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Prescribing Patterns of Antibiotics among the Pediatric Patients Attended the Outpatient Departments of the Tertiary Level Hospitals in Nigeria: A Cross-Sectional Study

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A B S T R A C T

Rationality analysis of the prescribing pattern of antibiotics for pediatric patients can help to point towards irrationality and can make a consensus among physicians for rational prescribing. This study was aimed at identifying the antibiotic prescription survey in pediatric outpatient prescriptions. This study was carried out in two hospitals namely; Usmanu Danfodiyo University Teaching Hospital, Sokoto, and General Hospital Katsina Nigeria during the period of October to December 2019. A total of 600 prescriptions cumulatively were used as a sample and were selected using the convenience sampling technique. For data collection, a self-designed data collection sheet was used. WHO / INRUD prescribing indicators were used for the analysis of prescription patterns. A total of 600 prescriptions (364 from UDUTHS and 236 from GHKS) were selected and used for the study. Most of the patients admitted to the two selected hospitals were male. The patient's ages varied from a few months to 12 years, with the majority aged 4 years or less (61.0%) of age. From the 600 prescriptions evaluated, 1564 drugs (912 from UDUTHS and 652 GHKS) were prescribed. The average number of drugs per encounter in UDUTHS and GHKS were 3.0±0.4 and 3.2±0.7 respectively. The percentages of encounters with an antibiotic prescribed in both hospitals were similar: 32.1% for UDUTHS and 31.1% for GHKS. Most antibiotics were targeted at respiratory tract infections Roxithromycin 126 (21.0%) was the most frequently prescribed antibiotic and was prescribed by the proprietary name. This study has revealed inappropriate drug prescriptions in the pediatric outpatient in these hospitals. These include the low rate of prescriptions in generic names; extensive polypharmacy; and inappropriate prescription of antibiotics which could lead to drug-drug interaction and adverse drug reaction is also evident in these hospitals.

Keywords: *Antibiotic, Prescription, Pattern, UDTHS, GHKS.*

1. Introduction

Antibiotics are most extensively used drugs. Wide ranges of antibiotics are available to treat various types of infections. The choice of antibiotics is available to treat various types of infections (1). Antibiotics have effectively prolonged the life expectancy and are currently the most commonly prescribed drugs in hospitals, worldwide (1{Hersh, 2013 #2421, 2)2428}. However, excessive and inappropriate use of antibiotics renders

increased drug resistance (3). Thus, the rational use of antibiotics is a major health need.

Children comprise a large proportion of the population of many developing countries, hence the importance of their health status. In Nigeria, according to the 2006 national census, children aged below 14 years constituted more than 40% of the population (4). Children aged five years and below constitute the bulk of patients attending the paediatric outpatient clinics in Nigeria (5). They are particularly vulnerable to many communicable /infectious diseases, and mortality among this group is usually very high, hence the need for special attention towards their care. When prescribing for children, there is a need to consider the aetiopathogenesis of the disease conditions as well as the developmental stage of the child at that particular time. Prescriptions can be described as rational and non-rational with the latter having possible consequences such as adverse drug reactions, increased frequency of drug-drug interactions and increased healthcare costs (6). Adverse drug reactions in children particularly could contribute to morbidity and mortality because of the immaturity of their immune system and their inability to communicate adequately.

Regular audit of prescriptions is essential in identifying the various types of non-rational prescribing such as polypharmacy, irrational use of antimicrobials and injectable among others (7). It is also necessary to describe trends and follow adherence to various treatment guidelines. Irrational use of antimicrobials has been identified as a major problem in many pediatric prescription studies; this could lead to antimicrobial resistance, treatment failures and increased healthcare costs (6, 8, 9).

Polypharmacy and other forms of inappropriate forms of prescribing could be extremely harmful in children because of their physiological peculiarities (10). The World Health Organization (WHO) has tried to address these non-rational practices through its resource “How to Investigate Drug Use in Health Facilities: Selected Drug Use Indicators”, which was published in 1993 (11).

This study evaluated drug prescribing pattern in two health care facilities in northwest geopolitical region in Nigeria providing mainly primary and secondary health care using the WHO Prescribing Indicators. It highlighted prescription pattern of antibiotic in outpatient from the health care facilities, and useful recommendations that can improve drug prescribing practices in Nigeria were proffered.

