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Point prevalence survey of antimicrobial prescription in a tertiary hospital in South East Nigeria: A call for improved antibiotic stewardship

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ABSTRACT

Objectives: Antimicrobial prescribing practices and use contribute to the growing threat of antimicrobial resistance (AMR) to global health. Information on antimicrobial prescribing and use are lacking in most developing countries, including Nigeria. This information is crucial for antimicrobial stewardship programmes, an effective tool in minimising AMR. This study was performed to gather baseline information on antimicrobial prescribing practices in Nigeria.
Methods: A cross-sectional survey was conducted on all inpatients of a tertiary hospital in South East Nigeria. All patients on admission on the day of the survey formed the study population. A standardised questionnaire, web-based data entry and validation process designed by the University of Antwerp, Belgium, were adopted. Information on basic patient demographics, antimicrobial agents used, indication for treatment, laboratory data prior to treatment and stop/review date was collected.
Results: Of 220 inpatients surveyed, 78.2% were receiving at least one antimicrobial agent. The highest prevalence of antimicrobial use was in the ICU (100%), adult surgical ward (82.9%) and paediatric medical ward (82.9%). Agents used were mainly third-generation cephalosporins (ceftriaxone 25.1%) and nitroimidazole (metronidazole 24.6%). Antimicrobial prescription was empirical (91.1% in medical wards, 96.8% in surgical wards and 100% in ICU). There was limited use of guidelines but clear documentation of stop/review dates and reasons for antimicrobial use.
Conclusion: Although a majority of antimicrobial prescriptions were made with indications, they were mostly prescribed empirically and the majority of prescriptions were parenteral formulations. There is a need to develop antibiotic guidelines, to educate prescribers on antimicrobial stewardship and to encourage targeted prescription.

1. Introduction

The use of antimicrobials has significantly reduced the morbidity and mortality of communicable diseases, but antimicrobial resistance (AMR) is a growing problem, jeopardising the care of thousands of patients worldwide and requiring international approaches [1,2]. The World Health Organization (WHO) has identified AMR as one of the most complex global public-health challenges [3] that could lead to serious health threats, and failure to tackle it could jeopardise modern medical achievements [4].

Irrational prescribing and use of antimicrobials as well as a lack of new drug development by the pharmaceutical industry are crucial factors behind the rapidly spreading AMR of micro-

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organisms [4,5]. Both Gram-positive and Gram-negative bacteria are involved, and global prevalence rates are as high as 50–60% or higher [4,6–8]. Rates of AMR are particularly high in the hospital environment [3,8]. Therefore, in order to tackle this rise in AMR, the WHO advocates the adoption of antimicrobial stewardship by healthcare providers to monitor and reduce the burden of AMR [3]. Antimicrobial stewardship programmes are an effective strategy to ensure that antibiotics are used in accordance with scientific evidence in order to improve patient outcomes, to minimise AMR and to reduce hospital costs [9]. This involves developing objective interventions that will influence prescribing practices and subsequently promote rational use of antimicrobial agents [6,10].

Most developing countries, including Nigeria, have poor antimicrobial prescribing practices. Moreover, inappropriate use of antibiotics is enhanced because drugs are sold over the counter with little or no regulation, thus increasing the risk of AMR [6,11,12]. Furthermore, there is limited information on AMR in Nigeria and therefore before any antimicrobial stewardship programme can be implemented, antimicrobial prescribing information is required [9,11,13].

The point prevalence survey has been documented to be a popular and widely accepted standardised method for collecting data on AMR for over 20 years [14]. It is less expensive and faster to execute like most observational studies and can be used to identify targets for quality improvement in order to resolve the problem of AMR and antimicrobial use [10,15]. This point prevalence survey was therefore performed to acquire baseline information on antimicrobial prescribing practices in a tertiary hospital in South East Nigeria.

2. Methods

The cross-sectional survey was conducted between October and November 2017 at Federal Teaching Hospital Abakaliki (Abakaliki, Nigeria), a 720-bed tertiary hospital established to train specialists and middle-level health manpower, to conduct research and to provide tertiary level care to the population. All inpatients of all wards in the hospital were surveyed using a standardised data collection form. For inpatients receiving at least one antimicrobial on the day of the point prevalence survey, detailed information was collected. The questionnaire gathered information on basic patient demographics, antimicrobial agents used, indication for treatment, laboratory data prior to treatment, stop/review date and other quality indicators.

