

## Antibiotic prescribing patterns at a level one hospital using national treatment guidelines prescribing indicators in Zambia

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### Abstract

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**Background:** Poor Prescribing patterns can greatly have a negative impact on patient care outcomes. With the inappropriate prescribing of antibiotics there tends to be antibiotic resistance, unnecessary expenditure on drugs, and increased risk of adverse reactions. The aim of this study was to assess antibiotic prescribing patterns at Matero level one hospital in the adult admission wards Lusaka, Zambia.

**Methods:** A retrospective cross-sectional study was undertaken data was collected using one-year patients records and administration of questionnaires to prescribers. 385 patient record files were selected using random sampling technique and 9 prescribers were enrolled using convenience sampling. National treatment guidelines were utilized to measure rational use of drugs with due focus on antibiotics prescribing patterns. The collected data was analyzed using statistical packages for social science (SPSS) version 23 and reported as Frequencies and percentages.

**Results:** Out of 385 patient files evaluated, 290 (75.3%) were prescribed with antibiotic(s). A total of 404 antibiotics were prescribed from 290 patient encounters. The average number for the most commonly prescribed antibiotics per prescription was 1.9 Benzylpenicillin (29.7%) followed by co-trimoxazole and metronidazole (19.3%), ceftriaxone (17.0%) and gentamicin (16.3%). The most prevalent conditions were tuberculosis (11.9%), sepsis (10.9%), gastroenteritis (9.6%) Anaemia (9.3%) and Alcohol intoxication (5.7%). lack of bacteriological tests was the main problem.

**Conclusion:** Given the deviation from recommended standards of prescribing antibiotics, Interventions aimed at improving the antibiotic prescribing patterns need to be implemented so as to prevent the inappropriate use of antibiotics and avoid further complications.

**Keywords:** *Antibiotics; Prescribing pattern; Antimicrobial resistance; Prescribing indicators*

## INTRODUCTION

Irrational use of drugs/medicines (Antimicrobials) continues to be a serious and widespread public health problem globally [1]. Antibiotics are the most prescribed medicines in the hospital setting and their inappropriate prescribing may increase the level of resistance which is a global concern [2]. Approximately 50% of antibiotic use is inappropriate [3]. Excessive and inappropriate use of antibiotics in hospitals, health care facilities and the community contribute to the development of bacterial resistance [4].

The consumption of antibiotics has increased worldwide with most of this occurring in low- middle-income countries. In developing countries antibiotics are prescribed for 44% to 97% of hospitalized patients often unnecessarily or inappropriately. [5,6] It is estimated that half of all medicines in Africa are used inappropriately including two third of antibiotics [7,8].

Irrational prescribing can be attributed to lack of knowledge about drugs, unethical drug promotions, high patient load, ineffective laboratory facilities and availability of drugs, and ineffective law enforcement by governments with subsequent failure to ensure compliance to guidelines [9]. The use of antibiotics and a large number of prescriptions do not conform to the ideal recommended pattern [10].

For a low-income country like Zambia, where infectious diseases are among the top causes of morbidity and mortality, proper management of antibiotic prescribing patterns is crucial to minimize the risk, extent, and rate of antibiotic resistance. To ensure that antibiotics are prescribed rationally, antibiotic use reviews need to be conducted regularly by pharmacy departments in facilities (Management Sciences for Health and World Health Organization, 1997). This study was aimed at assessing antibiotics prescribing pattern at Matero level 1 hospital, first level hospital is a primary level hospital with approximately 50 to 250 hospital beds [11], using Zambian national treatment guidelines indicators [12].

## MATERIALS AND METHODS

The study was conducted at Matero level one hospital, Lusaka, Zambia and it is in Zone 3 with an attachment population of 143, 988. The reason was this hospital is accessible,

easy communication, less congested and relatively affordable.

A retrospective cross-sectional study was conducted. Data were collected using a check list. Zambian national treatment guidelines on rational use of drugs, prescribing indicators with their standard values were utilized to measure rational use of drugs with due focus on antibiotics prescribing patterns [12].

