

Correlates of Antibiotics Use Pattern and Resistance among Pediatrics Patients in a Tertiary Hospital in South-South Nigeria.

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Abstract

In pediatrics, bacterial infection is an important cause of morbidity and mortality. Knowledge of microbiological studies and antibiotics use in pediatrics in tertiary facilities will help to develop prescribing guidelines, improve prescribing practices, and implement pediatric antibiotics stewardship programs, hence combating the threat of antimicrobial resistance. To evaluate antibiotic use Patterns in pediatrics in a tertiary hospital in south-south Nigeria. In a bid to understand the microbiological studies and antibiotics use in pediatrics in a tertiary hospital, a retrospective analysis of 300 systematically selected patients' folders was conducted. Out of the 300 patients included in this study, information was complete and obtained from 294 medical folders. The majority (57.5%) of participants were between 1-12 years and were males (55.4%). In this study, 17.65% of the samples retrieved showed a positive growth of microorganisms. The organisms isolated were mainly *Staphylococcus aureus*. Microorganisms isolated were majorly resistant to gentamicin (18.18%). It was recommended that pediatric antibiotic stewardship programs be implemented to promote the rational use of antibiotics.

Keywords: Antibiotics, Organisms, Pediatrics, Inpatient.

INTRODUCTION

Since the discovery of antibiotics in the 20th century, they have been effective in the treatment of bacterial infections, preventing opportunistic infections in immunocompromised patients (e.g. HIV/AIDS), prophylaxis for surgical procedures, and other illnesses. This has led to a reduction in the rate of diseases and death that could occur as a result of bacterial infections (Cook & Wright, 2020; Ventola, 2015).

These medications are highly accessible and effective; hence, some humans have misused and overused them. In addition to raising health care costs, this excessive and inappropriate use has aided in the emergence and spread of bacteria that are resistant to antibiotics. Antibiotics become less effective as a result of the emergence of these resistant bacteria (World Health Organization [WHO], 2023), which may increase morbidity and mortality [3].

Drug-resistant bacteria can grow and spread, which could result in additional healthcare expenditure (Tanwar, Das, Fatima, & Hameed, 2014) and increased duration of hospital stay for patients [1].

A study by [5] showed a strong correlation between invasive *Streptococcus pneumoniae* resistance and the overall usage of antibiotics for systemic use.

According to estimates from the Centers for Disease Control and Protection (CDC), each year in the United States, antibiotic-resistant bacteria cause around 3 million illnesses and 35,000 mortalities [4].

The WHO has identified some microorganisms that are known to have developed resistant mechanisms to antibacterial agents commonly used in the treatment of infections. They include:

Escherichia coli is resistant to third-generation cephalosporins, including resistance conferred by extended-spectrum beta-lactamases (ESBLs) and fluoroquinolones.

Klebsiella pneumoniae is resistant to third-generation cephalosporins, including resistance conferred by ESBLs and carbapenems.

Staphylococcus aureus; resistant to beta-lactam antibacterial drugs (methicillin, methicillin-resistant *Staphylococcus aureus*).

Streptococcus pneumoniae; resistance or non-susceptibility to penicillin (or both).

Nontyphoidal *Salmonella* (NTS); resistance to fluoroquinolones.

Shigella species; resistance to fluoroquinolones.

Neisseria gonorrhoea; decreased susceptibility to third-generation cephalosporins [16].

Less than one month of age (neonate), one month to one year (infant), and one year to twelve years of age (pediatric) comprise the pediatric population.

The high use of antibiotics in children has been linked to the emergence of resistant bacteria, which is a serious worldwide concern [14].

In tertiary care hospitals, antibiotics are important in the treatment of children's illnesses caused by bacterial infections [10].

Antibiotics kill or inhibit the growth of microorganisms. The results of microbiological studies are crucial for determining the necessity of antibiotics and their appropriate application [7].

Utilization of antibiotics has become a major concern in developing countries like Nigeria, and indeed globally, as inappropriate use has been identified to promote the colonization of the gastrointestinal tract by *Clostridium difficile*, an anaerobic gram-positive organism, which is the commonest cause of healthcare-acquired diarrhea in adult and children [15,8].

The development of antibiotic-resistant organisms could increase the healthcare system's monetary burden. [12] And prolonged patient hospital stays [9].

Infections resistant to conventional therapy can worsen over time, increase mortality, and increase the chance of the resistant microbe spreading. In addition, costs associated with duration of stay and use of last-generation antibiotics are increased [11].