The quality indicators assessed were: guideline compliance; reason for use in notes; stop/review date documentation; treatment type; and route of administration. Guideline compliance assessed whether antibiotic choice was compliant with local guidelines. Reason for use in notes examined whether a diagnosis or indication for treatment was documented in the notes when antibiotic treatment was started, whereas the stop/review date assessed whether the review or stop date of the antibiotics was documented. Treatment type classified the treatment into empirical (treatment based on local guidelines or experience in the absence of microbiological test results) or targeted (treatment based on microbiological results).

All patients on admission at 08:00 h on the day of the survey formed the baseline population of the survey (denominator). All collected survey data were entered into the web-based tool for data entry and validation designed by the University of Antwerp (Antwerp, Belgium) (http://www.global-pps.com). This is the first hospital-wide antimicrobial survey done using this tool in our hospital. Validated data were exported to Microsoft Excel (Microsoft Corp., Redmond, WA) and were analysed with Microsoft Excel 2016 and Epi Info 7.2 (US Centers for Disease Control and Prevention, Atlanta, GA). Ethical approval was obtained from the Research and Ethics Committee of the Federal Teaching Hospital Abakaliki.

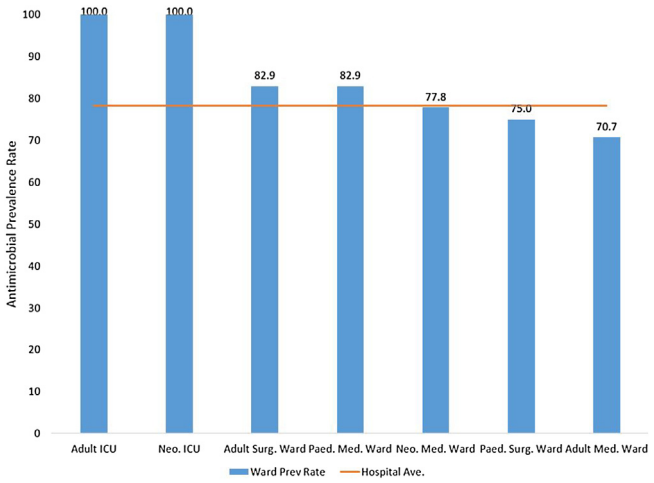

Fig. 1. Antimicrobial prescription rates in various hospital wards in a tertiary hospital in South East Nigeria compared with the hospital average. ICU, intensive care unit.

3. Results

A total of 220 patients in 28 wards were surveyed, of whom 172 (78.2%) were receiving at least one antimicrobial agent. The highest prescription rate of antibiotics was in the intensive care unit (ICU) (100%), followed by the adult surgical ward (82.9%), paediatric medical ward (82.9%) and neonatal medical ward (77.8%). The paediatric surgical ward (75.0%) and adult medical ward (70.7%) had an antimicrobial prescription rate below the hospital average (Fig. 1). Surgical prophylaxis constituted 44.0% of antimicrobial prescriptions (Table 1). The agents used were mainly metronidazole (33.9%), third-generation cephalosporins (ceftriaxone and cefpodoxime, 37.5%) and second-generation quinolones (ciprofloxacin, 7.7%) (Table 2). Most therapeutic treatments were empirical (not based on microbiological laboratory diagnosis) (91.1% medical wards, 96.8% surgical wards and 100% ICU) and there was limited use of guidelines (Table 3). However, there was clear documentation of stop/review dates and reasons in note (indication) for antimicrobial use. Ceftriaxone and Metronidazole were the two commonest antibiotics used for patients in medical and surgical units while Ampicillin with β-lactamase inhibitor and Ceftazidime were the commonest prescribed for patients in ICU (Table 4).

4. Discussion

AMR has been strongly linked to antibiotic consumption [16]. The current study evaluated antimicrobial prescribing practices for inpatients in a tertiary hospital in South East Nigeria.

Table 1
Indications for antimicrobial use.

Indication	Frequency	Percentage (%)
Therapeutic		
Community-acquired infection	174	45.5
Healthcare-associated infection	23	6.0
Prophylactic		
Medical	11	2.9
Surgical	168	44.0
Not specified	6	1.6
Total	382	100

Table 2
Top five most prescribed antibiotics disaggregated by treatment type.

