

# ANTIBACTERIAL

*Usage*

in four service delivery units  
in Federal Medical Centre, Yenagoa

## ABSTRACT

**Background:** Antibacterial agents are one of the most widely used drugs due to high prevalence of bacterial infections particularly in the tropical regions. It is therefore important to understand the pattern of their use particularly in our local environment. This will help to minimise the emergence of bacterial resistance in the community as well as optimising the effectiveness of antibacterial agents. The aims of this study are to determine the pattern of antibacterial drugs prescription in the hospital and the indications for which the antibacterial drugs were prescribed.

**Methods:** Two hundred and twenty (220) patients' case notes were obtained by systematic random sampling in the General Out- Patient Department (GOPD), Paediatric ward, Male surgical ward and Accident & Emergency (A&E) unit from April to June 2013.

**Results:** For the treatment of in-patients, the most preferred route of administration of antibacterial drugs was intravenous followed by the oral route. The antibacterial class of the cephalosporins were the most used prescribed in all service units accounting for approximately 40% of cases encountered followed by the nitroimidazoles, aminoglycosides and quinolones which accounted for 19%, 14% and 9% respectively. The two antibacterial drugs combination accounting for 42% was the most used while four antibacterial drugs combination accounting for 6.7% was the least used. Metronidazole and gentamicin were the drugs of choice used in combination with others. Metronidazole was the most prescribed antibacterial drug.

**Conclusion:** Cephalosporins were the most used class of antibacterials. For antibacterial combination therapy, metronidazole and gentamicin were most preferred. The two antibacterial drugs combination was used in 42% of encountered cases. The disease conditions for which antibacterials were prescribed were found to be justified.

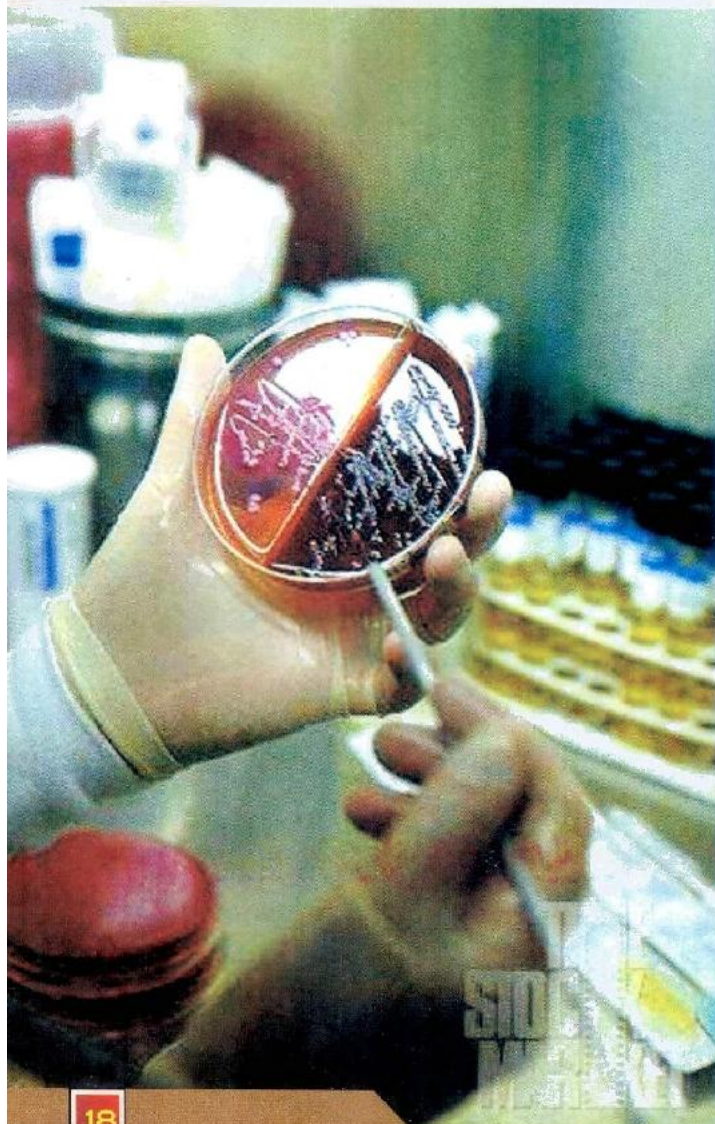
## Keywords:

Antibacterial agents, diagnosis, duration of treatment, prescribed.