This is important to note in the selection of antibiotics and hence, proper selection will prevent the development of antibiotic resistance and reduce the cost of treatment.

Knowledge of the prevalent microorganisms in tertiary facilities will help to develop prescribing guidelines, improve prescribing practices, and implement antibiotics stewardship programs, hence combating the threat of antimicrobial resistance [13].

In Bayelsa state, a study was conducted on pediatrics at the state Federal Medical Center (FMC) [2]. However, this study may not give a full representation of microbiological studies in the pediatric population in the State. No study has been carried out in pediatrics at Niger Delta University

Teaching Hospital, Bayelsa State; hence, a gap in information regarding the microbiological studies in this group in the State.

The purpose of this study is, therefore, to assess the antibiotic use Pattern in pediatrics in a tertiary hospital in south-south Nigeria.

Method

Study site.

The study area is the Paediatric Department of the Niger Delta University Teaching Hospital (NDUTH), located at Okolobiri in Yenagoa L.G.A of Bayelsa State.

Study design.

A retrospective cross-sectional design was used in this study.

Study Tool: Patients' folders were reviewed from 2020 to 2023, and data were collected using a data collection form.

Sampling technique

Systematic random sampling was used to select the medical folders. Every second medical record was selected.

Data collection

A data collection form was used as the research tool to collect the field data. The supervisor certified the instrument before formal use of it for data collection.

Data analysis

IBM SPSS version 27 and Microsoft Excel (Ver. 2013), descriptive statistics such as frequency and mean values were used to present data and further express them in charts.

Ethical issues

Approval and permission were obtained from the Research and Ethics Committee, Niger Delta University Teaching Hospital, Okolobiri, Bayelsa State.

Results

Demography of study participants

Fig. 1: Age of participants

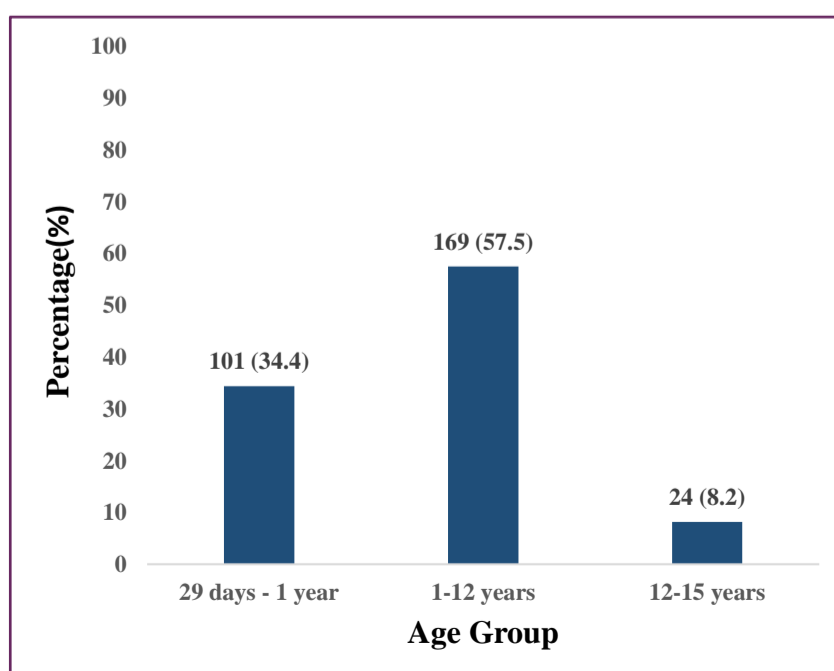


Fig. 1: From the results obtained, 34.4% of the patients were 29 days- 1 year of age (Infant), age group 1-12 years (child) were the highest patients at 57.5%, while 8.2% patients came from 12- 15 years (adolescent).

