



Antibiotic Prescribing Patterns in Paediatric Patients at Levy Mwanawasa University Teaching Hospital in Lusaka, Zambia

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Abstract

The use of antimicrobial agents has become a routine practice for the treatment of paediatric illnesses. The uncontrolled use of antibiotics has caused a rise in antimicrobial resistance. This study aimed to assess the antibiotic prescribing patterns in paediatric patients at Levy Mwanawasa University Teaching Hospital in Lusaka, Zambia. This was a cross-sectional study conducted between April 2019 to July 2019. The study population included both in-patients and out-patients aged between one month and eighteen years whose medical files were reviewed. A sample size of 357 medical files was conveniently sampled. Statistical Package for Social Sciences version 21.0 was used for data analysis. A chi-square test was used to assess the association between categorical variables. A $p < 0.05$ was considered to be statistically significant at 95% confidence level. The majority of the medical files 230 (64.4%) were for paediatrics in the age group of 1 month to 5 years. Antibiotic prescribing was found to be 78.7%. The study revealed that 119 (33.3%) of patients required antibiotics and were on antibiotic treatment while 46 (12.9%) did not require antibiotics but were on antibiotic treatment. The most common diseases 147 (41.2%) were those affecting the respiratory system. The most commonly prescribed antibiotics were penicillins 154 (54.8%), followed by cephalosporins 88 (31.3%). The association between age, white blood cell count status, and system of illness with antibiotic use were statistically significant ($\chi^2 = 15.083$, $p = 0.001$; $\chi^2 = 6.571$, $p = 0.037$ and $\chi^2 = 27.717$, $p < 0.0001$). The study also found that the frequency of antibiotic use was high among paediatric patients as per the World Health Organization's prescribing indicators. The most commonly prescribed antibiotics to paediatric patients were penicillins.

Keywords: Antibiotic prescribing patterns; Antimicrobial; Paediatrics; Lusaka; Zambia

Introduction

Antimicrobial agents are among the commonly prescribed medicines for the treatment of paediatric illnesses [1]. The prescribing pattern of antibiotics is complex and influenced by multiple factors other than clinical considerations [2].

These factors include patient characteristics, physician characteristics, and medical environments such as competition for clients. Among the patient characteristics, age, lower socioeconomic status, and higher co-morbidity are said to have significant effects on the antibiotic prescription rate whilst physician

characteristics such as gender, age, time since graduation, and volume of practice, significantly influence antibiotic prescription [3].

Antibiotics play a vital role in the treatment of infectious diseases globally [4]. Antibiotics are amongst the commonest medications prescribed for paediatrics [5]. Overprescribing of antibiotics has led to antibiotic resistance (ABR) which has led to difficulty in treating certain infections, increased morbidity and mortality rates, and healthcare costs [5]. The inappropriate prescribing of antibiotics for common diseases in paediatric patients has also contributed to an increase in ABR [6]. Irrational and inappropriate use of antibiotics has contributed largely to the development of antibiotic resistance (ABR) [7,8].

An increase in infections caused by resistant bacteria has called for rational and appropriate use of antibiotics in paediatrics [9]. Antibiotics should be used rightly and for the right patient, at the right time, in the right dose, and administered correctly while providing them at an affordable cost with the right information [10]. Rational prescribing of antibiotics is vital in controlling ABR [11]. Many prescribers fail to abide by rational prescribing of antibiotics despite many countries promoting good antimicrobial stewardship [5,11].

Therefore, prescribers need to have detailed knowledge of antibiotic prescribing patterns [12]. Due to a rise in ABR, studies have recommended prompt discovery of lead compounds from plant extracts [13-15]. This study aimed to assess the antibiotic prescribing patterns in paediatric patients at Levy Mwanawasa University Teaching Hospital (LMUTH) in Lusaka, Zambia.

Materials and Methods

Study Design

This was a cross-sectional study that was done at Levy Mwanawasa University Teaching Hospital in Lusaka from April 2019 to July 2019. This study was done as per the World Health Organization (WHO) prescribing indicators [16].

Study Frame/Population

All in-patient and out-patient paediatrics (1 month-18 year) at LMUTH, department of paediatrics comprised the study population. The medical files and prescriptions of these patients also comprised the study frame.

Inclusion Criteria

Medical files for both male and female paediatric patients aged 1 month to 18 years at LMUTH.

Exclusion Criteria

Paediatric patients in the Intensive Care Unit and those who were on antibiotic treatment for less than 72 hours were excluded.

Sample Size

The sample size was calculated using Cochran's formula and was found to be 357 paediatric medical files. The medical files were chosen using a convenient sampling method.

