Original Article

Evaluation of Antimicrobial Prescribing Patterns and Practices in A State Specialist Hospital in A Resource-Poor Country.

***Ola-Bello OI[1,2], Versporten A[3], Ines P[3], Goossens H[3], Pelemo OE[4], Bello EO[5], Oduyebo OO[6].**

[1] *Department of Microbial Pathology, University of Medical Sciences, Ondo-City Nigeria.* [2] *University of Medical Sciences Teaching Hospital, Akure Nigeria.*

[3] *Laboratory of Medical Microbiology, Vaccine & Infectious Disease Institute (VAXINFECTIO), Faculty of Medicine and Health Science, University of Antwerp, Antwerp, Belgium.*

[4] *Department of Pathology, State Specialist Hospital ,Akure Nigeria.* [5]*Department of Paediatrics and Child Health, State Specialist Hospital, Akure, Nigeria.*

[6] *Department of Medical Microbiology, University of Lagos/Lagos University Teaching Hospital, Lagos Nigeria.*

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***Correspondence:** Ola-Bello OI.

Email: oladbello@yahoo.com

ABSTRACT

Basic knowledge of the prescribing patterns of antibiotics and practices among the prescribers within the healthcare setting are to reveal the extent of inappropriateness that needs coordinated interventions. To obtain this baseline information for antimicrobial stewardship, a uniformly standardized method for surveillance of antibiotic use in the hospital was employed to assess the antimicrobial prescribing practices among the prescribers in a State Specialist hospital, Southwest, Nigeria through repeated point prevalence surveys (PPS). This study aimed to assess the antimicrobial prescribing practices and pattern of antibiotics used in the hospital.A point prevalence survey (PPS) was conducted in all the hospital wards in November2017 and 2019. It included all inpatients receiving an antimicrobial on the day of surveys. Data collected included age, gender, antimicrobial agents, microbiological data, compliance to guidelines, and documentation of reasons and stop/review date of the prescriptions. A web-based application was used for data entry, validation and reporting. One hundred and sixty four patients were surveyed; seventy nine and eighty five in 2017 and 2019 respectively, of which 122 (74.4%) were on antimicrobials.Antimicrobial prevalence rates in hospital were 79.7% and 64.4% for the period 2017 and 2019 respectively. Most patients were on multiple antibiotics, 38(64%) in 2019 and 35(55.5%) in 2017. Choice of therapy were mainly empiric. The most frequently prescribed antibiotics were metronidazole 59(24.5%), ceftriaxone 35(14.5%), cefuroxime 31(12.9%), and ciprofloxacin 16(6.6%). The antimicrobial prescribing patterns in this hospital and the quality indicators showed a tendency for inappropriate antibiotic use. There is a need for development and use of evidence based antibiotic guidelines and institution of a formal Antimicrobial Stewardship Program in the hospital.

Keywords: Antibiotics, Antimicrobial, Global-PPS, Guidelines, Inappropriate, Misuse, Quality indicators, Resistance, Stewardship.

INTRODUCTION

Surveillance is a vital tool in defining measures needed to control antimicrobial-drug resistance AMR[1-3] which has become global problem affecting all facet of health sector**.** AMR results from excessive use, wrong dosage, wrong duration, inappropriate prescribing for wrong diagnosis, and overzealous prescription of antimicrobials for non-infectious cases and lack of protocol or guidelines for antimicrobial prescription and use [4-7]. All these cumulative effect leads to selective pressure that permit the antimicrobial resistant organisms to