## INTRODUCTION

At some point in life, everybody is likely to suffer an infection

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that will require treatment with antibacterial agents. However, such an infection is unlikely to become serious unless there is underlying chronic condition, a complication, or when a highly resistant pathogen is implicated. Drug therapy is the most commonly used method of any disease treatment more so infectious diseases<sup>1</sup>. The constantly changing pattern of bacterial sensitivity has been a prime factor contributing to the use of antibacterial agents thus there is a wide range of antibacterial agents available for the treatment of patients<sup>2</sup>. The antibacterials available for the treatment of patients fall into one of the following classes: *Penicillins, Cephalosporins, Aminoglycosides, Macrolides, Tetracyclines, Quinolones, Nitroimidazoles, Sulphonamides and others*. Resistance to antibacterials is recognized as a significant threat to public health by compromising ability to treat infections effectively. It is widely acknowledged that antibacterial resistance is driven by high rates of antibacterial prescribing.

Evidence-based antibacterial guidelines are key tools to improve prescribing of antibacterial drugs, reduce the progression of antibacterial resistance and optimize patient outcomes<sup>3</sup>. WHO Surveillance of antibacterial use tracks how and why antibacterials are being used and misused by patients and healthcare providers. Monitoring antibacterial prescriptions and consumption behaviour provide insights and tools needed for informed therapeutic decisions; assess the public health consequences of antibacterial misuse, and to evaluate the impact of resistance containment interventions. Published studies on

antibacterial drug utilization have been cited in various biomedical literatures both in Nigeria and internationally. In a study at Abeokuta, Ogun State Nigeria, the penicillins and the cephalosporins were prescribed mostly for upper respiratory tract infections (URTI). Amoxicillin was prescribed for 9.9% of patients, Ampiclox (Ampicillin + Cloxacillin) for 16.1% of patients and Amoxiclav for 4.8% of patients. Cefuroxime the only cephalosporin was prescribed for all the conditions diagnosed<sup>4</sup>. In the USA, a study reported that flouroquinolones (51.4%), ceftriaxone (45%) and azithromycin (42.1%) were the three most commonly prescribed antibacterials for the treatment of hospitalized patients diagnosed of nursing homes acquired pneumonia<sup>5</sup>.

In a study carried out in a Nigeria military hospital 28.1% of patients prescriptions contained antibacterials<sup>6</sup>. In University of Ilorin Teaching Hospital (UITH) Ilorin, Kwara State of Nigeria it was reported that 83.5% of prescriptions had at least one antibacterial and that the penicillins were observed to be the most commonly prescribed antibacterial drugs.<sup>7</sup>

According to the Irish primary care guidelines for antimicrobial use, prescribing an antibacterial drug should be done only when there is likely to be a clear clinical benefit to the patient. One should consider a no, or delayed antibacterial drug therapy for acute sore throat, common cold, acute cough and acute sinusitis as well as limiting over the telephone prescribing to exceptional cases. Prescribed doses, duration of treatment and preferred route of administration of antibacterial drugs should be based on the following: severity of illness, age, weight,

rapidity of expected outcome and spectrum of activity of antibacterial drugs. Other factors of importance include availability and affordability of choice antibacterial drug. In severe or recurrent cases, a larger dose or longer duration at normal dose should be considered. Prescribers should avoid over-use of broad spectrum antibacterials (e.g. co-amoxiclav, quinolones and cephalosporins) as this can increase the risk of emergence of penicillin non-susceptible pneumococci, *Clostridium difficile*, Methicillin Resistant *Staphylococcus aureus* (MRSA) and resistant urinary tract infections (UTIs). Prescribers should consider the use of narrow spectrum agents for example, amoxicillin, cloxacillin, flucloxacillin, and trimethoprim. Reserve the use of cephalosporins and quinolones for cases where there is a clear rationale such as where the guideline recommends. Such cases will include the presence of true allergy with little alternative, specific indication for the agent and indication that is based on microbial sensitivity test results. Widespread use of topical antibacterials (especially those agents also available as systemic preparations, e.g. fusidic acid should be not be encouraged<sup>3</sup>.

Guidelines for antibacterial use differ from one hospital to another as result of the location of the hospitals in different communities and regions. The general pattern of hospital microbial sensitivity usually follows the pattern in the host communities. It is known that hospitalised patients are generally systemically unwell. This may be as result of possible recent exposure to antibacterials in the community, failed initial antibacterial therapy and increased severity of illness. Therefore, hospitalised patients may

require more prompt therapeutic interventions in the form of intravenous broad spectrum antibacterial injections.