2. Methods and Materials

2.1. Study Design and Participants

This study was carried out in two hospitals from northwest namely Usmanu Danfodiyo University Teaching Hospital, Sokoto State and, General Hospital Katsina State, Northern Nigeria during the period of October to December, 2019. A total of 600 prescriptions from the above-mentioned hospitals were used as sample and were selected using convenience sampling technique. For data collection, a self-designed data collection sheet was used. After pretesting the tool, data collectors collected different outdoor prescription from exit point of these hospital outdoor convenient to their time and patient approach.

2.2. Data Collection

The patients were informed about the study and took permission to capture the photograph of the prescription and Culture & Sensitivity (C/S) test report related to that prescription. After collecting the photograph of each prescription and related C/S report, data were recorded in the data collection sheet. Data were evaluated using the WHO-developed prescribing indicators (3). The WHO indicators calculated included: average number of drugs per encounter, percentage of drugs prescribed from generics, percentage of encounters with an antibiotic prescribed, percentage of encounter with an injection prescribed, and percentage of drugs prescribed from the National Essential Medicine List (EML).

2.3. Data Analysis

Collected data were analyzed using SPSS version 20 and descriptive statistics such as frequencies and percentages were used in the analysis of the data.

3. Findings

A total of 600 prescriptions (364 from UDUTHS and 236 from GHKS) were selected and used for the study. Descriptive statistics (Table 1) showed more male than female admission in the two hospitals. The patient’s ages varied from a few months to 12 years, with majority aged 4 years or less (61 %) of age.

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Table 1

Results of Descriptive Statistics

Socio-demographic variables		N (%)
Gender	Male	385 (64.2)
	Female	215 (35.8)
Age (Years)	<1	189 (31.5)
	1-4	182 (30.3)
	5-8	125 (20.8)
	8-12	101 (16.8)

The WHO core indicators calculated for the two hospitals are shown in (Table 2) From the 600 prescriptions evaluated, 1564 drugs (912 from UDUTHS and 652 GHKS) were prescribed. The average number of drugs per encounter in UDUTHS and GHKS were 3.0 ± 0.4 and 3.2 ± 0.7 respectively. The percentages of encounter with an antibiotic prescribed in both hospitals were similar: 32.1% for UDUTHS and 31.1% for GHKS. Most antibiotics were targeted at respiratory tract infections. The percentage of drugs prescribed by generic name was 73.1% in UDUTHS and 32.5% in GHKS. In UDUTHS, 65.8% of prescribed drugs were EML, which was not similar to that of GHKS (26%). Injectable drugs prescribed per encounter were 3.6% in UDUTHS and 8.7% in GHKS (Table 2).

