Antibiotic Utilization Pattern in Pediatrics Unit South–South of Nigerian Teaching Hospital

Mgbahurike A.A. 1, Ojiyi I.D. 1, Chijioke-Nwauche I. N. 1

Department of Clinical Pharmacy and Pharmacy Management, Faculty of Pharmaceutical Sciences, University of Port Harcourt, Rivers, Nigeria

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ABSTRACT

Background to study: Irrational prescribing of antibiotics in the pediatrics units is a global concern which requires periodic evaluation and monitoring. The concern is due to antimicrobial resistance emergence and an overall rise in health care cost as well as non-adherence to standard guidelines in prescription pattern.

Objective: The study aimed to assess the utilization pattern of antibiotics in the pediatrics unit of University of Port Harcourt Teaching Hospital.

Method: A retrospective cross sectional study of inpatient and outpatients in the unit who were diagnosed with one or more infection that required the use of at least one antibiotic, between January 2018 and June 2019, was conducted. A total of 249 cases were reviewed. Data extracted from the patients’ folders include demographic information; antibiotic prescribed; indication for which the antibiotic was prescribed; dosage forms; route of administration; and number of antibiotics per prescription.

Result: There were more male, 137 (55%) patients than the female. The highest, 83 (33%) number of these children were less than 12 months (1year) old, and the least number, 21 (9%), were 12 years to 18 years old. Overall children below 5 years 153 (61.4%) received more antibiotics than the 5 years and above. Upper respiratory tract infection (n=80) was the most frequently diagnosed infection while bronchopneumonia ranked fourth. Cephalosporin class n=142 (57%) of antibiotics particularly cefuroxime was the most commonly prescribed followed by the penicillin with Amoxicillin –Clavuunic acid, n =56 (22%) being the most used. Oral route of administration (86.3%) was mostly employed with suspension dosage form (53%) the highest. Level of parenteral route was 11.6%. Conclusion: Parenteral route of antibiotic use falls within WHO recommendation, but antibiotic prescription here was largely empirical. Cephalosporin class and Penicillin group are the most commonly utilized antibiotics in this unit.

Key words: Antibiotic Utilization–Pediatrics–Teaching hospital

1 INTRODUCTION

Irrational prescribing of antibiotics in the pediatric unit is a global concern which requires periodic evaluation and monitoring. The concern is due to antimicrobial resistance emergence and overall rise in health care cost and non-adherence to standard guidelines in prescription pattern. Antibiotic are types of antimicrobial substances which are active against bacteria, and they are the most important type of antibacterial agents for fighting bacterial infections. [1] The antimicrobial substance may either be bacteriostatic or bactericidal. Antibiotics are generally used in the treatment and prevention of bacterial infections. [2] An infectious disease diagnosis is reached by determining the site of infection, defining the host, and establishing when possible, the offending pathogen. Sometimes, before a definitive therapy is initiated, an empirical therapy may be useful, as the laboratory tests may need several days to yield results; this would require a broad-spectrum antibiotic. [3] On the other hand, if the offending pathogen is established a definitive therapy can be started, and this would require a narrow-spectrum antibiotic. It is also important to know that identifying the microbial organism can reduce the cost and supposed toxicity of therapy, as well as, the emergence of antimicrobial resistance. [3]
Antibiotic may be given prophylactically; though this is usually limited to at risk populations, such as those with compromised immune system, patients on immunosuppressant drugs, cancer patients, and patients undergoing surgery. [2]

Administration of antibiotic is mainly through the oral route, although other forms such as, intravenous, topical route could be administered when indicated. [1, 3, 4]

Antibiotics used in adults cannot be directly used on children. Although some antibiotics used in adult have proven to be safe in children with little side effect, we must note that children are different from adults. [5] There is a large difference between the pharmacokinetics of adults and that of children. As a result of this, there is a difference in therapeutic efficacy and toxicity of various antibiotics used in children. Due to known toxicity of certain drugs such as; chloramphenicol, the sulphonamides, and tetracycline, should not be used in neonates. Organs in neonates are not well developed, therefore antibiotic therapy should be adjusted to meet their demands. As a result of poor metabolism, excretion), serum concentration of many antibiotics may be increased, and their actions prolonged in neonates when compared to older infants, thus, lower doses, at longer intervals between hem are used in children. [6, 7].

