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Antibiotic Prescribing Practices for Upper Respiratory Tract Infection Among Clinical Officers at Kiambu County

Kevin Murigi[3,*], Joseph Thigiti[1], Muiruri King'ang'a[2]

[1]Department of Family Medicine, Kenyatta University

[2]Department of Physiology, Kenyatta university

[3]P.O. Box 43330-00100, Nairobi, Kenya

Abstract

Background

Antibiotics are the most prescribed medications worldwide. Global consumption rose by 65% in 76 low and middle-income countries between the years 2000 and 2015. According to the World Health Organization, improper administration of antibiotics occurs in over 60% of people with upper respiratory tract infections. Inadvertent antibiotic use has been identified as a contributor to antimicrobial resistance. Outpatient antibiotic use accounts for around 80-90% of all antibiotic use in patients. Clinical officers are non-physician healthcare workers who have received less training, have a more restricted scope of practice than physicians. Clinical officers are key service providers in this country especially at the primary healthcare level.

Objective

The study assessed the factors that influence antibiotic prescribing for upper respiratory tract infections by clinical officers.

Method

A prospective study was carried out at 20 public hospitals in Kiambu County, on 36 clinical officers and 600 patient prescriptions. The parameters measured were patient factors, prescriber factors, institutional factors and how they affected the antibiotic prescribing practices by either being rational or irrational. Rational prescribing was identified as prescribing the right drug, at the right frequency, in the right duration, right dose for the right indication. Prescriptions were considered irrational if they did not satisfy any of the rational indices. Data was collected via a questionnaire from the clinical officers while WHO prescription checklist was used to collect data from patient encounters. Data was analyzed using Statistical Package for Social Sciences version 22.0 (SPSS v22.0) with P-value, Confidence Interval and Odds Ratio.

Results

A total of 600 patient encounters were recorded and 79.8% of the 479 encounters had an antibiotic prescription for URTI, 91% of the antibiotics prescribed were

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Corresponding author:

Kevin Murigi, 3P.O. Box 43330-00100, Nairobi, Kenya

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the right dose, 98% had the right frequency, 75% had the right duration, and only 23% had the right indication. Patients above 65 years were more likely to receive an antibiotic prescription OR 3.98 CI 0.91,17.41 P=0.17 compared to children under 12 years old. Males were more likely to receive an antibiotic, but this was not significant OR 1.06 CI 0.70, 1.59 P=0.79. A total of 28 (4.6%) patients had fever, and all received antibiotics.

A total of 36 clinical officers were sampled and only 5 (13.8%) were found to have rational prescriptions (P=0.63), prescriber age (P=0.92), prescriber level of education (P=0.99) and prescriber work experience (P=0.22) were not associated with antibiotic prescription. As per institutional factors, availability of antibiotics (P=0.026) and availability of prescription guidelines (P=0.012) were associated with rational prescription of antibiotics.

Conclusion

The study indicated that there was a high antibiotic prescription rate deviating from the WHO standard. It demonstrated that most antibiotic prescriptions were irrational.

Introduction

The worldwide antibiotic consumption rose by 65% from 2000 to 2015 [1]. This rise was attributed to low- and middle-income nations. According to the Center for Disease Control (CDC), antibiotic resistance has been occasioned by the global rise in antibiotic consumption and misuse [2]. According to the English surveillance program for antimicrobial utilization and resistance (ESPAUR), approximately 80-90% of antibiotics are prescribed in the outpatient [3].

Irrational prescribing is defined as prescribing without achieving proper quality of therapy [4]. Irrational prescribing is common in developing countries [5]. It may be depicted in the following circumstances: incorrect prescribing, multiple prescribing, under-prescribing, and over-prescribing [6]. Irrational prescribing negatively results in increased incidence of adverse effects, drug interactions and emergence of antibiotic resistance [7]. Antibiotic resistance is linked to poorer health outcomes, longer hospital stays, higher costs for both the patient and the government, and a higher mortality rate [8].