Table 2

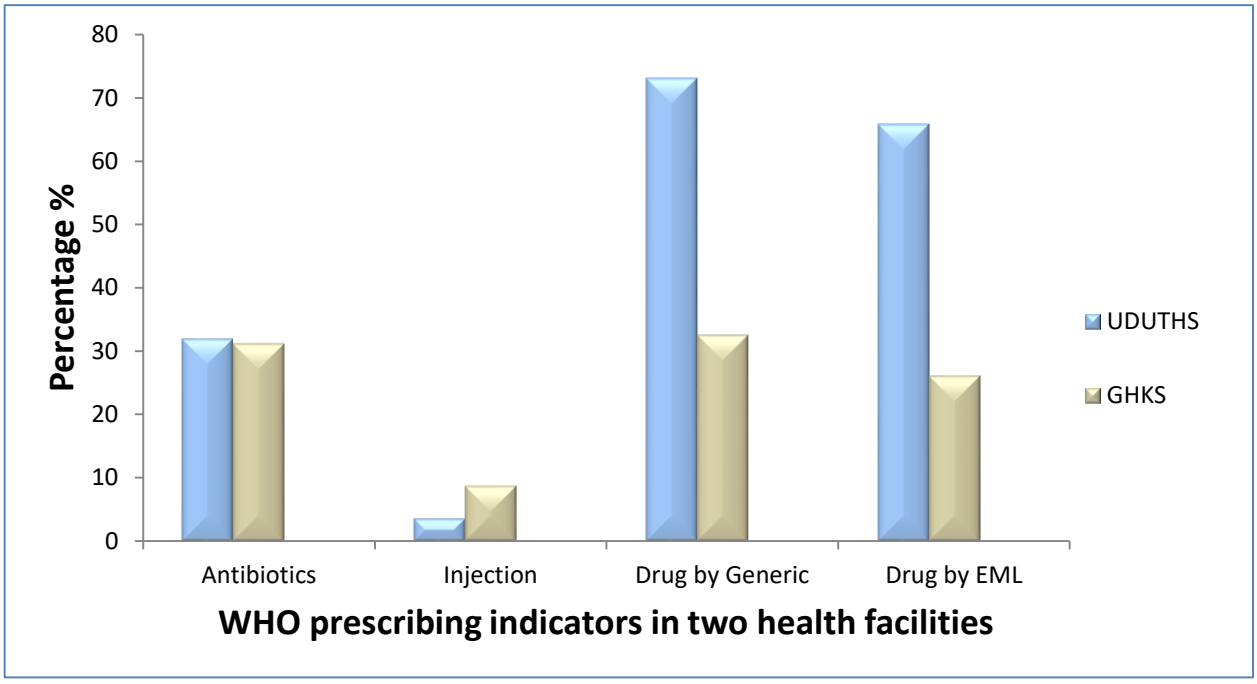
WHO prescribing indicators in the two health facilities

WHO Prescribing indicators	UDUTHS (N%)	GHKS (N%)
No. of drugs per encounter (mean ±SD)	3.0±0.4	3.2±0.7
Antibiotic prescribed/encounter	293 (32)	203 (31)
Injection prescribed/encounter	33 (3.6)	57 (8.7)
Drugs prescribed by generic name	667 (73.)	212 (32.5)
Drugs prescribed by EML	601 (65.8)	170(26)

N=Number, EML= Essential Medicine List

Figure 1

WHO prescribing indicators in the two health facilities



Antibiotics were prescribed for 496 children (Table 3). Roxithromycin 126 (21) was the most frequently prescribed antibiotic and was prescribed by the proprietary name. Amoxicillin was 120 with (20%) followed by Erythromycin 85 (14%) and Co-trimoxazole 73 (12.1%), Cefuroxime was 30 (5%), Amoxicillin + Clavulanic acid is 26 with (4.3%), Metronidazole prescribed to 21 patients with (3.5%) and Nitrofurantoin with 6 (1%), and second to the last one was Gentamicin 5 (0.83%) while Ampicillin found to be the lowest antibiotic prescribed in this survey with 4 (0.6%). All the prescribed drugs were in the

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Nigerian National Essential Drugs List, except for roxithromycin drugs. (Table 3).

