



Antibiotic Dispensing Practices in Community Pharmacies: A Major Health Concern in the Eastern Democratic Republic of Congo

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Authors' contributions

This work was carried out in collaboration among all authors. Author ABN wrote a structured questionnaire and supervised all data collection. Author BLR was helpful in pharmacological classifications of antibiotics. Author TYM was in charge of the statistics. Author ASK is the principal investigator who designed the study and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: The practice of antibiotic dispensing in community pharmacies may contribute to irrational use of antibiotics. The aim of this study was to evaluate the antibiotic dispensing patterns in community pharmacies of the Eastern DR Congo.

Methods: It is a cross-sectional study carried out at Bukavu city. The study included 1504 subjects attending community pharmacies. Thus, a total number of 40 pharmacies were selected. The sociodemographic profiles of patients and dispensers were also recorded. The pharmacological interventions were investigated in terms of antibiotics dispensed according to patient's complaints,

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antibiotic dispensing with or without prescription, the substitution of antibiotics in prescriptions.

Results: Participants attending pharmacies for antibiotic needs were in the mean age of 29.8±13 years. Most of the pharmacy workers consisted of pharmacy technicians (70%) and no trained dispensers (20%). Pharmacists represented only 10% of all dispensers in community pharmacies. We found that 67.8% of subjects purchased antibiotics without prescription. The antibiotics dispensed without prescription were either on patients' requests (70.1%) or the suggestion of dispensers (29.9%). Only 18.4% of prescriptions were subject to substitution. The conditions for requiring antibiotic dispensing without prescriptions were respectively gastrointestinal (34%), respiratory (27%), genitourinary (25%), skin (11%) and dental (2%) infections. Conditions that were not well defined represented 1%. In cephalosporins, Cefixime was the most important drug dispensed without prescription (72.5%) whereas in penicillins, this was Amoxicillin (55.5%). Doxycycline was more dispensed in the class of cyclines (69.4%). Erythromycin (53.1%) and Azithromycin (29.4%) were more dispensed in the class of macrolides. Ciprofloxacin was the most dispensed drug in the class of quinolones (74.3%) and Metronidazole (86.8%) in the class of imidazoles.

Conclusion: The Antibiotic dispensing practice is very critical in the community pharmacies of Bukavu city due to the lack of qualified dispensers. This may increase the antibiotic self-medication and contribute to antibiotic resistance.

Keywords: Community pharmacies; antibiotic dispensing; dispensers; prescription.

1. INTRODUCTION

For decades, antibiotics have played a crucial role in reducing mortality rate due to bacterial infections in the world. The discovery of penicillin in the early 20th century was followed by the development of new antibiotics belonging principally to cephalosporin, aminoglycoside, phenicol, polymyxine, macrolide, cycline, sulfonamide, glycopeptide, quinolone and lipopeptide groups [1]. Unfortunately, the world is facing with a life-threatening multidrug-resistance, particularly in low and middle income countries (LMIC) [2,3]. It is estimated at about 700,000 deaths annually due to an antimicrobial resistance and if no action is taken, the number is expected to increase more than tenfold by 2050 [4,5]. Although resistance to current drug therapies is emerging rapidly, there are few new antibiotics in development against resistant bacteria [6,7]. In 2015, the World Health Organization (WHO) launched a global action plan for antimicrobial resistance [8]. Democratic Republic of Congo (DRC), with the financial support of WHO, has adopted a strategic action plan 2018-2022 to combat an emergence of antimicrobial resistance [9].

Over-prescription and self-medication are common forms of antibiotic misuses leading to antimicrobial resistance. Self-medication is very common in Sub Saharan Africa countries and antibiotic dispensing practices may contribute to self-medication [10]. According to the US 2016 Centers for Disease Control and Prevention

report, at least 30% of antibiotics prescribed in outpatient settings are unnecessary [11]. The diagnosis leading to the most frequent inappropriate prescribing or dispensing of antibiotics is globally acute respiratory tract infections [12,13]. African practitioners were recently warned about the inappropriate coadministration of antibiotics (Azithromycin) to treat viral respiratory tract infections such as flu type respiratory infections [14].

