

Appropriateness of Antibiotic Prescription Practices in Health Centers in the District of Gisagara, Rwanda

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ABSTRACT

Introduction: Antibiotic over-prescription is a global public health problem. This increases antimicrobial resistance, health costs, and other adverse effects. In Rwanda, most outpatient visits occur in health centers where most antibiotics are prescribed. This study aimed to assess the appropriateness of antibiotic prescription practices in selected health centers in the District of Gisagara, Rwanda.

Methods: This was a cross-sectional study that included 645 antibiotic prescriptions between January and December 2017 in the health centers of Kigembe, Kibayi, and Agahabwa of Kibilizi Hospital, Gisagara district in Southern province, Rwanda. Data were collected from outpatient consultation registries. A systematic sampling technique was used to select study participants. A checklist comprising clinical symptoms, signs, diagnosis, and prescribed antibiotics was used for data collection. EPI DATA and STATA software were used for data entry and analysis.

Results: The average of antibiotic prescriptions was 54.2%. The mean age of patients treated was 26.6 years. The common symptoms related to antibiotics prescription were fever 29%, cough 26.9%, and running nose 17%. The most prescribed antibiotics were: amoxicillin (37.1%), penicillin V (13.2%), and cloxacillin (12.1%). The main indication was upper respiratory tract infection, 40.6%. The rate of the appropriateness of antibiotics prescription was 38.6%.

Conclusion: Antibiotics prescription is inappropriate in the three health centers. There is a need to train health center nurses in diagnostic and rational antibiotic practices to limit the antibiotics' over-prescription and antimicrobial resistance.

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INTRODUCTION

Antibiotic over-prescription, which leads to antimicrobial resistance (AMR), is a current global health challenge [1,2]. AMR leads to

increased health expenditure due to the high cost of developing new antibiotics or purchasing more expensive but currently effective antibiotics [3,4]. Studies done in Europe and South America in outpatient clinics have shown high prescriptions

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of antibiotics [5,6]. Studies in Sub-Saharan Africa showed that antibiotics treat more than 70% of upper respiratory infections (URTI) without clinical evidence of bacteria as a causative agent [7,8]. It was also found that 40% of infectious diarrhea is treated with antibiotics without confirmation of bacterial cause [9].

A study done in a tertiary hospital in Rwanda documented that amoxicillin was commonly used even though bacteria resistant to amoxicillin were present in 89.3% of bacterial cultures [10]. The 2017 Rwanda Health Management Information System report showed an increased trend toward antibiotic prescriptions in health centers of Kibilizi District Hospital, Gisagara, compared to the previous years. The National Institute of Statistics in Rwanda (NISR) report from 2018 showed that most outpatient visits (77.0%) occur at health centers. We could not find any study conducted at the health center level about prescription antibiotics. Most of the primary health care is provided by nurses at health centers [11,12].

Our study's objectives are to assess the proportion of outpatients receiving antibiotic prescriptions, evaluate the appropriateness of the antibiotic prescriptions based on diagnosis, and set recommendations to prevent AMR.

METHODS

This is a descriptive retrospective cross-sectional study done in 2019. The study was among those selected by the Rwanda Ministry of Health in a plan to operationalize health research at District levels in 2017 through the district operational research challenge fund. The principal investigator worked at Kibilizi Hospital, Gisagara District, from that time till now. The study was conducted in three of nine rural health centers of Kibilizi Hospital, Gisagara District, Rwanda. The hospital serves a population of 207,883. The three health centers, Kigembe, Kibayi, and Agahabwa, were selected for this study because they treated the largest number of patients (125,805) from a total of 345 846 patients consulted from January to December 2017. They prescribed the highest number of antibiotics in March 2017.

We checked the hospital data for the year 2017. We reviewed all patient registries for each of the three selected health centers and counted all the patients who visited the health centers. We divided the number of patients who received antibiotics by the

number of those who received any prescription to calculate the antibiotic prescriptions rate. We also reviewed the symptoms and diagnoses for which the antibiotics were prescribed. We matched the diagnosis and the criteria for prescribing antibiotics to determine the appropriateness of the antibiotics prescription. We set recommendations after the findings.

Study population

This consisted of patients who were prescribed antibiotics in outpatient consultations (68,186) from January to December 2017. In the study, we included patients who received antibiotic prescriptions and had complete required information in the health center registry.

We excluded from the study those whose records had incomplete information.

Sampling

The World Health Organization (WHO) recommends investigating at least one hundred prescriptions in a facility when researching drug use indicators [13]. We set the proportion of the antibiotic prescription's appropriateness at 50% as there were no data about the previous prevalence in our setting. The register's incompleteness rate was set at 40% to increase the sample size. We divided 384 (minimum sample size for a population where an expected proportion of the element studied was set at 50%, precision at 5%) and 1(100% completeness) minus the above incompleteness rate. The sample size became 645. We considered a number of more than a hundred participants (patients who received antibiotic prescriptions) enough recommended by the WHO. We considered almost an equal number of sample sizes for each health center. The sample sizes were 213, 217, and 215 patients from Kibayi, Kigembe, and Agahabwa health centers, respectively. For each of the health centers, patients were registered by order of arrival from the first to the last day of the month. We set a new order from 1st January to 31st December 2017 from which to allow sampling. We used a systematic sampling technique to select study participants from the list of patients who received antibiotic prescriptions. We obtained the sampling interval by dividing the total number of patients by the sample size. We considered the first patient who took the antibiotic, then we found the

second by adding the interval to the first one, and so on, until the required number was reached

Data Collection

We trained three nurses, one for each health center, to collect information from the registry. A predefined questionnaire was used. The questionnaire included the patient's age, sex, symptoms, signs, diagnosis, treatment (antibiotics), and dosage. These elements were used to determine the appropriateness of the prescription, which is the outcome variable. We completed the data collection from July to August 2018.

