

# MEDICATION MANAGEMENT OF INFECTIONS AT THE HEALTH CENTRE OF THE NIGER DELTA UNIVERSITY, WILBERFORCE ISLAND, BAYELSA STATE, NIGERIA

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## ABSTRACT

**Introduction:** Implementation of policies to support rational use of antimicrobials is needed to reduce the emergence of resistance to their activity.

**Objectives:** To explore pattern of medication prescribing in the management of infections at the Niger Delta University Health Centre (NDUHC), Wilberforce Island, Bayelsa state, Nigeria.

**Methods:** A retrospective observational study involving systematic random sampling of case notes of patients who presented with infections at NDUHC from January 1st to December 31st, 2019 was done. Each case note was assessed for patient's socio-demographics, infections treated, and antimicrobials prescribed, including their costs. All data obtained were analyzed as appropriate.

**Results:** A total of 334 patients' notes were identified for inclusion in this study. All case notes included were from adult patients, most of whom were students (99.4%) and females (68.6%). Average number of infections treated per patient was  $1.64 \pm 0.68$ , and only 39 (7.1%) of all cases treated were confirmed by means of appropriate laboratory tests. Common indications treated include malaria (33.6%), sexually transmitted infections (STIs), (23.0%), and respiratory tract infections (10.8%). Each patient received an average of  $1.92 \pm 0.95$  antimicrobial agents per encounter. Several (39.7%) of the antimicrobials were written in their brand names, and the most prescribed groups were the antibacterial (39.2%) and antimalarial (30.8%) agents. On the average, antivirals at ₦ 2314.29  $\pm$  664.40 per encounter were the most expensive of all.

**Conclusion:** Prescribers at primary care centres need to follow established guidelines when prescribing antimicrobials and document management pattern that can inform local site-specific policies.

**Keywords:** Antimicrobial, Infections, Health Centre, Students, Nigeria

## INTRODUCTION

The discovery of antibiotics and other antimicrobial agents close to eight decades ago was a huge breakthrough in medical sciences and global public health. Since then, antimicrobial drugs have been used to effectively manage infectious diseases.<sup>[1]</sup> Meanwhile, continuous effective use of these agents requires routinely reviewed policies and guidelines to regulate and ensure their rational use. While these policies are in place, they are however not always adhered to and the continuous overuse and misuse of these group of medications have led to the development of resistance.<sup>[2]</sup> The rate of resistance has continued to increase over the years especially in low- and middle-income countries (LMICs) where strict guidelines and policies are lacking. Also, high burden of infectious diseases and other factors such as affordability and availability of requisite medications interplay are other factors to contend with in virtually all LMICs.<sup>[3-5]</sup>

In Nigeria, earlier studies have reported a high use of antimicrobial drugs in hospitals and clinical settings. They are often prescribed in combination, with one prescription containing between one and four different antimicrobial medications.<sup>[1,6]</sup> The average number of antimicrobial agents per encounter in other studies ranges from as low as 1.53 to as high as 7.90 in some cases.<sup>[1,6,7,8]</sup> In a study conducted at a secondary health care facility on Wilberforce Island in Bayelsa State of Nigeria, it was observed that antibiotics were the most commonly prescribed class of drugs, with anti-malarial and anthelmintic drugs also in the top five classes.<sup>[9]</sup> Importantly, broad spectrum antibiotics are mostly prescribed due to limited availability of diagnostic test.<sup>[6,7,10]</sup> Common indications for which anti-infective agents are prescribed include malaria and upper respiratory tract infections (URTIs).<sup>[7]</sup> Many studies from LMICs found that less than half of the antimicrobials prescribed were based on the relevant diagnostics tests.<sup>[10,11]</sup> Also, in Nigeria like many other LMICs, many patients pay for medications through out-of-pocket payments owing to underdeveloped health insurance systems.<sup>[12]</sup> As a result, the cost of medications is one key factor impacting on the type of anti-infective agents commonly used. Previous

studies have reported the impact of costs and financial constraints on the use of drug, especially contributing to irrational use of antimicrobials.<sup>[13]</sup> One other study reported the possibility of potential cost savings if policies regulating and ensuring rational use of antibiotics are implemented in LMICs like Nigeria.<sup>[5,14]</sup>

Several studies reporting antimicrobial utilization in LMICs were conducted in hospital settings. Thus, there is a need to explore pattern of prescribing and current practices in outpatient clinics, health centres and other primary care units where the bulk of antimicrobial drugs are used. Hence, this study was aimed at assessing medication management of infections at a university health centre in Bayelsa state of Nigeria.