Data Collection

The data collection sheet containing the patient's demographic details, admission complaints, provisional diagnosis, investigations that were done, and antimicrobials used was used to record information from the file. A data collection tool was adopted from a study that was done in India by Gopal et al [11] and was adapted to our setting in Lusaka, Zambia.

Data Analysis

All collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) version 21.0. A chi-square test was used to assess the association between categorical variables. A $p < 0.05$ was considered to be statistically significant at 95% confidence level.

Results

Biographic characteristics of the study participants

Table 1 shows that the majority of the medical files 230 (64.4%) were found to belong to the paediatric patients from the age group of 1 month to 5 years. The most common system of illness was respiratory diseases, representing 147 (41.2%).

Frequency of antibiotic use in paediatric patients at Levy Mwanawasa University Teaching Hospital

Figure 1 shows that the frequency of antibiotic use in paediatric patients was found to be 281 (78.7%). A $p < 0.001$ gave statistical significance.

Table 1: General information of the study participants.

Characteristics		Frequency (n=357)	Percent (%)
Age	1 month - 5 Years	230	64.4
	5 -10 Years	56	15.7
	10- 18 Years	71	19.9
Sex	Male	181	50.7
	Female	176	49.3
WBC count status	Normal	210	58.8
	High	130	36.4
	Low	17	4.8
Haemoglobin status	Normal	189	52.9
	Mild anaemia	150	42
	Moderate anaemia	11	3.1
	Severe anaemia	7	2
The need for antibiotic use	No antibiotic used	76	21.3
	Required	119	33.3
	Can be required	116	32.5
	Not required	46	12.9
System of illness	Respiratory	147	41.2
	Gastro-intestinal	84	23.5
	Infectious disease	31	8.7
	CNS	19	5.3
	CVS	25	7
	Renal	11	3.1
	Others	40	11.2

Note: WBC = White Blood Cell; CNS = Central Nervous System; CVS = Cardiovascular System

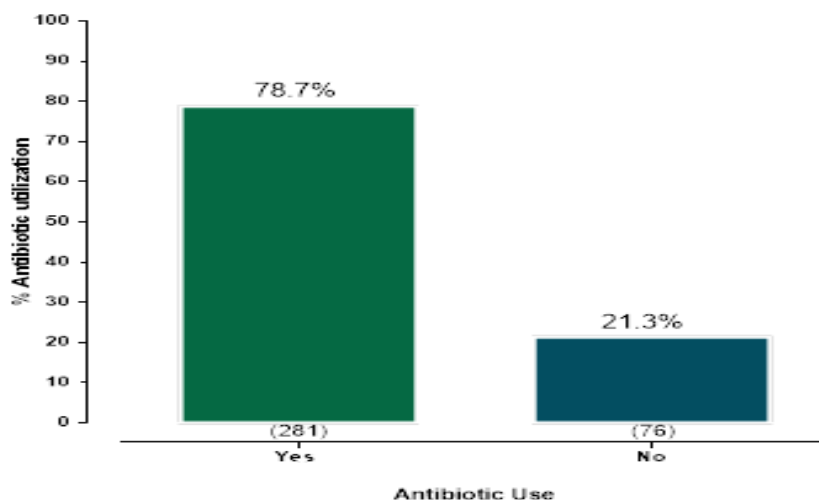


Figure 1: Frequency of antibiotic use in paediatric patients

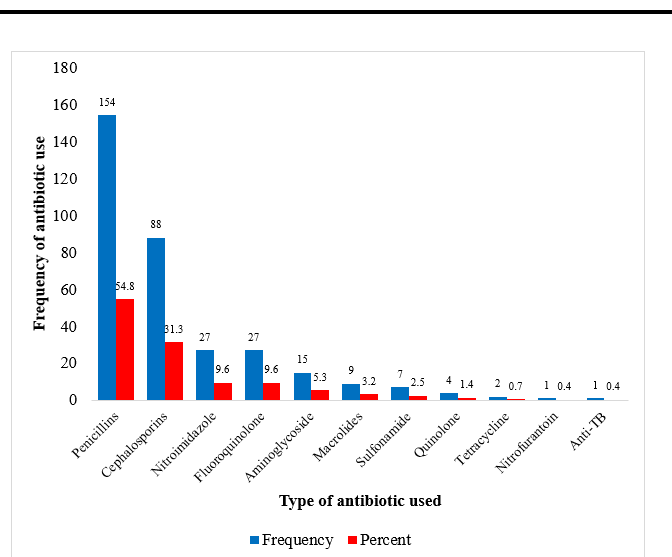


Figure 2: Profile of antibiotics used in any form among paediatric patients (n=281).

Figure 2 above shows that the most commonly prescribed antibiotics were penicillins 154 (54.8%), followed by cephalosporins 88 (31.3%).

