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USE PATTERN OF ANTIBIOTICS IN PEDIATRICS IN A TERTIARY HOSPITAL IN SOUTH-SOUTH NIGERIA

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ABSTRACT

Antibiotics are one of the widely utilized drugs in pediatrics. The evaluation of antibiotic utilization among admitted pediatric patients is an important step required to design policies for stewardship programs regarding rational antibiotic use. The study aimed to evaluate the drug utilization pattern of antibiotics prescribed to pediatric inpatients at a tertiary care hospital. A retrospective analysis of patients admitted into the Paediatric wards over a period of 3 years, who received antibiotics during admission. Medical folders of 300 patients were selected by systematic random sampling and included in this study. A proforma was used for data collection, information retrieved from patients' records included Demographic Data, Culture, and Sensitivity patterns, Clinical Information, Duration of Hospital Stay, Outcome, type, Class, and Route of administration of antibiotics. Field data were analyzed using IBM SPSS Version 27 and Microsoft Excel (Version 2023). Out of the 300 patients included in this study, information was complete and obtained from 294 medical folders. 101(34.4%) were between 29 days to one year, 169(57.5%) were between 1-12years and 24(8.2%) were between 12-15years. More patients between the ages of 1-12 years were admitted with bacterial infections. Out of the 294 patients studied, 163 (55.4%) were males and 131(44.6%) were females. 73(24.83%) were treated for sepsis, 54(18.37%) bronchopneumonia, 45(15.31%) meningitis. The remaining patients had other conditions such as urinary tract infection, upper respiratory tract infection, and gastroenteritis. Culture and sensitivity test was done in only 17.3% of cases. Most of the antibiotic prescriptions were based on clinical diagnosis, not on culture and sensitivity information. The most commonly prescribed antibiotic class was third-generation cephalosporins 219(33.85%). The most frequently prescribed antibiotics were gentamicin 160(54.42%) and ceftriaxone 120(40.82%). In the present study, 91.75% of antibiotics were administered by the parenteral route and 8.25% by oral route. 70.71% of antibiotics were prescribed by branded names. No adverse reaction was recorded. Following antibiotics use, the shortest duration of hospital stay was observed in 75.15% of patients. The study revealed the use pattern of antibiotics in pediatrics. It was recommended that pediatric antibiotic stewardship programs be implemented to promote the rational use of antibiotics. Regular training and continuing education on antibiotic use and stewardship should be carried out for healthcare professionals.

KEYWORDS: SAntibiotics Organisms Pediatrics Inpatient.

1. INTRODUCTION

Since their discovery in the 20th century, antibiotics have been used to treat infections caused by bacteria, as well as prevent opportunistic infections in immunocompromised patients (e.g. HIV/AIDS), prophylaxis for surgical procedures, and other conditions. This has reduced the rate of diseases and death that could result from bacterial infections.

Antibiotics are widely available 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 this resistant bacteria (WHO, 2014), which may increase morbidity and mortality (Melander, Ekdahl, Jonsson, and Molstad, 2000).

Drug-resistant bacteria can grow and spread, which could result in additional healthcare expenses (Alam et al, 2009) and longer hospital stays for patients (Apisarnthanarak et al., 2007: Mauldin, Salgado, Hansen, Durup, and Bosso, 2010).

A study by Cizman et al (2021), 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 deaths (CDC, 2019).

According to the World Health Organization report on the Global Status of Antibacterial Resistance (ABR) and surveillance in 2014, some microorganisms have been identified to have developed resistant mechanisms to antibacterial agents commonly used to treat infections. They include; *Escherichia coli*, *Klebsiella pneumonia*, *Staphylococcus aureus*, *Streptococcus pneumonia*, Nontyphoidal *Salmonella* (NTS), *Shigella* species, *Neisseria gonorrhea*.

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.

They are among the therapeutic agents that are most frequently administered in pediatrics (Hales, Kit, Gu, and Ogden, 2018). Several studies have indicated that the majority of prescriptions written for this population are inappropriate (Andrajati, Tilaqza, and Supardi, 2017). 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.