**METHODS**

**Study Setting**

The research was carried out at the Niger Delta University Health Centre (NDUHC), which is a 9-funtional-bed facility located on the university's main campus. The NDUHC is administered by the Niger Delta University Health Service Department, and it provides basic<sup>[1]</sup> primary level health-care services to the students and faculty of Niger Delta University, including other staff and their dependents. The facility has four medical officers, 17 nurses, five medical laboratory technicians, one pharmacist, two pharmacy technicians, and three pharmacy assistants on staff.

**Study Design**

Following ethical approval by the NDUHC management, 334 of 2,557 case notes belonging to patients who received at least an antimicrobial agent for treatment of infections, and who sought health-

care services at NDUHC from the 1st of January to 31st December 2019 were reviewed retrospectively. The sample size, 334, which was used for the study was arrived at with the aid of the sample size calculator software by qualtrics<sup>XM</sup> (www.qualtrics.com). The confidence level was set at 95%, while the margin of error was maintained at 5%. Case notes of interest were selected using systematic random sampling technique. Every 7th unit of all case notes was retrieved while using patients' clinic attendance register as a guide. Appropriately structured data collection form was employed for the retrieval of relevant data from the selected case notes. Each patient's clinical record was assessed for socio-demographic data, infections treated and their laboratory confirmations, as well as antimicrobials prescribed, and direct costs incurred by patients in the procurement of such antimicrobials measured in Nigerian Naira (₦).

**Data Analysis**

Data generated were analyzed with Statistical Package for Social Sciences (SPSS) version 23 and expressed in simple frequencies and percentages. Average values were presented in mean ± standard deviation (SD) with the aid of GraphPadInstat version 3.10 for Windows (GraphPad Software, San Diego California, USA) and were compared using one-way ANOVA as appropriate. A p-value < 0.05 at 2-tail was considered significant.

**RESULTS**

All of the 334 patients' case notes that were assessed in this study were for adults of average age, 22.41 ± 3.73 years, ranging from 18 to 49 years. Almost all patients seen were students (99.4%), and most were females (68.6%) (Table 1).

**Table 1: Socio-demographic characteristics of patients (N = 334)**

Patient's characteristics	n (%)
Gender	
Male	105 (31.4)
Female	229 (68.6)
Age	
Children (< 18 years)	-
Adult (18 – 49 years)	334 (100.0)
Elderly (= 50 years)	-
Occupation	
Student	332 (99.4)
Lecturer	-
Other university staff	2 (0.6)

n, number of observations; N, sample size; SD, standard deviation; Average patient's age (Mean ± SD), 22.41 ± 3.73 years

Average number of infections treated per patient was 1.64 ± 0.68. Malaria (33.6%), sexually transmitted infections - STIs (23.0%), and respiratory tract infections (10.8%) were the most treated presentations, the least been diarrhea (0.7%), hepatitis (0.2%) and helminthiasis (0.2%). Virtually all infections (92.9%) treated were not confirmed with appropriate diagnostic laboratory tests (Table 2).

**Table 2: Infections treated among patients seen**

Characteristics of infections treated	n (%)
Number of infections treated per encounter (N = 334)	
One	157 (47.0)
Two	143 (42.8)
Three	32 (9.6)
Four	2 (0.6)
Appropriate Diagnostic (Laboratory) Test Done (N = 547)	
Yes	39 (7.1)
No	508 (92.9)
Specific infections treated (N = 547)	
Malaria	184 (33.6)
Sexually transmitted infection (STI)	126 (23.0)
Respiratory tract infection	59 (10.8)
Peptic Ulcer Disease	52 (9.5)
Skin infection	49 (9.0)
PID	19 (3.5)
Typhoid fever	14 (2.6)
Ear, nose, and throat infection	12 (2.2)
Eye infection	10 (1.8)
Oral infection	10 (1.8)
Sepsis	6 (1.1)
Diarrhoea	4 (0.7)
Hepatitis	1 (0.2)
Helminthiasis	1 (0.2)