Viruses account for 80% of URTIs [9]. Even if the cause is bacterial, antibiotics only have a minor effect on RTIs, particularly in patients with URTIs [10]. There is no evidence that any therapy reduces the length of time a viral URTI lasts (11).

The aim of this study was to find out which factors influence antibiotic prescriptions for upper respiratory tract infections by clinical officers.

Materials and Methods

This was a descriptive cross-sectional public hospital-based study conducted among clinical officers that work in the outpatient departments in their respective hospitals within Kiambu County, Kenya. The study analyzed the antibiotic prescribing practices of clinical officers from September to October 2022. The study followed the methodology recommended by the WHO for investigating drug use in hospitals [12]. Convenience sampling was used to select clinical officers prescribing in the outpatient departments, simple random selection was used to collect patient prescriptions. Clinical officers that offer services in the outpatient department and patient encounters with treatment for URTIs were eligible to participate. According to the WHO's "how to investigate drug use in health facilities", 20 facilities with at least 30 prescribing encounters per facility were analyzed [12].

The outcome variable was antibiotic prescribing practice, whether rational or irrational. WHO core prescribing indicators checklist on rational use of medicine was used to assess rational antibiotic drug use. The independent variables which were assessed are socio-demographic attributes of the prescriber (age, gender, work experience, cadre and level of education), patient factors (age, gender, temperature, signs and symptoms) and institutional factors (availability of antibiotics, availability of hospital guidelines, and laboratory support).

The Statistical package for Social Science version 22.0 (SPSS v22.0) was used for analyzing the data. Descriptive statistics were applied to test differences of patient age, sex, temperature, prescriber age, sex, work experience and level of education and availability of antibiotics and availability of prescription guidelines. The association between antibiotic prescribing and the prescribing factors was assessed using logistic regression. Odds ratio with 95% confidence interval was reported in the logistic regression analysis. All analyses were considered significant when $P<0.05$.

Permission to conduct the study was acquired from Kenyatta University graduate school and the university Ethics Review Committee, National Council for Science and Technology and Kiambu County health research office.

Results

In the analysis of the demographic characteristics of the patient, their median age was 17 years, where females were 29% more than males. The median temperature was 36.5 degrees Celsius; (Table 1).

Those above the age of 65 years were most likely to receive an antibiotic prescription (OR 3.98, 95% CI 0.91 to 17.41). Adolescents (13-18 years) were more likely to receive an antibiotic prescription than children (OR 1.27 95% CI O.73 to 2.22). Adults were more likely to receive an antibiotic prescription

Table 1. Demographic characteristic of the patients and clinical diagnosis

Characteristic	**N = 600**
Age, Median (IQR)	17 (9-31)
Gender, n (%)	
Female	388 (64.7)
Male	212 (35.3)
Temperature (°C), Median (IQR)	36.5 (36.4-36.8)
Diagnosis, n (%)	
Cold	21 (3.5)
Cough	28 (4.7)
Flu	2 (0.3)
Pharyngitis	8 (1.3)
Rhinitis	23 (3.8)
Sinusitis	1 (0.2)
Sore throat	3 (0.5)
Tonsillitis	128 (21.3)
URTI	386 (64.3)

Table 2. Patients' predictors of antibiotic prescribing

Variable	Was Antibiotic Prescribed		Bivariate Analysis Crude Odds Ratio (CI)	*P Value*
	No n (%)	Yes, n (%)		
Age				0.17
0 – 12 years	52(24.2)	163 (75.8)	**Reference Category**	
13 – 18 years	23(20.0)	92(80.0)	1.27 (0.73, 2.22)	
19 – 64 years	54(22.2)	189(77.8)	1.12 (0.72, 1.72)	
65years and above	2(7.4)	25(92.6)	3.98 (0.91, 17.41)	
Gender				0.79
Male	45(21.23)	167(78.77)	1.06 (0.70, 1.59)	
Female	86(22.2)	302(77.8)	Reference Category	
Temperature				No p value
Normal	131(22.9)	441(77.1)	No odds ratio	
Fever	0	28(100)		

than children (OR 1.12 95% CI 0.72 to 1.72). However, these results were not statistically significant (P = 0.17). Similarly, male patients were more likely to receive an antibiotic prescription than females, but this was not statistically significant (OR 1.06, 95% CI 0.70 to 1.59, P = 0.79).