In western countries, antibiotic dispensing without prescription is very scarce whereas in low and middle income countries, this is of particular concern [15,16]. It is estimated that more than 50% of antibiotics worldwide are purchased without prescription from pharmacies or street vendors in the informal sector [17]. In LMIC, dispensing drugs without prescription can be facilitated by inadequate pharmacy regulation and economic problems. In fact, many pharmacies are operating without any license or legal authorization. Consequently, there is an easy affordability of broad-spectrum antibiotics in retail pharmacies. [18,19]. It is recognized to pharmacist as the only trained dispenser in selecting appropriate drug therapy, solving and preventing problems related to patient medications. In developing countries, the ratios pharmacists and pharmacies to population are low so that he can be helped by a pharmacy technician. Unfortunately, access to a better pharmaceutical care is impeded by the huge presence of no trained healthcare workers [10,15,16].

This study aimed to evaluate the extent of antibiotic dispensing in community pharmacy settings of Bukavu city. To the best of our knowledge, data about the antibiotic dispensing practices are either poorly documented or very scarce in the Eastern part of Democratic Republic of the Congo.

2. MATERIALS AND METHODS

2.1 Survey Site

This study was carried out in Bukavu city, which is the administrative center of the South-Kivu province in the eastern Democratic Republic of Congo, with an estimated 806,940 inhabitants. The city of Bukavu is lying the extreme south-western edge of Lake Kivu, and is separated of the west of Cyangungu in Rwanda by the outlet of the Ruzizi River. It consists of three administrative communes including Ibanda, Kadutu and Bagira [20].

2.2 Data Collection

A cross-sectional questionnaire-based study was conducted from January to June 2019. The city of Bukavu accounts at about 150 registered community pharmacies distributed in the health zones of Ibanda, Kadutu and Bagira. Three-quarters of pharmacies are located in the commune of Ibanda, which is the commercial center of Bukavu. The simple random sampling technique was used to select pharmacies, which recommends assigning a code to each pharmacy. A random sample of 40 community

pharmacies corresponding to different codes was selected for this study. Before starting this investigation, permission was granted from pharmacy proprietors or dispensers in charge. Eight students of the department of pharmaceutical techniques were instructed to collect informations from people (age>16years) attending community pharmacies for antibiotic needs. Subjects purchasing antibiotics for their relatives or friends were excluded. Considering the patient's attendance rate of selected pharmacies for antibiotic needs and due to the limited number of investigators, a total number of 50 respondents were found sufficient to evaluate the practice of antibiotic dispensing in each pharmacy. After a written informed consent and explanations, the respondents were invited to fulfill a structured questionnaire. The informations in the questionnaire leaflet were related to age, gender, education, profession, patient's complaints and antibiotics purchased. For convenient reasons, patients' complaints were grouped into classes such as genitourinary, gastrointestinal, respiratory, skin and dental infections. An overall number of 2000 respondents were included in this study but only 1504 questionnaire leaflets correctly fulfilled were taken into consideration.

The sociodemographic characteristics of dispensers were also recorded. The features of pharmaceutical interventions taken into account were the antibiotic dispensing pattern (with or without prescription), substitution or not substitution of antibiotics prescribed.



Fig. 1. Map of Bukavu city showing three administrative communes: Ibanda, Kadutu and Bagira (adapted from van Overbeek et al. [20])

2.3 Statistical Analyses

Data collected were analyzed on the statistical package for social sciences (SPSS for windows version 19, Armonk, USA) software. Descriptive statistics such as frequency, percentage, mean and standard deviation were used to present data. The Chi-square test was used to evaluate differences between categorical variables. If the p-value was less than 0.05, there was a statistically significant relationship between the two classifications.

