 13.4% and *Proteus* 7.2% [Figure 5].

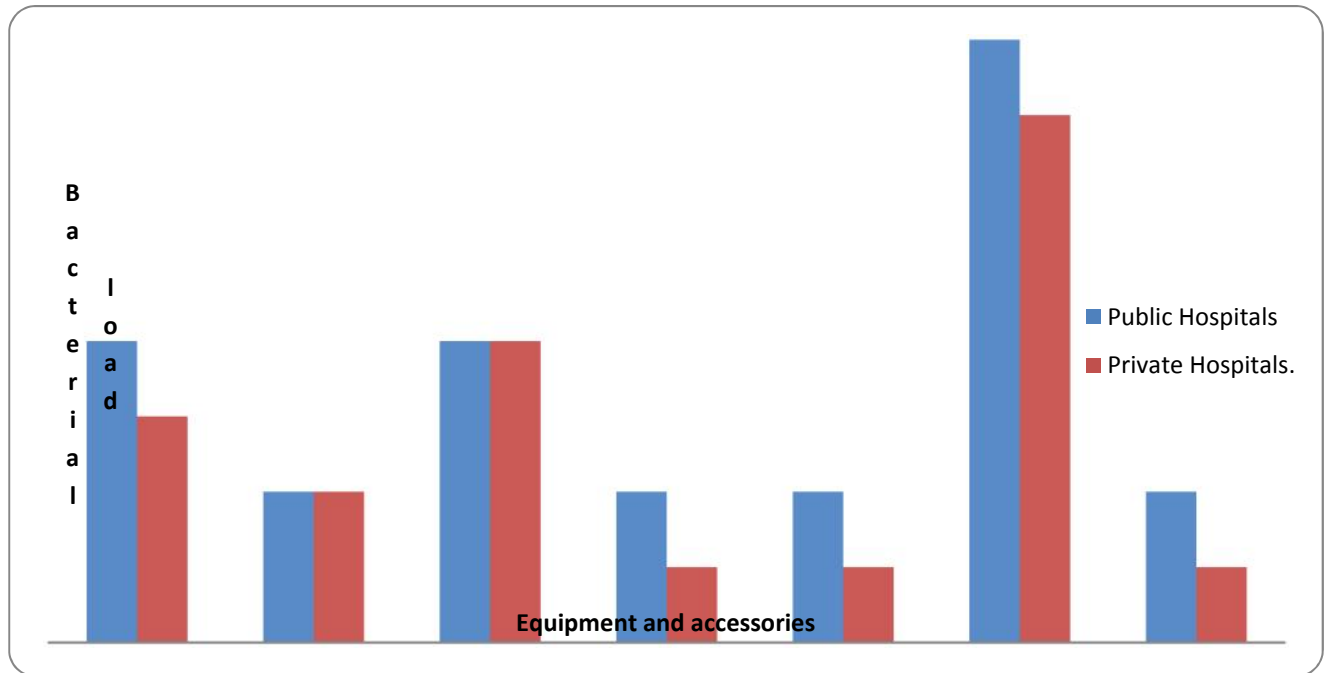


Figure 2: Distribution of bacterial loads on equipment and accessories

A higher percentage of *P. Aeruginosa* (68.2%) was found in public than private hospitals (31.8%) while a higher percentage of *Coliform* (55%) was observed in private above that in public hospitals (45%) [Figure 3]. Bacterial load was more on X-ray cassettes

followed by the X-ray couch with *S. Aureus* forming bulk of it. This was closely followed by *P. aeruginosa* and *coliform*. No *Proteus spp* and *P. aeruginosa* were found on the control console [Figure 4].

