

POINT PREVALENCE SURVEY ON ANTIBIOTIC USE BY IN-PATIENTS IN A TERTIARY HEALTHCARE FACILITY IN NIGERIA

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Abstract

Background: Hospital antibiotics are often misused and overused due to the absence of information regarding the indication and duration of therapy, which often leads to antibiotic resistance. Antibiotic resistance makes antibiotics ineffective in infection management, adversely impacting the health of millions of hospitalised patients annually.

Objective: This study evaluated the prevalence of antibiotic use and relevant documentation using the WHO Global Point Prevalence survey tool among hospitalised patients in Federal Teaching Hospital, Ido Ekiti.

Methods: A point prevalence survey (PPS) using a pre-validated structured questionnaire was employed across various clinical departments in Federal Teaching Hospital, Ido Ekiti. The Global Point Prevalence Survey Tool (Global-PPS Tool) was used to assess and compare the quantity and quality of antibiotic prescribing across 9 wards on 12th February 2022. A convenience sample of 108 patients on admission to the hospital was recruited. Data was analysed using descriptive statistics.

Results: The prevalence of antibiotic use among hospitalised patients was 75.9% (82 out of 108). Access-to-Watch ratio pattern of antibiotic prescription was 0.88 while prophylactic indication for prescribing was 73.2%. Indication for antibiotic prescription was documented for only 10.8% while targeted therapy accounted for only 14.6%. There was a low rate of documentation of stop or review dates (37.8%) to guide the course of antibiotics prescribed. Culture sensitivity tests were requested in 25.6% of patients out of which only 71.4% were performed.

Conclusion: A high prevalence of antibiotic use was identified. The proportion of prescriptions based on clear therapeutic indications was quite low. There is a need for the hospital to implement an antibiotic stewardship program for guidance.

Keywords: Antibiotic Stewardship; Point Prevalence Survey; Antibiotic Resistance, Antibiotic Use.

Abbreviations: ABR, Antibiotic Resistance; ASP, Antibiotic Stewardship Programs; PPS, Point Prevalence Survey; Global-PPS Tool, Global Point Prevalence Survey Tool.

Introduction

Inappropriate antibiotic use in hospitals and nursing homes is highly prevalent and is a major factor for antibiotic resistance.^[1] Antibiotic resistance (ABR) adversely impacts the health of millions of hospitalized patients every year.^[2] Antibiotic resistance is the ability of bacteria to withstand attack by an antibiotic that was originally effective for the treatment of infections caused by it, so that standard treatments become ineffective and infections persist, increasing the risk of spreading to others.^[3] These are serious problems impacting patients every day leading to morbidity and mortality.^[1] Many organizations such as the World Health Organization (WHO) consider antibiotic resistance a major problem and have tried to prevent it from spreading. Globally, 1.27 million deaths were the direct result of antimicrobial resistance - meaning that drug-resistant infections killed more

people than HIV/AIDS (864,000 deaths) or malaria (643,000 deaths).^[4] *E. coli*, *S. aureus*, *S. pneumoniae*, and *K. pneumoniae* were the most widely identified resistant bacteria.^[5]

In the United States, more than 2.8 million antibiotic-resistant infections arise per year, resulting in more than 35,000 deaths.^[1] Studies from Nigerian hospitals have also confirmed the problem of drug resistance and the presence of multiple resistance genes limiting therapeutic options in the management of infections.^[7-8]

In response to the surge in antimicrobial resistance, WHO developed a Global Action Plan (GAP), as mandated by the World Health Assembly (WHA) 2015 resolution to optimize the use of antibiotics. One such way is antibiotic stewardship. Antibiotic stewardship is a coordinated program that promotes the appropriate use of antibiotics, improves patient outcomes, reduces antimicrobial resistance, decreases the spread of infections caused by multidrug-resistant organisms and health-care-associated infections, and saves healthcare costs amongst others.^[9-10] Antibiotics are classified into three groups, Access, Watch and Reserve (AWaRe classification), taking into account the impact of different antibiotics and antibiotic classes on antimicrobial resistance, to emphasize the importance of their appropriate use.^[11] Continuous data collection on antibiotic prescribing required a high workload and the level of resources needed for regular monitoring. In October 2016, the World Health Organization (WHO) drafted a protocol for a point prevalence survey (PPS) on antibiotic use in hospitals.^[12] PPS on antibiotic use is already in use in hospitals around the world. The European Union and the United States have developed and carried out regional surveys using PPS.^[13-14] A Global Point Prevalence Survey (Global-PPS) which established an international network of hospitals to measure antimicrobial prescribing and resistance worldwide revealed an antimicrobial use prevalence of 34.4%.^[15]

