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AS MEN OF HONOUR WE JOIN HANDS

A Point Prevalence Survey of Antibiotic Prescribing in three Nigerian public children's hospitals.

Nneka Egbuchulam[1*], Emmanuel N. Anyika[1], Rebecca O. Soremekun[1], Oyinlola O. Oduyebo[2], Cecilia A. Mabogunje[3], Barakat A. Animasahun[4], Ann Versporten[5], Herman Goossens[5].

[1]Department of Clinical Pharmacy and Biopharmacy, Faculty of Pharmacy, University of Lagos, Nigeria
[2]Department of Medical Microbiology & Parasitology, College of Medicine, University of Lagos/Lagos University Teaching Hospital, Lagos, Nigeria.
[3]Massey Street Children Hospital, Lagos Island, Lagos, Nigeria.
[4]Department of Paediatrics, Lagos State University Teaching Hospital. Ikeja, Lagos, Nigeria
[5]University of Antwerp, Faculty of Medicine and Health Sciences Laboratory of Medical Microbiology, Antwerp, Belgium

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* *Corresponding Author:*
negbuchulam@gmail.com
+2348025378605
http://orcid.org/0000-0003-0873-2794

ABSTRACT

Background: Antibiotic resistance continues to impact public health globally hence the need to monitor antibiotic use in hospitals and in children in order to identify gaps in prescribing practices for possible intervention. This study investigated the prevalence and characteristics of antibiotic prescribing in three government hospitals in Lagos Nigeria in November/December 2015 using the Global point prevalence survey of antimicrobial consumption and resistance (G-PPS) as a tool. Data were analysed using the Statistical Package for Social Sciences (SPSS) software version 22. **Results:** Of the 207 inpatients, 180 (87%) were prescribed at least one antibiotic during the survey period. Furthermore, 81% and 89.3% of neonates and paediatric patients respectively were on antibiotics. The most commonly prescribed antibiotic class for neonates were the aminoglycosides (38.1%) and the third- generation cephalosporins (31%). In paediatric patients, the third-generation cephalosporins were the most prescribed (26.2%). Most common diagnosis in neonates was sepsis (38.3%) while lower respiratory tract infections (25.7%) were most occurring in paediatric patients. Community acquired infections were the most common indications for prescribing accounting for 48.8% and 56.6% of neonatal and paediatric prescriptions respectively. Overall, parenteral antibiotic accounted for 96.4% and 80.5% of antibiotics prescribed for neonates and paediatric patients. Targeted antibiotic prescribing was observed in 8.3% and 5.8% of neonatal and paediatric prescriptions. Furthermore, biomarker was used to guide prescribing in only 1.2 % of neonatal prescriptions. Antibiotic stop /review dates were documented in 11.9% and 12.5% of neonatal and paediatric prescriptions.

Conclusion: A high prevalence of antibiotic prescribing was observed in the surveyed children's hospitals. The high use of third generation cephalosporins, the predominant use of parenteral antibiotic formulations and the low documentation of stop review dates were among the identified areas for improving prescribing practices at these hospitals. The identified gaps can form the basis for implementing Antibiotic Stewardship Interventions in the hospitals of study.

1 Introduction

Antimicrobial resistance (AMR), has evolved into a threat of global and growing concern[1] . Policy makers and International Organizations such as the World Health Organization (WHO), the Centre for Diseases Control and Prevention (CDC) and the European Parliaments (EP) are also concerned about the burden of AMR and have instituted coordinated efforts targeted at addressing the problem[2-4]. In 2017, the Nigerian government developed and implemented a National Action Plan (NAP) based on the 'one health approach' to address the rising threat of AMR[5]. The National Action Plan was is in alignment with the WHO Global Action Plan (GAP) for AMR, which clearly highlights the need for measures such as awareness creation, surveillance and Antimicrobial Stewardship in addressing the problem globally[2].

Infections from resistant bacteria are now too common with some pathogens exhibiting resistance to multiple types or classes of antibiotics used specifically for the treatment of bacterial infections even amongst children [6,7]. The consequence of this menace is that patients are likely to spend more on their health care needs, suffer worse clinical outcomes or even death [8]. Also, the phenomenon of globalisation has further complicated the problem as 'superbugs' with a genetic code (New Delhi metallo-beta lactamase 1or NDM1) first identified in India were afterwards reportedly found in Pakistan, France, Japan, and in the United States [9]. In Africa, AMR imposes tougher challenges in the context of an already burdened and challenged health care system and further complicates the diagnosis and treatment of infections [3]. The problem and impact of AMR in Nigeria has also been clearly identified and documented [5,10]. Hence the need for a global response in combating AMR.