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survive and multiply as well as development of unpremeditated consequences such as adverse drugs effect, drug resistance, morbidity and mortality[4-7].In response to the global threat posed by AMR, a number of actions both at national and international level has been put in place to address this issue [8]. Such actions include; optimising antimicrobial use since the production of new antimicrobial is not feasible; strengthening and conducting surveillance; infection prevention and control; and improving health workers and public awareness of resistance through education[8]. Surveillance can be achieved by measurement of antimicrobial prescribing pattern and practices among prescribers [9] and this can be achieved through point prevalence survey. Data collected through Point prevalence survey (PPS) can be used to provide guides to medical practice in areas identified as inappropriate antimicrobial use [9]. The PPS helps in identifying areas for improvement using quality indicators such as reasons for antimicrobial used in notes, stop/ review date documentation which should be counted at the antimicrobial level[9,10]; antimicrobial guidelines is another quality indicator not very much in circulation nor upheld at hospital level[9]. Guideline compliance (GC) is one of the quality indicators of appropriateness of antimicrobial use. Most hospitals do lack structured antimicrobial guideline and thus, do not implement this. For the few who have antimicrobial guidelines, however have limited knowledge on how it's been implemented. GC are counted at patient level and diagnosis for compliance for combination therapy using more than one antimicrobial would mean non-complaints if 1 antibiotic by diagnosis is not compliant, therefore this combination therapy as a whole for this diagnosis will be counted as non−compliant. Understanding these different terms of quality indicators can also enhance the knowledge of the prescribers. PPS is designed as pointer to areas of inappropriate prescribing which can form baseline for antimicrobial stewardship program (AMS) interventions [9-11]. AMS as coordinated intervention aims at improving antimicrobial prescribing hence improving infection cure rates, reducing morbidity and mortality thereby improves patients' outcomes. At all levels, AMS focuses on theappropriate use of antimicrobial agents by promoting the selection of the optimal drug regimen including dosing, duration of therapy, and route of administration [12-17].This program reduces unintended antimicrobial consequences such as emergence of resistant and drug adverse effect as well as reduce healthcare cost without adversely impacting the quality of life [16, 17] .AMS helps in designing hospital interventions through repeated PPS, auditing, preauthorization, educational materials, guidelines and clinical pathways, antimicrobial order forms, streamlining or de-escalation, dose optimization, IV-to- per oral (PO) switch, and antimicrobial cycling [12,14, 15]. The ultimate goal is the preservation of current and future antibiotics against the threat of antimicrobial resistance, although improving patient safety and reducing healthcare costs are important concurrent aims [10, 11, 18]. This study aims at identifying antimicrobial appropriateness in this hospital through pattern of antimicrobial use and prescribing practices of the clinicians.

MATERIALS AND METHODS

Study Location;

The State Specialist Hospital, Akure is the major state government-owned hospital located in Akure metropolis in Akure South Local Government Area, of Ondo State in southwestern, Nigeria. The hospital was established in 1957 by the then Western Region Government (Verbal communication). The metropolis also houses the popular Mother and Child Hospital, 2 Comprehensive Health Centers and several Primary Health Care Centers as well as private hospitals. The Hospital serves the teeming population of Akure and the neighbouring communities of the Akure North, Idanre and Ifedore Local governments. It is also a major referral center for the entire state and the neighbouring states .For the purpose of study it was still referred to as state specialist hospital because this study was the continuation of an earlier review. The hospital has been upgraded to a teaching hospital since May 2018.

Study design

This was a repeated Point Prevalence Survey

conducted in 2017 and November 2019 using the Global-PPS of antimicrobial consumption and resistance surveillance protocol. This was one-day cross-sectional PPS in that each ward within the hospital were surveyed one day only. Survey was carried out in all the wards of the hospital which comprise seven adults' wards, two neonatal (inborn and out-born units), and one older children ward of the hospital to obtain baseline information on antimicrobial prescribing practices. The adults' wards were further divided into male and female wards plus their isolation areas. The total beds capacity of the hospital was 176.

Data Collection

A uniform and standardized method [9] for surveillance of antibiotic use in hospitals was employed as designed by the University of Antwerp, Belgium; www.global-PPS.com. All inpatients receiving an active or on an ongoing (at least one antimicrobial) who were present as at 8am on the day of survey were included. Patient discharged before 8 o'clock and/or patients admitted after that time were not included and all-day cases were excluded. The data were collected on two paper forms; one departmental form that represent the denominator data and patient form that stands for numerator data. The data needed basically for the PPS were: Number of admitted patients and number of total available beds both occupied and empty beds in each ward. Also, Patients' age in days, months or years and gender as well as the antimicrobial agents, their dose per administration, number of doses per day, and route of administration. Indication for therapy (community acquired infection, hospital acquired infection or prophylaxis). Documentation of reasons and stop/review date of prescription were equally necessary. The anatomical site of infection was equally of importance and the target for prophylaxis according to the list of reasons for therapeutic or prophylactic use. The choices of treatment based on microbiological investigations were also noted.

