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Research Article

Antimicrobial prescription pattern in the Deido health district, Douala, Cameroon

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Abstract

Inappropriate antimicrobial prescriptions are among the highest contributing factors to Antimicrobial Resistance (AMR). Most low and middle-income (LMICS) countries with high AMR burdens like Cameroon, seldom document information on prescription patterns, whereas this information is crucial in addressing inappropriate antimicrobial prescriptions. This study was therefore designed to elucidate antimicrobial prescription patterns in order to tailor interventions to mitigate AMR in Cameroon. The study adopted a multicentre cross-sectional design. Information on antimicrobial prescriptions was collected from four hospitals within the Deido Health District, between October 2019 and March 2020. Of the 1398 participants that were enrolled in the study, the most presented age group were participants aged 15-45 years 913(65.3%) and prescriptions were higher amongst females (923,53.6%). The highest number of antimicrobial prescriptions was made in the outpatient department 592(42.3%) followed by the pediatric unit, 344(24.6%). Most of the prescriptions were for patients with respiratory tract infections 436 (31.2%), followed by those with digestive tract infections 248 (17.7%). The most frequently prescribed class of drugs were the Penicillins 690 (40.3%, 37.8 – 42.6), with Amoxicillin clavulanic acid accounting for 27.8% of the overall prescriptions followed by Cephalosporins 392 (22.7, 20.6 – 24.7), with Ceftriaxone being the most prescribed in the class (13.3%). The need for prescription was mainly determined by clinical judgement (61.1%), while only 9.5% of prescriptions were based on antimicrobial sensitivity test. In the struggle to mitigate AMR, there is a great need to exploit data on prescription patterns and develop stewardship programs in order to optimise antimicrobial use in Cameroon. We emphasize in this communication the potential benefits and outcomes of foresight thinking, such as improved resilience, better resource allocation, and effective response strategies.

Background

Antimicrobial resistance (AMR) is a growing global threat to human, animal, and environmental health, as it threatens the ability to successfully prevent, control, or treat infectious diseases [1,2]. Over the past decades, the rapid emergence and dissemination of AMR have placed it among the top public health problems worldwide [3]. According to global estimates, 4.95 million deaths were associated with AMR and 1.27 million deaths were attributable to AMR in 2019, with the highest burden being from sub-Saharan Africa [4]. Evidence suggests that over 70% of bacterial infections are resistant to at least one of the antibiotics most commonly used for treatment. Some organisms have been found to be resistant to all approved antibiotics, hence can only be treated with experimental and potentially toxic drugs [5].

Low and Middle-Income Countries (LMICs) are more susceptible to infections and are increasingly exposed to antibiotic-resistant bacteria [6]. This increase has been attributed to several factors, namely: the burden of microbial infections, inadequate monitoring of AMR patterns, unavailability of prescription guidelines, and limited access to diagnostics [7-10]. In addition to increasing antimicrobial

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resistance, the investigated antimicrobial drugs have other side effects, for example, tetracyclines can cause immunosuppression [11], penicillins can cause side-reaction [12], and quinolones may have cardiovascular effects [13]. Therefore, complete monitoring of prescription statistics of these drugs is necessary to maintain the health of society and prevent the reduction of social safety. It is well established that antimicrobial use is a significant and modifiable factor of antimicrobial resistance as they are often misused [14,15]. Inappropriate antimicrobial prescriptions within the health sector and in the community are among the major factors that are contributing to global antimicrobial resistance and this greatly contributes to the increasing cost of healthcare services [9,16].

Studies have reported that prescribers often use broad-spectrum antibiotics to treat suspected cases of gram-positive and gram-negative infections. In some cases, prescriptions are made for conditions that do not warrant antibiotics, a common example is the prescription of antibiotics for viral infections [9,10].

In most developed countries, data on prescription patterns are well documented and often exploited to guide hospital stewardship programs in a bid to optimise antimicrobial use. On the other hand, most low and middle-income (LMICS) countries seldom document information on prescription patterns and very few countries have well-established antimicrobial stewardship programs.