Fig. 2: Gender of participants

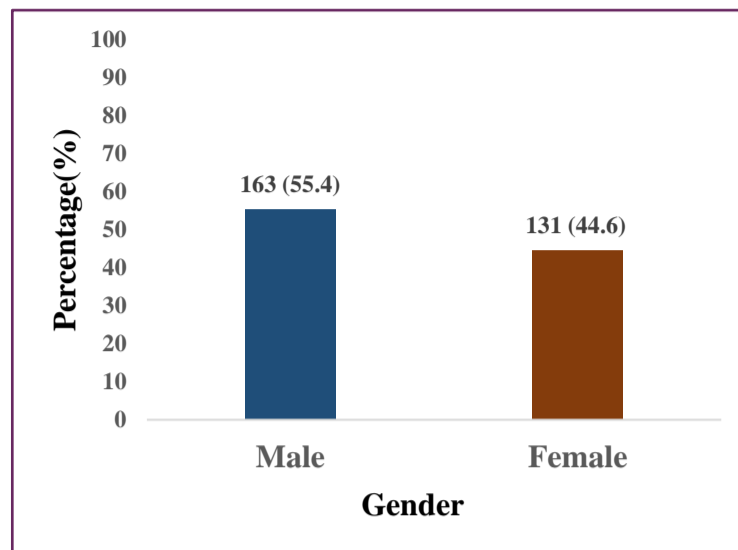


Fig. 2: From the results, 44.6% of the patients were female, while 55.4% were males.

Samples tested before prescription of antibiotics.

Fig. 3 Culture samples taken before the prescription of antibiotics.

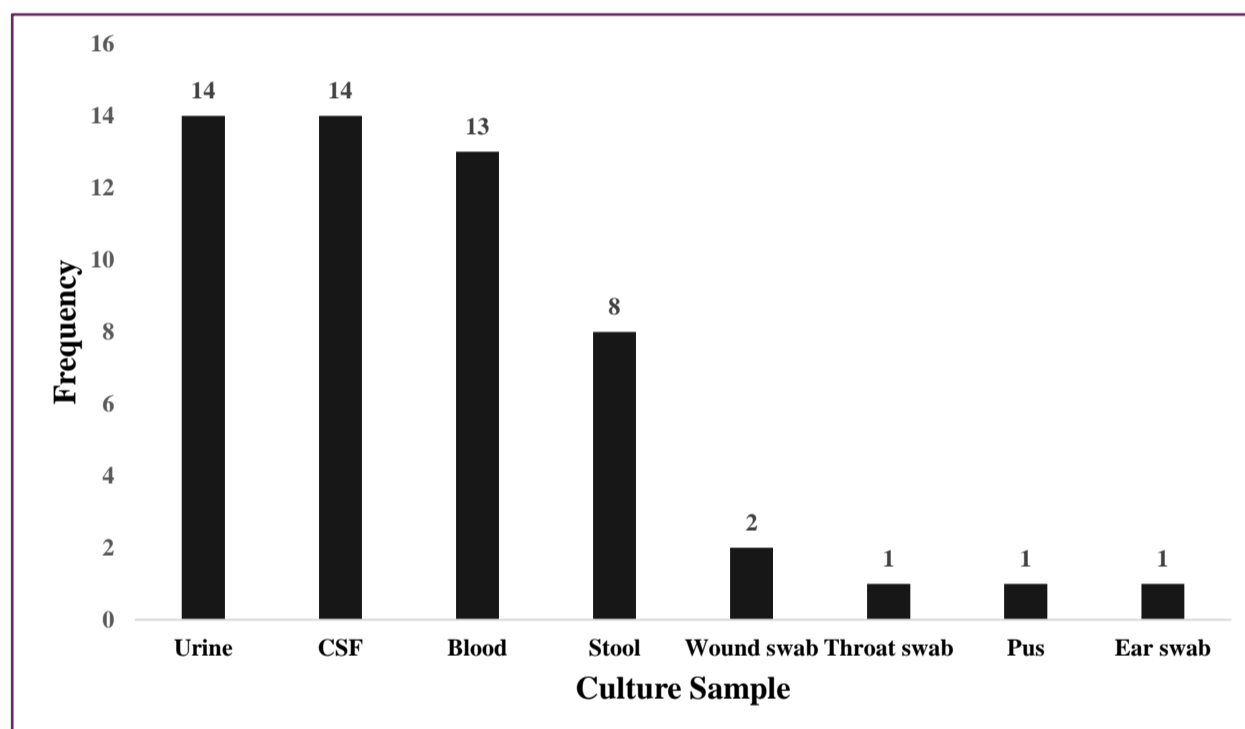


Fig. 3: shows that the culture samples taken include urine (14), cerebrospinal fluid (CSF) (14), blood (13), stool (8), wound swab (2), throat swab (1), pus (1), ear swab (1).

