Antibiotic consumption history of patients in a referred laboratory in Yaounde

Daniele Sandra Yopa Demen,[1] Emmanuel Nnanga Nga,[2] Claude Stephan Ohandza,[3] Hortense Gonsu Kamga,[4] Olive Nathalie Kouamen Njikeu,[4] Georges Nguefack-Tsague[1]

[1]Department of Public Health, University of Yaounde I, Cameroon; [2]Department of Pharmacology, University of Yaounde I, Cameroon; [3]Department of Infectious and Tropical Diseases, Fann University Teaching Hospital, Dakar, Senegal; [4]Department of Microbiology-Parasitology-Hematology, University of Yaounde I, Cameroon

Abstract

Background. Regulation of antibiotic prescription and consumption remains a major public health burden in low- and middle-income countries.

Objective. This study aimed to describe the antibiotic consumption of patients who had a positive antibiotic culture in a reference laboratory.

Methods. A retrospective descriptive study was conducted among 113 participants with positive antibiograms with a documented history of antibiotics intake at the Yaoundé University Teaching Hospital in Cameroon between January 2016 and June 2021. Data were stored and analyzed using the Census and Survey Processing System version 7.3 and Statistical Package for Social Science version 25.0. Descriptive statistics were used to estimate the indicators.

Results. Of the 113 patients enrolled, 105 had a history of drug use; 56 participants (53.3%) had taken at least 2 antibiotics prior to sampling. Cephalosporins were the most consumed antibiotics (41%), followed by nitroimidazols (28.6%) and penicillins (28.6%). According to the World Health Organization classification, 55 (52.4%) took major priority antibiotics.

Conclusion. We are on the alert and there is an urgent need to raise awareness among clinicians and patients alike by providing them with good clinical practice guidelines.

Correspondence: Daniele Sandra Yopa Demen, Department of Public Health, Yaounde, University of Yaounde I, Cameroon.
Tel.: +237.697942473.
E-mail: sandrayopa@gmail.com

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Introduction

Antibiotic residues in the environment, excessive use of antibiotics in animal production, and infectious disease management have led to one of the major plagues of this century which is antimicrobial resistance (AMR).[1-5] Antibiotics consumed by humans and animals are often excreted as active drugs and penetrate the sewage systems and water sources, where they select antibiotic-resistant bacteria in the environment. The double challenge of the reoccurrence of certain infectious diseases previously under control, coupled with the increasing ineffectiveness of antibiotics in routine clinical management, increases the phenomenon of therapeutic deadlock and premature death.[1,3,5-7] Although several authors suggested that pharmaceutical industries are returning to the development of new antimicrobial molecules, the immediate action is more focused on antimicrobial stewardship to reduce resistance.[8,9] As recommended by the Global Antimicrobial Resistance Surveillance System, many countries have stepped up and set up programs in the different sectors concerned to monitor the use and prescription of antimicrobials and educate both the prescribers and the general population.[2,10,11] As an example we have the antibiotic protection program initiated in Poland in 2004.[2] A survey on the implementation of antimicrobial stewardship was conducted in 67 countries revealed that the African continent had the lowest percentage of the implementation of antimicrobial stewardship guidelines.[12]

In various low-income countries, regulation of the quality, prescription, and purchase of antibiotics remains a challenge.[1,6] Street vendors are an unofficial source of supply and are highly represented in these regions.[7,10] Drugs classified as high priority by the World Health Organization (WHO) such as carbapenems, third/fourth generation of cephalosporins, and glycopeptides are

issued without prescription in these countries and are used in both humans and animals.[1,5]

In 2018, a survey of human and animal antibiotics sellers in Kenya found that most veterinary and human pharmacies (100% and 52% respectively) sold antibiotics without a prescription; it also highlighted that the customer's preference was an important factor when prescribing antibiotics in half of the pharmacies. In addition, colistin, often used as a last resort, was a drug of choice used in livestock production.[1]

To leave an efficient antibiotic legacy for the management of infectious and zoonotic diseases for future generations, low-income countries need to implement antimicrobial stewardship interventions.[6] One of the key aspects of global surveillance of antibiotic resistance, based on the population is the collection of data with regard to the consumption of antibiotics by the population.[13] However, these data are not always up to date in Cameroon. We proposed to describe the antibiotic consumption of patients who had a positive culture and sensitivity analysis in a reference laboratory.