Data analysis

A web-based application was used for data-entry, verification, validation and reporting using the Global-PPSprogram; http://app.globalpps.uantwerpen.be/globalpps-webpps. There was guarantee data privacy as patients were completely entered into the PPS program in an anonymous manner. Every patient record received a special, anonymous survey number. Based on a set of internal numbers, the computer programme automatically formed the unique identifier. In the GLOBAL-PPS database, the patient is uniquely identified by this number. The PPS was an audit of regional antibiotic prescribing practices conducted in strict anonymity.

RESULTS

One hundred and sixty-four patients were surveyed; 79 and 85 in 2017 and 2019 respectively. Of which 122 were treated with antimicrobials 63(79.7%) in 2017 and 59(69.4%) in 2019. Age ranged from 5 days old to 87years; male 70(59%) and female 50(41%) patients were on a total of 241 antimicrobials. The highest antimicrobial prevalence rate per ward activity was (90%) in Paediatrics (Figure 1). A total of 73(60%) patients were on multiple antimicrobials with a higher occurrence in 2019 (Table1). Reasons for antibiotic therapy were documented in 2017 for 77 (74.8%) patients and in all patients (100%) in 2019. Stop /review date documentation was markedly low in all wards ranging from 4.6% to 61% (Figure 2). Indications for therapy were more of community acquired infection (Table 1). Most patients were treated based on empirical therapy (Table 1); a total of 172 (71.4%) antimicrobial therapies were through the parenteral route (Table 1). Most commonly encountered infections were skin, soft tissue and bone infections 41(33.6%), Malaria 23(18.6%), Pneumonia 14(11.5%), Sepsis and CNS infections 12(9.8%) each (Figure 3). The most frequently prescribed antibiotics were metronidazole, ceftriaxone, cefuroxime, and gentamicin (Table 3).

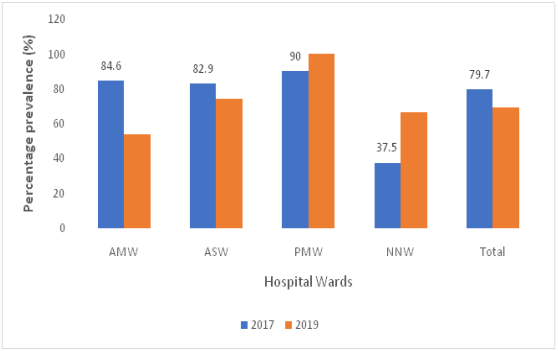

Figure 1: Antimicrobial Prevalence rate per ward activity

Antimicrobial prevalence is calculated as percentage of treated patients. Treated patients (%) = 100*(number of patients treated with at least one antimicrobial/number of admitted patients). AMW= Adult Medical Ward; ASW= Adult Surgical Ward; PMW; Paediatrics Medical Ward; NNW; Neonatal Medical Ward.

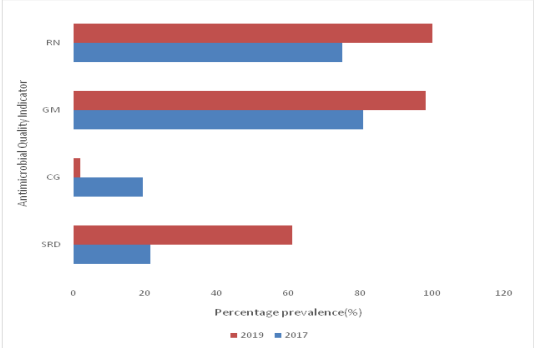

Figure 2: Summary of Antimicrobial quality indicators in the hospital. This is counted at the antimicrobial level while the guideline compliant is counted at the patient level. RN= Reason in note; GM= Guideline missing; CG= Compliant to Guideline; SRD=Stop/Review Date. For combination therapy with >1 antibiotic: if 1 antibiotic by diagnosis is not compliant, this combination therapy as a whole for this diagnosis will be counted as non−compliant.