The link between the development of antibiotic resistance and the use of antibiotics is well accepted as a combination of complex factors such as the inappropriate and excessive use of antibiotics in human and animal health [11]. In Nigeria, antibiotics can be freely purchased even without a doctor's prescription; a practice which encourages self-medication and contributes to the problem of AMR. This implies that the use of antibiotics must be regulated in all practice settings so that factors, which encourage the development of resistance, are checked and subsequently controlled. To curb the problem of AMR, specifically in hospital settings, world bodies recommend the implementation of antibiotic stewardship program [2,12]. The National Action Plan for AMR in Nigeria also recognizes the need for implementing Antimicrobial Stewardship in both private and public sectors which include hospitals managed by the government [5]. These stewardship programs or interventions are designed to ensure optimal and appropriate use of antibiotics with the ultimate aim of improving patient outcomes while minimizing toxicity and the emergence of antibiotic resistance [12].

In spite of the reality that children are major users of antibiotics in hospitals, very little progress has been made with respect to developing paediatric antibiotic stewardship programmes [13]. To successfully implement stewardship programs particularly one designed with the interest of the paediatric patient at hand, baseline information on antibiotic prescribing in the paediatric population is needed [13,14] as it will provide insight into prescribing practices of physicians within the hospital. With such information, targets for improving prescribing can be identified and suitable interventions implemented. Unfortunately, studies on antibiotic prescribing in hospitalised neonates and paediatric patients are also scarce particularly in low-middle- income - countries [14,15]. According to Abdul-Nasiru the inadequate data on antibiotic use in hospitalised children poses a challenge to rational antibiotic use in this patient population [16]. Specifically for Nigeria, it was reported [17] that most studies on antibiotic prescribing were on adult outpatients, leaving a gap of information on paediatric inpatients antibiotic use.

This study was therefore conducted to determine the prevalence and characteristics of antibiotic prescribing in hospitalised neonatal and paediatric patients in some Nigerian hospitals. In addition, targets for improving the use of antibiotics were identified as a basis for ultimately informing stewardship activities with a paediatric focus.

2. Methods

2.1 Study Design and Setting: This cross-sectional study was conducted in three government hospitals located in the urban and cosmopolitan city of Lagos State, Nigeria: Massey Street Children's Hospital (MSCH), Lagos State University Teaching Hospital (LASUTH) and Lagos University Teaching Hospital (LUTH). The hospitals surveyed consisted of two teaching hospitals (LASUTH and LUTH) and a paediatric specialist hospital (MSCH). MSCH and LASUTH are under the management of the Lagos State government while LUTH is under the management of the Federal Government. All hospitals provide neonatal and paediatric care to critically ill patients from several private and public hospitals within and outside Lagos state. Approvals and permissions for conducting the study were obtained from the Ethics and Research Committees of the participating hospitals prior to commencement of the study.

This study on antibiotic prescribing was carried out at the neonatal and paediatric wards of MSCH, LASUTH and LUTH between November 30, 2015 and December 10, 2015. Data were collected based on the Global Point Prevalence Surveillance (PPS) methodology from each ward by the research pharmacist and an assistant using a specific form for recording ward details [18]. The participating wards were surveyed only once during the study period.

Participants/ Inclusion and Exclusion Criteria: The survey included neonates (< 28 days) and paediatric patients (> 28 days – 17years) admitted in the wards before 08.00 hours on the day of survey. We excluded patients admitted in the emergency wards and those already discharged but still present in the ward at the time of survey.

No ward was surveyed on a public holiday or weekend. Also based on the methodology, the researchers used a patient specific form to retrieve information from patients prescribed antibiotics before or by 8 a.m. on survey day. Only antibiotics (Anatomical Therapeutic Classification code J01 including J01XD01 (metronidazole) were analysed for this study. Information on Patients demographics and characteristics of prescribed antibiotics were noted and recorded. The anatomical site for prescribed antibiotics for both neonates and paediatric patients was also documented.