Materials and Methods

Study design and population

We conducted a retrospective descriptive study over 4 years and 6 months, from January 2016 to June 2021. Our study was carried out at the Yaoundé University Teaching Hospital (YUTH) in Cameroon. YUTH is both a teaching university ensuring rigorous care and quality training for future health professionals and a sentinel site for emerging antimicrobial surveillance in Cameroon. Our main population was made up of patients with recorded antibiotic use and infected with bacterial strains considered resistant bacteria. All bacterial strains from the following biological fluids were included: blood, stool, urine, suppurations, probe tip, and catheter tip. We performed an exhaustive sampling during the entire period of recruitment.

Procedure search of archives and registers

After having obtained the agreement from the Director of YUTH, we collected the data based on archive files, we selected the results which met the inclusion criteria at the bacteriological laboratory of YUTH.

Selection of results

A pre-established and pre-tested data collection form was designed. The information collected included age, gender, drugs consumed before sample collection, nature of the bacteria, date of isolation, sampling site, department concerned, sensitivity profile tested for each antibiotic, and percentage of resistance for each species. We equally classified the antibiotics previously taken by the participants according to the WHO list of antibiotics of critical importance for human medicine, 5th revision of the expert committee on integrated surveillance of antibiotic resistance (AGISAR) November 2018.[14]

Research for resistant bacteria

For information purposes, the steps from the collection of resistant bacteria to the reading of the antibiogram were done according to the antibiogram committee of the French microbiology society protocol.[15]

Data analysis

All data collection forms were stored in a database designed under the Census and Survey Processing System version 7.3. The data were then analyzed using Statistical Package for Social Science version 25.0. Charts were done in MS Excel 2016. Categorical variables were presented in frequency and percentages. The antibacterial resistance rate was calculated by taking the number of times the study strain was resistant, divided by the number of times the strain was resistant and susceptible. The intermediate level of resistance was not considered for the calculation.

Ethical considerations

The study was conducted following the Declaration of Helsinki. A clearance from the Institutional Research Ethics Committee (IREC) of the Faculty of Medicine and Biomedical Sciences and a research authorization from the Director of the YUTH were obtained.

Results

In total, we had 113 participants with positive antibiograms for whom the notion of drug intake was documented. The most represented age group was 0-10 years (15.9%). The most represented department was the pediatric one with 23 patients (20.4%). Of the 113 patients enrolled, 105 had a history of drug use, 56 of which (53.3%) had taken at least 2 antibiotics prior to sampling (Figure 1). Among the antibiotics, cephalosporins were the most consumed (41%), followed by nitroimidazols (28.6%) and penicillins (28.6%), (Figure 2). Also, combinations including quinolones+nitroimidazols (13.3%) and aminosides+cephaloporins (11.5%)

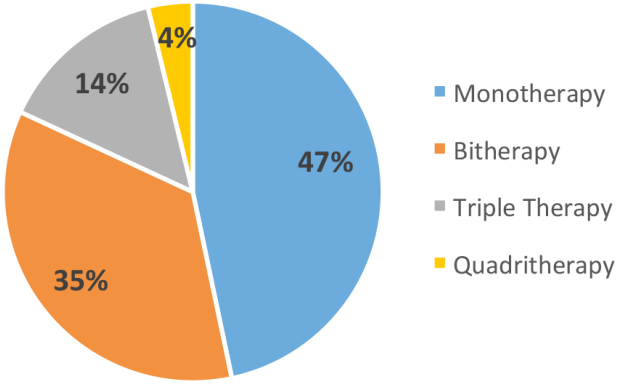

Figure 1. Number of antibiotics taken.

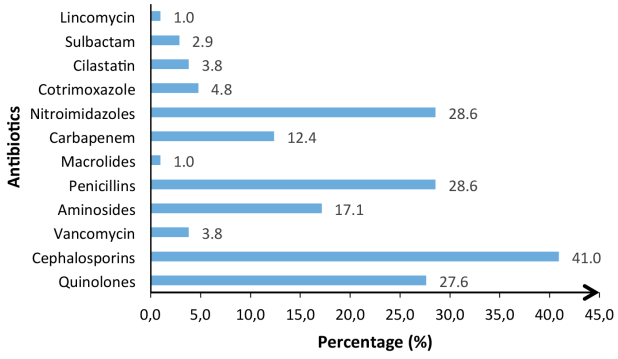

Figure 2. Medical history of patients with positive antibiotic susceptibility tests.

were the most used. The WHO classification of antibiotics according to priority levels shows that 30 (52.4%) of the patients took antibiotics of critical importance and major priority (Table 1).