Antibiotics are one of the most recommended therapeutic agents in pediatrics and are significant in the therapy of children's illnesses caused by bacterial infection (Hales et al., 2018).

High use of these medicines in children has been linked to the emergence of resistant bacteria, which is a serious worldwide concern (Melander et al., 2000).

Knowledge of the prescription and use pattern of these antibiotics in pediatrics will help in the development of prescribing guidelines and hence, combating this threat.

Utilization of antibiotics has become a major concern in developing countries like ours, 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 health-care-acquired diarrhea in adult and children (Vuotto et al., 2018; Enoch et al., 2011).

Excessive utilization of antibiotics has also been associated with the development of antibiotic resistance by organisms such as *Neisseria gonorrhea*, hence making the disease difficult to treat in patients infected with the resistant strains and therefore, leading to treatment failure (Unemo et al., 2011).

This development of antibiotic-resistant organisms could lead to additional healthcare costs (Alam et al, 2009) and prolonged hospital stays for patients (Mauldin et al., 2010).

Utilization of antibiotics has also been associated with an increased risk of adverse effects such as diarrhea, ototoxicity, and hepatotoxicity (Chang and Schiano, 2007). About 20% of drug-related emergency clinic visits in the United States are attributed to the use of antibiotics (Lode, 2011).

Inappropriate use of antibiotics has been shown to increase the number of visits to the hospital by patients, as it medicalizes self-limiting conditions (Little et al., 2013).

In the pediatric population, studies have indicated that the use of antibiotics in the early stages of life may increase the risk of developing chronic illnesses, such as juvenile idiopathic arthritis (Horton et al., 2015), diabetes (Boursi et al., 2015) and inflammatory bowel disease (Hviid et al., 2011).

Although much is being done to combat this threat, little has been done to information regarding the utilization of antibiotics in pediatrics in this state.

The purpose of this study is, therefore, to assess the utilization of antibiotics in pediatrics in a tertiary hospital in South-South Nigeria.

2. RESEARCH METHODOLOGY

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.

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 instrument was certified by the supervisor before the formal use 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 expressed in charts.

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

3. RESULTS
Demography of study participants
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) as seen in Fig. 1.

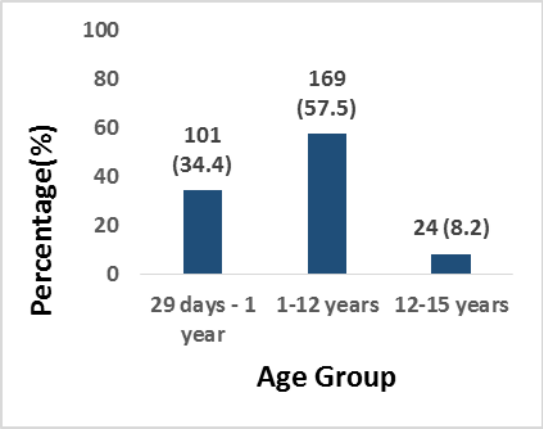


Fig. 1: Age of participants.

Gender of participants
From the results, 44.6% of the patients were female while 55.4% were males as seen in Fig. 2

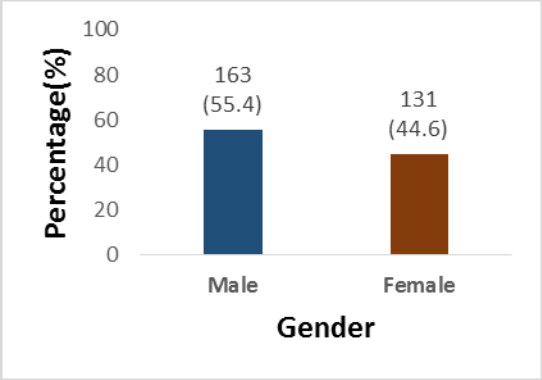


Fig. 2: Gender of participants.