Cameroon is one of the LMICS with strikingly high levels of resistance to commonly used antimicrobials [17]. Recent studies in Cameroon indicated that five out of 15 classes of antimicrobials (Cephalosporins, Penicillins, Beta-lactam, Macrolides, and Polyenes) had median resistance above 40% [18]. Nonetheless, there is limited information regarding the prescription pattern of antimicrobials within the Cameroon health system. Information about the prescription pattern is crucial in addressing inappropriate antimicrobial prescriptions in order to tailor interventions to mitigate AMR in Cameroon. This study was therefore designed to elucidate antimicrobial prescription patterns.

Methods

Study design and study population

The study adopted a multicentre cross-sectional study design that was conducted between October 2019 and March 2020, within selected hospitals in the Deido Health District.

Medical doctors working in selected hospitals were trained on how to collect information on the antimicrobial agents they were prescribing using a structured questionnaire incorporated into tablet phones. The study participants were individuals consulting in one of the three (Deido District Hospital, St Padre Pio Hospital, and Daniel Muna Memorial Clinic) main hospitals in the Deido Health District during the study period.

Data collection

Data collection was done by consulting physicians using a structured questionnaire incorporated into tablet phones. After consultation, the physician used the questionnaire to collect demographic information, the reason for prescription, the hospital units where the patient was consulted, the name of the antimicrobial prescribed, and the guide that was used. Since the questionnaire was incorporated into a tablet phone, an email address was created to facilitate data transmission and weekly backup of the data set.

Data analysis

The questionnaire for data collection was designed with Epi Info Data software. The data set was exported from Epi Info to an Excel spreadsheet. Missing variables or discrepancies in data were corrected from the consultation registers. The data was then exported and analyzed using SPSS version 20 (IBM, Chicago, IL). Descriptive statistics such as demographic information, the reason for antimicrobial prescription, number of antimicrobial prescriptions in various hospital units, the number of each type of antimicrobial prescribed, and the type of infection for which the drug was being prescribed, were expressed as proportions. The comparison of antimicrobial prescription between groups was assessed with the chi-square test and the threshold for statistical significance was set at $p < 0.05$.

Ethical considerations

Ethical clearance for the study was obtained from the Faculty of Health Sciences Institutional Review Board of the University of Buea (N0: 2019/941-01/UB.SG.IRB.FHS). The Littoral Regional Delegation of Public Health and the Medical officer of Deido Health District gave Administrative authorization for the study. Written consent was obtained from the participants after the purpose of the study was verbally explained to them. Since the questionnaire was incorporated into the tablet phones, passwords were assigned to each tablet to avoid unauthorized access to the database.

Results

Study characteristics

As shown in Table 1, a total of 1398 participants were enrolled in the study, with the majority being females 763(54.6%). The participants' mean age was 31.17 ± 17.7 SD, the most represented age group was participants aged 15-45 years 913(65.3%), while the age group < 15 years was the least represented, 229(16.4%).

With respect to the hospital department where the antimicrobial drug was prescribed, the highest number of antimicrobial prescriptions was made in the outpatient department 592(42.3%) followed by the Pediatric unit, 344(24.6%), while the lowest number of prescriptions was observed in the emergency unit 222(15.9%). The results showed that the majority of the antimicrobials were prescribed for patients with respiratory tract infection 436 (31.2%) followed by digestive tract infections 248 (17.7%), while the lowest number was prescribed for Angina 30 (2.1%) and flu 35(2.5%).

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A total of 28 antimicrobial agents were prescribed within the study period cut across 9 classes: Cephalosporins, Penicillins, Quinolones, Macrolides, Aminoglycosides, Tetracyclines, Antifolate, Nitrofurans and Antimycobacterial. The most frequently prescribed were the Penicillins 690 (40.3%, 37.8 – 42.6), with Amoxicillin clavulanic acid accounting for 27.8% of the overall prescriptions. Cephalosporins were the second most prescribed, with Ceftriaxone being the most prescribed in the class and accounting for 13.3% of all prescriptions. On the other hand, Tetracyclines, Antifolate, Nitrofurans, Antimycobacterial, Azoles, and Polyenes all accounted for less than 4% of total prescriptions (Table 2). Of the 28 antimicrobial agents prescribed, 22 (78.6%) were on Cameroon's essential drug list.

The study results showed that most of the decisions 861 (61.6%) to prescribe were arrived at from the physician's clinical judgement, followed by the interpretation of Laboratory findings, but not antimicrobial sensitivity testing (AST) 393(28.1%), while only 9.5% of prescriptions were guided by the results of AST. Of the antimicrobial agents prescribed, only 78.6% were from the Essential Drugs list.