Therapeutic prescription				Prophylactic prescription			
CAI	Percentage (%)	HAI	Percentage (%)	Medical	Percentage (%)	Surgical	Percentage (%)
Ceftriaxone	24.7	Ciprofloxacin	17.4	Ampicillin/BLI	36.4	Metronidazole	33.9
Metronidazole	17.8	Metronidazole	17.4	Ceftazidime	27.3	Ceftriaxone	29.2
Ciprofloxacin	10.3	Nitrofurantoin	17.4	Ceftriaxone	18.2	Cefpodoxime	8.3
Amoxicillin/BLI	8.6	Amoxicillin/BLI	13.0	Ampicillin/cloxacillin	9.1	Ciprofloxacin	7.7
Ceftazidime	4.0	Ceftazidime	8.7	Metronidazole	9.1	Cefixime	3.6

CAI, community-acquired infection; HAI, healthcare-associated infection; BLI, β-lactamase inhibitor.

Table 3
Quality indicators for antimicrobial prescriptions.

Quality indicator	Medical (%)	Surgical (%)	Intensive care (%)
Reason for use in notes			
Yes	97.5	100.0	100.0
No	2.5	0.0	0.0
Treatment			
Targeted	8.9	3.2	0.0
Empirical	91.1	96.8	100.0
Stop review date documented			
Yes	98.1	100.0	100.0
No	1.9	0.0	0.0
Route of administration			
Oral	35.7	41.9	0.0
Parenteral	64.3	58.1	100.0
Compliance with guidelines			
N/A	83.4	95.4	100.0
Yes	8.3	1.8	0
No	8.3	2.8	0

N/A, not applicable (no local guideline for the specific indication).

This study found a high rate of antimicrobial use, as 78.2% of inpatients surveyed were exposed to at least one antimicrobial agent. In another study in Owerri, Nigeria, a lower prevalence of antibiotic use of 55.9% was found [17]. Similar to the current study, findings from a multicentre Nigerian study showed that 70% of patients received at least one antimicrobial agent during admission [8]. Other studies among Ghanaian and Chinese patients found a lower proportion of antibiotic use than observed in the current study (51% and 56%, respectively) [10,18]. Studies conducted among paediatric inpatients also reported significant antimicrobial use, with 61–86% receiving one or more antimicrobials [19–21]. The prevalence of antimicrobial prescription in the current study is higher than the documented global prevalence of 34.4% in 2015 [22]. Reasons for the high prevalence of antimicrobial prescription in this study could be due to the high empirical prescribing, with a lack of prior laboratory evaluation using culture and susceptibility testing. It may also be due to poor implementation of antimicrobial stewardship in Africa (13% implementation, which is far lower than that obtained on other continents) [23].

The highest rate of antibiotic use in this study was found in the ICU where all patients (100%) were placed on antibiotics, followed by the adult surgical ward (82.9%), paediatric medical ward (82.9%) and neonatal medical ward (77.8%). Likewise, another study in Nigeria found that adult ICU wards had the highest rates of antimicrobial prescription, however, only 88.9% of them had antibiotic prescriptions [8] in contrast to the 100% seen in the current study. Other studies have also documented higher rates of antimicrobial prescription in the ICU compared with other hospital inpatient admission sites [18]. The ICU has been identified to have an increased frequency of hospital-acquired infections in low- and middle-income countries owing to prolonged and inappropriate use of invasive devices and antibiotics [24]. The critical state of health of such patients in the ICU, who also often have other co-existing health issues, may explain their high rate of antimicrobial use. The paediatric surgery ward has also been found to have the highest prevalence of antimicrobial prescription (91%) in other studies [10]. This contrasts with the current findings which showed that the paediatric surgical ward had a lower antimicrobial prescription rate (75.0%) than the hospital average. The high prevalence of antimicrobial used in surgical wards could be due to prolonged use of antibiotics for surgical prophylaxis.

Community-acquired infections and surgical prophylaxis were the main indications for antibiotic use (45.5% and 44.0%, respectively), which is similar to findings from other studies [8,10,25]. Overall, therapeutic indications accounted for the majority (51.6%) of prescriptions. This finding is in agreement with other studies among children and adults in Nigeria, Iran and the USA [17,19,25]. Antimicrobial use was mainly empirical without any laboratory support. The practice of empirical use of antibiotics has been reported in Lagos and Ethiopia [21,26]. This is probably due to logistical challenges associated with obtaining a targeted laboratory basis for antimicrobial treatment in developing countries. These challenges include the absence of readily available diagnostic equipment, cost concerns for patients, poor power supply, inadequacy of trained manpower, pre-hospital over-the-counter antimicrobial intake, and late presentation of patients to health facilities, among others.