Antibiotics prescribed in paediatrics
The results from Table 1 shows that the antibiotics commonly prescribed in pediatrics in NDUTH include gentamicin (54.42%), ceftriaxone (40.82%), cefotaxime 30.27%), cefuroxime (23.13%).

Table 1: Antibiotics Prescribed.

Antibiotics	Frequency	Percentage (%)
Gentamicin	160	54.42
Ceftriaxone	120	40.82
Cefotaxime	89	30.27
Cefuroxime	68	23.13
Ciprofloxacin	67	22.79
Azithromycin	30	10.20
Vancomycin	27	9.18
Amikacin	23	7.82
Metronidazole	19	6.46
Cefpodoxime	6	2.04
Erythromycin	6	2.04
Meropenem	6	2.04
Coamoxiclav	5	1.70
Ampiclox	4	1.36
Flucloxacillin	3	1.02
Cefixime	3	1.02
Penicillin G	2	0.68
Amoxicillin	2	0.68
Cloxacillin	1	0.34
Clindamycin	1	0.34
Ceftazidime	1	0.34
Ampicillin	1	0.34
Co-trimoxazole	1	0.34
Benzylpenicillin	1	0.34
Ofloxacin	1	0.34

Route of administration of antibiotics
Results in Fig. 3 reveal that the intravenous (IV) route is the most frequently used (90.91%) for antibiotics administration, 8.25% through the oral route, and 0.84% through intramuscular (IM).

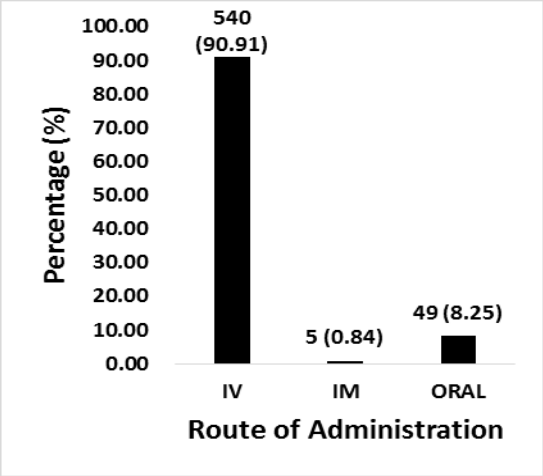


Fig. 3: Routes of administration of antibiotics.

Diagnoses for antibiotics prescription

Results from Table 2 show that the disease condition for which antibiotics are more frequently prescribed include sepsis (24.83%), bronchopneumonia (18.37%), and meningitis (15.31%).

Table 2: Diagnosis for antibiotics prescription.

Diagnosis	Frequency	Percentage
Sepsis	73	24.83
Bronchopneumonia	54	18.37
Meningitis	45	15.31
Malaria with sepsis	27	9.18
Dysentery	27	9.18
Severe Malaria to rule out meningitis	24	8.16
Tonsilitis	19	6.46
Anaemia with sepsis	15	5.10
Urinary Tract Infection	7	2.38
Septicaemia	7	2.38
Cerebral Malaria, to rule out meningitis	5	1.70
Marasmus With Sepsis	5	1.70
Gastroenteritis	4	1.36
Pertussis	4	1.36
Upper Respiratory Tract Infection	4	1.36
Generalized Tetanus	3	1.02
Hemolytic Crisis with bronchopneumonia	2	0.68
Multiple infected injuries	2	0.68
Infected flame burns	1	0.34
Shigella Septicaemia With Hypokalemia	1	0.34
Syphilitic Ulcers	1	0.34
Disseminated Tuberculosis	1	0.34
Vaso occlusive crisis with upper respiratory tract infection	1	0.34
Asthma, to rule out bronchopneumonia	1	0.34
Measles, complicated with bronchopneumonia	1	0.34
Otitis Media	1	0.34
Epistaxis, at risk of sepsis	1	0.34

Antibiotics prescribed in INN (generic name)

Fig 3 shows that the percentage of antibiotics written in INN was 70.71% while 29.29% were not written in their INN.