The study sample was from two sample frames: Patient records for the years January 2018 –May 2020 and prescribers in the admission ward. Patient files were randomly sampled whereas convenience sampling technique was used for prescribers. A sample size of 384 was calculated using an online calculator from [www.surveysystem.com](http://www.surveysystem.com) [13].

## Data Collection procedure

Data was collected by reviewing prescribing encounters in the patient logbook /patient files at the adult admission ward and by using structured self-administered questionnaires with open-ended questions for prescribers. A structured checklist adopted from Zambian national treatment guidelines on prescribing indicators and similar literatures were used following modifications to fit to the current study [10, 12,14,] patient records below 18 years of age were excluded. Permission was obtained from the Lusaka District Health Office and Matero level one hospital administration to conduct the study.

## Data Analysis

The appropriateness of antibiotic prescribing was assessed according to the following classification: appropriateness of the prescription, inappropriateness due to improper dose, dosing intervals, route of administration, duration, antibiotic not indicated, and records insufficient for categorization. To minimize errors, double entry, range and consistent checks were done.

Prescriptions were considered therapeutic if:

(a). the medical records contained information that the antibiotic was presented for therapy.

(b). an infectious disease was diagnosed.

(c). clinical signs of infection such as fever were present on the day that antibiotic therapy was initiated.

Antibiotics were classified as prophylactic if:

The medical record stated that the antibiotic was prescribed for prophylaxis. The antibiotic therapy was reviewed to assume compliance with recommendations of the standard guidelines (STG). The statistical package for social sciences (SPSS) version 23 was used for analysis and interpretation were frequencies, averages, and percentages were calculated. The answered questionnaires were checked for uniformity, accuracy and completeness.

## RESULTS

Out of the 385 patient files reviewed, 290 (75.3%) had antibiotic(s) prescribed, the average number of antibiotics per prescription was 1.9. This meant that up to 551 antibiotics prescription were noted.

### Most prescribed antibiotics

Benzyl penicillin followed by co-trimoxazole, metronidazole, ceftriaxone and gentamicin respectively. The least prescribed antibiotic was nitrofurantoin, nalidixic acid and chloramphenicol each accounting for 0.2% each as shown in figure 1.