Factors associated with the prescribing of antibiotics in paediatric patients at Levy Mwanawasa University Teaching Hospital

The study found that age, WBC count status and system of illness were statistically significantly associated with antibiotic use ($\chi^2=15.083$, $p=0.001$; $\chi^2=6.571$, $p=0.037$ and $\chi^2=27.717$, $p<0.001$) as shown in Table 2.

Table 2: Factors associated with the use of antibiotics among study participants.

Characteristics		Antibiotic use		χ^2 value	P-value
		Yes (%)	No (%)		
Age	1 month – 5 Years	192 (83.5)	38 (16.5)	15.083	0.001
	5 – 10 Years	45 (80.4)	11 (19.6)		
	10 – 18 Years	44 (62.0)	27 (38.0)		
Sex	Male	147 (81.2)	34 (18.8)	1.374	0.241
	Female	134 (76.1)	42 (23.9)		
WBC count status	Normal	159 (75.7)	51 (24.3)	6.571	0.037
	High	111 (85.4)	19 (14.6)		
	Low	11 (64.7)	6 (35.3)		
Haemoglobin status	Normal	145 (76.7)	44 (23.3)	3.561	0.313
	Mild anaemia	124 (82.7)	26 (17.3)		
	Moderate anaemia	7 (63.6)	4 (36.4)		
	Severe anaemia	5 (71.4)	2 (28.6)		
System of illness	Respiratory	131 (89.1)	16 (10.9)	27.717	<0.0001
	Gastro-intestinal	64 (76.2)	20 (23.8)		
	Infectious disease	16 (51.6)	15 (48.4)		
	CNS	12 (63.2)	7 (36.8)		
	CVS	21 (84.0)	4 (16.0)		
	Renal	8 (72.7)	3 (27.3)		
	Others	29 (72.5)	11 (27.5)		

Note: WBC = White Blood Cell; CNS = Central Nervous System; CVS = Cardiovascular System

Prescribing patterns of antibiotics based on the system of illness

Paediatric patients in the current study were divided into 3 groups to determine the requirement of antibiotic usage. Group 1=definitely required antibiotic use, Group 2=antibiotic use may be required, and Group 3=antibiotic use not required. The study found that

some paediatric patients did not require treatment with antibiotics, but they were on antibiotic treatment as shown in Table 3 below.

Table 3: Requirement of usage and actual usage of antibiotics among paediatric patients with the various system of illness.

System of illness	The need for antibiotic use				Total
	No antibiotic used	Required	Can be required	Not required	
Respiratory	16 (10.9)	46 (31.3)	78 (53.1)	7 (4.8)	147 (100.0)
Gastro-intestinal	20 (23.8)	38 (45.2)	22 (26.2)	4 (4.8)	84 (100.0)
Infectious diseases	15 (48.4)	3 (9.7)	1 (3.2)	12 (38.7)	31 (100.0)
CNS	7 (36.8)	0 (0.0)	6 (31.6)	6 (31.6)	19 (100.0)
CVS	4 (16.0)	18 (72.0)	1 (4.0)	2 (8.0)	25 (100.0)
Renal	3 (27.3)	8 (72.7)	0 (0.0)	0 (0.0)	11 (100.0)
Others	11 (27.5)	6 (15.0)	8 (20.0)	15 (37.5)	40 (100.0)

Note: CNS = Central nervous system; CVS = Cardiovascular system

Discussion

Excessive and inappropriate use of antibiotics has been a major contributor to the emerging problem of antibiotic resistance [17]. Paediatric patients are largely prone to be a victim of irrational antibiotic usage practice [18].

From this study, it was found that the majority of paediatric patients affected by irrational antibiotic usage were those within the age group of 1 month to 5 years. This is similar to the findings in Guyana, Germany, and India [5,19,20]. This age group is prone to different diseases especially conditions of the respiratory and gastro-intestinal systems due to their immature and yet developing immune system [19-21]. In India, it was found that the majority of the paediatric patients that received antibiotics were from the age of 5-12 years [22].

In this study, it was also found that most of the patients were males. This is in concordance with the studies that were done in Guyana, India, Sierra Leone, Ethiopia, Cameroon [5,22-25]. This similarity in findings suggests that male children are more likely to get infections than female children. This is because most male children are more active and as such that they get in contact with various objects and people who are likely to transmit various infections to them [26].

Another study suggested that parents give more attention to female children especially when they are growing older compared to male children and due to this less attention and care given to male children, they are likely to get infections [27].

Additionally, most of the paediatric patients presented with respiratory diseases followed by gastro-intestinal conditions such as diarrhoea. Other scholars found similar results in Guyana, Ethiopia, and India [5,21,28]. There are some reasons for these observed similarities in the findings. Firstly, respiratory infections are easily transmissible than any other diseases or infections especially in poorly ventilated areas or windy and dusty environments [6]. Secondly, most children especially when they start crawling and teething, are likely to eat various objects of which most are dirty and this could explain the high frequency of gastro-intestinal conditions seen in this study and other studies [1].