Several point prevalence surveys have been conducted globally. Surveys in Canada provided important baseline information on antimicrobial use, identified potential targets for future antimicrobial stewardship initiatives and reported an antimicrobial use prevalence of 44.9% in long-term care facilities.^[16] In the US it was reported that at least 30 percent of oral antibiotics prescribed in physicians' offices, emergency departments, and hospital-based clinics were unnecessary. An increase in the use of many broad-spectrum antibiotics with a commensurate decrease in the use of many narrow-spectrum antibiotics that target a limited group of bacteria was also reported.^[17]

In Nigeria, a point prevalence survey of antimicrobial prescribing in four Nigerian tertiary hospitals reported predominantly high rates within the range of 58.9% to 93.7%.^[18] Some Nigerian studies revealed a relatively high prevalence of antibiotic use among hospitalised patients with broad-spectrum antibiotics constituting a significant proportion of all antibiotic prescriptions.^[19-21]

Studies have shown that antibiotic stewardship programs (ASP) promote the appropriate use of antimicrobials, improve patient outcomes and reduce ABR.^[22-24] There is mounting evidence that the implementation of antibiotic stewardship programs (ASP) is a promising strategy to address the appropriate use of antibiotics and to reduce ABR, morbidity, mortality, and health care costs associated with infections.^[25] Other studies focused on analysing information on knowledge and attitudes toward antibiotic use and resistance while this work considered the prevalence of antibiotic use.

Therefore, this study aimed to assess the prevalence of antibiotic use and prescription pattern indication which is imperative for the policy-making process to curb antibiotic resistance in the Federal Teaching Hospital, Ido Ekiti, Ekiti State.

Methods

Study setting

The study was conducted at Federal Teaching Hospital (FETHI), a tertiary health facility in Southwest Nigeria. It is located in a rural area of the country with limited industrialization. FETHI has a 290-bed facility and records over 5,000 patients (in and out-patients) attendances in a month.^[26] This hospital also serves as a referral centre for primary and secondary health care centres in Ekiti state and adjacent states.

Study duration

The study duration was February- August 2022 during which data collection was initiated and completed in 1 day (12th February 2022) and statistical analysis was performed.

Study design

A descriptive point prevalence survey (PPS) was conducted using pre-validated structured questionnaires.

Study Population

The study was conducted among patients on admission receiving at least an antibiotic agent on the day of the survey and fulfilled the eligibility criteria.

Inclusion criteria

1. Acute care inpatient wards.
2. Patients admitted to the ward at least 24 hours before the survey and still present at 8 a.m. on the day of the survey.
3. All hospitalized patients receiving at least an antibiotic agent on the day of PPS administered orally, parenterally, rectally or through inhalation.

Exclusion criteria

1. Patients in the following wards were excluded: Long-term care wards, emergency wards, day surgery wards, and day care wards.
2. Patients hospitalized after 08:00 a.m., out-patient clinic, discharged patients who remain as lodgers while waiting for transportation, out-patient dialysis, out-patient parenteral antibiotic therapy.
3. Patients on topical antibiotics, ophthalmologic antibiotics, treatment initiated after 08:00 a.m., treatment discontinued before 08:00 a.m.

Sampling procedure

The sample size was calculated based on the prevalence of antibiotic use among hospitalized patients. From this calculation, a minimum sample size of 369 patients was required for this study. However, all eligible patients meeting the inclusion criteria were surveyed. The convenience sampling technique was applied and a total sampling of all 108 patients were recruited into the study. [27]

Data collection procedure

The Global Point Prevalence Survey Tool (Global-PPS Tool) [28] was used to assess and compare the quantity and quality of antibiotic prescribing. The Global-PPS Tool is a standardized two-part structured questionnaire consisting of ward and patient forms. The ward form was used to obtain information on activities and specialities available in each ward, while the patient form obtained demographic, clinical and laboratory data from selected patient files.