The Federal Medical Centre, Yenagoa being a tertiary hospital sources its antibacterial drugs from amongst the available drugs that are manufactured or imported and marketed in Nigeria. There are over 140 prescribing doctors in the hospital who are expected not only to prescribe the most applicable drugs for diagnosed conditions but are also expected to do so in line with the provisions of the National Essential Drug List and the hospital formulary. To this end it has become necessary to evaluate the antibacterial drug prescription pattern in the hospital. The objectives of this study are to determine the pattern of antibacterial drugs prescription in the hospital and the indications for which the antibacterial drugs were prescribed.

#### METHOD

The study was undertaken in the Federal Medical Centre, Yenagoa, Bayelsa State which is a tertiary health facility with a capacity of three hundred and fifty (350) beds. It renders both general and specialists care in Medicine, Surgery, Paediatrics, Obstetrics and gynaecology. Other specialties include orthopaedics, ophthalmology, Public Health, Renal dialysis, Urology, Mental health, Dental Surgery and Accidents and Emergency. The hospital runs decentralized pharmaceutical services. The hospital has 140 doctors out of which 22 are consultants in various medical and dental disciplines. Other health professionals of the hospital include 40 Medical Laboratory Scientists, 26

Pharmacists, about 350 Nurses and others such as optometrists, physiotherapists etc.

This is a retrospective study evaluating antibacterial usage in four service units in FMC Yenagoa. The selection criteria include children and adults (male and female), aged between less than 1 and 85 years of different ethnic, social, marital and religious backgrounds.

One thousand One hundred (1100) case notes of discharged and follow-up patients from the General out-patient clinic, Male surgical Ward, Paediatric ward and Accident and Emergency unit for the period covering April to June 2013 were obtained from the Medical Records Department. Out of this number, 220 case notes were chosen by systematic random sampling method taking every 5<sup>th</sup> case note of patient diagnosed and had at least one antibacterial prescribed. The following data were extracted and fed into MS Excel 2007 for analysis: age, sex, prescribed dose, dosage form, duration and frequency of prescribed antibacterials. Results are presented using simple descriptive statistics of mean, standard deviation, frequencies and percentages in tables and figures.

#### RESULTS:

From the two hundred and twenty (220) patients' medical case notes which were obtained for the study 52% were males and 48% were females. Paediatric ward had 17.2% male and 19.5% female, male surgical ward had 11.4% all males while in A&E, there were 8.6% male and 6.8% female. GOPD had 14.5 % male and 21.8% female (Figure 1). One hundred and forty seven (147) cases had definitive diagnoses which were classified using the International

coding for Diseases (ICD 9) classification. 23.3% of the paediatric patients were diagnosed of infectious and parasitic diseases. 29.3% of paediatric patients were diagnosed with diseases of the respiratory system while diseases of the blood and digestive systems had 12% each. Patients in the male surgical ward had diseases of the digestive system, diseases of the skin and subcutaneous diseases which accounted for 22.7% each while neoplasms accounted for 40.9%. Symptoms and signs of ill defined conditions were diagnosed in 22.9 % of patients in GOPD. Diseases of the respiratory system, digestive system and genitourinary system were diagnosed in 16.1%, 16.1% and 12.9% of cases respectively. At the A&E Infectious and parasitic diseases, diseases of the musculoskeletal system were diagnosed in 26.3% patients each while complications of pregnancy and child birth were diagnosed in 15.75%. See table 1.

Intravenous injection form of antibacterial drugs was the most prescribed dosage form in a 47.6% of the cases. Oral tablets were prescribed in 31.9% of cases. The least prescribed dosage forms were the topical preparations, eye drops and intramuscular injection at 3.1%, 2.1% and 0.3% respectively (Table 2). The mean duration of prescribed parenteral medications in days for paediatrics is  $4.94 \pm 2.62$ , male surgical  $4.05 \pm 2.11$ , A&E  $1.60 \pm 0.90$ , Mean duration prescribed for oral medications in days for paediatrics is  $6.24 \pm 3.72$ , Male surgical  $6.90 \pm 2.97$ , A&E  $3.19 \pm 3.12$ , and  $6.25 \pm 1.93$  at GOPD (table 3).