Average number of infections treated per patient,  $1.64 \pm 0.68$

A total of 614 antimicrobials were prescribed for all infections treated among the patients seen, of which each patient received average of  $1.92 \pm 0.95$  antimicrobial agents per encounter. Most (60.3%) of the antimicrobials were written in their generic names and the most prescribed groups were the antibacterial (39.2%) and antimalarial (30.8%) agents. They were followed by the antifungals (18.6%) and amoebicides (10.3%), while the least prescribed were the antivirals (1.1%). Specific agents prescribed among the antibacterial group were mostly penicillin (35.7%), fluoroquinolones (22.8%), and the macrolides (17.8%). Among the antimalarial drugs, artemisinin derived agents were the most prescribed, both as combination therapy (81.0%) and as monotherapy (9.0%). Clotrimazole (52.6%) and fluconazole (22.8%) were the most encountered antifungals, while metronidazole (100.0%) was the main amoebicide prescribed. Meanwhile, acyclovir (85.7%) and podophyllin (14.3%) were the only antiviral drugs encountered (Table 3).

**Table 3: Antimicrobial agents prescribed for patients seen**

Characteristics of anti-infective agents	n (%)
Number of antimicrobial agents prescribed per encounter (N = 334)	
None prescribed	3 (0.9)
One	128 (38.3)
Two	142 (42.5)
Three	47 (14.1)
Four	9 (2.7)
Five	5 (1.5)
Mode of antimicrobial prescribing (N = 614)	
Number of antimicrobials prescribed in generic name	370 (60.3)
Number of antimicrobials prescribed in brand name	244 (39.7)
Class of antimicrobial prescribed (N = 614)	
Antibacterial agent	241 (39.2)
Antimalarial	189 (30.8)
Antifungal agent	114 (18.6)
Amoebicide	63 (10.3)
Antiviral agents	7 (1.1)
Specific antimicrobials prescribed	
Antibacterial agents (N = 241)	

Penicillin	86 (35.7)
Cephalosporin	3 (1.2)
Fluoroquinolone	55 (22.8)
Aminoglycoside	17 (7.1)
Tetracycline	33 (13.7)
Macrolide	43 (17.8)
Chloramphenicol	4 (1.7)
Antimalarial (N = 189)	
Artemisinin derived combination therapy	153 (81.0)
Artemisinin derived monotherapy	17 (9.0)
Quinine	8 (4.2)
Sulfadoxine/pyrimethamine	11 (5.8)
Antifungal agents (N = 114)	
Ketoconazole	17 (14.9)
Fluconazole	26 (22.8)
Clotrimazole	60 (52.6)
Griseofulvin	11 (9.7)
Amoebicide (N = 63)	
Metronidazole	63 (100.0)
Antiviral agents (N = 7)	
Acyclovir	6 (85.7)
Podophyllin*	1 (14.3)

\*podophyllin, used here for the treatment of external genital warts(a viral infection); average number antimicrobials prescribed per encounter,  $1.92 \pm 0.95$

Average total cost of all antimicrobials prescribed per encounter was ₦ 1756.09 ± 1226.80. In all, the antiviral agents (₦ 2314.29 ± 664.40) were the most expensive per encounter, followed by the antifungals (₦ 1500.00 ± 841.37), antimalarials (₦ 1187.29 ± 685.04), and the antibacterial (₦ 928.64 ± 844.45). The least expensive was metronidazole, which was the main amoebicide (₦ 172.97 ± 112.57) prescribed. Among the antibacterial prescribed per encounter, the aminoglycosides (₦ 1771.05 ± 999.07), macrolides (₦ 1186.05 ± 638.29), and cephalosporins (₦ 434.52 ± 339.56) were the costliest, while the least of the lot were the penicillin (₦ 434.52 ± 339.56). Artemisinin derived agents, which were prescribed as combination therapy (₦ 1307.42 ± 645.26) were the most expensive of the four types of antimalarials encountered. They were distantly followed by those prescribed as monotherapy (₦ 400.00 ± 232.63), sulfadoxine/pyrimethamine (₦ 300.00 ± 0.00), and quinine (₦ 255.56 ± 199.13). Of all antifungals prescribed, ketoconazole and clotrimazole were the most expensive, while the acyclovir was the costlier of the two antivirals prescribed (Table 4).