The questionnaire was subjected to psychometric analysis by content validity using a pilot test on five patients to determine a need for adjustment before the commencement of the actual study. The content validity ratio was 0.8. The outcomes of the pilot testing were further used to edit the questionnaire to enhance clarity and flow.

Data collection was initiated and completed from nine clinical wards namely: postnatal, gynaecology, male surgical, male medical, female surgical, female medial, male orthopaedic, female mental health and children wards of the hospital on 12th February 2022. The correctness of the information entered was verified by an independent pharmacist not directly involved with the study. Information entered in the structured data collection sheet formed the basis for analysis and interpretation.

Ethical Considerations

Ethical approval for the study was obtained from the ethics and research committee of Federal Teaching Hospital, Ido-Ekiti with correspondence number ERC/2021/12/27/689A. Informed consent was obtained from each respondent. Furthermore, participants' confidentiality was respected by coding the patient's identification and no unauthorized use of the information was made.

Data Management

Patients were anonymized. The patient identifier (i.e. "Patient ID") did not contain any directly identifiable information, such as name and/or date of birth. An anonymous code was assigned to each surveyed patient (i.e. "Patient Code"). This code was unique for each surveyed patient at the hospital level. Prescribed antibiotics were categorized into WHO access, watch or reserve (AWaRe) classification and their respective anatomical therapeutic chemical (ATC) codes to emphasize the importance of their appropriate use.

Quality indicators of antibiotic use included clinical indication, guideline compliance, stop/review date, targeted therapy and parenteral use.

Data Analysis

The collected data were checked and cleaned for completeness and then analyzed using Statistical Product and Service Solutions (SPSS) software (version 22.0). Descriptive statistics were used for demographic and clinical characteristics of the patients. Categorical variables were reported as frequencies and percentages.

The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines were used to report the study. ^[29]

Results*Socio-demographic Characteristics of the Respondents*

The average age of inpatients was 35 years. Male patients accounted for the majority of patients on antibiotics and a total of 231 antibiotics were prescribed for the 82 patients (Table 1).

Table 1: Patient Demographics (N=82)

Parameters	Sub-group	Proportion
Gender	Male	43 (52.4%)
	Female	39 (47.6%)
Age category	Paediatric	20 (24.4%)
	Adult	62 (75.6%)
Total number of Antibiotics	231	
Number of patients	82	
Mean antibiotic prescribed (SD)	2.82 (0.9)	

Number of antibiotics prescribed	One	13 (15.9%)
	Two or more	69 (84.1)

Antibiotic Prevalence Rate within the hospital and across wards

The total hospital prevalence of antibiotic use was 75.9% (82 of 108 inpatients). Among the wards, the prevalence of antibiotic use ranged from 33.3% to 93.3% with the highest prevalence in the female surgical ward 93.3%, and the lowest in the male mental health ward. The majority of patients were admitted for surgical activities (Figure 1).