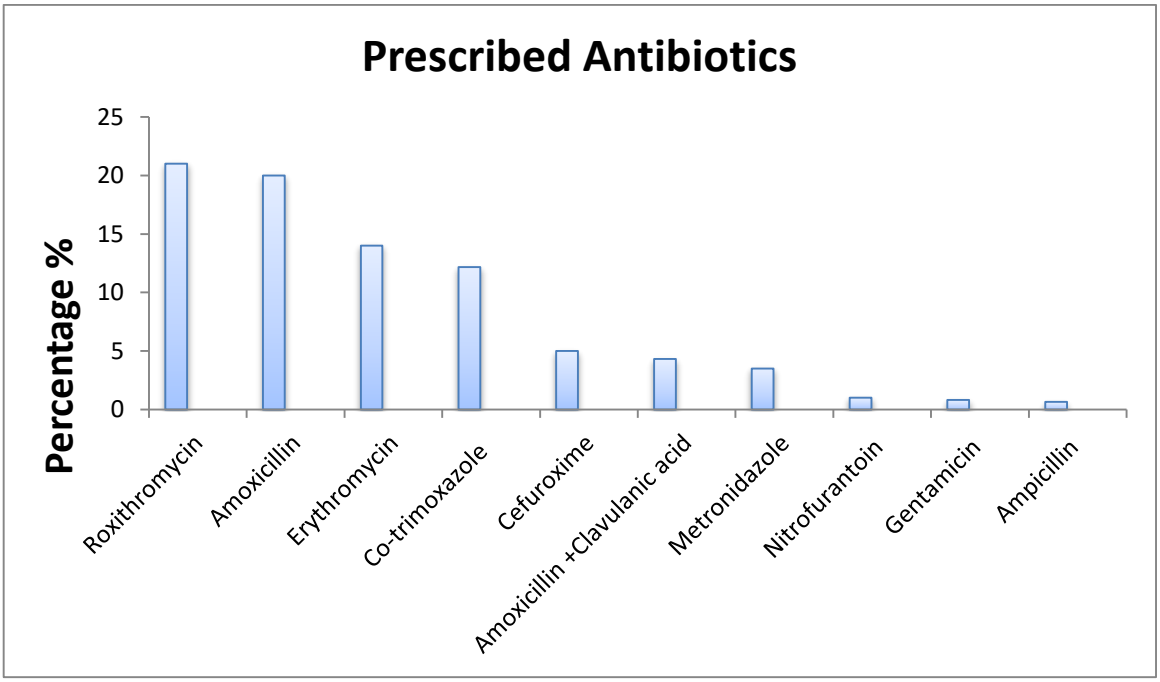
Table 3

Prescribed Antibiotics for Children

Antibiotic	Number Prescribed	Percentage (%)
Roxithromycin	126	21%
Amoxicillin	120	20%
Erythromycin	85	14%
Co-trimoxazole	73	12.1%
Cefuroxime	30	5%
Amoxicillin + Clavulanic Acid	26	4.3%
Metronidazole	21	3.5%
Nitrofurantoin	6	1%
Gentamicin	5	0.83%
Ampicillin	4	0.6%

Figure 2

The Chart of Prescribed Antibiotics for Children



4. Discussion

This study identified irrational use of drugs involving polypharmacy, high use of antibiotics and injectables and non-adherence to generic prescribing in pediatrics in the two hospitals studied. Rational prescribing is usually evaluated by conducting prescription audit at frequent intervals; the results of such studies are used to facilitate and promote rational drug use in health facilities (12, 13). Thus, the World Health Organization formulated a set of core drug use indicators that can be used to measure prescriber's performance, patients experience at health facilities and the degree of effectiveness of the health personnel (14, 15). The indicators used for these assessments are prescribing indicators, patient care indicators, facility indicators and complementary indicators (3).

Polypharmacy is an important component of irrational prescribing. It implies the use of many drugs in one prescription or the prescription of too many medications for a particular patient with associated risk of drug interactions and adverse drug reactions (13, 16). It is known that the

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number and severity of adverse medication reactions are directly related to the number of drugs administered (17). Thus, chances of polypharmacy occurring increase as the number of drugs in a prescription increases (10, 18). In the current study, the average number of drugs prescribed per encounter was 3.0 in UDUTHS and 3.2 in GHKS. These values are higher than the WHO recommended limit of not more than 2 drugs per encounter (3). Consequently, the observed higher values are indicative of higher risk of polypharmacy in these hospitals. Similar results have been obtained in other studies in Nigeria and Pakistan (6, 19). The use of high number of drugs which may have been influenced by factors like financial incentives to prescribers by medical sales representatives and/or inadequate therapeutic training of prescribers can lead to high risk of drug interactions, adverse effects and high medication cost to the patients (15, 16).

The percentage of antibiotics prescribed in the two hospitals is high compared to the WHO standard of 20.0 - 26.8 % (3). This finding is comparable to other findings in some hospitals in Nigeria in which the percentage of antibiotics prescribed per encounter was within the range of 50 - 70 % (20). This is similar to results from studies conducted in USA and Canada which showed that 50 and 85 % of antibiotics respectively, were prescribed inappropriately to children, with resultant increase in the cost of treatment, and adverse drug reactions (2, 10). The present study also observed that most of the antibiotics were targeted at respiratory tract infection and malaria with the Beta lactam antibiotics being the most prescribed. These observations are similar to the findings of Feudtuer et al who also expressed concerns over high use of antimicrobial and respiratory agents in pediatrics (13, 21). The use of generic names results in low treatment cost and prevents errors and confusion in writing and dispensing prescriptions. The percentage of drugs prescribed by generic name in the two hospitals was lower than the approved standard of 100 % (10, 12, 18). Factors responsible for prescribing with brand names include promotional activities by companies, pressures from company representatives, lack of continuing education and training on rational prescribing principles and non-familiarity with generic names by most prescribers (7, 14, 16, 22).