3. RESULTS AND DISCUSSION

3.1 Patients' and Dispensers' Characteristics

As shown in Table 1, the majority of participants were between the age group 21 to 65 years

(mean age 29.8 ± 13 years). Besides, males and females were equally distributed and the majority of participants who purchased antibiotics were unemployed (85.8%). There was a significant difference (p less than 0.05) in education levels between subjects (25.5% no level, 10.9% primary level, 36.6% secondary level and 26.7% university level). Majority of the population who purchased antibiotics in pharmacies came from the administrative communes of Kadutu (50.1%) and Ibanda (35.8%).

There were a total number of 40 community pharmacies selected in this study (Table 2). Majority of dispensers were in the age group > 20 years (87.5%) and females were more represented than males (62.5%). Among pharmacy workers, pharmacy technicians represented a more significant ($p < 0.05$) and higher group of dispensers (70%).

Table 1. Socio-demographic profile of patients

Variables	Frequency	Percentage (%)	p-value
Age (years)			<0.0001
≤ 20	544	36.2	
21 – 65	928	61.7	
> 65	32	2.1	
Gender			0.125
Female	740	49.2	
Male	764	50.8	
Employment status			<0.0001
Employed	213	14.2	
Unemployed	1291	85.8	
Education levels			<0.001
No	384	25.5	
Primary	165	10.9	
Secondary	555	36.9	
University	402	26.7	
Commune			0.140
Bagira	212	14.1	
Ibanda	538	35.8	
Kadutu	754	50.1	

Table 2. Dispensers' characteristics

Variable	Frequency	Percentage (%)	p-value
Age (years)			<0.001
≤ 20	5	12.5	
>20	35	87.5	
Gender			0.007
Female	25	62.5	
Male	15	37.5	
Employment status			0.014
Pharmacists	4	10.0	
Pharmacy technicians	28	70.0	
Others	8	20.0	

3.2 Antibiotic Dispensing Practices

It was observed two antibiotic dispensing patterns in the community pharmacies of Bukavu city (Table 3). An important group of subjects purchased antibiotics without prescription (67.8%) and another one with prescription (32.2%). Among those who purchased antibiotics without prescription, 70.1% requested it by themselves whereas 29.9% of them were recommended by dispensers. On the other hand, we found that 81.6% of prescriptions containing antibiotics were not substituted whereas 18.4% were subject to substitutions. Most of the substitutions were made in the same pharmacological classes of antibiotics (62.9%). As illustrated in Fig. 2, the most common pathological conditions for requiring antibiotic dispensing without prescriptions were respectively gastrointestinal (34%), respiratory tract infections (27%), genitourinary infections (25%), skin (11%) and dental (2%) infections. Conditions that were not well defined represented 1%.

All classes of antibiotics were concerned by the antibiotic dispensing practices without prescriptions. The Fig. 3 indicates that antibiotics dispensed without prescriptions belonged in majority to the pharmacological classes of

penicillins (37%), quinolones (13%), macrolides (12%), cyclines (11%) and cephalosporins (9%). The antibiotics dispensed in combinations represented only 1%. The most common pharmacological combinations were imidazoles with fluoroquinolones (40.7%) and Penicillins with penicillins (17.7%) (Table 4).

In cephalosporins, Cefixime was the most important drug dispensed without prescription (72.5%) whereas in penicillins, this was Amoxicillin (55.5%). Doxycycline was more dispensed in the class of cyclines (69.4%). Erythromycin (53.1%) and Azithromycin (29.4%) were more dispensed in the class of macrolides. Ciprofloxacin was the most dispensed drug in the class of quinolones (74.3%) and Metronidazole (86.8%) in the class of imidazoles (Table 5).

The Table 6 shows that antibiotics in the class of cephalosporins were the most suggested or requested for genitourinary infections (67.3%) followed by cyclines (38.6%) and macrolides (33.3%). The antibiotics belonging to sulfonamides were more dispensed for respiratory infections (77.3%) followed by macrolides (39.5%) and penicillins (30.1%). Imidazoles (81.8%), fluoroquinolones (42.9%) and penicillins (35.8%) were given for gastrointestinal infections.