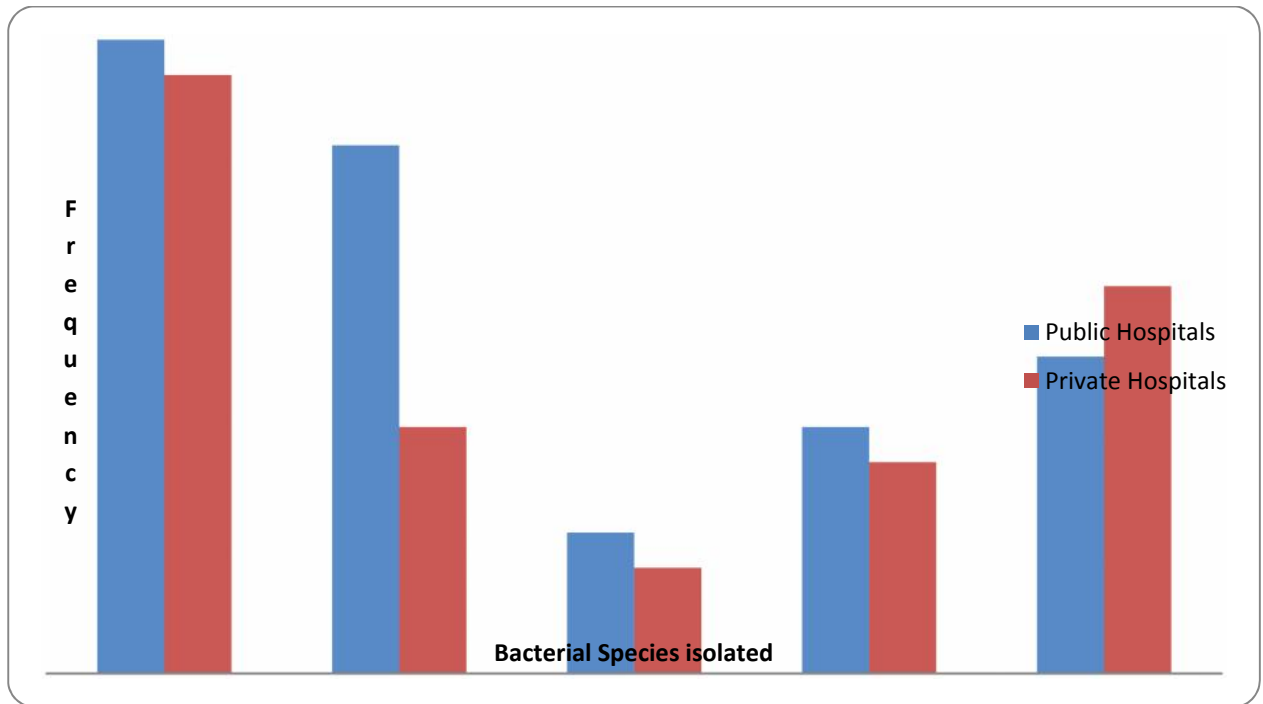


Figure 3: Distribution of isolated bacteria species in public and private hospitals.