Although the percentage of drugs prescribed from the Essential Medical List (EML) was seen to be high in the two hospitals, they were still lower than the recommended value of 100 % (3, 17). This could be as a result of prescribers' lack of awareness of the EML for children, or non-adherence to the list by some prescribers. A high incidence of unapproved use of drugs (prescribing outside the recommended dosage, indication, route of administration, or age of patient) and unlicensed use of drugs in the pediatric population has been reported (8, 17, 23, 24). A study conducted in the Europe and Australia indicated that 80 - 93 % of neonatal medications were off-labelled or unlicenced, with an overall off-label prescription rates of between 25 % and 60 % across populations and mostly seen in children less than 2 years of age and also in adolescents (12, 21).

Finally, the study observed irrational prescribing seen in these hospitals may predispose their patients to high risk of adverse drug effects and harm. Although most other studies have also reported similar findings, poor implementation of evidenced-based prescribing with poor training attitudes especially in developing countries has allowed this problem to persist. Education and training of prescribers with the introduction of prescription review systems and periodic audits have been suggested as ways of improving prescription practices (3). These will help guarantee patients safety.

Antibiotics are one of the group of drugs involved in ADRs in children and are greatly misused and over-prescribed in Nigeria (6, 7, 12). Roxithromycin was the most frequently prescribed antibiotic and is not listed in the Nigerian National Essential Drug List (9, 25). The indications for the prescription of roxithromycin and other antibiotics in this study are not known, but it has been reported in Nigeria that malaria, upper respiratory tract infection and diarrhoea constituted the most common health conditions for which antibiotics are usually prescribed (4, 5, 25). Roxithromycin is not contained in the essential drug lists and its prescription is likely to be due to the product promotion and possible gifts to the prescribers from the pharmaceutical company producing and marketing this drug. Such influence on the prescribers has previously been reported in Nigeria (6, 25).

5. Conclusion

In conclusion, this study highlights the pervasive issue of irrational drug use in pediatric care within the two hospitals studied, characterized by polypharmacy, excessive use of antibiotics and injectables, and non-adherence to generic prescribing. The findings indicate that the average number of drugs prescribed per encounter

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exceeds the WHO recommended limit, suggesting a prevalent risk of polypharmacy with its associated dangers of drug interactions and adverse reactions. The high percentage of antibiotic prescriptions, far exceeding WHO standards, points to a systemic issue of over-prescription, which aligns with similar findings in various regions, leading to increased treatment costs and adverse drug reactions.

The study also underscores the underutilization of generic prescribing and the Essential Medical List (EML), influenced by factors such as promotional activities by pharmaceutical companies and a lack of continuous medical education on rational prescribing. The frequent prescription of non-listed antibiotics like roxithromycin, often driven by pharmaceutical promotion, further complicates the issue, as it may lead to inappropriate drug use and resistance.

The observed irrational prescribing practices not only increase the risk of adverse drug effects and financial burdens but also reflect a broader issue of inadequate training and awareness among prescribers. To combat these challenges, the study suggests the implementation of more robust education and training programs for prescribers, the introduction of prescription review systems, and the enforcement of periodic audits. These measures are critical in promoting rational drug use, ensuring patient safety, and ultimately improving healthcare outcomes in the pediatric population. The study's findings call for urgent attention and action from healthcare providers, policymakers, and stakeholders to address the irrational use of drugs and to foster a more rational, safe, and cost-effective prescribing culture.

Authors' Contributions

A. A.: Conceptualization of the study, Methodology design, Supervision of the research, Writing of the article; F. R. F.: Data collection, Data curation, Formal analysis and investigation, Writing of the article; H. R.: Contributed to the study design, Literature review, Writing assistance and editing; K. P.: Statistical analysis using SPSS software, Interpretation of statistical results.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethics Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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