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Evaluation of Antimicrobial Prescribing Patterns among Paediatric Outpatient Population in Benin City, Nigeria

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Abstract

Paediatrics accounts for the largest population in developing countries, including Nigeria. This population group is prone to infections and therefore has a greater burden of antimicrobial use. Antimicrobial use is associated with concerns about antimicrobial resistance. This study evaluates the antimicrobial prescribing in a paediatric outpatient setting in Benin City, Nigeria. This was a cross-sectional study conducted among paediatric patients filling prescriptions at the outpatient pharmacy department of the paediatric unit in Central Hospital, Benin City, Nigeria. A data collection form was used to extract prescribing indicators and AWaRe classification from the case files, and descriptive statistics were conducted using SPSS version 21. Of the 241 prescriptions evaluated, only 4 (1.7%) were based on definitive diagnosis. Upper respiratory tract infections accounted for the most common diagnosis (134, 55.6%), followed by scabies (24, 10%). All prescribers adopted the generic prescription method 241 (100%). Amoxicillin-clavulanic acid was the most commonly prescribed antimicrobial, 74 (30.7%), followed by cefuroxime, 59 (24.5%). The Access group of antimicrobials was most commonly prescribed, with 155 (64.3%), followed by those in the Watch category, with 79 (32.8%). Prescribers relied mainly on presumptive diagnosis but were highly compliant with generic prescribing and the AWaRe antimicrobial classification. There is a need for healthcare institutions and prescribers to target antimicrobial stewardship activities to address identified problems that encourage antimicrobial misuse and resistance.

Keywords: Antimicrobial resistance, Paediatrics, Antimicrobial use, Nigeria, AWaRe

INTRODUCTION

Children constitute a large proportion of the population in Sub-Saharan Africa, with a projected population of 1 billion by 2055. This region also accounts for half of the global under-five mortality rate of 1 in 13 (UNICEF, 2017). In Nigeria, paediatrics make up about half of the total population, with 110 million children aged 0-17 years as at 2024 (UNICEF, 2024). Paediatric children are particularly vulnerable to many communicable and infectious diseases such pneumonia, diarrhea, sepsis, and mortality among them is usually very high; hence the need for prompt therapeutic action.

Globally, pneumonia, diarrhea and malaria make up the burden of paediatric infections, resulting in 25% of under children below 5years. Western Sub-Saharan Africa and South Asia have more of these infections (Zui *et al.*, 2025). In Nigeria, the order of infectious disease burden is: malaria, pneumonia, acute respiratory tract infections, and diarrhoea. Pneumonia causes about 20% of paediatric deaths in the country, and about 56 million episodes of acute respiratory tract infections occur annually (Isah *et al.*, 2020). Many infections in paediatrics are treated with antimicrobials. The paediatric population tends to suffer more adverse effects from irrational antimicrobial use than adults, and they are also more at risk of developing resistance to antimicrobials, given the global threat of antimicrobial resistance (AMR) (Ozawa *et al.*, 2018). This is because factors that fuel AMR are more prevalent in developing countries such as Nigeria. They include inadequate access to effective healthcare, inadequate diagnostic facilities, poor regulation and prescription and dispensing practices pertaining to antimicrobial use by the public, and an increase in substandard medicines (Venito et al., 2015; Ozawa *et al.*, 2018).

The World Health Organisation (WHO) and its partners have increased awareness of AMR and initiated several strategies to minimise their use and curb resistance. One strategy that has been adopted is the development of the WHO Essential Medicines List, where antibiotics are classified into three, namely, Access, Watch,

and Reserve (AWaRe) antibiotics, based on their potential for resistance (WHO 2021a; WHO 2021b). Under this classification, antibiotics from the Access group, which have a narrow spectrum of activity, are encouraged to be used as the first line of treatment when there is a need for antibiotic prescribing because they generally have low resistance potential; using this guideline aims to reduce inappropriate use of antimicrobials and hence AMR (WHO 2021a; WHO 2021b). The WHO has also called for a global action plan against AMR, where each country develops and implements coordinated activities to reduce resistance with guidance from WHO thus streamlining it to national action plan [NAP] (WHO 2015) Since antimicrobial resistance is directly linked to its utilization, a focus of the national action plan is to reduce irrational use of antimicrobials across healthcare facilities by encouraging the implementation of antimicrobial stewardship programmes. Still, many countries, including Nigeria, have yet to respond to the call for NAP (Murray *et al.*, 2022).