All patients with high temperatures received antibiotics. The logistic regression gives an output of 1 and no standard error, it means that the model is perfectly predicting antibiotic prescription for the temperature. As such, the odds ratio cannot be computed because the model perfectly separates the two

Table 3. Total antibiotics prescribed in either correct or incorrect dose, duration, indication and frequency

	Incorrect				Correct			
	Dose	Duration	Frequency	Indication	Dose	Duration	Frequency	Indication
Amoxyclav	4(7.4)	0 (0.0)	0 (0.0)	30 (55.6)	50 (92.6)	54 (100.0)	54 (100.0)	24 (44.4)
Amoxyl	9 (3.9)	0 (0.0)	1 (0.4)	179 (78.2)	203 (88.6)	229 (100.0)	227 (99.1)	49 (21.4)
Ampiclox	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	1 (100.0)	1 (100.0)	0 (0.0)
Augmentin	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	1 (100.0)	1 (100.0)
Azithromycin	3 (4.4)	10 (14.7)	0 (0.0)	40 (58.8)	64 (94.1)	58 (85.3)	68 (100.0)	28 (41.2)
Cefclav	0 (0.0)	0 (0.0)	0 (0.0)	2 (40.0)	1(20.0)	5 (100.0)	5 (100.0)	3 (60.0)
Cefixime	0 (0.0)	0 (0.0)	0 (0.0)	8 (100.0)	8 (100.0)	8 (100.0)	8 (100.0)	0 (0.0)
Cefuroxime	0 (0.0)	1 (100.0)	0 (0.0)	0 (0.0)	1 (100.0)	0 (0.0)	1 (100.0)	1 (100.0)
Clarithromycin	0 (0.0)	4 (100.0)	0 (0.0)	1 (25.0)	4 (100.0)	0 (0.0)	4 (100.0)	3 (75.0)
Clindamycin	0 (0.0)	3 (100.0)	0 (0.0)	2 (66.7)	3 (100.0)	0 (0.0)	3 (100.0)	0 (0.0)
CO-amoxyclav	1 (20.0)	3(60.0)	3(60.0)	3(60.0)	4(80.0)	2 (40.0)	2 (40.0)	2 (40.0)
Cotrimoxazole	0 (0.0)	90 (100.0)	1 (1.1)	88 (97.8)	89 (98.9)	0 (0.0)	89 (98.9)	2 (2.2)
Erythromycin	2 (33.3)	6 (100.0)	2 (33.3)	4(66.7)	4(66.7)	0 (0.0)	4(66.7)	1 (16.7)
Flagyl	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	1 (100.0)	1 (100.0)	0 (0.0)
Floxapen	0 (0.0)	0 (0.0)	0 (0.0)	1 (100.0)	1 (100.0)	1 (100.0)	1 (100.0)	0 (0.0)
Tunaclav	0 (0.0)	2 (100.0)	0 (0.0)	2 (100.0)	2 (100.0)	0 (0.0)	2 (100.0)	0 (0.0)
Total	19 (4.0)	119 (24.8)	7 (1.5)	362 (75.6)	437 (91.2)	360 (75.2)	471 (98.3)	114 (23.8)

categories of the outcome variable.