An analysis of antibiotics consumed according to the WHO classification per age group shows that among the 55 (52.4%) who took the major priority antibiotics, 22 (40%) were 50 years old and above and 13 (23.6%) were aged 0-10 years (Table 2). The departments where patients consumed more antibiotics before performing their antibiotic susceptibility test were the emergency and the internal medicine departments (Table 3).

Discussion

There are numerous concerns about the anarchic consumption of antimicrobials by individuals all over the world. Many authors have pointed out the risk of emerging resistance and the dawn of a pre-antibiotic era when people could die of simple/common infections. One of the causes of AMR is the inappropriate use of AMR and the transmission of AMR microorganisms.[16] The overuse of antibiotics is common worldwide, from low- to high-income countries, and affects various age groups.[17] Our aim was to investigate

Table 1. Distribution of consumed antibiotics according to the World Health Organization's medically important antibiotics ranking categories.

WHO antibiotic class	Frequency (n)	Percentage (%)
High importance antibiotics	30	28,6
High priority antibiotics	15	14,3
Major priority antibiotics	55	52,4
Multiple major priority antibiotics	5	4,8
Total	105	100,0

WHO, World Health Organization.

Table 2. World Health Organization medically important antibiotics ranking categories of consumed antibiotics by participants' age groups.

Age	High importance ATB, n (%)	High priority ATB, n (%)	Major priority ATB, n (%)	Multiple major priority ATB, n (%)	Total, n (%)
0-10	0 (0)	4 (26.7)	13 (23.6)	0 (0)	17 (16.2)
10-20	4 (13.3)	0 (0)	6 (10.9)	0 (0)	10 (9.5)
20-30	3 (10.0)	2 (13.3)	2 (3.6)	0 (0)	7 (6.7)
30-40	5 (16.7)	1 (6.7)	6 (10.9)	0 (0)	12 (11.4)
40-50	7 (23.3)	0 (0.0)	6 (10.9)	0 (0)	13 (12.4)
>50	11 (36.7)	8 (53.3)	22 (40.0)	5 (100.0)	46 (43.8)
Total	30 (100.0)	15 (100.0)	55 (100.0)	5 (100.0)	105 (100.0)

ATB, antibiotic.

Table 3. World Health Organization medically important antibiotics ranking categories of consumed antibiotics by department.

Age	High importance ATB, n (%)	High priority ATB, n (%)	Major priority ATB, n (%)	Multiple major priority ATB, n (%)	Total, n (%)
General surgery	7 (43.8)	7 (43.8)	2 (12.5)	0 (0)	16 (100.0)
Intensive care surgery	1 (50.0)	1 (50.0)	0 (0)	0 (0)	2 (100.0)
Gynecology- obstetrics	2 (40.0)	2 (40.0)	1 (20.0)	0 (0)	5 (100.0)
Hemodialysis	1 (100.0)	0 (0)	0 (0)	0 (0)	1 (100.0)
Hospitalization	0 (0)	1 (100.0)	0 (0)	0 (0)	1 (100.0)
Internal medicine	7 (41.2)	8 (47.1)	2 (11.8)	0 (0)	17 (100.0)
Neonatology	0 (0)	2 (28.6)	4 (57.1)	1 (14.3)	7 (100.0)
ORL	2 (100.0)	0 (0)	0 (0)	0 (0)	2 (100.0)
Pediatrics	9 (60.0)	4 (26.7)	2 (13.3)	0 (0)	15 (100.0)
Resuscitation	6 (46.2)	5 (38.5)	2 (15.4)	0 (0)	13 (100.0)
Outpatient	6 (66.7)	3 (33.3)	0 (0)	0 (0)	9 (100.0)
Emergency	8 (47.1)	4 (23.5)	2 (11.8)	3 (17.6)	17 (100.0)
Total	49 (46.7)	37 (35.2)	15 (14.3)	4 (3.8)	105 (100.0)

ATB, antibiotic; ORL, otorhinolaryngology.

the consumption of antibiotics in patients with positive antibiogram culture samples obtained from a reference laboratory.

