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Antibiotic Prescribing Patterns in Adult Patients According to the WHO AWaRe Classification: A Multi-Facility Cross-Sectional Study in Primary Healthcare Hospitals in Lusaka, Zambia

Steward Mudenda[1*], Mary Chomba[1], Billy Chabalenge[2], Christabel Nang'andu Hikaambo[1], Michelo Banda[1], Victor Daka[3], Annie Zulu[4], Abraham Mukesela[5], Maxwell Kasonde[5], Peter Lukonde[5], Enock Chikatula[6], Lloyd Matowe[7], Ronald Kampamba Mutati[1], Tyson Lungwani Muungo[1], Tobela Mudenda[8], Shafiq Mohamed[9], Scott Matafwali[10]

[1]Department of Pharmacy, School of Health Sciences, University of Zambia, Lusaka, Zambia
[2]Department of Medicines Control, Zambia Medicines Regulatory Authority, Lusaka, Zambia
[3]Department of Public Health, Michael Chilufya Sata School of Medicine, Copperbelt University, Ndola, Zambia
[4]Bell Pharmacy, Kabulonga Centro Mall, Lusaka, Zambia
[5]Ministry of Health Headquarters, Ndeke House, Lusaka, Zambia
[6]Department of Pharmacy, Levy Mwanawasa University Teaching Hospital, Lusaka, Zambia
[7]Faculty of Pharmacy, School of Pharmacy, Eden University, Lusaka, Zambia
[8]Department of Pathology, Ndola Teaching Hospital, Ndola, Zambia
[9]Remedium Pharmaceuticals Limited, Lusaka, Zambia
[10]Clinical Research Department, Faculty of Infectious and Tropical Diseases, London School of Hygiene & Tropical Medicine, London, UK
Email: *freshsteward@gmail.com

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Abstract

Introduction: Indiscriminate prescribing and using of antibiotics have led to the development of antimicrobial resistance (AMR). To reduce this problem, the World Health Organization (WHO) developed the "Access", "Watch", and "Reserve" (AWaRe) classification of antibiotics that promotes antimicrobial stewardship (AMS). In Zambia, there are gaps in practice regarding prescribing of antibiotics based on the AWaRe protocol. This study assessed antibiotic prescribing patterns in adult in-patients in selected primary healthcare hospitals in Lusaka, Zambia. **Materials and Methods:** This retrospective cross-sectional study was conducted using 388 patient medical files from September 2021 to November 2021, five primary healthcare hospitals namely; Chawama, Matero, Chilenje, Kanyama, and Chipata. Data analysis was performed using the Statistical Package for Social Sciences version 23. **Results:**

Of the selected medical files, 52.3% (n = 203) were for male patients. Overall, the prevalence of antibiotic use was 82.5% (n = 320) which was higher than the WHO recommendation of a less than 30% threshold. The most prescribed antibiotic was ceftriaxone (20.3%), a Watch group antibiotic, followed by metronidazole (17.8%) and sulfamethoxazole/trimethoprim (16.3%), both belonging to the Access group. Furthermore, of the total antibiotics prescribed, 41.9% were prescribed without adhering to the standard treatment guidelines. **Conclusion**: This study found a high prescription of antibiotics (82.5%) that can be linked to non-adherence to the standard treatment guidelines in primary healthcare hospitals. The most prescribed antibiotic was ceftriaxone which belongs to the Watch group, raising a lot of concerns. There is a need for rational prescribing of antibiotics and implementation of AMS programs in healthcare facilities in Zambia, and this may promote surveillance of irrational prescribing and help reduce AMR in the future.

Keywords

Antibiotic Prescribing, Antimicrobial Resistance, Antimicrobial Stewardship, AWaRe Classification, Prescribing Patterns, Primary Healthcare, Surveillance, Zambia

1. Introduction

Antibiotics have been critical in managing infectious diseases [1] [2]. However, their inappropriate use has contributed to the development of antimicrobial resistance (AMR) [3] [4] [5]. AMR is a global public health issue that has been exacerbated by an increase in the consumption of antibiotics [3] [4] [6]. Prescribers of medicines may help reduce the problem of AMR by ensuring that they avoid overprescribing antibiotics [7] [8]. Besides, they should adhere to the guidelines when prescribing antibiotics [8] [9] [10]. Additionally, all healthcare workers (HCWs) should collaborate to address AMR and promote antimicrobial stewardship (AMS) programs [11] [12] [13] [14] [15]. This can improve the surveillance and reduction of AMR [16] [17] [18].