Antibiotics are an unnoticeably abused class of medications; they have a very wide spread in both the hospital and the community setting. Respiratory Tract Infections (RTIs) account for more primary care consultations than any other group of illnesses and are the most likely reason for a parent or care-giver to contact a health professional, some of which does not require initial or prompt antibiotic treatment. [8] The rising incidence of bacterial resistance to most commonly used antibiotics, especially multi-drug resistant Pneumococci, has necessitated the judicious use of antibiotics in pediatrics practice. [9] These problems of resistance can lead to therapeutic failure due to increase side effects from drug combinations and use of harmful alternatives. Many of these antibiotics are prescribed for wrong purposes, such as viral infections (e.g. common cold) which do not require antibiotic treatment, as they are self-limiting. This dangerous trend can result to high cost of healthcare services in developing countries, and also increase the burden on research to determine other alternatives for these multi-drug resistant infections. In order to prevent these problems, there is need to make proper diagnosis, follow standard antibiotic-use guidelines, and identify first line of treatment with lesser side effects. The World Health Organization (WHO) developed the prescribing indicators to measure the rational use of drugs in primary health care facilities and to measure the prescribing pattern of antibiotics. [10] A number of professional societies have issued guidelines to monitor the use of these medications to achieve a safer and cost-effective course of treatment in the healthcare sector [11, 12]. A proper study on how this medications are utilized is essential to implement these guidelines set for the effective use of these medications. Inappropriate antibiotic dispensing and use, due to commercial interests and lack of knowledge about the rational use of antibiotics and antibiotic resistance, were the main findings of in-depth qualitative study [13]. Development of resistance by some strains of organism is an important knowledge that need to be utilized by prescribers. This study therefore aimed to assess the antibiotic utilization pattern in pediatric unit of a Nigerian Teaching Hospital.

2 METHOD

2.1 Study Area

The study was carried out at the Pediatrics Unit of the University of Port Harcourt Teaching Hospital (UPTH). UPTH is a tertiary hospital located at Choba, in Port Harcourt, Rivers State in the South-South Zone of Nigeria. The hospital receives referrals from other hospitals and health centres within and outside Rivers State. The department is responsible for children emergency cases ‘CHEW’, special care for babies ‘SCBU’ and children out-patient ‘CHOP’ amongst others.

2.2 Study Design

A retrospective study of in-patient and out-patient case notes of the pediatric population was carried out in the hospital between January 2018 and June 2019.

2.3 Study Population

In-patient and out-patient cases of children in the pediatrics department of UPTH who were diagnosed with one or more infectious disease and that were prescribed at least one or more antibacterial agent

2.4 Sample Size

Based on an estimated record of a total of 658 in-patient and out-patient cases (for the study period) obtained from the record unit, folders of children (aged one month to twelve years) in pediatric department of UPTH, who were diagnosed with one or more infectious diseases and prescribed one or more antibiotics were obtained. Sample size was determined using Taro Yamane (20) sample size formula.

\[
\text{Where } n = \frac{N \times e^2}{(N - 1) + e^2}
\]

Where n= sample size
N= population size
e= margin of error

2.5 Inclusion Criteria

Medical records of pediatric (in-patients and out-patient) who was prescribed at least one antibacterial agent. And aged below 18 years

2.6 Exclusion Criteria

Neonates, and patients from other departments, patient case folders with no antibiotics and those with incomplete...
information such as patient demographics and ineligible writings were excluded.

2.7 Ethical Considerations

Ethical approval was obtained from the University of Port Harcourt Teaching Hospital (UPTH) research ethics committee before permission was granted for use of the facility for study. Approval number UPTH/ADM/90/S.II/VOL.XI/825.