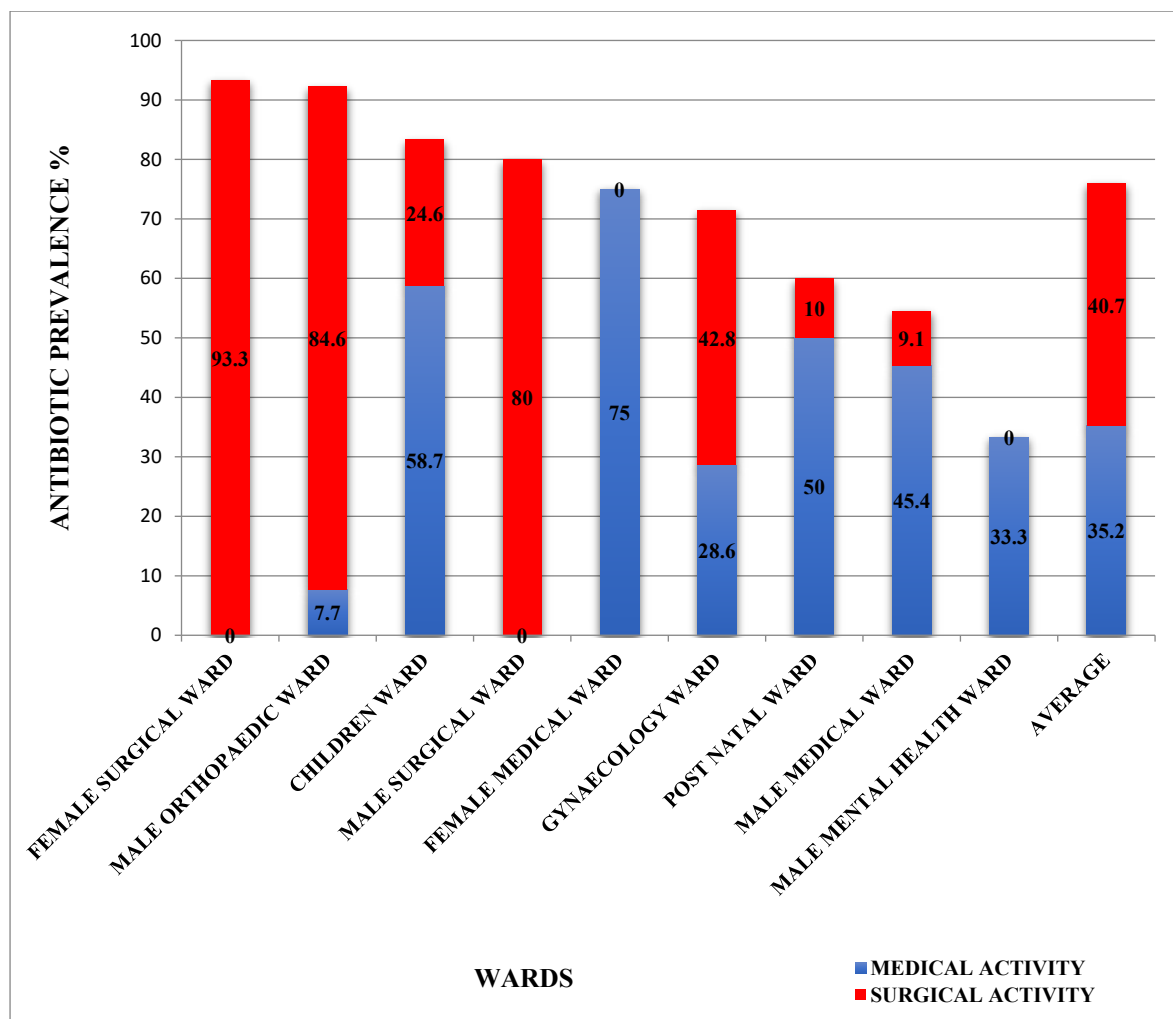


Figure 1: Antibiotic Prevalence Rate within the hospital and across wards

Pattern of Antibiotic Prescriptions

Total hospital-wide AwaRe percentages for antibiotics were composed of 46.8% Access and 53.2% Watch. The access-to-watch ratio was 0.88. Specifically, metronidazole, cefuroxime, ceftriaxone, ciprofloxacin and gentamycin were the top five most frequently prescribed antibiotics (Table 2). The proportion of patients on multiple antibiotics use was 84.1% (Table 1).

Table 2: Distribution of Antibiotic Prescriptions by AWaRe Category AND WHO EML list

s/n	ANTIBIOTIC	ATC CODE	AWaRe CATEGORY	WHO EML LIST (YES/NO)	FREQUENCY (PERCENT) N=231
1	PERFLOXACIN	J01MA03	WATCH	NO	1 (0.004)
2	CEFTAZIDIME	J01DD02	WATCH	YES	1 (0.004)
3	AMIKACIN	J01GB06	ACCESS	YES	1 (0.004)
4	VANCOMYCIN N	A07AA09	WATCH	YES	1 (0.004)
5	MEROPENEM	J01DH02	WATCH	YES	1 (0.004)
6	AMPICLOX	J01CA01	ACCESS	YES	2 (0.008)
7	CEFEPIME	J01DE01	WATCH	NO	2 (0.008)
8	CEFIXIME	J01DD08	WATCH	YES	3 (0.013)
9	LEVOFLOXACIN	J01MA12	WATCH	NO	4 (0.017)
10	AZITHROMYCIN	J01FA10	WATCH	YES	4 (0.007)
11	AMOXICILLIN	J01CA04	ACCESS	YES	5 (0.022)
12	AMOXYL/CLAVULANIC ACID	J01CR02	ACCESS	YES	13 (0.056)
13	GENTAMICIN	J01GB03	ACCESS	YES	16 (0.069)
14	CIPROFLOXACIN	J01MA02	WATCH	YES	23 (0.099)
15	CEFTRIAZONE	J01DD04	WATCH	YES	25 (0.108)
16	CEFUROXIME	J01DC02	WATCH	YES	58 (0.251)
17	METRONIDAZOLE	J01XD01	ACCESS	YES	71 (0.307)