Against this backdrop, it is important to document antimicrobial utilisation in healthcare facilities to identify areas for improvement and promote rational antimicrobial use. There are limited studies on antimicrobial utilisation among paediatric patients in Nigeria, especially in the southern part where this study was conducted. In addition, data on antimicrobial utilisation among paediatrics will be necessary to assess compliance with global standards and to develop strategies tailored to the local setting to address possible inappropriate antimicrobial use (Ozawa *et al.*, 2018; Okello *et al.*, 2020; Godman *et al.*, 2020).

Despite increasing concerns about antimicrobial resistance in Nigeria, there is limited data on antimicrobial prescribing patterns among paediatric outpatients, particularly in southern Nigeria. Understanding prescribing practices is essential for guiding antimicrobial stewardship interventions. Therefore, this study aimed to evaluate antimicrobial prescribing patterns among paediatric outpatients at Central Hospital, Benin City, using WHO prescribing indicators and the AWaRe classification

METHODS

Study Design and Setting

This was a cross-sectional study conducted at the paediatric outpatient department of Central Hospital, a secondary, state-owned hospital in Benin City, Edo State, Nigeria. The study was conducted between May and June 2021.

Study Population and Sampling

The study was conducted among paediatric patients visiting the outpatient pharmacy department to fill their prescriptions. Case files of patients with prescriptions containing antibiotics were included in the study; exclusions were patients older than 17 years, those hospitalised, and those with incomplete prescriptions. Raosoft online calculator was used to determine sample size. The average daily prescription volume in the outpatient pharmacy is 120. Working days are Monday to Friday, 8 am to 2pm, giving an average monthly prescription of 2400. The following were used to compute the sample size: confidence interval 95.0%, margin of error 5.0%, and response distribution 80.0%, yielding a minimum sample size of 224. Systematic sampling was adopted, with every 5th prescription that included one or more antimicrobial agents included in the study until the daily sample size of 12 was complete.

Data Collection Tool

A proforma was designed to extract data from patients' case files. Patient demographics, antibiotic use in the past 1 month, microbial culture and sensitivity test results, and the diagnosis and prescribed antibiotic for current treatment were documented. Some of these data were used to document the WHO group of antibiotics prescribing approach, whether generic or by brand and the spectrum of antibiotic activity, percentage of antimicrobials from the Essential Medicine List; and categorising into Access, Watch and Reserve antimicrobials (WHO 2003; WHO 2021a; WHO 2021b).

Ethical Consideration

Ethical approval was obtained from the Department of Medical Services, Edo State Ministry of Health with approval number HA-737/45. Administrative approval was received from the study centre, participant's care-givers were duly oriented about study objectives and verbal informed consent was obtained. Patients' anonymity and confidentiality were maintained.

Data Analysis

The data obtained from the study were sorted and cleaned, and the analysis was descriptive using SPSS version 22.

RESULT

A total of 241 paediatric patients were included in the study. The majority of them were aged 1 to 24 months (166, 68.9%), with an average age of 2.4 ± 3.0 months. Most participants had no prior medical history, with 33 (13.7%) reporting a prior episode of malaria. Twenty-two (9%) paediatric participants had used antibiotics in the past month to treat infections; amoxicillin was the most common antibiotic used by 10 participants (4.1%) (Table 1).

Table 1: Characteristics of Paediatric Participants (N=241)

Variables	Frequency, N (%)
Age	
< 1 month	3 (1.2)
1–24 months	166 (68.9)
> 2–12 years	70 (29.0)
> 12 years	2 (0.8)
Sex	
Male	147 (61.0)
Female	94 (39.0)
Past Medical History	
Malaria	33 (13.7)
Upper Respiratory Tract Infection	18 (7.5)
Pneumonia	4 (1.7)
Scabies	3 (1.2)
Others	14 (5.8)
Nil	169 (70.1)
Antimicrobial Use in the Past One Month	
Amoxicillin	10 (4.1)
Ampiclox	3 (1.2)
Cefuroxime	3 (1.2)
Others	6 (2.5)
Nil	219 (90.9)

Table 2: Diagnosis and Causative Agent among Paediatric Population (N=241)