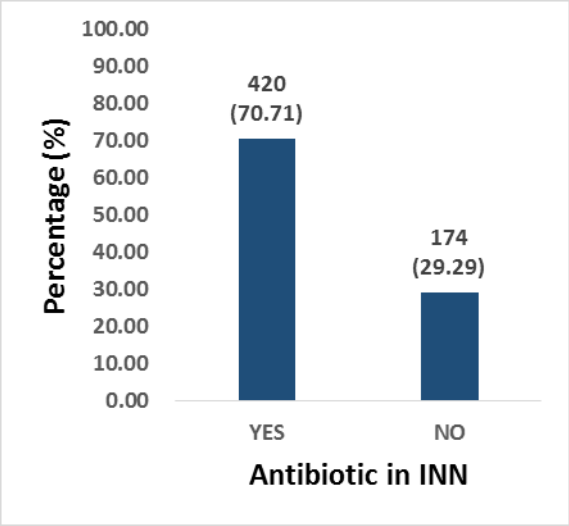


Fig. 3: Chart of antibiotics in INN.

Prescriptions for which culture samples were taken

Table 3 shows that for 17.3% of prescriptions, a culture sample was taken before the prescription of antibiotics, while 82.7% had no culture sample taken.

Table 3: Prescriptions for which culture samples were taken.

Culture Sample Taken	Frequency	Percentage
Yes	51	17.3
No	243	82.7

Number of prescribed antibiotics per patient

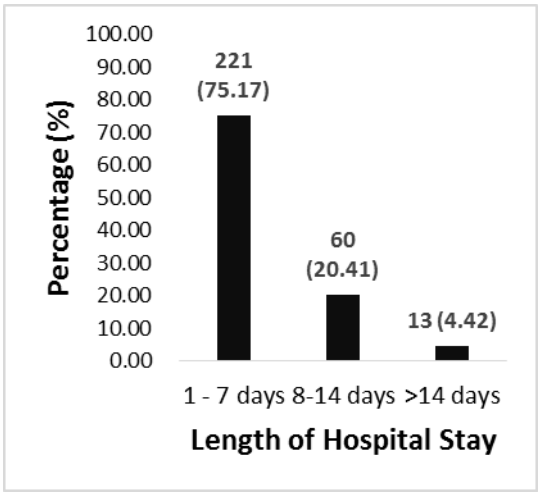
Participants who were prescribed two antibiotics (48.98%), one antibiotic was prescribed (24.15%), and 0.68% were prescribed 8 antibiotics in the course of their stay in the hospital as shown in Table 5.

Table 5 Number of antibiotics prescribed

Number of Prescribed Antibiotics	Frequency	Percentage
1	71	24.15
2	144	48.98
3	50	17.01
4	16	5.44
5	7	2.38
6	4	1.36
8	2	0.68

Duration of hospital stay

From Fig 4, the shortest length of hospital stay of 1-7 days was observed for 75.15% of participants while the longest of > 14 days was observed for 4.42%.



4. DISCUSSION

The characteristic descriptors of the participants considered in the study include age and sex. From the study above, male participants were more than female participants. The study further cuts across several age groupings in which the highest participants 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 study for the most prescribed antibiotics in pediatrics showed that third-generation cephalosporins are the mostly prescribed with more than a quarter of the total antibiotic usage, followed by aminoglycosides, second-generation cephalosporins, and fluoroquinolones. The least prescribed antibiotics in pediatrics are lincosamides and sulphonamides. This corroborates the findings of Labi et al., (2018) in which the most commonly prescribed antibiotics were third-generation cephalosporins, aminoglycosides, and second-generation cephalosporins. This is also in line with studies carried out by Umeokonkwo et al., (2019); Zhang et al (2018), and Mgbahurike, et al., (2020) where cephalosporins were the mostly prescribed antibiotics in pediatrics. However, other studies have shown that the most prescribed antibiotics in pediatrics are penicillins. (Sie et al., 2019) and (Chaw et al., 2018). The high rate of third-generation cephalosporins use in these countries could be attributed to its good tolerability and broad spectrum of activity against several organisms.