In this study, it was found that the antibiotic prescription was high (78.7%). This is higher than the World Health Organization (WHO) prescribing indicators which recommend antibiotic use of less than 30%. The studies in the following countries also found antibiotic prescribing to be high; in India by Majhi et al. (31%), in Guyana by Sharma et al. (36.9%), in India by Kumar et al. (50.05% India), in India by Choudhury et al. (66%), in Cameroon by Chem et al. (36.71%), in Jordan by Al-

Niemat et al. (85%), in Nigeria by Fadare et al. (71.1%), in India by Akhtar et al. (81.1%), in Sudan by Ahmed et al. (81.3%), and United Arab Emirates by Sharif et al. (44.6%) [2,5,20,22,29-35]. On the contrary, Mohajer and colleagues found the prescribing of antibiotics to be 18.5% in Saudi Arabia.

The most common antibiotic class that were prescribed were penicillins followed by cephalosporins. This is even though most bacteria are resistant against penicillins [36]. These findings are in agreement with what was found in studies that were done in Ethiopia, Cameroon, Nigeria, and Iraq [24,29,36,37]. These similarities in the findings could be due to the availability of these drugs in these various hospitals and hence their use. Additionally, there could also be some similarities in the treatment guidelines developed by these hospitals in the various hospitals that were considered for the studies [9]. However, the findings of this study were contradicted by what was found in other studies which found that cephalosporins were the most commonly used antibiotics unlike penicillins [21,38]. This can be due to the reported prevalence of penicillin resistance bacteria and hence the use of cephalosporins, especially of second and third generations. The over-prescription of antibiotics that are known to be more potent against most bacteria might still result in these very antibiotics becoming less effective and the emergence of resistant strains against such antibiotics [39].

Various factors can be associated and influence the prescribing patterns of antibiotics and these could be related to the clinicians themselves or the patients that they are attending to. In this study, it was found that age, White Blood Cell (WBC) count status and system of illness were significantly associated with the use of antibiotics as shown in Table 3. Similar to these findings, studies that were done in India and Nigeria also found that these factors are associated with the use of antibiotics [18,36]. The age of paediatric patients was a factor that could influence the use of antibiotics. Neonates and infants are susceptible to illness, even to that caused by usually harmless normal flora, thus making clinicians more inclined to prescribe antibiotics without confirmation of bacterial cause [40]. Further, white blood cell count can also influence the use of antibiotics, with clinicians leaning toward prescription when the WBC count is high, as is usually suggestive of some infections, even though at times it could be due to cancers [41].

System of illness was another factor that was found to be associated with the use of antibiotics, with

respiratory and gastro-intestinal conditions mostly resulting in antibiotic prescriptions. The findings confirmed what other researches have reported that most of the respiratory and gastro-intestinal conditions are treated with antibiotics despite the absence of confirmatory tests to indicate bacterial cause [20,23]. Despite most of the conditions being appropriate for antibiotic treatment, several cases did not require antibiotic treatment and the highest value was found in infectious diseases. Some studies that found similar results indicated that the most frequently reported reason for prescribing antibiotics was a fear of complications, such as pneumonia, bronchitis, and otitis media and also maintaining the parents' peace of mind [26]. This could also explain the observed prescribing patterns in this study. Additionally, other studies have indicated that other clinicians would prescribe antibiotics depending on the knowledge and experience acquired over the years and the less experienced clinicians being more likely to prescribe antibiotics without proper bacteriological tests [42,43].

Finally, this study found that the prescribing of antibiotics in paediatric patients was high. Therefore, this calls for continuous education on rational antibiotic prescribing, use and antimicrobial resistance among healthcare providers.

Conclusion

This study found that most of the paediatric patients whose files were reviewed were male within the age group of 1 month to 5 years. Most of the paediatric patients presented with respiratory tract conditions followed by gastrointestinal conditions. The study further found that the frequency of antibiotic use was high among these paediatric patients and the most commonly prescribed antibiotics were penicillins followed by cephalosporins.

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Ethical Approval

Written permission was obtained from Levy Mwanawasa Teaching Hospital prior to use of medical files and prescriptions of the patients in the study. Ethical approval to conduct this study was obtained from University of Zambia Health Sciences Research Ethical Committee (protocol ID: 20190217024, IORG

no: 0009227, IRB no: 00011000) and the National Health Research Authority (NHRA).

Conflicts of Interests

The authors declare no conflict of interest.

Author Contributions

All authors contributed to proposal development, write up, data collection, data analysis, manuscript writing, editing and endorsed the final version of the manuscript.

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