Indications for prescribing antibiotic was noted as either for therapeutic or prophylactic use. Stratification of therapeutic use into community-acquired infection (CAI) or hospital-acquired infections (HAI) was also noted. Community acquired infections referring to infections occurring <48 hours from admission or were present at admission. Hospital acquired if symptoms occurred 48 hours after admission. Furthermore, prophylactic use was noted either as medical or surgical prophylaxis. For patients admitted in surgical wards, administration of prophylactic antibiotics in the previous 24 hours for surgical patients was recorded as a single dose, multiple doses in one day and for more than one day.

We also documented information on compliance to antibiotic quality indicators such as route (oral versus parenteral administration), documentation of stop/review date of prescriptions as well as extent of empiric or targeted prescribing.

To calculate antibiotic prevalence, the numerator was the total number of patients on antibiotics while the denominator was the total number of hospitalised children surveyed as shown in Equation 1.

$$\text{Prevalence} = \frac{\text{Number of children on antibiotic}}{\text{Number of hospitalised children at the time of the study}} \times 100 \quad \text{…Equation 1}$$

We analysed the data using Statistical Package for Social Sciences (SPSS) software version 22. Descriptive statistics such as frequencies, cross-tabulations, and proportions were used to examine data on antibiotic use. Chi square was used to test the association between the use of various antibiotic classes among neonates and paediatric patients and a p-value of ≤ 0.05 was considered significant.

3. Results

3.1 Prevalence of Antibiotics Prescribing in Three Government Hospitals

The survey included 207 patients (58 neonates and 149 paediatric patients) in 19 wards, of which 180 (87%) were prescribed at least one antibiotic on the day of the point prevalence survey. Prevalences of AB prescribing for individual hospitals were found to be similar, within the range of 82.8% to 93.5%, (χ^2 test p=0.169). Furthermore, 81% (47/58) of neonates and 89.3% (133/149) of paediatric patients received at least one antibiotic on the survey day. Considering ward activity,

the highest prevalence of AB use was observed in surgical wards (96.4%) followed by intensive care unit (95.7%) when compared to medical wards (84%) as shown in Table 1. Furthermore, specific wards had prevalence rates within the range of 81.8% to 100% amongst participating wards. Lowest prevalence of 81.8% was observed for patients admitted in the Paediatric General Wards while the Protein Energy Malnutrition (100%) and the Infectious Diseases Wards (100%) had the highest prevalence of AB use.

Table 1: Antibiotic prevalence rates in surveyed hospitals and wards

NICU: Neonatal Intensive Care Unit, PGW: Paediatric general ward, IDW: Infectious Diseases Ward, PEM: Protein Energy Malnutrition ward.

Characteristics	Number of patients on antibiotic	Number of hospitalised patients	Antibiotic Prevalence Rates (%)
Hospitals			
All	180	207	87
Hospital A	58	62	93.5
Hospital B	48	58	82.8
Hospital C	74	87	85.1
Ward Activity			
Medical	131	156	84
S urgical	27	28	96.4
Intensive	22	23	95.7
Wards			
Neonatal	23	28	82.1
NICU	22	23	95.7
PGW	81	99	81.8
Surgical	27	28	96.4
Oncology	12	14	85.7
IDW	6	6	100
PEM	9	9	100

NICU: Neonatal Intensive Care Unit, PGW: Paediatric general ward, IDW: Infectious Diseases Ward, PEM: Protein Energy Malnutrition ward.

3.2 Demographics of patients on Antibiotics in Surveyed hospitals

Majority of patients 133 (73.9%) on antibiotics were paediatric patients within the age bracket of 2 – 17 years (54%) as shown in Table 2. Neonates accounted for 47 (26.1%). Furthermore, male patients amongst neonates were 55.3% and 54.1% among paediatric patients. Table 2 shows indications for prescribed antibiotics. The most common indication for antibiotic prescribing in neonates and paediatric patients was CAIs accounting for 48.8% and 56% of antibiotics prescribed respectively. Furthermore, 41 prescriptions were administered for surgical antibiotic prophylaxis (SAP). Prescriptions for SAP was given for more than 24 hours in 92.6% of cases as shown in Table 2.

Table 2: Demographics, indication and quality indicators of antimicrobial prescribing for neonates and paediatric patients.