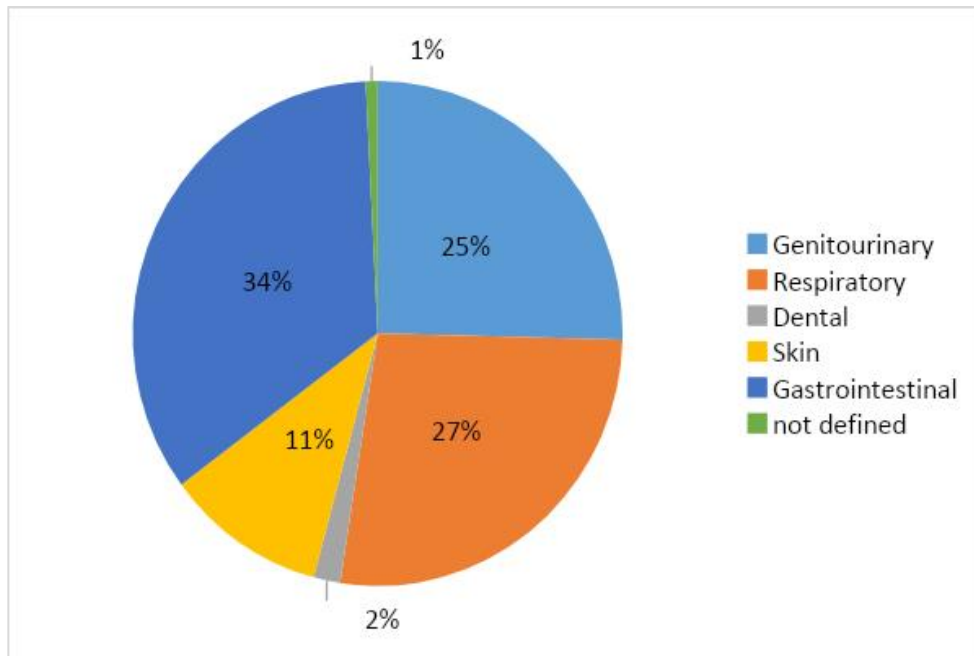


Fig. 2. Pathological conditions for antibiotic dispensing without prescriptions

Table 3. Antibiotic dispensing patterns

Variables	N (1504)	Percentage (%)	p-value
Without prescription	1020	67.8	
- On Patient's request	716	70.1	0.001
- Suggestion of dispensers	304	29.9	
On prescription	484	32.2	
- Prescriptions not substituted	395	81.6	<0.001
- Prescriptions substituted	89	18.4	
Types of substitutions (n=89)			
- Same pharmacological class	56	62.9	0.001
- Different pharmacological classes	33	37.1	

Table 4. Antibiotics dispensed in combinations

Combinations	Frequency (113)	Percentage (%)
Penicillins / Quinolones	4	3.5
Imidazoles / Quinolones	46	40.7
Penicillins / Sulfonamides	4	3.5
Penicillins / Penicillins	20	17.7
Quinolones / Macrolides	2	1.8
Penicillins / Macrolides	6	5.3
Cephalosporins / Quinolones	2	1.8
Cephalosporins / Macrolides	4	3.5
Penicillins / Cephalosporins	3	2.7
Penicillins / Imidazoles	11	9.7
Cephalosporins / Cyclines	3	2.7
Phenicols / Sulfonamides	3	2.7
Penicillins / Cyclines	5	4.4