The World Health Organization (WHO) developed the "Access", "Watch", and "Reserve" (AWaRe) classification of antibiotics to tackle AMR [19] [20] [21] [22]. In the Access group, narrow-spectrum antibiotics are generally used as the first and second choice for most infections, while broad-spectrum antibiotics comprise the Watch group antibiotics [20] [23]. Access group antibiotics must be readily available, affordable, and of good quality in treating infections [23]. The Reserve group contains last resort antibiotics and is usually used to treat multi-drug resistant infections [20] [23]. Therefore, the reserve antibiotics must be left as a treatment of last resort, which may preserve the effectiveness of antibiotics [23]. Literature has shown that prescribers which adhere to the AWaRe protocol have reported a reduction in AMR cases in their healthcare facilities [24] [25]. However, most prescribers do not adhere to the AWaRe protocol,

thereby worsening the number of microorganisms developing resistance to antibiotics [26] [27]. Conversely, in Ghana, prescribers adhered to the AWaRe classification protocol, indicating good AMS [28].

The AWaRe protocol of antibiotics is an important tool for AMS [29] [30]. The tool may help prescribers minimise prescribing antibiotics and adhere to the prescription of less than 30% as recommended by the WHO [31] [32]. The AWaRe protocol also guides prescribers to ensure that they prescribe more than 60% of Access group antibiotics compared to the other groups [33]. However, evidence has shown an overprescribing of Watch group antibiotics compared to Access antibiotics [27] [30] [33] [34].

Evidence has shown that antibiotics are overprescribed in healthcare facilities across countries [26] [35] [36] [37]. Approximately 20 to 50% of antibiotics are prescribed inappropriately without adhering to the standard treatment guidelines (STG) [33] [35] [38]. Therefore, educating prescribers about the rational prescribing of antibiotics is crucial to reducing AMR in the future [15] [39] [40] [41]. Alongside, educating healthcare students about AMR is critical as they are the future HCWs [42] [43].

In Zambia, AMR is of public health concern and has been reported in various studies [42] [44]-[53]. However, little is known about the antibiotic prescribing patterns based on the WHO AWaRe classification in primary healthcare hospitals that offer primary healthcare services. Therefore, this study assessed antibiotic prescribing patterns in in-patients according to the WHO AWaRe classification in selected primary healthcare hospitals in Lusaka, Zambia.

2. Materials and Methods

2.1. Study Design, Site and Population

This was a retrospective cross-sectional study that was conducted by reviewing medical records of in-patients in five first-level hospitals, namely Matero, Chawama, Chipata, Chilenje, and Kanyama in Lusaka, Zambia. In Zambia, first-level hospitals offer primary care services and usually act as the first point of contact with the healthcare system. The study was conducted from September 4th to November 9th, 2021, and we included all patient medical files from January 2021 to October 2021.

2.2. Sample size Determination and Sampling Technique

The sample size was determined using the Raosoft online sample calculator [54]. With no known previous study done in primary healthcare hospitals in Zambia, a 50% prevalence was used at a 95% confidence level and a margin of error of 5%. This resulted in a sample size of 385 patient medical files. All patient medical files were randomly selected to increase the chance of every file being part of the study.

2.3. Data Collection Tool

A data entry sheet was used to collect data on diseases diagnosed and antibiotics

prescribed in primary healthcare hospitals in Lusaka, Zambia. Furthermore, a consent form was given to prescribers who agreed to participate in the study. The data collection tool was adapted from a similar study [55]. Before carrying out this study, a pilot survey was done using 30 patient medical files. Data collection was done by two data collectors who were trained on how to select patient medical files and data entry. The collected information included gender and age of the patient, name of the healthcare facility, antibiotic use, adherence to treatment guidelines, and type of antibiotics prescribed. Adherence to prescribing antibiotics was done based on the Zambia STG [56] and AWaRe classification was used to classify antibiotics into Access, Watch, and Reserve groups [22]. Overall, 388 patient medical files were selected and used in this study.