	Neonates n=47 (%)	Paediatric n=133	All (n=180)
Sex			
Male n (%)	26 (55.3)	72 (54.1)	98 (54.4)
Female n (%)	21 (44.7)	61 (45.9)	82 (45.6)
Age category			
0-28 days n (%)	47 (100)		47
29 days to 2 years (%)		52 (39.1)	
>2 years to 17 years (%)		81 (54)	
Total number of AB prescribed	84	191	275
Mean AB per patient	1.79	1.44	1.52
Number of antibiotics prescribed			
One n (%)	11(23.4)	77 (57.9)	88 (32)
Two n (%)	35 (74.5)	54 (40.6)	89 (32.7)
Three n (%)	1 (2.13)	2 (1.5)	3 (1.09)
Indication for prescribing			
Therapeutic use n (%)	56 (66.6)	121 (63.4)	177 (64.4)
Prophylacti c use n (%)	28 (30.9)	70 (36.6)	98(35.6)
Therapeutic indication			
Community acquired n (%)	41(48.8)	107 (56)	148(53.8)
Hospital acquired n (%)	15 (17.9)	14 (7.3)	29(10.5)
Prophylactic antibiotic			
Medical prophylaxis n (%)	20 (23.8)	37 (19 .4)	57(20.7)
Surgical prophylaxis n (%)	8 (9.4)	33 (17.3)	41(14.9)
Surgical prophylaxis			
Single dose n (%)	0 (0)	1 (3.0)	1 (2.4)
One -day n (%)	1 (12.5)	1 (3.0)	2 (4.7)
More than one - day n (%)	7 (87.5)	31 (94)	38 (92.6)

3.3 Patients diagnoses and prescribed antibiotics

Diagnoses for prescribed antibiotics for both neonates and paediatric patients in this survey is below in Figure 1. For neonatal patients, sepsis (38.3 %) and prophylaxis for maternal and neonatal risk factors (27.6%) were the most common diagnoses for prescribing. For paediatric patients, lower respiratory tract infections (25.7%) and central nervous infections (10.3%) were the most commonly occurring diagnosis for prescribing as shown in Figure 1

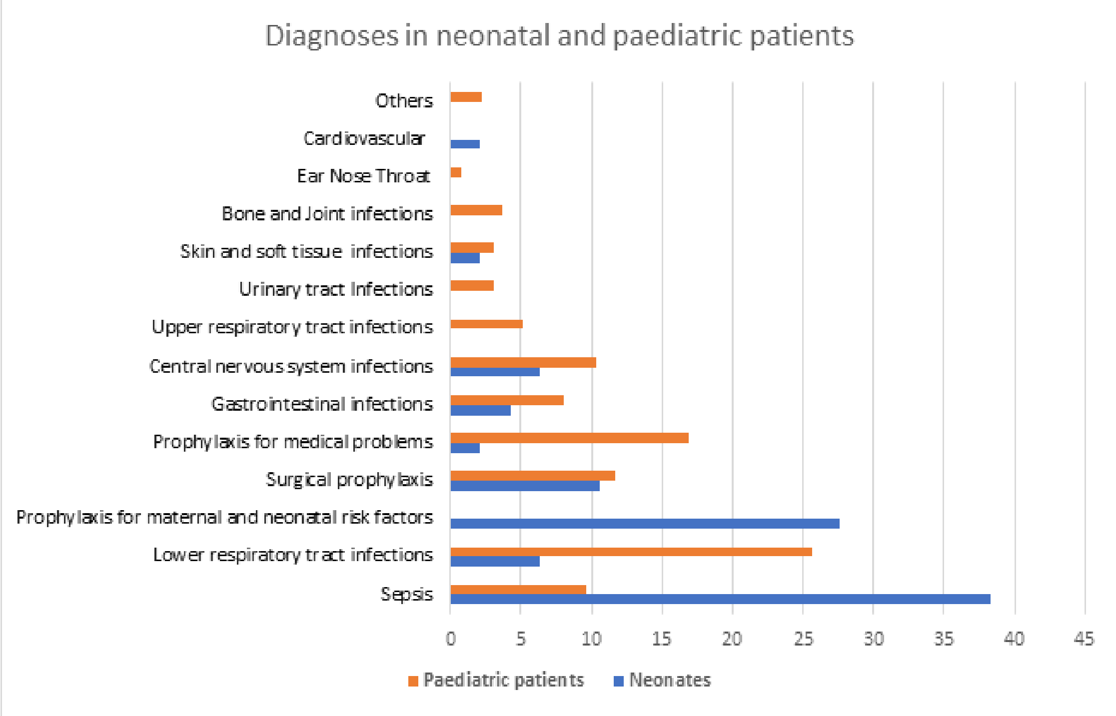

Figure 1: Patients diagnoses for prescribed antibiotics.