Most of the participants were aged between 0-10 years, deferring from a similar study carried out by Okoth *et al*., where participants were mostly aged between 20-64 years.[18] This could be explained by the fact that our samples were mostly obtained from the neonatology and pediatric units combined, together with emergency departments where we assume some samples from those age groups could have been collected. This is in contrast with the study conducted by Okoth *et al*., where the most concerned units were the surgical and medical ones with 28% and 19% respectively.[18]

We recorded more males (57%): this is similar to a study conducted in 53 countries by Versporten *et al*. mostly on adult inpatients.[19] This could be due to the fact that most of our patients came from adult units such as medical and surgical units which were among the most represented ones (18% and 17% respectively). Nevertheless, this was somewhat different from the study conducted by Ngu *et al*. who recorded more females.[20] This may be due to the fact that their study solely focused on self-medications among patients with respiratory tract infections.

Emergency, internal medicine, surgical, pediatric, and intensive care units (ICU) were the departments with the highest proportion of participants with prescribed antibiotics with 19%, 16%, 15%, 14%, and 12% respectively. This is unlike other studies conducted in Nigeria and Kenya where the most represented departments were the ICU and surgical departments.[21,22] The differences could be explained by the fact that either study did not take into account the emergency departments of each respective hospital, whereas we did. Antibiotics prescription for febrile children in Europe in emergency departments is high according to a study conducted by Van de Maat *et al*.[23]

The most prescribed classes of antibiotics were third-generation cephalosporins and penicillins, which is consistent with the work of Okoth *et al*.[18] This is in line with the recurrent use of cephalosporins and penicillins in pediatric infections such as neonatal infections, pneumonia, and meningitis.[24] It should be equally noted that third-generation cephalosporins are used for their broad-spectrum nature and as empirical antimicrobial agents with no readily identified culprit. The ease and convenience of prescription by healthcare professionals makes it one of the most prescribed agents in current practice both in adults and children.[18,22,25]

The simultaneous use of several antibiotics was observed in this study where 53.3% of patients took at least 2 antibiotics. A similar observation was made in Kenya where they had a higher proportion of 68%.[18] The most prescribed combination in this study was imidazoles and quinolones (11%). We had different combinations made up of aminoglycosides, cephalosporins, quinolones, and imidazoles. Sadly, this study did not tell us which class of antimicrobial was prescribed per unit and their various indications.

Patients in the neonatal ward who were taking antibiotics were already at least on dual therapy before performing their antibiotic susceptibility test. This could be explained by the fact that in current practice, doctors use probabilistic antibiotics to rule out a neonatal infection or meningitis in case of fever, even if there is no evidence from the paraclinical examinations.

Patients had a history of antibiotic consumption before visiting the hospital. The most consumed agents were cephalosporins, imidazoles, and penicillins. This could be due to the fact that these medications are readily affordable without prescriptions at pharmacies or roadside vendors.[20] They are used by healthcare professionals as empirical treatment without prior culture or sensitivity.[22] The use of fluoroquinolones and cotrimoxazole was equally seen in the same study.[20]

This is an opportunity to urge various practitioners, and health authorities on the necessity of appropriate antimicrobial stewardship to change the rising curve of AMR.

Limitations

We were not able to obtain the doses of antibiotics consumed by the patients in the archives. We do not know whether prior antibiotic consumption is self-medication or a medical prescription.

Conclusions

It is clear that antimicrobial stewardship is one of the pillars in the control of the new public health emergency of AMR. Although this study could not highlight the link between antibiotic use and AMR, it does show how early all age groups, especially newborns, are exposed to antibiotic use. This is partly because, in admitted newborns, antibiotic therapy is often instituted before biological evidence for infection. Therefore, we are on the alert today and there is an urgent need to raise awareness among clinicians and patients alike by providing them with good clinical practice guidelines. Moreover, it is important to limit the anarchic access to antibiotics outside hospital settings by fighting against street medications and by strengthening the regulations on access to antibiotics in pharmacies conditioned by a medical prescription.

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