It was observed that 964 (69.0%) prescriptions were based on in-service Guidelines, 284 (20.3%) on the prescriber's previous experience of treating the infection, while advice from microbiologists guided 62 (4.4%) of the prescriptions made (Table 3).

Overall, antibiotic prescription was higher in females (923, 53.6%) than in males (798, 46.4%). It was observed that Cephalosporins (54.1%), Penicillins (51.2%), Quinolones (61.7%), and Macrolides (66.7%) were mostly prescribed for females, while Aminoglycosides (57.5%) and Tetracycline (59.3%) was prescribed for males (Table 4). With respect to the participants' age group, the age group 15-45 years had the highest number of prescriptions across all the classes. Within the age group < 15 years, Quinolones were the least prescribed (2, 0.8%) while penicillins were the most prescribed (131, 19.5%). Penicillins were also the most prescribed among the age group > 45 years (Table 5).

Our findings show that Cephalosporins were frequently prescribed in the outpatient department (159, 40.6%) followed by the Pediatric unit (142, 36.2%). Penicillins were mostly prescribed in the Pediatric unit (259, 37.5%) and in the outpatient (194, 28.1%). Most of the Quinolones were

Table 1: Participants and Prescription Characteristics.

Factor	Variable	Number Enrolled (%)
Age group (Years)	<15years	229(16.4)
	15-45years	913(65.3)
	>45years	256(18.3)
Gender	Male	635 (45.43)
	Female	763(54.6)
Hospital Department	Outpatient	592(42.3)
	Emergency	222(15.9)
	Pediatric unit	344(24.6)
	Medical ward	240(17.2)
Infection Type	Respiratory tract infection	436 (31.2)
	GIT	248(17.7)
	Urinary tract infection	172(12.3)
	Genital infection	157(11.2)
	flu	35(2.5)
	Others	39(2.8)
	neonatal_infection	72(5.2)
	measles	158(11.3)
	ENT infection	51(3.6)
	Angina	30(2.1)
Total		1398(100)

GIT: Gastrointestinal Tract; ENT: Ear, Nose, and throat

Table 2: Commonly Prescribed Antimicrobial Drugs.

Antimicrobial Class	Class Frequency (%, 95% CI)	Antimicrobial	Prescription Frequency (%)
Cephalosporins	392 (22.7, 20.6 – 24.7)	Cefuroxime	25(1.4)
		Cefotaxime	55(3.3)
		Ceftazidime	5(0.3)
		Ceftriaxone	222(13.3)
		Cefixime	85(5.1)
Penicillins	690(40.0, 37.8 – 42.6)	Amoxicillin	80(4.8)
		Ampicillin	55(3.3)
		Cloxacillin	56(3.4)
		Amoxiclav	480(27.8)
		oxacillin	19(1.1)
Quinolones	256 (14.8, 13.1 – 16.5)	Ciprofloxacin	150(9.0)
		Ofloxacin	69(4.1)
		Levofloxacin	37(2.2)
Macrolides	156 (9.0, 7.8 – 10.4)	Josamycin	1(0.1)
		Erythromycin	5(0.3)
		Clarithromycin	7(0.4)
		Azithromycin	143(8.3)
Aminoglycosides	200 (11.6, 10.1- 13.1)	Gentamicin	192(11.1)
		Amikacin	6(0.4)
		Netilmicin	2(0.1)
Tetracyclines	27 (1.6, 1.0-2.2)	Doxycycline	24(1.4)
		Monocycline	3(0.2)
Antifolate	2 (0.1, 0.01-0.15)	Trimethoprim	2(0.1)
Nitrofurans	1 (0.06)	Nitrofurantoin	1(0.1)
Antimycobacterial	4 (0.2,0.1-0.3)	Rifampicin	4(0.2)
Total			1,728 (100)

Table 3: Basis of prescription.

Factor	Variable	Number Enrolled (%)
Determinant of need for prescription	Sensitivity test	133(9.5)
	Laboratory findings but sensitivity not done	393(28.1)
	Previous medical history	11(0.8)
	Clinical judgement	861(61.6)
Guide of prescription	Previous experience	284 (20.3)
	In service Guideline	964 (69.0)
	Senior colleague advice	88 (6.3)
	microbiologist advice	62 (4.4)

Table 4: Prescription with respect to gender.