3.4 Antibiotic Classes and types Prescribed in Surveyed Hospitals

A total of 275 antibiotics were prescribed for 180 patients, 84 for neonates and 191 for paediatric patients, which is on average of 1.79 per hospitalised neonate, and 1.44 per hospitalised paediatric patient. Considering the use of multiple antibiotics, majority (76.6 %) of neonates were prescribed two or three antibiotic combinations as against 42.1% in paediatric patients. Furthermore, the association between patient age and class of antibiotics prescribed was determined to understand the influence of age on the choice of certain classes of antibiotics. The aminoglycosides (38.1% of neonatal prescriptions), the third generation cephalosporins (31%) and the floroquinolones (8.3%) were the most prescribed for neonatal patients while the third generation cephalosporins (26.2% of paediatric prescriptions), the second generation cephalosporins (17.1%) and the penicillins (13.1%) were the most prescribed antibiotic class for paediatric patients respectively. These findings were statistically significance as shown in Table 3

Also, with respect to specific antibiotics, the most prescribed for neonatal patients were amikacin (27.4% of neonatal prescriptions), cefotaxime (19%) and gentamicin (10.7%) while ceftriaxone (20.9% of paediatric prescriptions), cefuroxime (17.3%) and gentamicin (10.7%) were the most prescribed for paediatric patients as reported in Table 3.

Table 3: Antibiotics class, types prescribed for neonatal, and paediatric patients

Antibiotic prescribed	Total	Neonates	Paediatric	*p* value
3rd generation cephalosporins	76(27.6)	26(31)	50 (26.2)	0.479
Cefotaxime	19(6.9)	16(19)	3(1.6)	
Ceftriaxone	47(17.1)	7(8.3)	40(20.9)	
Ceftazidime	8(2.9)	2 (2.4)	6(3.1)	
Cefpoxidime	1(0.4)	0(0)	1(0.5)	
Cefixime	1(0.4)	1(1.2)	0(0)	
Aminoglycosides	55(20)	32(38.1)	23 (12)	**<0.001**
Amikacin	30(10.9)	23 (27.4)	7 (3.7)	
Gentamicin	25 (9.09)	9 (10.7)	16 (8.4)	
2nd generation cephalosporins	36(13.1)	3 (3.6)	33(17.3)	**0.004**
Cefuroxime	36(13.1)	3 (3.6)	33(17.3)	
Penicillins	29(10.5)	4(4.8)	25(13.1)	**0.038**
Ampicillin cloxacillin	21 (7.6)	1 (1.2)	20 (10.5)	
Ampicillin	1 (0.4)	1 (1.2)	0 (0)	
Amoxicillin	3(1.1)	1 (1.2)	2 (1.05)	
Cloxacillin	3(1.1)	1(1.2)	2(1.05)	
Crys talline penicillin	1(0)	0(0)	1(0.5)	
β-lactam + β lactamase inhibitors	14 (5.1)	4(4.8)	10(5.2)	0.869
Ampicillin/sulbactam	8(2.9)	4(4.8)	4(2.1)	
Ampicillin clauvalanate	6 (2.2)	0(0)	6(3.1)	
Imidazole	24 (8.7)	5 (6)	19 (9.9)	0.280
Metronidazole	24(8.7)	5 (6)	19 (9.9)	
Fluoroquinolones	13(4 .7)	7 (8.3)	6(3.1)	0.062
Ciprofloxacin	6(2.2)	6 (7.1)	0(0)	
Levofloxacin	7(2.5)	1(1.2)	6(3.1)	
Trimethoprim sulfamethoxazole	16(5.8)	0 (0)	16(8.4)	**0.006**
Cotrimoxazole	16(5.8)	0 (0)	16(6.4)	
Macrolides	5(1.8)	0 (0)	5(2.6)	0.135
Erythromycin	5(1.8)	0 (0)	5(2.6)	
Carbapenems	4(1.5)	3 (3.6)	1(0.5)	0.052
Meropenam	4(1.5)	3 (3.6)	1(0.5)	
Glycopeptides	3(1.1)	0 (0)	3(1.6)	0.248
Vancomycin	3(1.1)	0 (0)	3(1.6)	
Total number of prescriptions	275	84	191	

3.5 Antibiotic Quality Indicators

Of the 275 antibiotics prescribed, parenteral administration was in 85.5%, specifically 96.4% in neonates, and 80.6% in paediatric patients. Targeted therapy was 6.5%. Overall, biomarkers were used to guide prescribing in 0.4% of prescriptions, with procalcitonin being the only biomarker used in one neonatal antibiotic prescription (1.2%). Documentation of stop or review date was done in only 11.9% and 12.5% of neonatal and paediatric prescriptions respectively (Table 4).