**Table 4: Costs of antimicrobials prescribed**

Costs of antimicrobials prescribed per patient	Mean ± SD (₦)	p-value (ANOVA)
Total cost of all antimicrobials prescribed per encounter	1756.09 ± 1226.80	
Cost of antibacterial agents prescribed per patient	928.64 ± 844.45†	< 0.05†
Cost of antimalarial agents prescribed per patient	1187.29 ± 685.04†	
Cost of antifungal agents prescribed per patient	1500.00 ± 841.37†	
Cost of amoebicide agents prescribed per patient	172.97 ± 112.57†	
Cost of antiviral agents prescribed per patient	2314.29 ± 664.40†	
Costs of specific antimicrobial agents prescribed		
Cost of specific antibacterial agents prescribed per patient		
Penicillin	434.52 ± 339.56	> 0.05
Cephalosporins	933.33 ± 923.76	
Fluoroquinolones	699.12 ± 289.16	
Aminoglycosides	1771.05 ± 999.07	
Tetracyclines	626.32 ± 165.93	
Macrolides	1186.05 ± 638.29	
Chloramphenicol	625.00 ± 396.86	

Cost of specific antimalarial agents prescribed per patient		
Artemisinin derived combination therapy	1307.42 ± 645.26	< 0.05
Artemisinin-monotherapy	400.00 ± 232.63	
Quinine	255.56 ± 199.13	
Sulfadoxine/pyrimethamine	300.00 ± 0.00	
Cost of specific antifungal agents prescribed per patient		
Ketoconazole	885.71 ± 793.10	> 0.05
Fluconazole	1270.37 ± 1549.10	
Clotrimazole	1255.88 ± 451.66	
Griseofulvin	800.00 ± 0.00	
Cost of specific amoebicide agents prescribed per patient		
Metronidazole	172.27 ± 110.90	-
Cost of specific antiviral agents prescribed per patient		
Acyclovir	2450.00 ± 612.37	-
Podophyllin	1500.00 ± 0.00	

₦, Nigerian Naira (NGN)

## DISCUSSION

All of the patients seen in this study were adults, aged between 18 and 49 years. A clear majority were students, most of whom were females. Most of the patients presented with two or more infections and were mostly treated for malaria, STIs, and respiratory tract infections, although almost all of these conditions were not confirmed with appropriate diagnostic laboratory tests. Each of the patients received average of 2 antimicrobials, which were not often written in their generic names. The antibacterials, antimalarials, and antifungals were the most encountered of all antimicrobials prescribed. In all, average total cost of antimicrobials prescribed per encounter was ₦ 1756.09 ± 1226.80 of which the antiviral, antifungal, and antimalarial agents were the most expensive.

The study was conducted at a health centre, which is located on the campus of a university. This obviously accounted for majority of patients seen being adults, majority of whom were students. Furthermore, the mean age of all patients treated was estimated to be 22.41 ± 3.73 years, which in a way reflects the age of an average youth presumably attending higher institution of learning in Nigeria.<sup>[15]</sup> Meanwhile, more females than males presented for treatment of infections in this study, which is consistent with the finding from a previous study conducted in a hospital in the same locality.<sup>[6]</sup> This finding is further corroborated by a report, which posited that females are more likely than males to visit healthcare facilities when suffering from health conditions.<sup>[16]</sup>

An average of two infectious diseases comprising mostly malarial and STIs were treated per encounter among the patients seen. Similar to the foregoing, in a couple of previous studies conducted at health facilities in the community within which the university health centre is located, malaria was consistently reported as the most encountered infection. In those

studies, a number of possible reasons were advanced to explain this observation, and these are still prevailing in the university environment where the students live. The factors identified are those which encourage active breeding of mosquitoes that are responsible for transmission of malaria.<sup>[9,17]</sup> Second to malaria, several of the subjects studied also presented with STIs. Corroborating this finding, a report from Ethiopia concluded that prevalence of STIs among the students of a particular higher institution in the country was high and therefore called for evidence-based treatment and proper reproductive health education for the youths.<sup>[18]</sup> Moreover, other forms of infections that were widely treated at the study centre were respiratory tract infections. Incidentally, a similitude of the aforementioned scenario has been reported previously at health facilities located within the vicinity of the present study centre and elsewhere.<sup>[17,19]</sup>