Fig. 4 Culture sample results

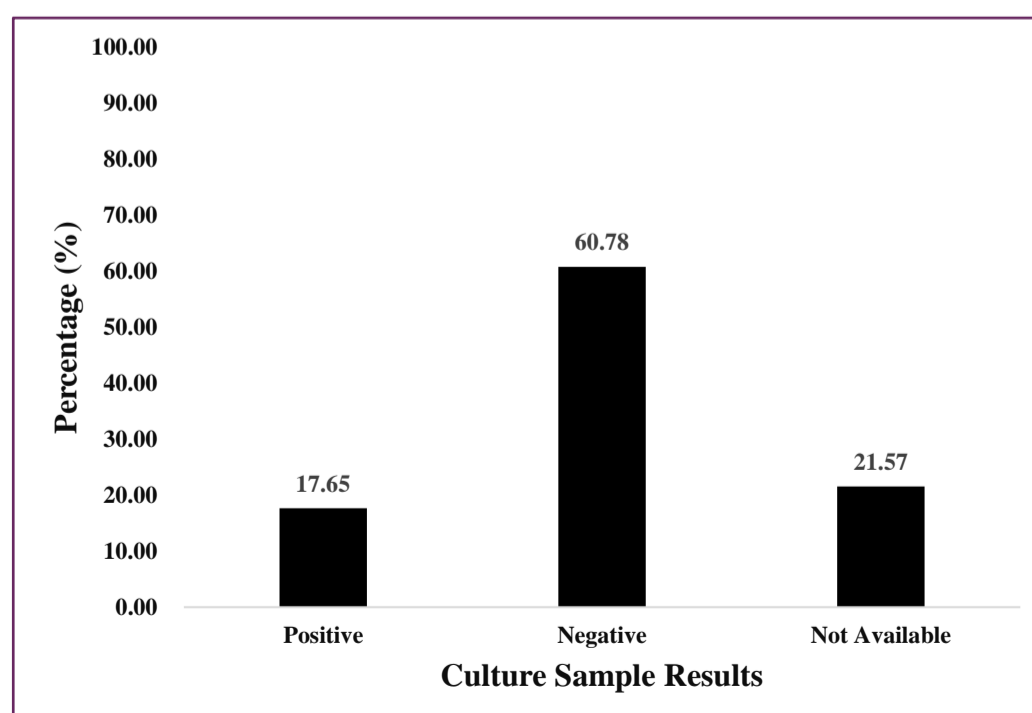


Fig 4: Culture revealed negative results for 60.78% of samples and positive for 17.65%. Results were unavailable for 21.57% of the samples.