Table 4: Quality indicators for antimicrobial prescribing

Quality Indicators	Neonates	Paediatric patients	All
Parenteral antibiotics n (%)	81 (96.4)	154 (80.6)	235 (85.5)
Targeted antibiotic therapy n (%)	7 (8.3)	11 (5.8)	18(6.5)
Use of biomarkers n (%)	1 (1.2)	0 (0)	1(0.4)
Stop review date do cumented n (%)	10 (11.9)	24 (12.5)	34 (12.4)

4. Discussion

The study provides information on antibiotic use for hospitalised children in health facilities located in Lagos, Nigeria. Antibiotic prescribing rates of 81% and 89.3% were observed for neonates and paediatric patients respectively reflecting absence of antimicrobial stewardship programs and activities in the country at the time of study. Findings from this study is in concordance with previous studies in Nigeria where high prescribing rates ranging from 78% to 94.6% were reported in neonatal and paediatric wards of Nigerian hospitals[19-21]. These figures are much higher when compared to studies from Europe and the United States of America[22-26] where prescribing rates of 21% to 43.8% were reported but somewhat within the range of studies conducted within other African countrie[27-29]. Accordingly, a high prevalence of antibiotic use possibly suggests that a significant proportion of prescribed antibiotic may be inappropriate or unnecessary, necessitating appropriate intervention[29]A needs assessment for antimicrobial stewardship has been performed in the same state to identify gaps for future interventions. The study revealed minimal antimicrobial stewardship activities in healthcare facilities in the state and highlighted possibilities of leveraging on available information technology resources for a coordinated antimicrobial stewardship strategy[30].

In Kenya, a prevalence of 93.7% and 84.2% was reported for neonatal medical and paediatric medical wards respectively[27]. In Egypt, a prevalence of 80.5% and 68.1% was reported for children < 5years and those within 5-12 years respectively[28] while a prevalence of 90.9% was reported[29] in paediatric surgical wards in a Ghanaian hospital.

In this study, majority of antibiotics (48.8% and 56.6% in neonates and paediatric patients) were prescribed for community acquired infections which is similar to studies conducted in similar patient populations [31,32]. A possible reason for this could be due to the prevalence of childhood community related infections which are of frequent occurrence in children[33]. Furthermore, sepsis (38.3%) and respiratory tract infections (25.7%) were the most common diagnosis in neonates and paediatric patents which is similar to findings in a Latvian hospital[22] Furthermore, prophylactic prescribing (surgical prophylaxis and medical prophylaxis) accounted for 33.3% and 36.7% of all neonatal and paediatric antibiotics prescriptions. This is similar to rates reported in other studies.[34,35] In another study, medical prophylaxis was reported to be the most common indication in a Kenyan hospital where it was reported that local guidelines encouraged prophylactic antibiotic use in neonates with birth asphyxia and low birth weight[27].

However, there are concerns regarding the prophylactic use of antibiotics in the prevention of infections and the importance of checking the use of these medicines for such indications has been emphasized[34]. In addition, strengthening infection control practices could help reduce the use of antibiotics for prophylactic purposes as physicians' often prescribe these medicines with the intention of reducing the risk of patients acquiring healthcare-associated infections during hospital stay.[28]

In this present study and with respect to surgical prophylaxis, prolonged duration beyond one day (twenty-four hours) was observed in 87.5% and 94% of neonatal and paediatric prescriptions. This correlates with findings from other studies where majority of patients had antibiotic prophylaxis for more than one day [22,34]. Although, there is little evidence to support routine prophylaxis for greater than twenty-four hours for certain surgical procedures [36]. Perhaps strengthening infection prevention and control measures within hospitals could boost the confidence of prescribers and prevent unnecessary prescription of antibiotics.

In addition, and in this study, the aminoglycosides were the most commonly prescribed class for neonates. In advanced countries, aminoglycosides use is tightly regulated and mainly confined to inpatient settings for endocarditis, sepsis and other severe infections; however, this may not be the case in developing countries where there is common use of this drug which is often encouraged by their affordability [37]. Specifically in Nigeria, high resistance to gentamicin encouraged by its wide spread use have been reported 5. The need for monitoring the use of aminoglycosides to avoid renal, vestibular and auditory toxicity in patients as well as the problems associated with antibiotic resistance is worthy of emphasis.