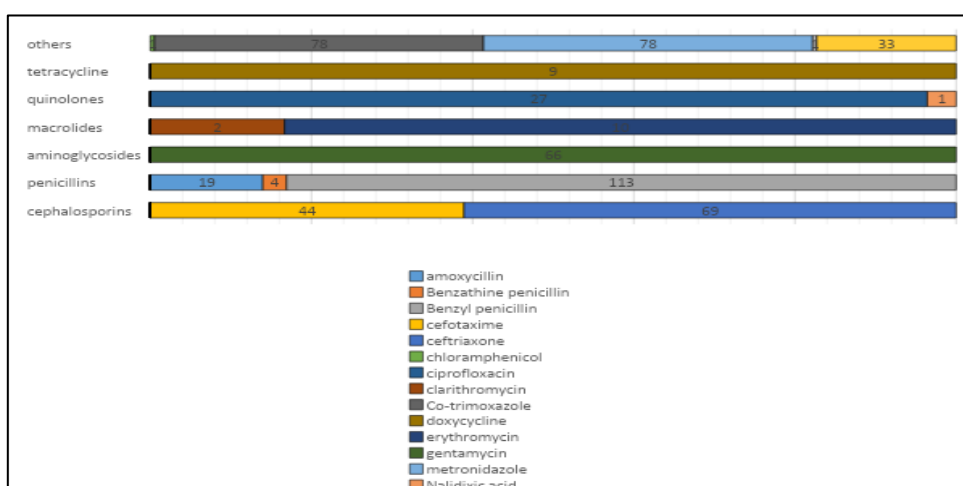


Figure 1 frequency of distribution of antibiotics prescribed

### Documentation of dose, frequency, duration and route of administration

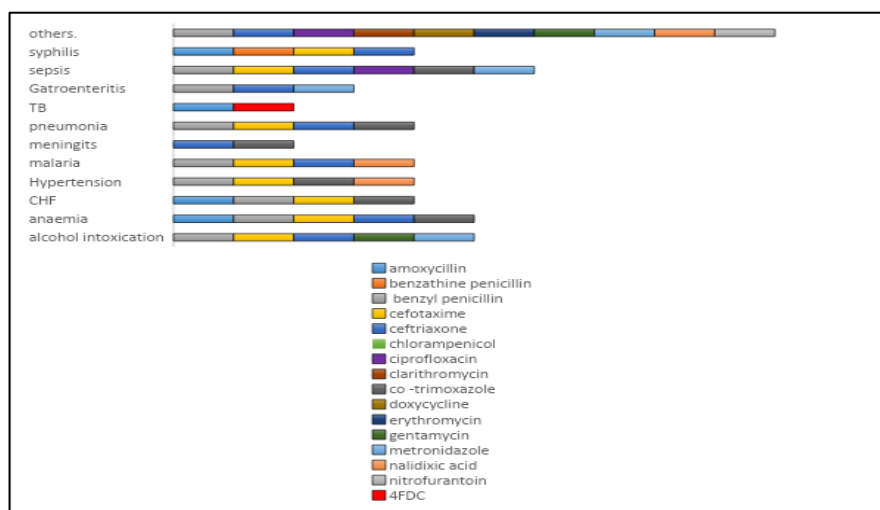
A total of 551 antibiotics were prescribed out of 290 prescriptions, 540 (98%) prescriptions had the treatment dose indicated while 11(2%) had non, 537 (97.5%) had the frequency of dosing indicated while 14 (2.5%) had non, 117(40.3%) had the duration of treatment indicated while 173 (59.6%) had non and finally, route of administration was in indicated in 509 (92.2%) of the total antibiotic's prescriptions while 42 (7.8%) without.

### Compliance of prescribers to the national standard treatment Guidelines

148/290 prescriptions (51.1%) showed compliance while 142/290(48.9%) prescriptions did not comply to the Zambian standard treatment guideline in terms of right choice of drug for the right condition at the right dose.

### Reasons for prescribing antibiotics

218/290 (75.2%) were prescribed for treatment, 18 (4.8%) for prophylaxis and 58 (20%) were prescribed without indication.



**Figure 2: graphical distribution of conditions and prescribed antibiotics**

Tuberculosis was most prevalent 46 (11.9%) with amoxicillin and 4FDC antibiotics, followed by sepsis 42 (10.9%) and antibiotics prescribed were ceftriaxone, benzylpenicillin, ciprofloxacin, gentamycin and co-trimoxazole. Others were gastroenteritis 37 (9.6%) prescribed metronidazole, ceftriaxone and benzylpenicillin; anaemia 36 (9.3%) prescribed Amoxicillin, benzylpenicillin, cefotaxime and ceftriaxone; Alcohol intoxication 22 (5.7%) prescribed Benzyl penicillin, gentamicin, ceftriaxone and cefotaxime, Congestive heart failure 25 (6.5%) prescribed Amoxicillin, benzylpenicillin, cefotaxime and co-trimoxazole; Malaria 18 (4.6%) prescribed Benzyl penicillin, nalidixic acid and ceftriaxone.

### **Microscopic, Culture and Sensitivity (MCS)**

With the 290 patients prescribed antibiotics only 28 (9.7%) had bacteriological tests ordered while 262 (90.3%) had no bacteriological test ordered. Bacteriological tests ordered 2 were urine samples and the test results were available before commencing antibiotic treatment. Most of the bacteriological tests were classified as others and these include Rapid diagnostic test (malaria, meningitis), sputum and blood culture

### **DISCUSSION**

Patients of age over 40 years had more antibiotics prescribed (45.9%) this can be explained by the high prevalence rate of infectious diseases in the elderly. Similarly other studies record a prevalence of 14.5% of all elderly patient visit were infectious related [15].