2.4. Data Analysis

The collected data were entered into Microsoft Excel 2016 for cleaning and coding. Subsequently, the data was exported to the Statistical Package for Social Sciences (SPSS) for Windows Version 23 for analysis. Descriptive statistics were then presented in the form of tables.

3. Results

Of the 388 patient files that were screened, 52.3% were male, 19.3% were 34-41 years old, 82.5% (n = 320) received antibiotics, and 41.9% (n = 134) prescribers did not adhere to the STG as shown in **Table 1**.

The most prescribed antibiotic was ceftriaxone (20.3%) which belongs to the Watch group of antibiotics. However, the overall proportion showed that antibiotics belonging to the Access group were the most prescribed (55%) in primary healtcare hospitals. A total of 10 Access and 6 Watch antibiotics were prescribed (**Table 2**).

4. Discussion

This study assessed antibiotic prescribing patterns in five primary healthcare hospitals in Lusaka, Zambia. The study reported a high rate (82.5%) of antibiotic prescribing, and ceftriaxone was the most prescribed for in-patients. Adherence to the national STG was found to be 58.1%, meaning that 41.9% of antibiotics were prescribed without adhering to the national STG.

The prevalence of antibiotic use in the present study was high. Our findings are in line with a study that was conducted in Iraq though a higher prevalence (93.7%) was reported [57], 88.2% in Eswatini [58], slightly lower prevalence (82.3%) in Pakistan [35], 74% in Uganda [59], and 60.6% in Ethiopia [60]. These findings are higher than the reference value of less than 30% recommended by the WHO [31] [32]. This high use of antibiotics in healthcare facilities may be due to various diseases that in-patients suffer from and puts pressure on the prescribers to prescribe these drugs for disease prevention and treatment [61] but may promote the emergence of antibiotic-resistance microbes [62]. The

Table 1. Sociodemographic characteristics.

Variable	Characteristic	Frequency (n = 388)	Percent (%)
Gender	Female	185	47.7
	Male	203	52.3
Age (years)	18 - 25	72	18.6
	26 - 33	64	16.5
	34 - 41	75	19.3
	42 - 49	60	15.5
	50 - 57	39	10.1
	58 - 65	29	7.5
	>65	49	12.6
Healthcare facility	Chawama	78	20.1
	Chilenje	67	17.3
	Chipata	72	18.6
	Kanyama	87	22.4
	Matero	84	21.6
Antibiotic use	No	68	17.5
	Yes	320	82.5
Adherence to STG	No	134	41.9
	Yes	186	58.1

Table 2. Prescribing patterns of antibiotics according to WHO AWaRe classification.

Antibiotic name	Access, n (%)	Watch, n (%)
Amoxicillin	8 (2.5)	-
Amoxicillin/clavulanic acid	3 (0.9)	-
Azithromycin	-	37 (11.6)
Cefotaxime	-	8 (2.5)
Ceftriaxone	-	65 (20.3)
Cefuroxime	-	2 (0.6)
Cephalexin	4 (1.3)	-
Chloramphenicol	2 (0.6)	-
Ciprofloxacin	-	31 (9.7)
Cloxacillin	27 (8.4)	-
Doxycycline	5 (1.6)	-
Erythromycin	-	2 (0.6)
Gentamicin	15 (4.7)	-
Metronidazole	57 (17.8)	-
Phenoxymethylpenicillin	2 (0.6)	-
Sulfamethoxazole/trimethoprim	52 (16.3)	-
Total	**175 (55)**	**145 (45)**

most prescribed antibiotic in our study was ceftriaxone (20.3%) which belongs to the Watch group. These findings are comparable with reports from other countries [33] [35] [59] [60] [63] [64] [65]. The high prescription rate of ceftriaxone has a high resistance potential and should not be prescribed routinely [65]. The over-prescription and use of ceftriaxone also highlight the need for antibiotic prescription guidelines at these facilities per national and international guidelines to reduce its irrational use. Contrary to our findings, the most prescribed antibiotic was amoxicillin in Eswatini [58], penicillins in China due to increased respiratory tract infections [62], and metronidazole in Ghana due to increased dental and gastrointestinal problems [28].