Table 1: Prescribers' prescribing patterns

	PRESCRIPTION PATTERN	2017 n (%)	2019 n (%)
1	Indication antimicrobial use:	No of therapy 136	No of therapy 105
	CAI	90(66.2%)	63(60%)
	SP	32(23.5%)	25(23.8%)
	MP	11(8.1%)	15(14.3%)
	HAI	3(2.20%)	2(1.9%)
2	Duration Surgical prophylaxis based on antimicrobial therapy		
	- One dose (SP)	0(0%)	0 (0%)
	-One day (SP2)	0(0%)	1(0.95%)
	-Greater than one day (SP3)	32 (23.5%)	24(22.9%)
3	Most commonly used antibiotics for surgical prophylaxis based on treated patients	Metronidazole14 (43.8%) Ceftriaxone 8(25%) Cefuroxime 3(9.4%)	Metronidazole 9(37.5%) Ciprofloxacin 5(20.0%) Cefuroxime 4(16.7%)
4	Commonly used antibiotics for medical prophylaxis based on treated patients	Cefoperazone 3(27.3%) Cefuroxime 2(18.2%) Amoxicillin 2(8.2%)	Cefuroxime 10(66.6%) Gentamicin 3(20% Ceftriaxone 1(6.66%) Metronidazole 1(6.66%)
5	Multiple antimicrobial combination used based on treated patients	35(55.6%)	38(64.4%)
6	Intravenous therapy counted at antimicrobial level	97(71.2%)	75(71.4%)
7	Empiric therapy counted at antimicrobial level	136(100%)	99(94.3%)
8	Targeted therapy counted at antimicrobial level	0(0%)	6(5.7%)

CAI= Community Acquired Infection; MP= Medical Prophylaxis; SP= Surgical Prophylaxis; HAI= Hospital Acquire Infection

Table 2: Overall Proportion of antimicrobial used

	Antimicrobial therapy	2017	2019
1	Metr onidazole	35(25.7%)	24(22.8%)
2	Ceftriaxone	18(13.2%)	17(16.2%)
4	Cefoperazone	13(9.6%)	2(1.9%)
4	Cefuroxime	10(7.4%)	21(20%)
5	Other Cephalosporin	1(0.7%)	4(3.8%)
6	Ciprofloxacin	7(5.2%)	9(8.6%)
7	Levofloxacin	1(0.7%)	2(1.9%)
8	Co -amoxiclav	5(3.7%)	3(2.8%)
9	Gentamicin	1(0.7%)	11(10.4%)
10	Imipenem	3(2.2%)	1(1.0%)
11	Artesunate	12(8.8%)	5(4.8%)
12	Artemether and lumefantrin	8(5.9%)	0(0%)
13	Doxycycline	5(3.7%)	1(1.0%)
14	Clindamycin	4 (2.9%)	0(0%)
15	Fluconazole	4 (2.9%)	0(0%)
16	Co -trimox azole	3(2.2%)	1(1.0%)
17	others	6(4.4%)	4(3.8%)

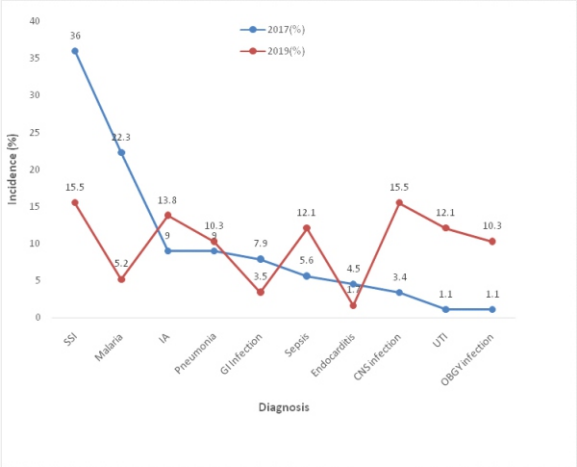

Figure 3: Ten Most Common Diagnoses Treated Therapeutically with antimicrobials
Counted on the number of diagnoses treated with at least one antimicrobial. Medical and Surgical Prophylactic prescriptions are excluded from this analysis.
SSI= Skin, Soft tissue and bone infections; IA= Intra-abdominal infection; GI= Gastrointestinal infection; UTI= Urinary tract infection; OBGY infection= Gynaecology-obstetric infection