A significant number of patients were prescribed with antibiotics. The findings of this study were higher (75%) in comparison to those reported by Hangoma in 2014 (70.1%) [15]. Furthermore, they also show a significant difference to the antibiotic prescription patterns in Cameroon (36.71 %) [16]. The high rate of antibiotic prescribing can be attributed to the knowledge gap, as observed with the indiscriminate prescribing of broad-spectrum antibiotics in aims of covering all suspected infections.

The average number of antibiotics per prescription was 1.9 comparable to that reported by other studies with 2.4 [17] and a much lower record of 1.14 [15]. Multiple prescribing of antibiotics to patients can be attributed to lack of bacteriological test results, hence the need to cover all suspected infections. The mean number of drugs per prescription should be as low as possible because the higher the number of drugs, the greater the risk of drug resistance, non-compliance as well as cost [18].

Benzyl penicillin, metronidazole and co-trimoxazole 78 were the most prescribed. Prescribing of broad-spectrum antibiotics is a common phenomenon also reported in similar studies [19]. Lack of proper culture facility promotes prescribing of broad-spectrum antibiotics contributing to the emergency of antibiotic resistance.

The study found that indication of dose was not a serious problem. Indication of duration of treatment is of serious concern, less than half had the duration of treatment indicated while slightly more than half had none. This was comparable with other studies who found that only 41.9% of prescriptions with treatment duration. There is a need to indicate duration of

treatment especially with antibiotics otherwise the microbes may develop resistance and ineffective clinical outcomes [20].

The study showed that the indication of frequency of dosing and route of administration was not a serious problem indicating good antibiotic prescribing pattern [1]. Dosing frequency and route of administration and other parameters optimizes therapy. Indication of route of administration and other parameters optimizes therapy. Route of administration is essential as certain drugs may not be as effective if given via other routes [21]

The number of antibiotics that were prescribed without indication are quite significant at 58 (20%). Examples are the prescribing of Amoxicillin, benzylpenicillin, cefotaxime and ceftriaxone in anaemia with 36 (9.3%) cases recorded or the prescribing of Amoxicillin, benzylpenicillin, cefotaxime and co-trimoxazole Congestive heart failure 25 (6.5%) cases. Inappropriate prescribing of antibiotics could lead to ineffective and unsafe treatment of medical conditions [22,23].

In this study, the practice of ordering bacteriological tests and processing of samples were very poor. Out of 290 patients only 28(9.7%) had bacteriological tests ordered before initiating treatment. Other studies have also reported poor culture sensitivity practice of 19.8% among practitioners [24]. Therefore, it is essential that clinical microbiologists and physicians collaborate on a day-to-day basis for effective clinical outcomes. [25]. The delay in

culture results tends to delay initiation of treatment and thus physician tend to commence treatment without tests.

The study found that only 51.1 % of prescriptions with antibiotics complied with the national STG compared with 57.65% compliance reported in another study conducted in Zambia [24]. This clearly shows that prescribing practices were not up to ideal standards. This is consistent with reports by other researchers that up to 50% of antibiotic prescribing is inappropriate [26].

### LIMITATIONS

Inadequate number of physicians available to answer the questionnaires only 9 physicians participated in the study. The study was only conducted in one department (adult admission) and thus may not correctly indicate the entire antibiotics utilization pattern in the hospital.

### CONCLUSION

Antibiotics prescribing patterns in the current study showed a deviation from the standard recommended by National standard treatment guidelines of Zambia. Prescribing and administration of antibiotics without bacteriological tests was a significant problem. This calls for sustained interventional strategies and periodic audit at all health care levels to avoid the negative consequences of inappropriate antibiotics prescribing.

### DECLARATION

**Contributors** BS developed the concept in close guidance with PM. All authors have read and approved the final version of the manuscript.

**Competing interests** There were no competing interests from all authors in this study.

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