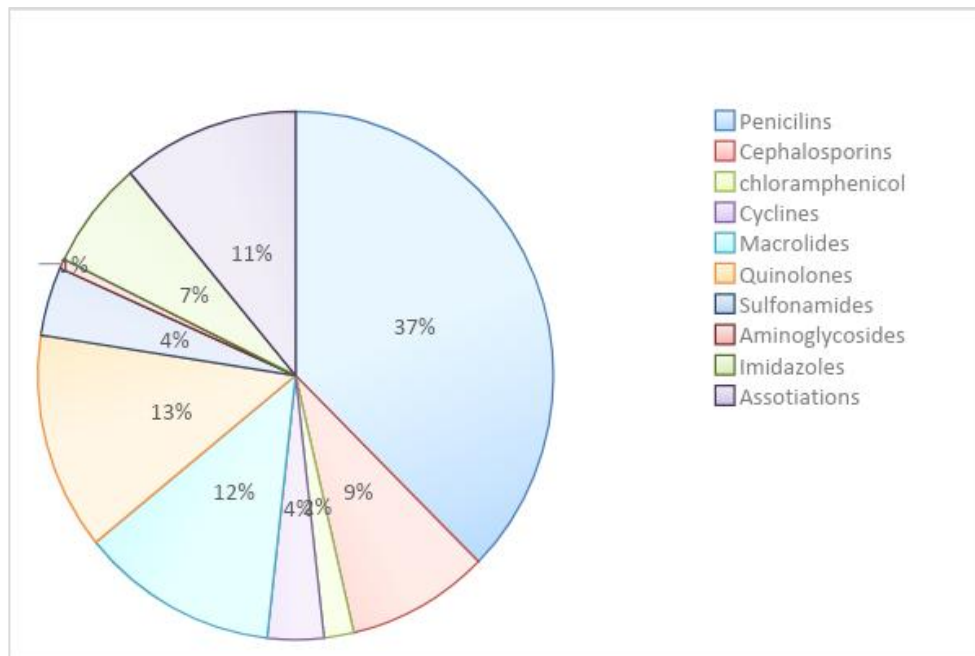


Fig. 3. Pharmacological classes of antibiotics dispensed without prescription

Table 5. Antibiotics dispensed without prescriptions by pharmacological classes

Pharmacological Classes	Frequency (n=907)	Percentage (%)
Penicillins (n=382)		
Amoxicillin	212	55.5
Ampicillin	21	5.5
Penicillin G	3	0.8
Amoxicillin/clavulanic acid	54	14.1
Cloxacillin	47	12.3
Penicillin V	45	11.8
Cephalosporins (n=91)		
Cefadroxil	6	6.6
Cephalexin	1	1.1
Cefixime	66	72.5
Cefotaxime	5	5.5
Cefpodoxime	3	3.3
Ceftriaxone	6	6.6
Cefuroxime	4	4.4
Phenicol (n=19)		
Chloramphenicol	19	100.0
Cyclines (n=36)		
Tetracycline	11	30.6
Doxycycline	25	69.4
Macrolides (n=126)		
Erythromycin	67	53.1
Clarithromycin	13	10.3
Azithromycin	37	29.4
Rovamycin	4	3.2
Clindamycin	4	3.2
Lincomycin	1	0.8
Quinolones (n=136)		
Ciprofloxacin	101	74.3
Norfloxacin	21	15.4
Levofloxacin	10	7.4
Ofloxacin	3	2.2
Nalidixic acid	1	0.7
Sulfonamides (n=43)		
Cotrimoxazole	43	100.0
Aminoglycosides (n=6)		
Gentamicin	1	16.7
Amikacin	1	16.7
Spectinomycin	4	66.6
Imidazole (n=68)		
Metronidazole	59	86.8
Tinidazole	6	8.8
Ornidazole	3	4.4

3.3 Discussion

Infectious diseases are main causes of deaths in low and middle income countries and antibiotics

are very useful in fighting against bacterial infections [21]. The efficacy of antibiotics depends partly on its rational use in clinical as well as pharmacy settings [22]. This study shows

Table 6. Classes of antibiotics dispensed according to different pathological conditions

