Original Article

Survey of Antimicrobial Consumption in a University Teaching Hospital in Southern Nigeria

Agantem Emmanuel Ekuma, Echey Ijezie[1], Tiemah Akpabio[2], Ifeanyi Abraham Onwuezobe

Departments of Medical Microbiology and Parasitology and [1]Pediatrics, University of Uyo, [2]Department of Internal Medicine, University of Uyo Teaching Hospital, Uyo, Akwa Ibom, Nigeria

Abstract

Background: There is increasing use of antimicrobial agents worldwide and especially in low- and middle-income countries. Point prevalence studies of antimicrobial consumption can be used to determine intervention areas for antimicrobial stewardship programs. This point prevalence study was conducted in preparation for antimicrobial stewardship program in our hospital. **Methods:** Data on antimicrobial consumption was collected from patients in the hospital during 4 weeks by hospital doctors. Data was entered into the Global Point Prevalence Survey internet-based application, downloaded, analyzed, and presented in frequencies and percentages. **Results:** Of 197 patients surveyed across 21 wards, 62.4% had one or more antimicrobial agents. Metronidazole was the most frequently prescribed agent, whereas cephalosporins were the most frequent class prescribed. Community-acquired infection was the most common indication for antimicrobial therapy, whereas skin and soft-tissue infections were the most common diagnosis. Reason for prescription was stated in notes of 61.4% of patients, whereas 34.8% had stop or review dates documented. There was no record of the use of biomarkers to guide antimicrobial treatment. **Conclusion:** There is a high antimicrobial prevalence in our institution with cephalosporins as the most frequently prescribed class of antimicrobials. Community-acquired infections are the most common indication for an antimicrobial prescription but are surpassed by medical and surgical prophylaxis combined. There is a need for clinicians in this institution to use guidelines and microbiology laboratory reports to guide antimicrobial prescribing to reduce the antimicrobial prevalence among patients.

Keywords: Antimicrobial stewardship, Nigeria, Uyo, point prevalence survey

Introduction

Use of antimicrobial agents is on the increase worldwide and especially in low- and middle-income countries like Nigeria.[1] Antibiotics have been pivotal in treating and preventing common infections. However, their misuse has contributed to the selection of antibiotic-resistant bacteria.[2] The 2014 WHO Global report on surveillance of antimicrobial resistance noted very high rates of resistance in bacteria that cause common healthcare associated and community-acquired infections in all regions of the world.[3] In 2007, over 8000 deaths were attributed to bloodstream infections caused by methicillin-resistant *Staphylococcus aureus* and *Escherichia coli* resistant to the 3rd generation cephalosporins.[4]

Antimicrobial stewardship is a coordinated program that promotes the appropriate use of antimicrobials, improves patient outcomes, reduces antimicrobial resistance, and decreases the spread of infections caused by multidrug-resistant organisms.[5,6] A clear link has been established between the percentage of resistant strains and antimicrobial use.[4,7] Lack of data on the quantity and quality of antimicrobial prescribing can be a major hindrance to the successful development and implementation of antimicrobial stewardship programs.

The Global Point Prevalence Survey (PPS) was developed to assess the international prevalence of antimicrobial use and resistance. It was built on the findings of three-PPSs done by the European Surveillance of Antimicrobial Consumption Network.[8] The applicability and benefits of point prevalence studies have been established by several studies.

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Address for correspondence: Dr. Agantem Emmanuel Ekuma, Department of Medical Microbiology and Parasitology, University of Uyo, Uyo, Nigeria.
E-mail: agantemekuma@uniuyo.edu.ng

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This is the first PPS of antimicrobial consumption in our institution, state and South-South geopolitical zone of Nigeria to our knowledge. It was carried out in preparation for the institution of an antimicrobial stewardship program in this institution.

Methods

This study was conducted in a 500-bed government tertiary hospital which serves the entire state as well as neighboring states. It reports 6000–7000 patient admissions per year.

The PPS was carried out within a 4-week period between February and March 2018. Each ward in the hospital was surveyed once on a single day.

Inclusion/exclusion criteria

All patients on admission in the ward as at 8 am on the survey day were included. Outpatient and day care patients were excluded as well as patients admitted after 8 am on the selected day. Antimicrobial agents included were antibacterials for systemic use, antifungals for systemic use, drugs for the treatment of tuberculosis, antibiotics used as intestinal anti-infectives, antiprotozoals, antivirals for systemic use, and antimalarials. Antimicrobials for topical use were excluded from this study.