2.8 Data Collection

Using data collection form, information extracted from the patients’ chart include demographic characteristics, body weights, disease condition for which the antibiotic was prescribed; drug data information including name of the drug, dosage regimen; dosage form; route, and frequency of administration. Other drugs other than Antibiotics, were not included in the study.

2.9 Data Analysis

Drug data and patient characteristic data were computed using Microsoft Excel and SPSS statistical package. The results were expressed as proportions or as means ± standard deviation (SD). The retrieved medical records contained most of the required information.

3 RESULTS

A total of 249 cases were reviewed in pediatrics Unit of University of Port Harcourt Teaching Hospital. The demographic data of the study group is shown in Table 1. There were more male patients than female patients, (n=137, 55%) and (n=112, 45%) respectively. The mean age of all the patients was 4.86 ± 4.62years and their average weight was 21.73 ± 16.41. Children less than 12 months had the highest occurrence (n=83, 33%), 1year to 5 years occurred n=70, 28%, 5years to 12 years occurred n=75, 30% and 12years to 17years occurred least n=21, 9%.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Proportion</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>137</td>
<td>55%</td>
</tr>
<tr>
<td>Female</td>
<td>112</td>
<td>45%</td>
</tr>
<tr>
<td>Age</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1month &gt; 12 months</td>
<td>83</td>
<td>33%</td>
</tr>
<tr>
<td>1 year - &gt; 5 years</td>
<td>70</td>
<td>28%</td>
</tr>
<tr>
<td>5years - &gt;12years</td>
<td>75</td>
<td>30%</td>
</tr>
<tr>
<td>12 years – 18 years</td>
<td>21</td>
<td>9%</td>
</tr>
</tbody>
</table>

Figure 1 shows the various dosage forms of antibiotics used in the management of the infections in the Unit, and suspension is the most commonly used dosage form.

The different routes of administration employed is shown in Figure 2. Oral route of administration was shown as the most frequently (86.3%) route of administration, while intravenous route was 11.6%.

Figure 1. Various antibiotic dosage forms utilized in the pediatric Unit

Figure 2. Various routes of administration of antibiotics in the pediatric Unit

The result of the study illustrated in Figure 3, further showed the different classes of antibiotics used in the management of infections in the Unit. Cephalosporin was the most frequently prescribed class (n = 142(57%), particularly Cefuroxime (n=117). This is followed by the Penicillin group (34%) with amoxicillin –clavuvinic acid occurring in n = 56(22.5%) cases.

In Table 2, the specific diagnosis for which the antibiotic was prescribed and the individual antibiotic utilized is shown.

| *AMC=Ampicillin, AMX=Amoxicillin, APC=Ampicillin/loxacin,AZM=Azithromycin, CFM=Cefixime,CHL=Chloramphenicol,CIP=Ciprofoxacin, CPD =Cefpodoxime, CRO=Ceftriazone, CXM=Cefuroxime, ERT= Erthromycin, GENT = Gentamycin, URTIs=Upper respiratory tract infections, UTI =Urinary tract infection |
|----------------|-------------|----------------|
| Variable       | Proportion  | Percentage     |
| URTIs          | 80          | 32%            |
| UTI            | 13          | 5%             |
| Upper respiratory tract infections | 67          | 27%            |
| Cefuroxime     | 36          | 14%            |

The result showed that upper respiratory tract infection (URTI) (n= 80) is the commonest diagnosed infection and in majority of the cases, cefuroxime (n= 36) was prescribed.
Table 2. Frequency of Individual antibiotic utilized for specific diagnosis in the Unit (N = 249)