This study identified certain aspects for improving the quality of paediatric antibiotic prescribing. Specifically, there is need to control the high use of 3rd generation cephalosporins which accounted for 31% and 26.2% of all neonatal and paediatric prescriptions respectively. This scenario is similar to findings from other studies[22,37] where concerns over the high use of 3rd generation cephalosporins in paediatric patients were expressed. The increase in third-generation cephalosporin-resistant *Escherichia coli* has necessitated the need for controlling the use of ceftriaxone in European hospitals [38]. To control the use of these medications in hospitals, policies are required. For instance, rates of *Methicillin Resistant Staphylococcus Aureus* reportedly declined with the introduction of policies that controlled the use of cephalosporins or quinolones in certain hospitals [39]. However, introducing policies to address this issue will require raising awareness of the hospital leadership.

Another concern identified in this survey was the high rate of parenteral antibiotic prescriptions, which was observed to be 85.5% overall. This is similar to findings from other studies where the use of parenteral antibiotics accounted for 86% - 96.6% of all prescribed antibiotics [22,40,41]. It was suggested that the high use of parenteral formulations may be associated with the social acceptance that intravenous antibiotics are more effective than oral formulations [22].. The high rate of use of aminoglycosides and third generation cephalosporins (ceftriaxone and cefotaxime), which were commonly prescribed in this study and available as parenteral formulations supports this. However, the predominant use of parenteral formulations contributes to an increased cost of medications, more chances of experiencing adverse reactions or even infections associated with the use of intravenous lines.

Documentation of duration of antibiotic prescribed or (stop or review dates) in patients' notes were noted in 11.9% and 12.5% of neonatal and paediatric prescriptions. It appears that the documentation of this quality indicator is not common practices in the surveyed hospitals. A study conducted in Nigeria reported a range of 0.5 to 12.2% for documentation of stop review dates in different units of surveyed Nigerian hospitals, although the study included data from adult patients as well[19]. Ensuring that prescriptions are always accompanied by an indication and a clear duration or review date is a good practice that facilitates the review of empirically prescribed antibiotic and optimization of antibiotic therapy[36].

Furthermore, in this study, overall, only 6.5% of antibiotic prescriptions (8.3% in neonates and 5.4 % in paediatric group) were targeted at an identified pathogen implying that most prescriptions were empirically prescribed. This findings is slightly higher for the neonatal group but comparable with the paediatric group when compared with a similar study where targeted antibiotic prescribing was observed in 4.6% of neonates and 5% of paediatric patients where microbiological support for clinicians was recommended[40,41]. The use of biomarkers in guiding empiric antibiotic therapy was extremely low (0.4%) in this study. This also correlates with similar findings from a Nigerian study where the use of biomarkers was also observed to be low; it was also clearly reported that biomarkers were expensive and their use is still novel in many parts of the Nigeria[19].

Overall, this study demonstrates the usefulness of the point prevalence methodology in evaluating antibiotic prescribing in hospitalized children in a developing country. Furthermore, the study made use of three healthcare facilities, analyzing and interpreting information regarding paediatric antimicrobial prescribing in a developing country. However, the data may not be representative for most of the country considering that all participating hospitals were in one state of the country. We also acknowledge other limitations of this study, which includes the cross-sectional design of this work, as it does not provide a robust overview of antibiotics use during the entire period of hospitalization.

5. Conclusion

The Point prevalence survey was useful in identifying some characteristics of antibiotic use in three hospitals. Identified targets for quality improvement include the need to: reduce the high use of parenteral antibiotics, review the use of third generation cephalosporins especially in paediatric patients, encourage definitive antibiotic treatment and documentation of stop review dates. Lastly, there is a need for implementing antibiotic stewardship program in the surveyed hospitals considering the high antibiotic prevalence rates and the issues shown by the quality indicators.

Competing interests

Authors declare no conflict of interest.

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Authors' contributions

NE, ENA, ROS conceptualized this study. NE, ENA, ROS with input from OOO, did data collection, analysis and interpretation. NE wrote original manuscript with important contributions and critical revisions from ENA, ROS, OOO, CAM, BAA, AV and HG. All authors read and approved the final manuscript.

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