Findings from this study showed that the intravenous (IV) route is the most frequently used route for

antibiotics administration, followed by the oral and intramuscular (IM) route. This study is similar to findings from Ogunleye et al., (2022). However, a study done by Mgbahurike et al., (2020) showed the most frequently used route of antibiotics in pediatrics as the oral route. There was a high rate of use of the parenteral route for the administration of antibiotics in this study. This raises a concern because this route is associated with unpleasant side effects such as inflammation of the vein, systemic infections (Shrayteh et al., 2014), and pain at the injection site (Cyriac and James, 2014). These effects could prolong hospital stays and lead to an increase in the cost of therapy (Smith et al., 2019).

Findings from this study revealed that sepsis and bronchopneumonia were the most frequent diagnoses. This is similar to a research carried out by Chaw et al., (2018) and Zhang et al., (2018) in which pneumonia was the most frequent diagnosis. However, other studies conducted by Wang et al., (2022) and Mgbahurike et al., (2020) showed upper respiratory tract infection as the most frequent.

Prescribing of medications should be written in their International non-proprietary name (generic name), according to the World Health Organization (WHO). This will promote the prevention of errors in writing and dispensing of prescriptions, hence, reducing the cost of therapy. From this study, the percentage of antibiotics prescribed appropriately using the generic name was 70.71%. This is not in line with the WHO guidelines recommendation of 100% generic prescription. However, a study by Nduka et al., (2017), in tertiary hospitals in the South East, showed that the percentage of drugs prescribed by generic names was 65.3% and 62.5% respectively.

Another study by Dutta et al., (2017) in North East India showed a percentage of 8.2 for antibiotics prescribed by generic names.

The results from this study show that the majority of antibiotic prescriptions were based on signs and symptoms indicative of bacterial infection, as sensitivity testing was not done for the majority of participants (82.7%). It was carried out for only 17.3% of participants. This corroborates the findings of Adisa et al., (2018) and Isezuo et al., (2020) where only 2% of antibiotic prescriptions had documented evidence of sensitivity test. This implies that the empirical use of antibiotics was high, as culture and sensitivity were not carried out before antibiotic prescribing. Such practices could promote inappropriate prescribing of antibiotics and, hence should be monitored. It calls for concern as extended use of antibiotics for prophylaxis has been linked to the risk of adverse reactions, increased costs, and the emergence of antimicrobial resistance without increasing the effectiveness of therapy (Nwita et al., 2021).

For several antibiotics prescribed per patient, patients who were prescribed two antibiotics were about (48.98%), one antibiotic was prescribed in 24.15% of participants and three antibiotics were prescribed in 17.01%. This data is similar to a study done by Shamshy et al., (2011) where the majority of the patients were prescribed at least one antibiotic, two were prescribed in 28.57% and three were prescribed in 15.02% of cases. The amount of antibiotics utilized per patient is important to note to reduce future rates of antimicrobial resistance due to increased exposure to antibiotics.

The longest duration of hospital stay (>14 days) was observed in 4.42% of participants, while the shortest was observed in 75.15%.

This is good, compared to a study by Garedow et al., (2022) which showed that following the use of antibiotics, a short duration of hospital stay of less than seven days was observed for about 27% of participants, while greater than seven days of hospital stay was observed for about 71% of patients.

No adverse reaction was recorded in the medical charts of participants. This could be due to poor reporting and pharmacovigilance practices among patients, caregivers, and healthcare workers. This shows a lack of adequate monitoring of antibiotic use among healthcare professionals.

5. RECOMMENDATION

The findings here suggest that a lot needs to be done by health facilities and the Government to promote rational antibiotic use in pediatrics.

6. ACKNOWLEDGMENT

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