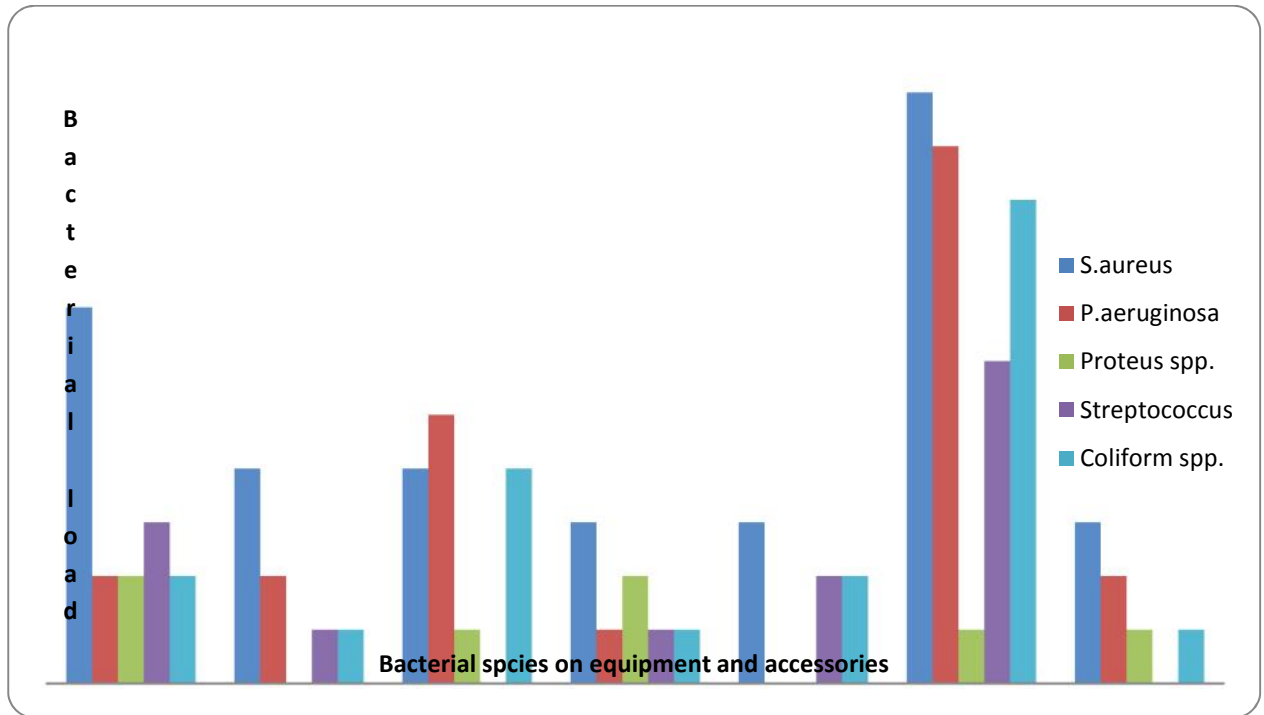


Figure 4: Distribution of bacterial species load on the various X-ray equipment and accessories.

## DISCUSSION

Patients presenting for radiological examination are often ill or require certain X-ray examination to examine their health status. Such patients may either transmit or contract infections from the radiology department through

contact with radiological equipment and accessories, droplets and airborne routes<sup>14-15</sup>. Most patients contract these infections because their immune system is down<sup>2</sup>. Medical asepsis is therefore required before, during and after radiological investigations.

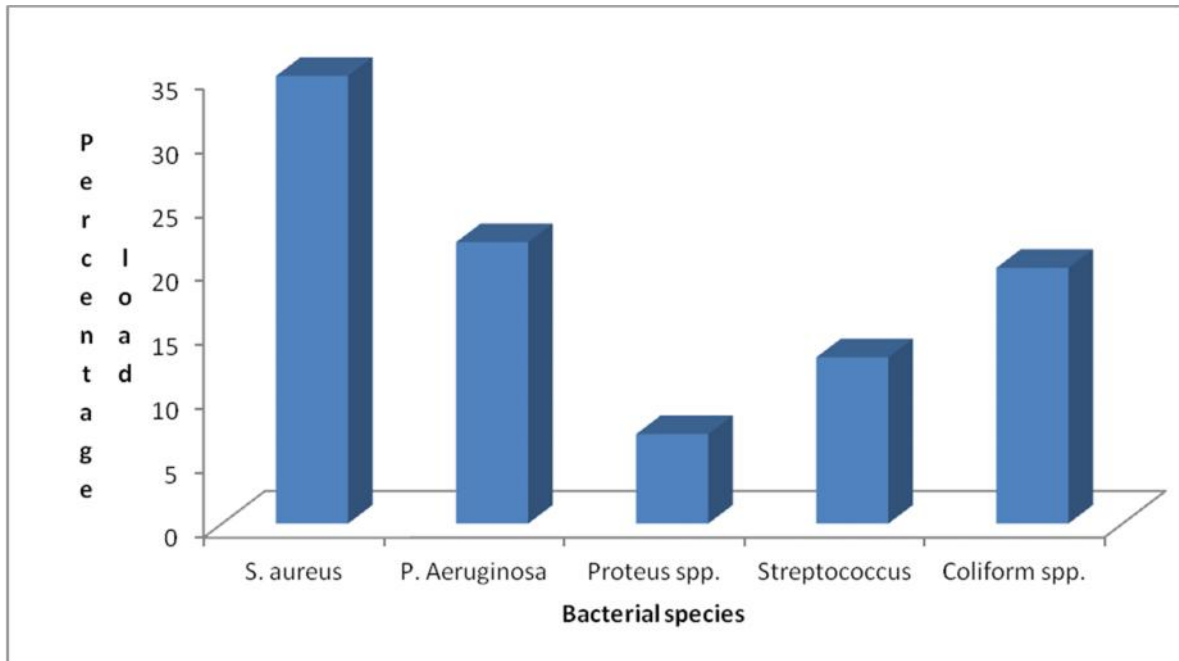


Figure 5: Percentage distribution of bacterial specie in study population.