Variables	Frequency, N (%)
Current Diagnosis	
Upper Respiratory Tract Infection	134 (55.6)
Scabies	24 (10.0)
Tonsillitis	19 (7.9)
Others	64 (26.6)
Source of Sample for Culture and Sensitivity Test	
Blood	1 (0.4)
Stool	1 (0.4)
Urine	2 (0.8)
Nil	237 (98.3)
Causative Pathogen	
Giardiasis	2 (0.8)
Pseudomonas aeruginosa	1 (0.4)
Salmonella Typhi	1 (0.4)
Nil	237 (98.3)

Table 2 shows that upper respiratory tract infection was the predominant diagnosis (134, 55.6%), followed by tonsillitis (19, 7.9%). Other infections include dysentery, otitis media, typhoid fever and gastroenteritis. Laboratory investigation was conducted in 4 (1.6%) participants, and 3 causative agents were detected, with giardiasis most frequently isolated (2, 0.8%).

All 241 (100%) of the antimicrobial agents prescribed were from the Essential Medicine List. Empirical treatment was the primary approach used by physicians (237; 98.3%). The majority of antibiotics prescribed fell into the Watch group of the WHO classification (79; 32.8%). All prescribed antibiotics were generic, and broad-spectrum antibiotics were mostly prescribed (211; 87.5%). Amoxicillin-clavulanic

acid combination accounted for a third of antibiotic prescriptions (74; 30.7%), followed by cefuroxime (59; 24.5%). Other details are shown in Table 3.

Table 3 Evaluation of Current Antibiotics among Paediatrics (N=241)

Variables	Frequency, N (%)
Treatment Approach	
Empirical	237 (98.3)
Definitive	4 (1.7)
WHO AWaRe Classification of Antibiotics	
Access	155 (64.3)
Watch	79 (32.8)
Access and Watch	7 (2.9)
Reserve	0 (0.0)
Prescription Approach	
Generic	241 (100.0)
Brand	0 (0.0)
Antibiotic Spectrum of Activity	
Broad-spectrum	211 (87.5)
Narrow-spectrum	30 (12.5)
Antibiotics Prescribed	
Amoxicillin-clavulanic acid	74 (30.7)
Cefuroxime	59 (24.5)
Amoxicillin	58 (24.1)
Cefpodoxime	20 (8.3)
Metronidazole	30 (12.4)
Combination Therapy	
Monotherapy	218 (90.5)
More than one antimicrobial	23 (9.5)

DISCUSSION

This study investigated antimicrobial use in a paediatric outpatient facility. The results of the study showed that paediatric patients aged less than 2 years made up the majority of participants. Studies have shown that children under 5 years are more susceptible to infections, necessitating the use of antimicrobials (Liu et al., 2015; Godman *et al.*, 2022; Siachalinga *et al.*, 2023). In addition, two third of the participants in this study were males. A study in Northern Nigeria reported male dominance in paediatric infections (Umar et al., 2018). This has been documented in studies from other countries such as Sierra Leone, Ethiopia and India (Lui et al., 2015; Ravika et al., 2014). Some likely factors contributing to this observation are selective preference and priority of care for male children over females, the impact of sex hormones, and the higher prevalence of immunodeficiency in males than in females (Muenchhoff *et al.*, 2014; Liu *et al.*, 2015; Ravika *et al.*, 2014).

A study in Sokoto, Nigeria, also reported that upper respiratory tract infections (URTIs) were mostly diagnosed and warranted the use of an antimicrobial agent, as noted in the current study (Abubakar *et al.*, 2025). This observation is linked to the fact that paediatrics, especially those below 5 years with poorly developed immune system, are exposed to unhygienic surrounding such as in daycare centres, crèches and other immediate environment during crawling and playing, at this stage many of them pick up items from hand to mouth which many at times are contaminated (Okello *et al.*, 2020; Godman *et al.*, 2020).

It was noted that the diagnosis was mainly empirical, with physicians making assessments based on symptom presentation and history-taking. Only a few patients underwent further laboratory investigations to guide diagnosis and treatment. It has been well documented that antibiotic prescribing in many developing countries is based on an empirical approach (Siachalinga *et al.*, 2023; Godman *et al.*, 2022). A study in a university medical centre in Lagos noted that 62.5% of prescribers based their antibiotic prescriptions on individual experience and the disease prevalent in the community at the time, while 12.5% relied on signs and symptoms presented by the patient (Mgbahurike *et al.*, 2012). Major factors encouraging empirical-based treatment in Nigeria are the cost burden on patients and caregivers for conducting laboratory investigations, and the lack of access to quality laboratory services.