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>*AMC</th>
<th>AMX</th>
<th>APC</th>
<th>AZM</th>
<th>CFM</th>
<th>CHL</th>
<th>CIP</th>
<th>CLR</th>
<th>CPD</th>
<th>CRO</th>
<th>CXM</th>
<th>ERY</th>
<th>GENT</th>
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</thead>
<tbody>
<tr>
<td>URTIs (80)</td>
<td>27</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>36</td>
<td>2</td>
</tr>
<tr>
<td>Tonsillitis (62)</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>Pharyngitis (11)</td>
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<td>0</td>
<td>0</td>
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<td>0</td>
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<td>4</td>
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<td>UTI (26)</td>
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<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
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<td>10</td>
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<tr>
<td>Bronchopneumonia (21)</td>
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<td>3</td>
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<td>0</td>
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<td>4</td>
<td>4</td>
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<tr>
<td>Peptic ulcer disease (4)</td>
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<tr>
<td>Pertussis (3)</td>
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<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Bacteria conjunctivitis (4)</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Meningitis (8)</td>
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<td>0</td>
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<td>0</td>
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<td>0</td>
<td>8</td>
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<tr>
<td>Mumps (1)</td>
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<td>1</td>
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<td>0</td>
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<tr>
<td>Steven Johnsns syndrome (1)</td>
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<td>0</td>
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</table>

Figure 3. Different classes of antibiotics prescribed in the pediatrics Unit

Cefuroxime was also employed in the second most frequent diagnosed infection, tonsillitis n =62 cases. Urinary tract infection was the third in line of the infections while bronchopneumonia ranked fourth, n =21. Amoxicillin was found to be prescribed in a case of mumps. [14]

4 DISCUSSION

This study aimed to assess the antibiotic utilization pattern in pediatric unit of a typical Nigerian Teaching Hospital. A total of 249 children cases were reviewed. The result showed that there were more male children than female. Overall, their mean age was 4.86 ± 4.62 years and their average body weight was 21.73 ± 16.41kg. The highest number of these children were less than one year (>12 months) 83(33%). These results are in line with similar study by Choudhury and Bezburaah [15] in India where the highest number of children in the study were age group less than one year. Also previous similar study by Thapliya et al. [16] added credence to the finding that the age group less than 1 year received antibiotics more frequently than older children. Among the 249 cases reviewed, male children were more than the female children. Similar findings were reported by Khaled et al [17] ; Girma et al. [18] and many others [19–22] previous findings are in accord with these findings. These results may be explained by the possibility that this age group (>1 year) are more susceptible to infection than the older children and presumably the male children are more vulnerable than the female.

This study showed parenteral route of administration to be 11.6% Figure 2. This compared closely to similar study among admitted children in Sierra Leone [23] but in contrast to previous study in a different setting in Nigerian tertiary hospital by Anyanwu and Arigbe- Osaka that reported 80 – 886% parenteral [24] route of administration. Achalu et al [25] in Southern Ethiopia reported 90.17% of parenteral antibiotic administration among the pediatric patients studied, while in Palestine [26] similar study reported 61.8% parenteral route of administration. Report in Tamilnadu, India [19] , parenteral administration accounted for 58.3% which somewhat compared with report in Bishoffu hospital, India [27] where parenteral route accounted for 83.1%. Meanwhile, in Pakistan, the report is as high as 96% for parenteral antibiotic administration [28]. World Health Organization (WHO) recommends only 13.4 to 24.1% of injectable from the total prescriptions for health care settings. This present result compared favorably to WHO recommendation and this may be attributed to skills among the healthcare providers and availability and use of treatment guidelines. [10, 29].