Data collection

Data forms adapted from the Global PPS of Antimicrobial Consumption and Resistance protocol were filled by hospital doctors. A data form was completed for each ward noting the number of beds and number of patients present. Another data form was filled for each patient who was receiving any antimicrobial agent noting age, weight, and prescribed antimicrobial agent. For each agent, information on the single unit dose, number of doses per day, route of administration, diagnosis, type of indication, the reason for prescription given in notes, guideline compliance, stop or review date given, empirical or targeted was recorded. Antimicrobial agents were classified by the Anatomic Therapeutic Classification. Wards were classified into Departments based on the Global PPS protocol.

Statistical analysis

Data were entered into the freely available Global PPS program, an internet-based application for anonymized data entry, validation, and reporting. Data validation included several built-in checks with error and warning messages that had to be managed by the user to generate a real-time feedback report. Data were downloaded from the Global PPS website (www.global-pps.com) as an excel file transferred to SPSS and analyzed. Frequencies and percentages were used to present variables.

Ethical consideration

This study was approved by the Research Ethics Committee of the University of Uyo Teaching Hospital. All data were completely anonymized within the database. No information that could be used to identify particular patients was collected.

Results

Twenty-one wards with 197 patients were surveyed. One hundred and twenty-three patients were receiving antimicrobials giving an overall antimicrobial prevalence of 62.44% [Table 1]. The mean age of all patients receiving antimicrobials was 29.77 ± 22.50 years (0–83 years), and 48% of them were male [Table 2].

Quantitative antimicrobial use

Antimicrobial prevalence across the surveyed wards ranged from 41% to 100% and involved 264 antimicrobial prescriptions [Table 1]. Of patients receiving antimicrobial agents who were surveyed, 22.76% were on one agent, 53.66% on two, 15.45% on three, and the rest on four or more antimicrobial agents. More antimicrobials prescribed were administered parenterally (62.7%) than orally [Table 2]. Metronidazole was the most frequently prescribed agent followed by ceftriaxone and gentamicin [Figure 1]. However, by class, the cephalosporins were the most frequently prescribed, followed by nitroimidazoles and quinolones [Table 3].

Indications and diagnosis

The most common indication for prescription of antimicrobial agents was community-acquired infection (40.7%) followed by surgical prophylaxis (24.4%) and medical prophylaxis (19.5%) [Figure 2]. The most prevalent diagnosis for antimicrobial prescription was skin and soft-tissue infections (18.7%), prophylaxis for obstetrics/gynecology conditions (14.6%), sepsis (13.8%), and pneumonia (12.2%).

Antimicrobial prescription practice

Reasons for prescription were stated in the notes of 61.4% of cases, whereas 34.8% had stop or review dates

Table 1: Antimicrobial prevalence by department

Department	Number of patients	Patients on antimicrobial therapy (%)	Prescriptions	Average prescriptions per patient
Adult medical	54	39 (72.2)	93	2.4
Adult surgical	44	27 (61.4)	49	1.8
Obstetrics/gynaecology	35	20 (57.1)	47	2.4
Neonatal	33	14 (42.4)	29	2.1
Pediatric medical	25	18 (72.0)	36	2.0
Pediatric surgical	6	5 (83.3)	10	2.0
Total	197	123 (62.4)	264	2.2

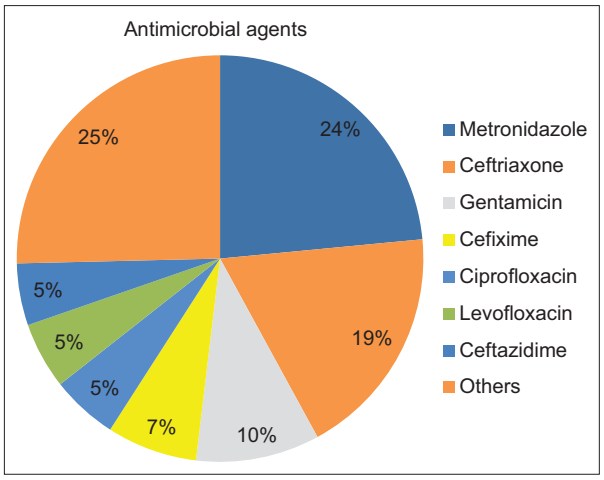

Figure 1: Most frequently prescribed antimicrobial agents

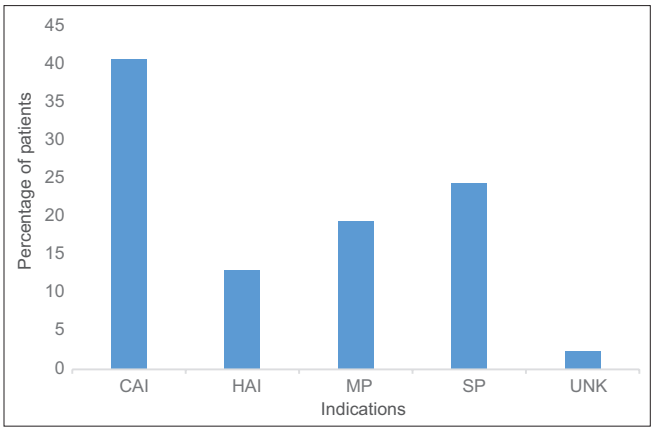

Figure 2: Indications for administration of antimicrobial agents. CAI: Community-acquired infection, HAI: Hospital-acquired infection, MP: Medical prophylaxis, SP: Surgical prophylaxis, UNK: Unknown indication