Class	Total	Male (%)	Female (%)	X- *p*, Value
Cephalosporins	392	180(45.9)	212(54.1)	0.00
Penicillins	690	337(48.8)	353(51.2)	
Quinolones	256	98(38.3)	158(61.7)	
Macrolides	156	52(33.3)	104(66.7)	
Aminoglycosides	200	115(57.5)	85(42.5)	
Tetracycline	27	16(59.3)	11(40.7)	
Total	1721	798 (46.4%)	923 (53.6)	

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prescribed in the outpatient department (166, 64.8%) and least prescribed in the paediatric unit (1,0.4). On the other hand, most of the Macrolides and Tetracycline were prescribed in the outpatient department with 61.5% and 74.1%, respectively. Aminoglycosides were mostly prescribed in the paediatric unit (151, 75.5%) (Table 6). Overall, a prescription was highest in the outpatient department (38.5%).

With respect to the type of infection, it was observed that Cephalosporins were more prescribed for genital infections (83, 21.2%) and for neonatal (71, 18.1%). A total of (358, 51.9%) of penicillin was prescribed for respiratory tract infections, while the least (3, 0.4%) was prescribed for genital infections. Quinolones were more prescribed for GIT infections (157, 61.3%). Most Macrolides (98, 62.8%) and Tetracycline (26, 96.3%) were prescribed for genital infections (Table 7).

Discussion

Mindful of the importance of understanding antimicrobial prescription patterns in addressing antimicrobial inappropriate usage, which is one of the leading costs of AMR, this study set out to collect information on prescription patterns in some selected hospitals in the Deido Health District. Among antimicrobial drugs prescribed, a higher percentage of participants who were prescribed antimicrobials were aged 15-45 years (65.3%), with the female gender dominating (54.6%). Previous studies have also reported high antimicrobial prescriptions for individuals above 15 years old [19-21]. The observed higher prescriptions to female patients could be explained by the fact that females have better health-seeking behavior compared with males [16,18,19].

Most of the prescriptions were made at the Outpatient (42.3%) and Pediatric (24.6%) units. The higher proportion of prescriptions in the outpatient department could be attributed to the fact it is one with a high influx of patients within the hospital. High antimicrobial prescription has been reported in the pediatric unit in previous studies [22]. Antibiotics have been reported to be strong and effective medicines used to treat most different bacterial infections in the pediatric department [23]. Other studies have reported higher prescriptions of antimicrobials in the pediatric unit compared to other hospital departments [24,25].

The study shows that the majority of the prescriptions were to treat respiratory (31.2%) and digestive (17.7%) tract infections. This can be explained by the fact that respiratory and digestive tract infections are common reasons for seeking medical care across all age groups. This finding is similar to reports from other studies [9,10,24,26].

It was also observed that the most commonly prescribed bed class of drug was the Penicillins (40.3%, 37.8 – 42.6), of which Amoxicillin clavulanic acid accounted for 27.7% of the overall prescriptions that were made. Cephalosporins were the second most prescribed with Ceftriaxone being the most prescribed in the class. This can be accounted for by the fact that the greatest number of prescriptions were to treat respiratory tract infections, and Penicillin (Amoxicillin clavulanic acid) and Cephalosporins (Ceftriaxone) are the drugs of choice for the treatment of respiratory tract infections. This result is in line with findings from other publications [9,10,20,27].

The study reported that only 9.5% of prescriptions were guided by the results of antimicrobial sensitivity tests, and 69.0% of prescriptions were based on in-service guidelines. It has been reported that the laboratory turnaround time for AST remains long and the laboratories' capability to conduct the tests is limited [18]. Priority needs to be given to antimicrobial susceptibility testing to ensure the use of laboratory data for clinical decision-making [18]. The predominant use of in-service guidelines and prescriber experience to treat can be explained by the fact that there is a lack of National Guidelines on the prescription of antimicrobials [7-10] reason why only 78.6% of the prescriptions were on the Essential Drug List of the Ministry of Public Health [28], lower than the 99.87% reported by Chem, et al. [9].

Table 5: Prescription with respect to Age group.