Infections	Cephalosporins	Penicillins	Macrolides	Quinolones	Sulfonamides	Cyclines	Imidazoles	Phenicol
Genitourinary	67.3	12.4	33.3	21.4	13.6	38.6	7.6	28.0
Respiratory	23.1	30.1	39.5	28.6	77.3	11.4	3.0	36.0
Gastrointestinal	9.6	35.8	21.9	42.9	4.5	34.1	81.8	20.0
Dental	0.0	2.8	2.6	0.0	0.0	0,0	0.0	0.0
Skin	0.0	18.1	2.7	0.0	4.6	13.6	7.6	16.0
Not defined	0.0	0.8	0.0	7.1	0.0	2.3	0.0	0.0
Total	100	100	100	100	100	100	100	100

the poor quality of antibiotic dispensing in community pharmacies of the Eastern DR Congo. Community pharmacies are the principal point of antibiotic access in Bukavu city. As shown in this study, most of the pharmacy workers consisted of pharmacy technicians and non-trained dispensers. Pharmacists represented only 10% of all dispensers. A study carried out in Eritrea reported that dispensers were essentially made up of 35.9% community pharmacists, 41.8% pharmacy technicians and 22.3% others [10]. In Sub Saharan Africa, the ratios pharmacist and community pharmacies to population are found very low. It was reported a mean of 6 pharmacists per 10,000 population in a total of 89 WHO countries [23]. In Nigeria, pharmacists 'density was estimated at about 0.39 per 10,000 population [24]. Because of the occurrence of antibiotic resistance, antibiotics are medications which are dispensed on prescription only [18]. Unfortunately, in dispensing practices observed in community pharmacies of Bukavu, 67.8% of subjects purchased antibiotics without prescription. The extent of dispensing antibiotics without prescription was estimated at about 87.6% in Eritrea [10]. In contrast, it was reported low levels of antibiotic dispensing without prescription in Kenya, with over 90% of antibiotics dispensed with a valid prescription. This was explained by the presence of well-trained personnel in community pharmacies [25].

Antibiotic dispensing without prescription is a matter of concern since it may lead to self-medication in the population [10]. In Sub Saharan Africa, the prevalence of self-medication is different between countries, ranging from 30% to 95%. Factors such as age, income, education level, occupation and easy access to pharmacies were associated with self-medication [26,27,28]. A study in north Kivu, eastern of DR Congo, reported that 90.7% of students self-medicated to antibiotics, with community pharmacies as the most common source of antibiotic self-medication [29].

Our findings show that antibiotics dispensed without prescription were principally on patients' request or on the suggestion of dispensers. Besides, the antibiotic substitutions are very common in pharmacy settings. Consequently, dispensers are not valued as healthcare providers since they cannot adequately solve or prevent problems related to patient medications [18]. A study carried out in Tanzania reported that in subjects

purchasing antibiotic without prescriptions, instructions for medicine use was rarely given and none of the dispensers explained side effects [30].

We found that many antibiotic classes dispensed without prescriptions belonged to the broad spectrum pharmacological classes, with betalactamines (penicillins, cephalosporins), quinolones and macrolides the most important classes used in different pathological conditions. The observed misuse or overuse of antibiotics in single or combinations may contribute to antibiotic resistance. It was reported a higher prevalence of multidrug-resistance among self-medicated healthy adults [28]. The profile of antibiotic resistance reported in Bukavu city is consistent with the antibiotic misuse found in the present study. In fact, uropathogens such as *E. coli*, *Klebsiella* were found resistant to antimicrobial drugs (Ciprofloxacin, third generation cephalosporin) used for urinary tract infections in Bukavu [31]. Furthermore, high rates of resistance to Cotrimoxazole, erythromycin and moderate to high resistance to Ciprofloxacin, Cefuroxime were observed among Gram-negative bacteria isolated from patients with blood stream infections in South-Kivu [32].

4. CONCLUSION

Antibiotic dispensing practice is a major health concern in community pharmacies of Bukavu. Considering the lack of qualified dispensers, there is an urgent need for strengthening the pharmacy legislation and regulation in the Eastern Democratic Republic of Congo. As the practice of dispensing may contribute to self-medication and antibiotic resistance, factors associated with self-medication as well as the monitoring of antibiotic resistance need to be assessed in Bukavu city.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

All subjects provided written informed consent prior to participation.

ETHICAL APPROVAL

This study received an ethical approval of the local ethic committee of ISTM-Bukavu.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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