Our study revealed that most prescribed antibiotics belonged to the Access group. These findings corroborate reports from a point prevalence survey across six hospitals in Tanzania that revealed that most patients received antibiotics from the Access group [66], similar to what was reported in Eswatini [58], Ghana [28], and Uganda [59]. On the contrary, In China, a study revealed that most antibiotics consumed in healthcare facilities belonged to the Watch group [67]. According to a point prevalence survey carried out in 69 countries, the research found that the overall use of Watch group antibiotics was high, and stratification by World Bank classification showed that hospitals in lower-middle- and upper-middle-income countries contributed substantially to the proportion of Watch antibiotics [30]. Worldwide, a large proportion of Reserve group antibiotics were prescribed empirically [30]. In lower-middle-income countries, up to 53.0% of all Reserve prescriptions were empirical, which indicates a lack of diagnostic capacity [30]. This indicated poor prescribing patterns in these facilities and calls for strict implementation of AMS programs.

Interestingly, our study found that 55% of Access, 45% of Watch and no Reserve group antibiotics were prescribed. Unfortunately, this is not in line with the WHO recommendations in which Access group antibiotics must be prescribed more than 60% of all antibiotic prescriptions [33]. In Uganda, similarly, despite the Access group antibiotics reported to be prescribed more than Watch group antibiotics, the proportion was 47.2%, which did not meet the WHO recommendations [59]. In India, a study reported that 42.3% of Access group antibiotics were prescribed with no Reserve antibiotics recorded in their findings [63]. Since these findings did not meet the WHO recommendations of AWaRe prescribing of antibiotics, this may mean non-adherence to the protocols and a contributing factor to AMR in most healthcare facilities. In many health settings, non-adherence to protocols has been attributed to prescriber preferences [59], which may be the case in the current study. This result highlights the need for urgent AMS in these facilities, as prescribing watch antibiotics may scale up AMR and lead to the prescription of Reserve antibiotics. In contrast to our findings, other surveys reported the use of Access group antibiotics as more than 60% as recommended by the WHO [58] [64]. Similar to our study finding regarding Reserve group antibiotics, other studies also found that no Reserve group antibiotics were prescribed in their surveys

[58] [63] [68]. This is a positive finding because Reserve group antibiotics must be preserved as the last resort of treatment after other options have failed. To maintain the status quo, AMS programs must be implemented or enhanced.

Of note is that some prescribers in our study did not adhere to the treatment guidelines. This practice is inappropriate and may contribute to the development of AMR. Similar findings were reported in other surveys where the overall compliance with the outlined prescribing guidelines was suboptimal [57] [69] [70]. Lower adherence to treatment guidelines was reported in Uganda [59]. Non-adherence to the standard treatment guidelines of infectious diseases may be due to the absence of these guidelines in healthcare facilities [35] [59], out of stock of key antibiotics [60], prescriber preferences, lack of efficient laboratory services and lack of proper diagnostic stewardship [59]. Additionally, shortages of medicines, increased burden of disease, and lack of healthcare workers put pressure on the prescribers leading to non-adherence to STGs when prescribing [71].

The current study findings may help identify key areas that require interventions through the promotion of AMS programs across healthcare facilities in Zambia. The study also highlights the need for rational prescribing and adherence to the National STG. Additionally, this calls for sensitisation and educational activities on the rational use of antibiotics across healthcare workers. Ministries responsible for health must ensure that all antibiotics listed under the Essential Medicines List (EML) are available to avoid inflicting pressure on prescribers and overuse of Watch group antibiotics.

This study was conducted in one province of Zambia, hence, the findings may not be generalized to the other provinces across the country.

5. Conclusion

Our study found high prescribing of antibiotics without adhering to the National Treatment Guidelines by the prescribers. Ceftriaxone, a Watch group antibiotic, was the most prescribed medicine, and this requires prescriber educational and training activities on the AWaRe protocol and adherence to the treatment guidelines. Therefore, AMS programs should be implemented and enhanced across healthcare facilities in Zambia.

Ethical Approval

This study was approved by the University of Zambia Health Sciences Research Ethics Committee (UNZAHSREC) with protocol ID 202112030048.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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