Data Analysis

We set criteria (with reference to a study done in Lesotho) to determine appropriate or inappropriate antibiotic prescriptions [14]. An appropriate antibiotic prescription was defined as one that includes the drug prescribed with dosage and duration appropriately indicated for the patient's clinical condition or prophylaxis [15,16]. The prescription was considered appropriate when it met the following criteria: suggestive signs and symptoms of bacterial infection present, or presence of infection established by laboratory test if any; presenting signs and symptoms absolute for bacterial infection; site of infection or possible areas of infection identified; potential site of infection (i.e., open wound); antibiotic prescribed is only one and indicated against all commonly likely pathogens associated with the area of infection; the prescribed antibiotic, the dosage, and duration of treatment are correct; and antibiotics in multiple therapies are compatible. We considered the antibiotic prescription inappropriate when it did not meet the above criteria.

We entered data in Epidata and exported these in STATA. Descriptive analysis for demographics and other variables (clinical signs and symptoms, prescribed antibiotics) was done using frequency and proportions. The research protocol has been cleared and approved by the National Health Research Committee (NHRC). Rwanda National Ethics Committee reviewed and approved it (Ref: NHRC/2018/PROT/023).

RESULTS

Of 125,805 patient visits at the three selected HCs,

68,186 (54.2%) were prescribed antibiotics. The mean age of study participants was 26.6 years. Children under five years old represented 21.4% of patients. More than half of the study population were female (Table 1).

Table 1: Age and gender distribution of study participants (n=645)

Characteristics	n (%)
Age group (years)	
< 5	138 (21.4)
5-14	96 (14.9)
15-24	101 (15.7)
25-44	166 (25.7)
45-64	105 (16.3)
65+	39 (6.0)
Sex	
Male	281 (43.6)
Female	364 (56.4)

Fever was the most common presenting symptom (29%), followed by dry cough (26.9%), runny nose (17.0%), productive cough (12.5%), and dysphagia (10.9%). Upper respiratory tract infection was the most frequent clinical diagnosis 40.6% followed by non-specific infection (no clear diagnosis) (26.7%), tonsillitis (21.5%), intestinal parasites (13.2%), and wound (10.1%) (Table 2).

The most commonly used antibiotic was amoxicillin (37.1%), followed by penicillin V (13.2%), cloxacillin (12.1%), cotrimoxazole (11.0%) and metronidazole (9.8%) (Table 3).

The study findings revealed that the overall appropriateness of the antibiotic prescription was 38.6%. The lowest test rate of antibiotic prescription suitability was observed in children under five years of age, 24.6%. Among the antibiotics prescribed, amoxicillin was associated with the lowest rate of appropriate prescribing, 20.1%. URTI was the diagnosis most frequently associated with inappropriate antibiotic prescribing 98.1% (Table 4).

DISCUSSION

In this study, we assessed antibiotic prescription suitability in three health centers of Kibilizi District Hospital, South Rwanda.

Table 2: Distribution of the symptoms and diagnosis (n=645)

Characteristics	n (%)
Symptoms	
Fever	176 (29.0)
Dry cough	163 (26.9)
Running nose	103 (17.0)
Productive cough	76 (12.5)
Dysphagia	66 (10.9)
Wound	33 (5.4)
Liquid diarrhea	30 (4.9)
Abdominal pain	30 (4.9)
Dysuria	30 (4.9)
Skin ulceration	29 (4.8)
Dyspnea	16 (2.6)
Ear discharge	15 (2.5)
Thoracic pain	13 (2.1)
Urethral/vaginal discharge	12 (2.0)
Abscess	11 (1.8)
Vomiting	10 (1.7)
Hemoptoc cough	2 (0.3)
Bloody diarrhea	2 (0.3)
Eye discharge	1 (0.2)
Other	49 (8.1)
Clinical Diagnosis	
URTI	262 (40.6)
Urinary tract infection	42 (6.5)
Pneumonia	14 (2.2)
Gastroenteritis	10 (1.6)
Other	326 (50.5)
Other (Specified diagnosis)	
Non-specific infection	87 (26.7)
Tonsillitis	70 (21.5)
Intestinal parasites	43 (13.2)
Wound	33 (10.1)
Cutaneous infections	32 (9.8)
Otitis media	15 (4.6)
Abscess	12 (3.7)
Dental decay	8 (2.5)
Sexually transmitted infection	5 (1.5)

The percentage of patients receiving antibiotic prescriptions was 54.2%. This was more than the WHO's standard, less than 30% [13]. It was

almost equal to what has been found in a study done in Ghana, where the percentage of patients receiving antibiotic prescriptions was 55.2% but

considerably higher than that found in Egypt and Saudi Arabia, 39.2% and 32.2%, respectively [17,18].