Class	Total	< 15 years (%)	15-45 years (%)	> 45 years (%)	X- *p*, value
Cephalosporins	392	93(23.7)	246(62.8)	53(13.5)	0.000
Penicillins	690	135 (19.5)	404(58.6)	151(21.9)	
Quinolones	256	2(0.8)	202(78.9)	52(20.3)	
Macrolides	156	16(10.3)	120(76.9)	20(12.8)	
Aminoglycosides	200	50(25)	123(61.5)	27(13.5)	
Tetracycline	27	0(0.0)	25(92.6)	2(7.4)	

Table 6: Prescription across different hospital departments.

Antimicrobial Class	Total	Outpatient (%)	Emergency (%)	Pediatric unit (%)	Medical ward (%)	X- p, Value
Cephalosporins	392	159(40.6)	53(13.5)	142(36.2)	38(9.7)	0.000
Penicillins	690	194(28.1)	105(15.2)	259(37.5)	132(19.1)	
Quinolones	256	166(64.8)	44(17.2)	1(0.4)	45(17.6)	
Macrolides	156	96(61.5)	36(23.1)	13(8.3)	11(7.1)	
Aminoglycosides	200	28(14.0)	5(2.5)	151(75.5)	16(8.0)	
Tetracycline	27	20 (74.1)	3 (11.1)	1(3.7)	3(11.1)	
Total	1,721	663 (38.5)	246 (14.3)	567 (33)	245 (14.2)	

Table 7: Prescription Versus Type of Infections.

Antibiotic	Total	RTI (%)	GIT (%)	UTI (%)	(%)GI	Flu (%)	Others (%)	Neonatal Infection (%)	Measles (%)	ENT infection (%)	Angina (%)	X- *p*, value
Cephalosporins	392	56(14.3)	70(17.9)	67(17.1)	83(21.2)	1(0.3)	12(3.1)	71(18.1)	25(6.4)	3(0.8)	2(0.5)	0.000
Penicillins	690	358(51.9)	9(1.3)	17(2.5)	3(0.4)	4(0.6)	16(2.3)	60(8.7)	144(20.9)	48(7.0)	26(3.8)	
Quinolones	256	4(1.6)	157(61.3)	79(30.9)	10(3.9)	0(0.0)	1(0.4)	0(0.0)	5(2.0)	0(0.0)	0(0.0)	
Macrolides	156	39(25.0)	2(1.3)	4(2.6)	98(62.8)	0(0.0)	3(1.9)	0(0.0)	9(5.8)	0(0.0)	1(0.6)	
Aminoglycosides	200	19(9.5)	12(6.0)	12(6.0)	8(4.0)	1(0.5)	11(5.5)	124(62.0)	11(5.5)	1(0.5)	1(0.6)	
Tetracycline	27	0(0.0)	0(0.0)	0(0.0)	26(96.3)	0(0.0)	0(0.0)	0(0.0)	1(3.7)	0(0.0)	0(0.0)	

RTI: Respiratory Tract Infection; GIT: Gastrointestinal Tract Infection; UTI: Urinary Tract Infection; ENT: Ear, Nose and Throat

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Conclusion

The study revealed that antimicrobials are more prescribed for the age group 15-45 years, females, in the Outpatient and Pediatric departments. Respiratory and digestive tract infections were responsible for most of the prescriptions. Despite the importance of AST in the effective treatment of infections and lessening the risk of treatment failure, its' usage for prescription decision-making remains low.

Most of the prescriptions were based on in-service guidelines and the prescribers' experience. In the struggle to optimise antimicrobial use and mitigate resistance, there is a great need to exploit data on prescription patterns and develop hospital stewardship programs in order to avoid antimicrobial overuse, misuse, and inappropriate prescription, as well as adherence to treatment guidelines.

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Declarations

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Author's contributions: PAN conceived, designed, and supervised the study implementation, CN conceived, designed, coordinated the study, analysed the data, and drafted the paper, ETA designed, coordinated the study, and participated in drafting the paper, PTNM contributed to developing the manuscript. JKTA reviewed and corrected the study proposal and the final manuscript write up and DZ contributed to developing the manuscript. All authors read and approved the final manuscript Ethics approval

This study protocol was reviewed and approved by the Faculty of Health Sciences Institutional Review Board (IRB) of the University of Buea, Cameroon (N0: 2019/941-01/UB.SG.IRB. FHS).

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