The latter have broader dimensions, including poorly equipped laboratories, a lack of trained laboratory personnel, and delays in processing laboratory results and in timely communication with physicians (Godman *et al.*, 2022; Siachalinga *et al.*, 2023).

Prescribers who initiated prescriptions in the study all prescribed generic antimicrobials. This complies with the WHO prescribing indicator (WHO 2003; WHO 2021b). Similar studies in some parts of Nigeria have reported lesser degree of compliance. A study conducted at a federal teaching hospital in South Eastern Nigeria found that many prescribers practised generic prescribing (Emeka *et al.*, 2023). Factors discouraging generic prescribing include pressure from pharmaceutical representatives and companies, as well as concerns about efficacy and prescribers' experience (Ozawa *et al.*, 2018; Godman *et al.*, 2022; Siachalinga *et al.*, 2023).

Access antimicrobials were mostly prescribed, followed by the watch group of antimicrobials, which made up the majority of prescriptions. A study conducted in Gombe, Nigeria, reported that the antibiotics prescribed were in the Access group. In four West African countries, Niger, Burkina Faso, Mali and Guinea, 85% of collective antibiotics prescribed fell within the Access category (Hedima *et al.*, 2025; Gres *et al.*, 2025). The WHO guideline stipulates that prescribed antibiotics from the Access group should be at least 60% to encourage rational prescribing and reduce inappropriate antibiotic use (WHO 2021b). The AWaRe categorisation is now rooted in the WHO Essential Medicines List (EML) (WHO 2021a). The incorporation of the AWaRe classification into the EML will also help control and improve empirical antibiotic prescribing by guiding prescribers for common infections in adults and children. This is practical in resource-limited settings like Nigeria, where empiric prescribing is the norm and can be an effective approach to antimicrobial stewardship (Siachalinga et al., 2023; Mambula et al., 2023). Amoxicillin-clavulanic acid accounted for one-third of the antimicrobial agents most prescribed, followed by cefuroxime and amoxicillin. A similar trend in antimicrobial use among paediatric outpatients was noted in a study in South Eastern Nigeria (Emeka et al., 2023). Many antibiotic prescriptions in Sub-Saharan Africa typically include two antibiotics per patient, including cephalosporins, penicillins, and metronidazole (nitroimidazoles). A study in Gombe noted that metronidazole was the most common antibiotic prescribed and was used in addition to other antimicrobial agents (Siachalinga *et al.*, 2023; Hedima *et al.*, 2025).

The majority of antibiotics prescribed in this study are broad-spectrum, except for metronidazole. The preference for the broad-spectrum antimicrobials could also be linked to the empirical treatment approach. Broad-spectrum antimicrobials are often used because prescribers are neither guided by specific bacteriological diagnosis nor by the organism's sensitivity pattern; hence, they prefer to initiate treatment with broad-spectrum antibiotics to ensure wider coverage of microorganisms. This approach to treatment with antibiotics usually leads to polypharmacy, where other antibiotics or combinations of antibiotics are used to target the suspected infection. Empirical treatment is a major factor that drives antimicrobial resistance and could lead to treatment failure and increased treatment costs (Godman *et al.*, 2022). The strength of this study lies in the use of primary data, which ensures the the reliability of the results presented. However, limitations of this study include the fact that not all prescribing indicators were used in the evaluation of prescriptions, as the study was conducted in the outpatient department; only oral antimicrobials were captured. In addition, the study focused on prescriptions with antimicrobials; hence, the percentage encounter with antimicrobials was not ascertained.

CONCLUSION

This study demonstrated substantial compliance with WHO AWaRe recommendations and generic prescribing practices among paediatric outpatients in Benin City. However, antimicrobial prescribing remained predominantly empirical with limited microbiological confirmation. Strengthening laboratory diagnostic capacity and antimicrobial stewardship interventions may improve rational antimicrobial use and reduce antimicrobial resistance in paediatric populations.

COMPETING INTEREST

The authors declare no conflict of interest. The data and findings are solely for research purposes and the author takes full responsibility for the manuscript content.

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