While the most common route of administration was via the oral route, suspension dosage form was mostly employed. Oral route of drug administration is known to be the safest route of drug administration as the tendency for use of more injections than ideal is evidence for irrational medicine, of a public health concern. Apart from its potential to generate hazardous waste, it predisposes to unwarranted pain, promotes the spread of blood- borne infections,
development of complications and promote microbial resistance [30] as well as increase health cost. The result of this study further revealed that Cephalosporins were the most prescribed class of antibiotic 57% Figure 3 in the pediatric Unit, particularly cefuroxime which is a second generation cephalosporin. The second most prescribed class was the Penicillin (34%), especially amoxicillin – clavulanic acid (Augmentin). These finding are in agreement with some previous studies [18, 27, 31] that reported cephalosporin as the most commonly prescribed class of antibiotic in pediatric unit. Mean this differs from some other study done in different setting in Southern Nigeria [32], where gentamicin (Penicillin class) was reported as the most prescribed antibiotic then. This disparity may be attributed to availability of antibiotics or updated prescription guideline with emergence of newer evidence based medicine. Third generation cephalosporin were also prescribed, such as cefixime, ceftriaxone and cefpodoxime. Both classes are given more commonly because they cover a wide range of bacterial infection otherwise known as broad spectrum antibiotics. Most therapies were empirical; this may be most likely due to delays in making a definitive diagnosis. This is similar to the study reported by Prabahar et al [33] where most of prescription in the study contained antibiotics given on empirical basis that is without confirmation of diagnosis and Hekster et areport that the antibiotic prescription was independent of diagnosis in over 50% of the hospitalized children. The broad spectrum antibiotics are good enough for this purpose, and so are used more commonly, however, according to Medscape 2019 [34, 35], the safety and efficacy of cefuroxime has not been established in children less than 3 months of age. Cephalosporins are more preferred to Penicillins as bacteriologic cure and clinical cure were both significantly more likely with Cephalosporin than with Penicillin [36]. Another reason for the preference Cephalosporin to penicillin is due to an increased risk of allergic reactions with penicillins. However, first generation cephalosporin are excluded as they confer an increased risk allergic reactions with penicillins. However, first generation cephalosporin were also prescribed, such as cefixime, ceftriaxone and cefpodoxime. Both classes are given more commonly because they cover a wide range of bacterial infection otherwise known as broad spectrum antibiotics. Most therapies were empirical; this may be most likely due to delays in making a definitive diagnosis. This is similar to the study reported by Prabahar et al [33] where most of prescription in the study contained antibiotics given on empirical basis that is without confirmation of diagnosis and Hekster et areport that the antibiotic prescription was independent of diagnosis in over 50% of the hospitalized children. The broad spectrum antibiotics are good enough for this purpose, and so are used more commonly, however, according to Medscape 2019 [34, 35], the safety and efficacy of cefuroxime has not been established in children less than 3 months of age. Cephalosporins are more preferred to Penicillins as bacteriologic cure and clinical cure were both significantly more likely with Cephalosporin than with Penicillin [36]. Another reason for the preference Cephalosporin to penicillin is due to an increased risk of allergic reactions with penicillins. However, first generation cephalosporin are excluded as they confer an increased risk of allergic reactions among patients with penicillin allergy. Cefuroxime, which is the most prescribed in this study, does not increase risk of allergic reaction [37].

Gastroenteritis accounted for n=3 diagnosis in this study. In two cases cefuroxime was prescribed for treatment, and in one case ceftriaxone was utilized. Meanwhile, according to Oxford pediatric antibiotic prescribing guideline 2015, no antibiotic is required for this diagnosis. This study identified upper respiratory tract infection (n = 80) as the most occurring clinical indication for the antibiotic prescribed, and tonsillitis (n = 62) was the second most commonly diagnosed, while bronchopneumonia ranked fourth in frequency. This finding differed from the study done in pediatric ward of Bishoftu hospital East Ethiopia, which revealed that pneumonia was the most frequent clinical indication for which antibiotic was prescribed in hospitalized children. [27] The reason for this disparity may be environmental difference or seasonal variation. This study identified a case of mumps for which amoxicillin was prescribed. Because mumps is a viral infection, antibiotic cannot be used to treat it and at present there is no antiviral medication that can treat mumps. Current treatment can only help relieve the symptoms until the infection has run its course and the body has built up immunity, much like cold, Mumps is caused by rubula virus and it’s extremely contagious. [38]

5 CONCLUSION

Antibiotic utilization pattern in the pediatrics Unit of University of Port Harcourt Teaching Hospital falls within WHO recommendation for parenteral administration. However, the use of empirical therapy is still prevalent with cephalosporin class being the most commonly prescribed antibiotics. Again the use of antibiotic in certain diagnosis like mumps should be justified.

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[35] ;


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