Table 2: Characteristics of patients on antimicrobial agents (*n*=123)

Characteristic	Frequency (%)
Male	59 (48.0)
Age (years), mean±SD	29.77±22.5
Number of antimicrobials prescribed	
One	28 (22.8)
Two	66 (53.7)
Three	19 (15.5)
≥Four	10 (8.1)
Route of administration	
Oral	98 (37.1)
Parenteral	166 (62.9)

SD: Standard deviation

Table 3: Prescription of antimicrobial agents by class

Antimicrobial class	*n* (%)
Cephalosporins (J01D)	84 (32.2)
Nitroimidazole derivatives (J01X/P01A)	63 (23.8)
Quinolone antibacterials (J01M)	30 (11.4)
Aminoglycoside antibacterials (J01G)	26 (9.8)
Beta-lactam antibacterials, penicillins (J01C)	20 (7.6)
Antimalarials (P01B)	14 (5.3)
Macrolides, Lincosamides and Streptogramins (J01F)	12 (4.5)
Sulfonamides and Trimethoprim (J01E)	4 (1.5)
Direct acting antivirals (J05A)	4 (1.5)
Antimycotics for systemic use (J02A)	3 (1.1)
Carbapenems (J01D)	2 (0.8)
Intestinal anti-infectives (A07A)	1 (0.4)
Tetracyclines (J01A)	1 (0.4)
Total	264 (100.0)

documented [Table 4]. There was no record of the use of biomarkers to guide antimicrobial treatment.

Discussion

This survey was conducted in preparation for instituting an antimicrobial stewardship program in our hospital. We found an overall antimicrobial prevalence of 62.4% which is comparable to 69.7% found in four other tertiary institutions in Nigeria.[9] The Global PPS of 2015 found the antimicrobial prevalence of 49.9% among 12 hospitals across five countries in Africa. Rates in other regions of the world were much lower, ranging from 11.6% in Eastern Europe to 42.0% in West and Central Asia.[8]

Cephalosporins were the most frequently prescribed class of antibiotics. Most of these were broad and extended spectrum cephalosporins. Quinolones, another class of broad-spectrum antibiotics were the third most frequently prescribed class of antibiotics. The high use of cephalosporins and other broad-spectrum antimicrobial agents as observed in this study has also been found in similar studies in Nigeria[9,10] and elsewhere.[8,11] This trend has serious implications for the development of antimicrobial resistance.

While community-acquired infections were the most common indication for antimicrobial use, surgical, and medical prophylaxis combined were more common. This pattern is similar to those of other hospitals in Nigeria.[9] Prolonged surgical prophylaxis is a significant contribution to high antimicrobial prevalence in Nigerian hospitals. Surgical prophylaxis has been associated with high rates of inappropriate antimicrobial use.[12] Surgical prophylaxis is erroneously believed to be a cover for poor aseptic techniques.

Poor quality of antimicrobial prescribing practice was observed in this study. Guidelines were not available for most indications for antimicrobial therapy. Antimicrobial guidelines have emerged as an important intervention to support clinical decision-making through a consensual process based on evidence.[13,14] The absence of guidelines leave prescribers open to the influence of marketers of pharmaceutical products. Furthermore, majority of prescriptions (97.7%) in this survey were not guided by clinical microbiology laboratory results. This has also been observed in this institution[10] and elsewhere in Nigeria. While microbiology results may not guide initial prescriptions, therapy should be adjusted, if necessary, as soon as microbiology results

Table 4: Antimicrobial prescription practice

Characteristics	*n* (%)
Reason in notes	
No	102 (38.6)
Yes	162 (61.4)
Guideline	
Yes	15 (5.7)
No	1 (0.4)
NA	248 (93.9)
Stop/review date documented	
Yes	92 (34.8)
No	172 (65.2)
Treatment	
Empirical	258 (97.7)
Targeted	6 (2.3)