DISCUSSION

Pattern of antimicrobials use in this hospital over the period of study show high rates of antimicrobials prescribed across all the hospital specialties, majorly for community acquired infections. This pattern is similar to reports from various studies across the country, however above the expected as obtainable in developed world [9,18-25]

In the medical wards, CNS infections, Pneumonia, sepsis and gastrointestinal infections were the most commonly encountered infections to which antimicrobials were prescribed while skin, soft tissue and bone infections had higher prevalence for antibiotic use . All these infections are priority infections that needed targeted treatments based on microbiology investigation, characterization of pathogens and antibiotics guidelines for appropriate choice of antibiotics[24, 26-28]. However, all prescriptions were empirical in 2017 (100%) while 6(5.7%) treatments were targeted therapy in 2019. This finding is in support of NCDC, 2017 reports which revealed essentially most bacterial infection are treated empirically [24]. Of note is the high rate of antimalarial use which are based on empiric therapy. It should be noted that most recommended standard antimicrobial guidelines for treatment are compromised by resistance. Failure to investigate the causative pathogens exposes the population to complication of AMR [9, 26-30,]. The importance of microbiology investigations cannot be over emphasised for surveillance as well as prompt detection of clusters of pathogens which may carry resistance strains [31-34].

Infectious diseases are responsible for around 60% cases of mortality, with the misuse of antimicrobial drugs estimated at 20-50% of prescriptions [5,7,8]. This inappropriate use of antimicrobial drugs contributes significantly to the development of antimicrobial resistance among pathogens [4, 34, 35]. Coupled with the emergence of new and resurgent bacteria, it exacerbates the rise in mortality rates.

Studies in Nigeria on antibiotic use reviewed reported high level of antibiotic excesses above international limit [9, 26-30,]. Worthy of note are high rates of multiple antimicrobial combinations used on treated patients either as medical or surgical prophylaxis in this study. This needs to be discouraged because it could hasten emergence of antimicrobial resistance if used inappropriately[36]. High usage of broad-spectrum antibiotics as seen in this study is an indicator of poor prescribing practices [9,36]. Several studies point to a link between the misuse of broad-spectrum antibiotics, including second and third-generation cephalosporins, and the rise of antimicrobial drug resistance (AMR)[3,29-32,36-41]

In this study, surgical antibiotic prophylaxes were not based on universally accepted guidelines. [42, 43]. Of note, most prescriptions were for more than one day and open without stop/review date for the therapy. Practice guidelines recommend single-dose prophylaxis for most surgical procedures or a maximum duration of 24 hours of antimicrobial prophylaxis postoperatively, regardless of the presence of invasive drains [42,43]. A high incidence of intravenous therapy in this hospital indicates needs to establish policy to implement early IV to oral switch [36].

CONCLUSION/ RECOMMENDATION

Antimicrobial quality indicators such as intravenous therapy, missing of antimicrobial guidelines, reason in note for therapy, and stop/review date for antimicrobial used were pointers towards

inappropriate antimicrobial therapy. These revealed areas that need improvement in the prescribing patterns of antimicrobials in the hospital of study showing the urgent need to establish and implement antimicrobial stewardship program as an intervention to reduce this inappropriate use of antimicrobials as well as to improve prescribing practices.

Clinical diagnosis and treatment of infectious disease based on empiric therapy underscores the significant need for policy and guideline on diagnosis and testing. Embracing the importance of Microbiology laboratory investigations would enhance early detection of resistant strains and possible reduction in AMR loads. Awareness of any existing antimicrobial guidelines among the prescribers would improve pattern of antimicrobial use.

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Conflict of Interest

The authors declared no conflict of interest in performing or reporting this research.

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