Most of the patients (91.2%) were given the correct dose of the antibiotics prescribed. Of the six patients given erythromycin, two were incorrectly prescribed dosage. Of the patients prescribed for antibiotics, there were a total of seven patients that had incorrect frequency (under 2%). These include one patient on amoxyl, three on co-amoxyclav, one on cotrimoxazole, and two on erythromycin. Of the patients prescribed for antibiotics, 360 (75.2%) received the right duration. Most of the patients had incorrect antibiotic indications (n=362; 75.6%) whilst 114 (23.8%) had correct indications, there were 24 (4.4%) and 49 (21.4%) of the patients with correct indications for amoxyclav and amoxyl respectively. All the patients given cefixime (100%), Ampiclox (100%), flagyl (100%), floxapen (100%) and tunaclav (100%) had incorrect indications.

Antibiotics were prescribed in 479 encounters. Most of the total antibiotics prescribed were generic (96.8%) and almost all the prescribed antibiotics (96.6%) were on the Kenya Essential Medicines List.

Table 4. Prescribing Indicators using WHO core indicators.

Prescribing indicators	Total Medicines or encounters	Average or percent	WHO Optimal Value	Standard For Africa
Number of encounters with antibiotics	479	79.8%	20-26.8	45.9
Number of encounters with generic antibiotics	464	96.8%	100	-
Number of encounters with antibiotics from KEML	463	96.6%	100	-

Table 5. Prescriber & Institutional factors affecting antibiotic prescribing practices.

		Prescribing practice		
Variable	**Overall, N = 36[1]**	**irrational, N = 31[1]**	**rational, N = 5[1]**	**p-value[2]**
Gender, n (%)				0.63
Male	15 (41.7)	12 (38.7)	3 (60.0)	
Female	21 (58.3)	19 (61.3)	2 (40.0)	
Prescriber Age, n (%)				0.92
Under 25 years	6 (16.7)	5 (16.1)	1 (20.0)	
26-30 years	13 (36.1)	11 (35.5)	2 (40.0)	
31-35 years	12 (33.3)	11 (35.5)	1 (20.0)	
36-40 years	5 (13.9)	4 (12.9)	1 (20.0)	
Highest level of Education, n (%)				0.99
Diploma	30 (83.3)	25 (80.6)	5 (100.0)	
Higher diploma	4 (11.1)	4 (12.9)	0 (0.0)	
Bachelor's degree	2 (5.6)	2 (6.5)	0 (0.0)	
Years of Work experience, n (%)				0.22
Under 1 year	6 (16.7)	5 (16.1)	1 (20.0)	
1-5 years	8 (22.2)	6 (19.4)	2 (40.0)	
6 - 10 years	19 (52.8)	18 (58.1)	1 (20.0)	

11-15 years	3 (8.3)	2 (6.5)	1 (20.0)	
Laboratory guidance, n (%)				0.53
Strongly agree	5 (13.9)	5 (16.1)	0 (0.0)	
Agree	18 (50.0)	16 (51.6)	2 (40.0)	
Neutral	9 (25.0)	7 (22.6)	2 (40.0)	
Disagree	4 (11.1)	3 (9.7)	1 (20.0)	
Availability of antibiotics, n (%)				0.026
Strongly agree	2 (5.6)	1 (3.2)	1 (20.0)	
Agree	20 (55.6)	17 (54.8)	3 (60.0)	
Neutral	13 (36.1)	13 (41.9)	0 (0.0)	
Disagree	1 (2.8)	0 (0.0)	1 (20.0)	
Strongly disagree	0 (0.0)	0 (0.0)	0 (0.0)	
Availability of Prescription Guidelines, n (%)	16 (44.4)	11 (35.5)	5 (100.0)	0.012

[1]Median (IQR) or Frequency (%)
[2]Fisher's exact test

Prescribers

A total of 36 clinicians were included in the study, of whom 21 (58.3%) were females. Most of them were either in the age-group 26-30 years (n=13; 36.1%) or 31-35 years (n=12; 33.3%). The majority (n=30; 83.3%) had diploma level of education and had worked for a duration of 6-10 years (n=19; 52.8%). Two (5.5%) prescribers had a bachelor's degree in clinical medicine.