The antimicrobial agents mostly prescribed in this study were third-generation cephalosporins (ceftriaxone 25.1%), metronidazole (24.6%) and second-generation quinolones (ciprofloxacin 9.7%). Ceftriaxone was mostly used for community-acquired infections (24.7%), whilst metronidazole (33.9%) was commonly used for surgical prophylaxis. Cephalosporins have equally been identified as the most commonly prescribed antimicrobials in other studies [18,20,26]. Ceftriaxone was specifically identified in one of these studies [19], similar to the current finding. Widespread use of cephalosporins could have been because of their broad-spectrum nature, given that prescriptions in this study

Table 4
Antibiotic prescriptions disaggregated by unit.

Medical	Percentage (%)	Surgical	Percentage (%)	Intensive care	Percentage (%)
Ceftriaxone	24.8	Metronidazole	30.9	Ampicillin/BLI	25.0
Metronidazole	16.6	Ceftriaxone	25.4	Ceftazidime	25.0
Ciprofloxacin	8.3	Ciprofloxacin	11.1	Ceftriaxone	25.0
Amoxicillin/BLI	7.0	Cefpodoxime	6.0	Imipenem/BLI	12.5
Ampicillin/BLI	5.1	Amoxicillin/BLI	5.1	Metronidazole	12.5

BLI, β-lactamase inhibitor.

and others cited were made empirically most of the time. Other studies have equally noted that fluoroquinolones and third-generation cephalosporins were in the top three prescribed antimicrobial agents [22,25]. In other studies, one of which was in children, penicillin, metronidazole and gentamicin were also listed as commonly prescribed antimicrobials [10,17,21].

The parenteral route of administration was prescribed in 100%, 64.3% and 58.1% of intensive care, medical and surgical antimicrobial prescriptions, respectively. This may be because most of the time patients admitted to hospital may not tolerate medications orally due to the severity of illness, type of lesion, age or contraindications to oral intake. In addition, cephalosporins, which were the commonest antimicrobials prescribed in this study, are often manufactured as parenteral formulations for either intravenous (i.v.) or intramuscular use. Other similar studies have likewise identified high prescription by the parenteral route for antimicrobial use among inpatients [8,19,21,22,27]. Good antimicrobial stewardship practices aim to minimise parenteral antimicrobial use because of the associated potential untoward effects and role in the transmission of pathogens [28]. A switch from i.v. to oral antibiotics has advantages, including decreases in catheter-related complications, healthcare costs and duration of hospital stay, and is recognised as a key metric for stewardship processes in hospitals [22,29,30].

The reason for antimicrobial use was documented in the majority (>97%) of cases in medical, surgical and intensive care prescriptions. Similarly, the stop/review date for antimicrobial use was also documented in all surgical and ICU prescriptions and in 98.1% of medical prescriptions. In contrast, a multicentre study in the western and northern parts of Nigeria found that the reason for antimicrobial use was only documented in 38.2% of cases and the stop/review date was indicated just in 12.2%. This commendable practice of proper documentation should be encouraged among antimicrobial prescribers as part of good antimicrobial stewardship. In addition, the hospital should consider setting up an antimicrobial stewardship committee, develop department-level antibiotic guidelines to support the appropriate use of antibiotics, and continuously monitor the level of implementation of these interventions with repeated audits or surveys.

5. Conclusion

In summary, although the majority of antimicrobial prescriptions were made with indications, these indications were not based on microbiological test results. Hence, treatments were largely on an empirical basis and the majority of prescriptions involved parenteral drug formulations. Whilst there may be a need for continuing medical education for antimicrobial prescribers to update their knowledge, improve their stewardship and make more specific and targeted prescription of oral antimicrobial formulations, there is need for further studies to investigate the reasons behind these practices with a view to curtailing the growing global problem of the emergence of AMR. We recommend the establishment of an antimicrobial stewardship programme in the hospital as well as follow-up studies on the reasons for empirical treatment.

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Competing interests

None declared.

Ethical approval

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