Indications for Antibiotic Prescriptions

Of 231 antibiotic prescriptions, 73.2% were issued for prophylaxis, 47.6% were issued for surgical prophylaxis, and 18.2% were issued therapeutically for community-acquired infections. Prescriptions for surgical prophylaxis were given for >1 day in 95.0% of cases (Table 3).

The most common diagnosis among patients prescribed antimicrobials was skin and soft tissue; bone/joint infections SSTBJ (37.8%). About two percent of diagnoses (2.4%) had no defined site (Figure 2)

Table 3: Indications for antibiotic prescriptions (N=231)

Indication	n (%)	Total
Therapeutic		59 (25.5%)
Community-acquired infections (CAI)	42 (18.2)	
Healthcare-associated infections (HAI)	17 (7.4)	
Prophylactic		169 (73.2%)
Medical prophylaxis (MP)	59 (25.5)	
Surgical prophylaxis (SP)	110 (47.6)	
Indication not inferred	3 (1.3)	3 (1.3%)

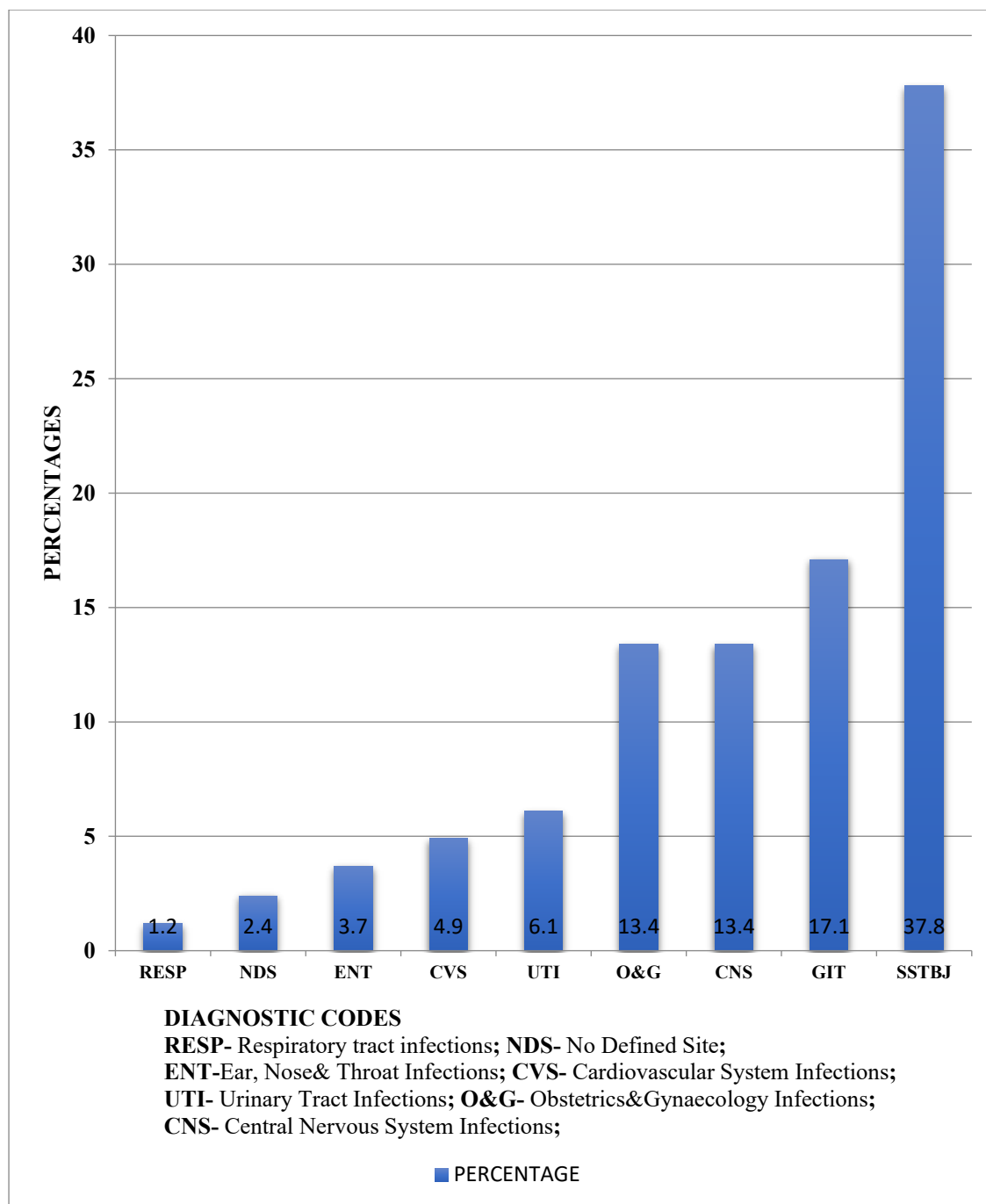


Figure 2: Common Diagnosis among Patients Prescribed Antibiotics

Quality Indicators of Antibiotic Use

Indication for antibiotic prescription was documented in the notes for 10.8% of the antibiotic prescriptions. Stop/review date was documented for 37.8% of prescriptions, and guideline compliance for all antibiotic prescriptions was not accessible because of the absence of local guidelines. Three percent (3%) of antibiotics were not prescribed according to the WHO essential medicines list. Targeted therapy accounted for 14.6% of antibiotic prescriptions. Parenteral use of antibiotics was 74% (Table 4).

Table 4: Quality Indicators of Antibiotic Prescribing

Quality Indicators	Proportion (%)
Clinical indication	10.8%
Guidelines compliance	Not assessable
Stop/review date	37.8%
Targeted therapy	14.6%
Parenteral use	74%

Discussion

In this point prevalence study, the majority (75.9%) of patients were found to have had at least a single antibiotic exposure. This value is substantially higher than the global data of 34.4%^[15] and 44.9% in long-term care facilities in Canada.^[16] Meanwhile, this finding is in concordance with recent PPS data from Africa including Nigeria which have reported predominantly high rates within the range of 58.9% to 93.7% possibly implying that antibiotic use in this region is higher than in Western countries.^[18; 30-33] A high prevalence of inappropriate antibiotic prescription was reported and this is consistent with a previous study in the US.