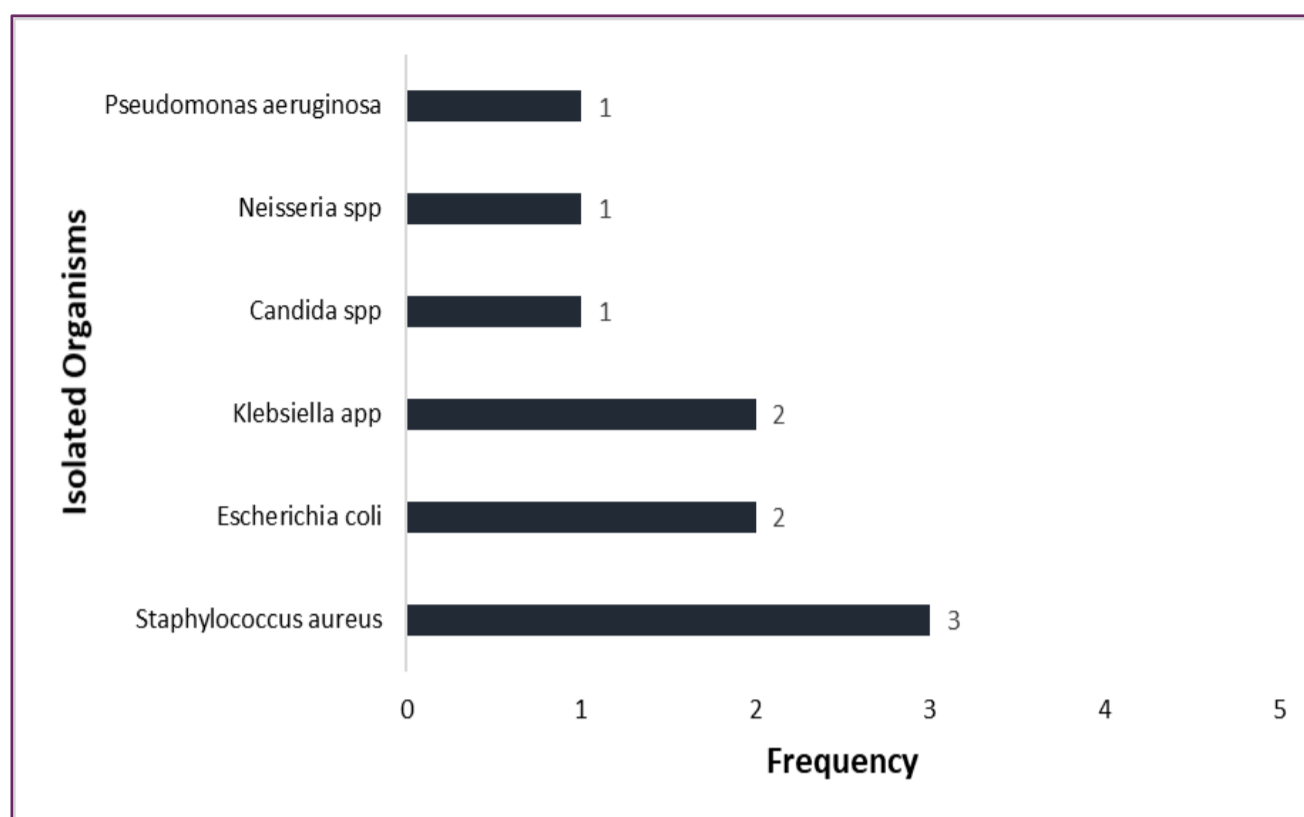
Fig. 5 Isolated pathogenic organisms

Fig. 5 shows that the pathogenic organisms isolated include *Staphylococcus aureus* for 3 participants, followed by *Escherichia coli* and *Klebsiella spp*.

Table 1 Antibiotics with resistant phenotype detected.

Antibiotic	Frequency	Percentage (%)
Gentamicin	4	18.18
Co-amoxiclav	3	13.64
Cefixime	3	13.64
Ceftazidime	3	13.64
Cefuroxime	2	9.09
Ofloxacin	2	9.09
Ciprofloxacin	2	9.09
Ceftriaxone	2	9.09
Augmentin	1	4.55

Discussion

The characteristic descriptors of the participants considered in the study include age and sex. In the study above, there were more male participants than female participants. The study further cuts across several age groupings in which the highest number of participants in this study were children (1- 12 years), who formed about half of the participants. The infants were next to them, forming over a quarter of the total participants while the least participating group was the adolescents.

The majority of specimens collected included urine, cerebrospinal fluid (CSF), blood, and stool. However, a study done by Bandela et al. (2019)

showed that specimens collected to identify pathogenic organisms included sputum, serum, cerebrospinal fluid, and stool.

Specimen culture was positive for 17.65% of specimens and negative for 60.78%. Results were unavailable for 21.57%.

Isolated organisms identified mainly included *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella spp*. This is similar to the findings by Bandela et al. (2019) and Skosana et al. (2022). These similar findings raise a concern, as infections caused by these prevalent organisms should be properly treated to prevent the development of resistance. Also, policies on antibiotic

prescribing in pediatrics should take into consideration these prevalent organisms to make appropriate treatment guidelines.

Antibiotic resistance was mainly identified to gentamicin, where gentamicin is one of the most prescribed antibiotics in pediatrics in NDUTH. This result is similar to a study by Chaw et al. (2018) in a hospital in Gambia, in which antibiotic resistance was mainly identified to ampicillin, the most commonly prescribed drug in that hospital. This shows that the overuse of a class of antibiotics in the treatment of infections caused by a particular organism increases the risk of the development of resistant strains by that organism. This should be looked into to prevent further development of resistance.

Conclusion

The study identified isolated organisms such as *Staphylococcus aureus*, *Escherichia coli*, and *Klebsiella* spp. Antibiotic resistance was mainly identified to gentamicin, where gentamicin is one of the most prescribed antibiotics in pediatrics in NDUTH.

Recommendation

1. In prescribing antibiotics, the knowledge of the prevalent pathogenic organisms and sensitivity patterns of antibiotics in hospitals will help healthcare professionals in selecting appropriate antibiotics for use.
2. Antimicrobial stewardship in pediatrics is important, and therefore, policies should be put in place to improve antibiotic use patterns in pediatrics in the state.
3. The findings here suggest that a lot needs to be done by health facilities and the Government to promote rational antibiotic use in pediatrics.

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Conflict of interest

There was no conflict of interest among the authors. The researchers appreciated the statistician, participants, and researchers for the time.

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