Our findings show that x-ray equipment and accessories used in the medical imaging departments of hospitals in Anambra state harbour nosocomial pathogens, especially bacteria [Table 1]. *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Proteus spp.*, *Streptococcus* and *Coliform spp.* were the common bacteria isolated in our study [Figure 5]. *Staphylococcus aureus* was however the most predominant bacteria (68.2%) in public hospitals and 36.1% overall and coliform spp (55%) in private hospitals [Figure 3]. Fox and Harvey<sup>11</sup> reported staph aureus as the most common bacteria isolated from X-ray cassettes, couches, bucky and stretchers. This is because staph aureus are cutaneous bacteria that colonize the skin and nose

and therefore can easily be transmitted through contact with staff, equipment and accessories as well as inhalation by visitors/patients and are resistant to antibiotics<sup>2</sup>.

*Pseudomonas aeruginosa* (22.6%) and *coliform spp* (20.6%) were also found to be the second and third most prevalent bacteria [Figure 5]. These microorganisms were isolated more from all equipment and accessories studied except the control console with no growth of *P aeruginosa* [Figure 4]. *P aeruginosa* is often isolated in water and damp areas. They may colonize the digestive tract of hospitalized patients<sup>2</sup>. This may be the reason why there was no growth of it on the control console which is usually far from patients examined.

Some studies<sup>10, 11, 16</sup> have reported the presence of these bacteria on x-ray equipment and accessories.

*Streptococcus* (13.4%) and *Proteus spp.* (7.2%) were the least bacteria isolated in our study [Figure 5]. *Streptococcus* has been identified as one of the microorganisms colonizing x-ray cassettes, x-ray tables, chest boards, Franklin head units and wheel chairs in the imaging department<sup>20,21</sup>.

*Proteus spp.* were more on the couch and exposure button. They are usually more effective when the host defences are compromised, and can cause serious infections like; surgical site infections, bacteraemia and lung infections<sup>2</sup>. X-ray cassettes had the highest bacterial load in all hospitals studied [Figure 3]. There are reports<sup>10,13</sup> that x-ray cassettes are the most frequently contaminated accessories. Surfaces touched by radiographer and patients such as the X-ray tube head handle, exposure button and control console x-ray couches as well as chest stands/erect buckies all recorded bacterial growth [Figure 4]. Microorganisms are therefore spread by the radiographers attending to patients and patients presenting for examination. Bacterial contaminations of surfaces touched by radiographers and patients have also been reported<sup>10,17</sup>. Infections acquired in the healthcare setting raise a great risk for patients. Therefore measures to prevent detect, monitor and protect patients and staffs are essential and will reduce mortality, morbidity and cost resulting from such infections. This is comprehensive and requires a

collaborative effort by all stakeholders in the health sector.

## CONCLUSION

The X-ray department is a source of nosocomial bacteria. All equipment and accessories studied recorded a significant amount of bacterial growth. The common species of bacteria contracted from the radiology department are *Staphylococcus aureus*, *Psuedomonas aeruginosa*, *Proteus spp.*, *Streptococcus*, and *Coliform spp.* X-ray cassettes are the most potent reservoir of bacteria followed by the X-ray couch and surfaces touched by the radiographer. Overall bacterial load is more in public hospitals than private hospitals. *Staph aureus* load is higher in public hospitals and *coliform spp* in private hospitals in Anambra State of Nigeria. Observation of medical aseptic technique before, during and after radiographic examinations will help reduce the spread of nosocomial infections.

**Acknowledgement:** We appreciate the co-operation of all staff and personnel of the surveyed hospitals especially the Radiographers. The Laboratory Scientists who assisted us in the culture of samples is hereby acknowledged. Thank you.

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