^[34] Although male patients accounted for the majority of patients on antibiotics, prevalence across wards was highest in the female surgical ward probably due to gender differences in co-morbidity, cosmetic surgeries, female patient demand for antibiotics and health-seeking behaviour.^[35-36] Similarly, high rates were reported in a UK-based gender gap study.^[37]

This problem of poor antibiotic prescribing practice is further reinforced by the dominance of the Watch category of antibiotics in the categories prescribed in the hospital (Table 2). The WHO recommends that Access to antibiotics should account for at least 60% of the national antimicrobial consumption. This target has been developed to support antimicrobial use monitoring and to improve access to essential medicines, ultimately reducing the emergence and spread of antimicrobial resistance.^[38] However, in this survey, less than the WHO-required proportion of antibiotics fell within the Access category (46.8%); consistent with global and South African report findings.^[39-40] This is probably due to fear of the risk of treatment failure, low socioeconomic background and poor regulation.

Broad-spectrum antibiotics, particularly cephalosporins accounted for a significant proportion of prescribed antibiotics (Table 2). The reason is not far-fetched as skin and soft tissue; bone and joint infection was the most common diagnosis in this centre and cephalosporins are the drugs of choice in this facility especially in the surgical wards. However, this prescription pattern, which is associated with the tendency to use broad-spectrum antibiotics, is usually due to poor or absent diagnostic tools or failure to utilize them properly where available. Similarly, several studies reported an increase in the use of many broad-spectrum antibiotics with a commensurate decrease in the use of many narrow-spectrum antibiotics that target a limited group of bacteria %.^[17, 31] As broad-spectrum antibiotics have been shown to significantly increase the risk of drug-resistant infections, this trend should be of concern.⁽⁴¹⁾ The study also reflected a significantly high rate of fluoroquinolone usage; specifically ciprofloxacin, perfloracin and levofloxacin probably due to their broad-spectrum bactericidal activity and easy access. This should be cautioned as perfloracin and levofloxacin are not included on the WHO