There was an association between availability of antibiotics and antibiotic prescribing, P = 0.026. Availability of prescription guidelines significantly affected prescribing of antibiotics, P = 0.012.

Discussion

The antibiotic prescribing rate (79.8%) exceeded that set by the WHO of under 30% [13]. This is higher than the 46.8% found in 11 African countries [6]. A study in Ethiopia found inappropriate antibiotic prescribing in 86% of prescriptions for children with cough [14]. This increased use of antibiotics may be due to several reasons. First, misdiagnosis of bacterial infections by the healthcare providers. They may prescribe antibiotics for conditions that are caused by viral agents or other factors leading to unnecessary antibiotic use. Secondly, this may be due to pressure from patients, some studies have shown patients may demand antibiotics even when they are not indicated [15], putting pressure on clinical officers to prescribe them. Third may be due to lack of regulation. Efforts to enhance appropriate antibiotic consumption in developing countries are inadequate [16]. Fourth is due to multiple prescribing of antibiotics. In this study 0.83% of the patients were prescribed more than 2 antibiotics.

The results showed that 91% of antibiotics prescribed were the right dose, less than two percent had incorrect frequency, and 75.2% had the right duration. Over 75% of the antibiotics were wrongly prescribed. Research from Turkey found that 11.5% of antibiotic prescriptions failed to comply with current guidelines and 29.7% of antibiotic prescriptions were inadequate [17]. An Indian study found over 60% of antibiotic prescriptions had no valid indication and were prescribed for an inadequate duration [7]. Irrational prescribing is common in developing countries [5].

This study found that the male prescribers were more rational than females. This is contrary to a study done in the Netherlands that found female practitioners are less likely to prescribe antibiotics than males [18]. A similar study conducted in rural China found that male physicians were more likely to prescribe antibiotics inappropriately [19]. This difference in prescribing between genders could be attributed to different reasons. The studies above had different study populations and settings compared to this study. Secondly, there could be interaction effects between gender and other variables like patient demographics, clinical setting, or medical conditions.

In this study all patients with fever were prescribed an antibiotic. This is similar to a study done in Malta that found patients with fever were more likely to receive an antibiotic [20]. A similar study done in the USA showed that presence of fever was linked to antibiotic prescriptions for URTIs [21].

There was no significant difference between the age groups of receiving an antibiotic prescription. The lack of a difference in antibiotic prescriptions across the different age groups may be due to a few reasons. Firstly, the prescribers may have prescribed antibiotics based on the symptoms presented by the patient rather than the age. Second, antibiotics may be prescribed at similar rates across all the age groups due to a perceived high prevalence of infectious disease in the population. Lastly, it may be due to the lack of specific guidelines for prescribing antibiotics to different age groups.

Availability of antibiotics influenced those over 30 years to prescribe antibiotics. A study in Malta found older practitioners had higher antibiotic prescribing rates while female practitioners were twice as likely to write an antibiotic prescription for URTI [20].

In conclusion, there was a high antibiotic prescription rate deviating from the WHO standard. This study demonstrated that most antibiotic prescriptions were irrational. Despite prescribing antibiotics when not indicated, the dose, frequency and duration were noted to be correct in most prescriptions. Only five out of thirty-six clinical officers were rational in their approach to prescribing antibiotics. Availability of antibiotics and availability of guidelines were noted to influence antibiotic prescribing for URTIs by clinical officers. Fever was associated with prescribing of antibiotics for patients with URTIs. Institutional factors such as availability of antibiotics and availability of hospital guidelines significantly affected antibiotic prescribing. Prescriber factors did not influence prescribing of antibiotics.

Competing interests

The authors declare no competing interests.

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