Table 2: Distribution of type of antibiotic prescribed (n=645)

Antibiotics	n (%)
Amoxicillin	239 (37.1)
Penicillin V	85 (13.2)
Cloxacillin	78 (12.1)
Cotrimoxazole	71 (11.0)
Metronidazole	63 (9.8)
Erythromycin	59 (9.2)
Ciprofloxacin	32 (5.0)
Chloramphenicol	1 (0.2)
Doxycycline	14 (2.2)
Tetracycline	1 (0.2)

There was a clear difference in age distribution: children below 5 years old had the lowest appropriateness rate. This may be explained by the fact that children suffer more frequently from URTIs than adults, and we have observed that antibiotics are commonly prescribed inappropriately for this condition [19].

Among the diagnoses made based on the presenting symptoms and signs, we have observed that URTI constitutes 40.6% of the diagnoses. This is not different from the observations made in other studies done in Japan, Cameroon, or Brazil, where the percentages of patients diagnosed with URTI were 46.2%, 21.27%, and 50%, respectively [19,20,21]. The most prescribed antibiotic for this condition was amoxicillin 37.1%, followed by penicillin V 13.1%. The use of amoxicillin for this common condition has been observed in many other studies, including those done in Ethiopia, Botswana, and Bangladesh, where the percentage of patients prescribed amoxicillin was 64.4%, 28.4%, and 17%, respectively [22, 23, 24]. Amoxicillin is frequently used in managing URTI, which seems to be linked to low cost and availability as a generic antibiotic. It is also recommended as the first-line medication in managing URTI of bacterial origin.

The three most common clinical conditions where antibiotics were prescribed were fever 29%, dry

cough 26.9%, and runny nose 17.0% (Table 4). In studies done in Ethiopia and the United Kingdom, acute cough accounted respectively for 22.7% and 34.4% of the clinical conditions where antibiotics have been prescribed [25,26]. These symptoms are usually related to upper respiratory tract infections and do not require antibiotics in their management [21].

We found that antibiotics were used appropriately at a rate of 38.6%. Appropriateness is defined as prescriptions given with clinical evidence of bacterial infection. In Lesotho, the appropriateness of antibiotic prescription was 76.8% [14]. In a study done in Ecuador, the appropriateness of the antibiotic prescription was found to be 9.7%, very different from our study's results [26]. Similar results were found in a study done in China, where 39.4% of antibiotic prescription was appropriately done [15]. A study done in Zanzibar showed that antibiotics are prescribed inappropriately in primary care centers with no performance-based financing [27].

Our study has some limitations for consideration. The retrospective design is limited in determining the causation, prone to recall bias and confounding. Our sample size was small which limits the generalization of our results. Therefore, a countrywide prospective research on appropriateness of antibiotics prescription at the primary health care level with a large sample is recommended.

CONCLUSION

Though our study is purely descriptive, we found that the appropriateness of antibiotic prescription is low in the three health centers, and the decision-making is mainly based on clinical symptoms. This is likely the primary factor leading to the high rate of inappropriate antibiotic prescriptions. Improper use of antibiotics is felt to be one of the major causes of antibiotic resistance.

The physicians at District hospital should supervise the application of the available guidelines on managing different clinical conditions, mainly upper respiratory tract infection.

Initiate training for nurses regarding why to prescribe antibiotics and limit their misuse, primarily amoxicillin.

Motivate healthcare workers to appropriately use

Table 2: Characteristics of antibiotic prescription in relation to the appropriateness

Characteristics	Antibiotic prescription appropriateness		Total
	Yes	No	
Overall	249 (38.6%)	396 (61.4%)	645
Age group			
< 5 years	34 (24.6)	104 (73.4)	138
5-14 years	41 (42.7)	55 (57.3)	96
15-24 years	51 (50.5)	50 (49.5)	101
25-44 years	72 (43.4)	94 (56.6)	166
45-64 years	38 (36.2)	67 (63.8)	105
65+ years	13 (33.3)	26 (66.7)	39
Type of antibiotics			
Amoxicillin	48 (20.1)	191 (79.1)	239
Ciprofloxacin	18 (56.3)	14 (43.8)	32
Penicillin V	60 (70.6)	25 (29.4)	85
Metronidazole	31 (49.2)	32 (50.8)	63
Cloxacillin	43 (55.1)	35 (44.9)	78
Cotrimoxazole	12 (16.9)	59 (83.1)	71
Erythromycin	26 (44.1)	33 (55.9)	59
Clinical diagnosis			
Pneumonia	13 (92.9)	1 (7.1)	14
URTI	5 (1.9)	257 (98.1)	262
Gastroenteritis	3 (30.0)	7 (70.0)	10
UTI	39 (92.9)	3 (7.1)	42

drugs especially antibiotics through performance based financing (PBF) and other methods

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