Model Lists of Essential Medicines and excessive fluoroquinolone usage has been shown to promote antimicrobial resistance. [42, 43]

Regarding indication, prophylactic antibiotic prescribing occurred in 73.2% of the patients, with surgical prophylaxis being more prevalent (47.6%); and metronidazole being the most commonly prescribed antibiotic for GI-related surgeries. This practice is supported by a study in the US that opined that the use of prophylactic antibiotics has led to the prevention of a large number and variety of infections and substantial declines in surgical site infections. [44] Similarly, a randomized controlled trial showed benefit of a single dose of prophylactic antibiotic after non-operative vaginal birth in reducing the incidence of wound infection and endometritis. [45] However, prophylactic use of antibiotics to prevent infections is contentious. The latest American Heart Association and European Society of Cardiology guidelines recommend a restriction on the use of prophylactic antibiotics even to patients thought to be at high risk. This reduction in antibiotic use did not yield a significant increase in the number of cases of infective endocarditis. [46]

Evaluation of the quality indicators for appropriateness of antibiotic prescribing revealed several specific areas calling for improvement. The lack of indications for therapy in the majority (89.2%) and the low rate of documentation of stop or review dates (37.8%) to guide the course of antibiotics prescribed are examples. This resulted in healthcare staff leaving patients on these medications for inappropriate durations. Several studies have reported a low rate of documentation of stop review dates in different units of surveyed Nigerian hospitals. [47-48] This finding is of major concern because documentation of treatment should include a clinical indication, duration of treatment or review date, route, and dose of antibiotics. [49] Ensuring all antibiotic prescriptions are always accompanied by an indication and a clear duration or review date will help clinicians and healthcare staff intervene to modify antibiotic therapy when appropriate. However, a standard practice of clear documentation of stop/review dates and reasons for antimicrobial use was reported among inpatients of a tertiary hospital in South East Nigeria. [31]

There was a very high rate of parenteral use of antibiotics in this hospital (74%), contrary to the advocated practices in the WHO antimicrobial stewardship program. [50] This could be due to differences in patient characteristics, their need for parenteral antibiotics, absence of antibiotic policies and physician training. Furthermore, many patients prefer injections because they wrongly believe that these will provide quick relief or work better than oral medicines. Similar values were also reported in Indonesia (85.1%). [51] The overuse of parenteral antibiotics often increases the duration of hospital stays and poses a challenge for infection prevention and control, especially in resource-constrained countries. [19, 52]

Concerning targeted antibiotic prescribing; very few antibiotic prescriptions (14.6%) were targeted at an identified pathogen, implying that most prescriptions were empirically prescribed. This observation could arise because most of the prescriptions were from the surgical ward where patients get initiated on treatment before culture and sensitivity screening possibly due to the emergency nature of the setting. Furthermore, late delivery of results and financial constraints on the part of patients could also have contributed to the high percentage of empirical therapy. This correlates with findings from other studies in Africa where targeted prescribing was observed to be in a range of 3.8% to 14.9%. [18, 53] Training of health professionals with emphasis on the physicians, development of clinical-based guidelines and laboratory support, and retraining of prescribers on the importance of definitive or targeted therapy will be necessary to improve prescribing practices in this hospital.

Limitations to the study

The point prevalence survey was limited to just one study site and results may not be generalized. It will however stand as a take-off point for further studies in the state/region of study. Secondly, this study had a low sample size. Thirdly, it did not include resistance patterns of the isolates. Lastly, the cross-sectional nature of the design may underestimate the prevalence of antibiotic use compared to other study designs.

Despite these limitations, this study is the first point prevalence survey on antibiotic use in the Federal Teaching Hospital, Ido Ekiti.

Conclusion

A high prevalence of antibiotic use was identified. The proportion of prescriptions based on clear therapeutic indications was quite low. It is evident that the hospital needs to implement an antibiotic stewardship program. Thus, establishing antibiotic stewardship programs through established guidelines, diagnostic algorithms, and appropriate prescribing behaviours will present an efficient platform for effective antibiotic resistance prevention and control.

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