Unfortunately, almost all of the infections treated in this study were not confirmed by means of requisite diagnostic laboratory tests. Instead, the attending physicians resorted majorly to their clinical experiences in diagnosing and treating diseases encountered. A similar trend was observed in a study conducted at a secondary health facility located within the community which hosts the university health centre.<sup>[6]</sup> Interestingly, this type of antimicrobial prescribing behaviour is not limited to resource limited settings such as Nigeria; similar scenario has been reported in higher income settings with more robust healthcare delivery system.<sup>[20]</sup> Thus, the foregoing observation cannot be solely linked to non-availability of required equipment or the required expertise. However, it is important to note that information generated from the laboratory regarding the microbiology of an infection is essential in the appropriate treatment of a given patient. This is

because it has been established that such information often guides the prescriber in making informed decision in terms of selection of required therapy, which is based on rational prescribing, hence preventing antimicrobial resistance and wastage of resources.<sup>[6,20,21]</sup> Thus, in settings where laboratory services are not readily available, use of established guidelines and rapid diagnostic test kit can guide prescribing and use of antimicrobials.

In treating the infections diagnosed in this study, every patient received an average of two antimicrobial agents. This is somewhat proportionate to the average number of infections treated per encounter, being two. Moreover, most of the patients presented with conditions, which mostly required the prescribing of antibacterial and antimalarial agents, followed by those requiring antifungals, amoebicides, and antivirals. These findings corroborated the fact that patients often visit healthcare centres with conditions requiring prescribing of a variety of antimicrobial medications.<sup>[1]</sup>

In treating their conditions, a patient spent an average of ₦ 1756.09 ± 1226.80 on antimicrobial prescribed per encounter. On the average, those who required antiviral agents spent more money compared to those who required antifungal, antimalarial, and antibacterial drugs. These scenarios are likely to make adherence to antimicrobial therapy challenging for a student given payment is out-of-pocket. Hence, sourcing for equally effective alternatives and provision of subsidized cost of care may be beneficial to the students.

This report is the first exploration of antimicrobial use within the facility studied (i.e., NDUHC), and data collection was spread across a year period (January to December) capturing different seasonal variations that may impact on types of infections presented and classes of antimicrobial drugs prescribed. However, this is a single site study, with rather small sample size comprising mostly student population. Hence, conclusions reached may not be generalized to other communities in Bayelsa State, Nigeria.

## CONCLUSION

All patients seen at the university-based health facility studied were adults, virtually all students, and were mostly females. Malaria, STIs, and respiratory tract infections were the most encountered infections, and they were treated mostly with antibacterials, antimalarials, and antifungals.

management that can inform more local site-specific policies.

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## CONFLICT OF INTEREST

No conflict of interest.

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## REFERENCES

1. Abdu-Aguye SN, Haruna A, Shehu A and Labaran KS. An assessment of antimicrobial prescribing at a tertiary hospital in north-western Nigeria. *Afr J Pharmacol Ther*, 2016;5(4).
2. Chatterjee A, Modarai M, Naylor NR, Boyd SE, Atun R, Barlow J et al. Quantifying drivers of antibiotic resistance in humans: a systematic review. *Lancet Infect Dis.*, 2018;18(12), e368-e378.
3. Klein EY, Van Boeckel TP, Martinez EM, Pant S, Gandra S, Levin SA et al. Global increase and geographic convergence in antibiotic consumption between 2000 and 2015. *Proc Natl Acad Sci.*, 2018;115(15), E3463-E3470.
4. Sulis G, Adam P, Nafade V, Gore G, Daniels B, Daftary A, et al. Antibiotic prescription practices in primary care in low-and middle-income countries: A systematic review and meta-analysis. *PLoS med.*, 2020; 202;17(6), e1003139.
5. Ogunleye OO, Fadare JO, Yinka-Ogunleye AF, Anand BD and Godman B. Determinants of antibiotic prescribing among doctors in a Nigerian urban tertiary hospital. *Hosp Pract.*, 2019; 47(1), 53-58.
6. Ganiyu KA, Kpokiri EE and Ikiogha N. Study of antimicrobial prescribing at a secondary health facility in a semi-urban community in Bayelsa State, south-south Nigeria. *Nig J Pharm Res.*, 2018;14(2), 167-174.
7. Anyanwu N and Arigbe-Osula M. Pattern of antibiotic use in a tertiary hospital in Nigeria. *Eur J Hosp Pharm*. 2012; 19(2) 195-195.

surgical hospital in Southeast Nigeria: Need for a

17. Ganiyu KA, Owonaro PA, and Adjerebe C.