NA: Not available

are available. The poor use of microbiology laboratory data may be due to both prescriber and laboratory factors.[15] This is further compounded by lack of use of infection biomarkers to guide antibiotic use found in this study. Biomarkers of bacterial infection such as C-reactive protein and procalcitonin have been shown to be useful in guiding antibiotic therapy and improving antibiotic stewardship.[16,17]

Conclusion

There was high antimicrobial prevalence in our institution with cephalosporins as the most frequently prescribed class of antimicrobials. Community-acquired infections were the most common indication for an antimicrobial prescription but are surpassed by medical and surgical prophylaxis combined. The majority of prescriptions were not guided by microbiology laboratory reports or clinical guidelines. There is a need for clinicians in this institution to use guidelines and microbiology laboratory reports to guide antimicrobial prescribing to reduce the antimicrobial prevalence among patients. PPSs are recommended as a veritable tool for assessing antimicrobial prescription and guiding targeted interventions for antimicrobial stewardship.

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Conflicts of interest

There are no conflicts of interest.

References

1. The Center for Disease Dynamics Economics and Policy. Policies to Address Antibiotic Resistance in Low – And Middle-Income Countries; 2014.
2. Huttner A, Harbarth S, Carlet J, Cosgrove S, Goossens H, Holmes A, *et al.* Antimicrobial resistance: A global view from the 2013 world healthcare-associated infections forum. Antimicrob Resist Infect Control 2013;2:31.
3. World Health Organization. Antimicrobial Resistance: Global Report on Surveillance. Geneva, Switzerland: World Health Organization; 2014.
4. Akhloufi H, Streefkerk RH, Melles DC, de Steenwinkel JE, Schurink CA, Verkooijen RP, *et al.* Point prevalence of appropriate antimicrobial therapy in a Dutch University hospital. Eur J Clin Microbiol Infect Dis 2015;34:1631-7.
5. DePestel DD, Eiland EH 3rd, Lusardi K, Destache CJ, Mercier RC, McDaneld PM, *et al.* Assessing appropriateness of antimicrobial therapy: In the eye of the interpreter. Clin Infect Dis 2014;59 Suppl 3:S154-61.
6. James R, Upjohn L, Cotta M, Luu S, Marshall C, Buising K, *et al.* Measuring antimicrobial prescribing quality in Australian hospitals: Development and evaluation of a national antimicrobial prescribing survey tool. J Antimicrob Chemother 2015;70:1912-8.
7. Bitterman R, Hussein K, Leibovici L, Carmeli Y, Paul M. Systematic review of antibiotic consumption in acute care hospitals. Clin Microbiol Infect 2016;22:561.e7-561.e21.
8. Versporten A, Zarb P, Caniaux I, Gros MF, Drapier N, Miller M, *et al.* Antimicrobial consumption and resistance in adult hospital inpatients in 53 countries: Results of an internet-based global point prevalence survey. Lancet Glob Health 2018;6:e619-29.
9. Oduyebo OO, Olayinka AT, Iregbu KC, Versporten A, Goossens H, Nwajiobi-Princewill PI, *et al*. A point prevalence survey of antimicrobial prescribing in four Nigerian tertiary hospitals. Ann Trop Pathol 2017;8:42-6.
10. Israel EU, Sylvester EG, Elijah A. The use of antibiotics in a Nigerian tertiary health care facility. Am J Biomed Sci Eng 2015;1:25-31.
11. Talaat M, Saied T, Kandeel A, El-Ata GA, El-Kholy A, Hafez S, *et al.* A point prevalence survey of antibiotic use in 18 hospitals in Egypt. Antibiotics (Basel) 2014;3:450-60.
12. Ierano C, Nankervis JM, James R, Rajkhowa A, Peel T, Thursky K, *et al.* Surgical antimicrobial prophylaxis. Aust Prescr 2017;40:225-9.
13. Årdal C, Outterson K, Hoffman SJ, Ghafur A, Sharland M, Ranganathan N, *et al.* International cooperation to improve access to and sustain effectiveness of antimicrobials. Lancet 2016;387:296-307.
14. Elias C, Moja L, Mertz D, Loeb M, Forte G, Magrini N, *et al.* Guideline recommendations and antimicrobial resistance: The need for a change. BMJ Open 2017;7:e016264.
15. Kimang'a AN. A situational analysis of antimicrobial drug resistance in Africa: Are we losing the battle? Ethiop J Health Sci 2012;22:135-43.
16. Nora D, Salluh J, Martin-Loeches I, Póvoa P. Biomarker-guided antibiotic therapy-strengths and limitations. Ann Transl Med 2017;5:208.
17. Reinhart K, Hartog CS. Biomarkers as a guide for antimicrobial therapy. Int J Antimicrob Agents 2010;36 Suppl 2:S17-21.