Metronidazole accounted for 20% of prescribed antibacterials. Ceftriaxone and gentamicin accounted for 17.3% and 14.5%

respectively. Most prescriptions had more than one antibacterial agent used in the course of treatment, two antibacterial combination accounted for 42%, while three antibacterial combination accounted 14.7%, four antibacterial combination accounted is 6.7%. One drug therapy accounted for 36.6% (Figure 2). The overall summary of classes of antibacterial agents prescribed for patients shows that cephalosporins were the most used antibacterial class (38.8%). Others were nitroimidazole 19%,

aminoglycoside 13.9%, penicillin 12.3%; quinolone 9%, (Figure 4). Prescribers in the paediatric ward used gentamicin in 73.5% of paediatric treatment. Gentamicin was prescribed in 14.5% cases of all patients under study. All of the cefotaxime and 70% of prescribed ceftazidime were used in the paediatric ward. There was also some minimal quantity usage of flouroquinolones (ciprofloxacin and ofloxacin). The paediatric ward also accounted for 66.7% of the prescribed amoxiclav.

Flouroquinolones were more prescribed in GOPD than in other units. The use of metronidazole was reasonably spread amongst all the units except A & E. The most prescribed antibacterial drug was metronidazole (20%). The least used antibacterial drug in this study was amoxicillin (1.9%). Generally, the paediatric ward showed good preference for the cephalosporins than other units. See table 4.

**Table 1: Summary of diagnoses for which antibacterial agents were prescribed classed according to ICD 9**

Service delivery Unit	Pead A	M.Surg	A&E	GOPD
Diagnosis classification(ICD9 Code)	f (%)	f (%)	f (%)	f (%)
Infectious and Parasitic diseases(001-139)	16(23.3)	0(0)	5(26.3)	3(9.7)
Neoplasm(140-239)	0(0)	9(40.9)	0(0)	0(0)
Endocrine, nutritional and metabolic diseases, and immunity disorders(240-279)	2(2.7)	0(0)	2(10.5)	1(3.2)
Diseases of the blood and blood forming organs(280-289)	9(12.0)	0(0)	0(0)	0(0)
Mental disorders(290-319)	0(0)	0(0)	0(0)	1(3.2)
Diseases of the nervous system(320-359)	6(8.0)	0(0)	0(0)	0(0)
Disease of the sense organs(360-389)	0(0)	0(0)	1(5.25)	0(0)
Diseases of the circulatory system(390-359)	0(0)	0(0)	0(0)	5(16.1)
Diseases of the respiratory system(460-519)	22(29.3)	0(0)	2(10.5)	1(3.2)
Diseases of the digestive system(520-579)	9(12.0)	5(22.7)	0(0)	5(16.1)
Diseases of the genitourinary system(580-629)	0(0)	1(4.5)	1(5.25)	4(12.9)
Complications of pregnancy, childbirth and the puerperium(630-679)	0(0)	0(0)	3(15.75)	3(9.7)
Diseases of the skin and subcutaneous tissue(680-709)	2(2.7)	5(22.7)	0(0)	0(0)
Diseases of the musculoskeletal system and connective tissue(710-739)	8(10.7)	2(9.1)	5(26.3)	1(3.2)
Symptoms, signs, and ill-defined conditions(780-799)	1(1.3)	0(0)	0(0)	7(22.6)
External causes of injury and supplemental classification(E and V)	0(0)	0(0)	1(5.25)	0(0)
Other not defined				
<b>Total</b>	<b>75(100)</b>	<b>22(100)</b>	<b>19(100)</b>	<b>31(100)</b>

Table 2: Summary of dosage forms prescribed

Dosage form	Peadiatric A & B[f(%)]	Male Surgical [f(%)]	A&E [f(%)]	GOPD [f(%)]	Total [f(%)]
INTRAVASCULAR INJECTIONS	126(63.3)	46(50)	9(25)	4(6.4)	185 (47.6)
INTRAMUSCULAR INJECTIONS	1(0.5)	0(0)	0(0)	0(0)	1 (0.3)
TABLETS	25(12.6)	43(46.7)	9(25)	47(75.8)	124 (31.9)
CAPSULES	0(0)	1(1.1)	8(22.2)	8(12.9)	17 (4.4)
EYE DROPS	6(3.0)	1(1.1)	1(2.8)	0(0)	8 (2.1)
SYRUPS/SUSPENSIONS	35(17.6)	0(0)	7(19.4)	0(0)	42 (10.8)
CREAMS/OINTMENTS	6(3.0)	1(1.1)	2(5.5)	3(4.8)	12 (3.1)
Total	199(100)	92(100)	36(100)	62(100)	389 (100)

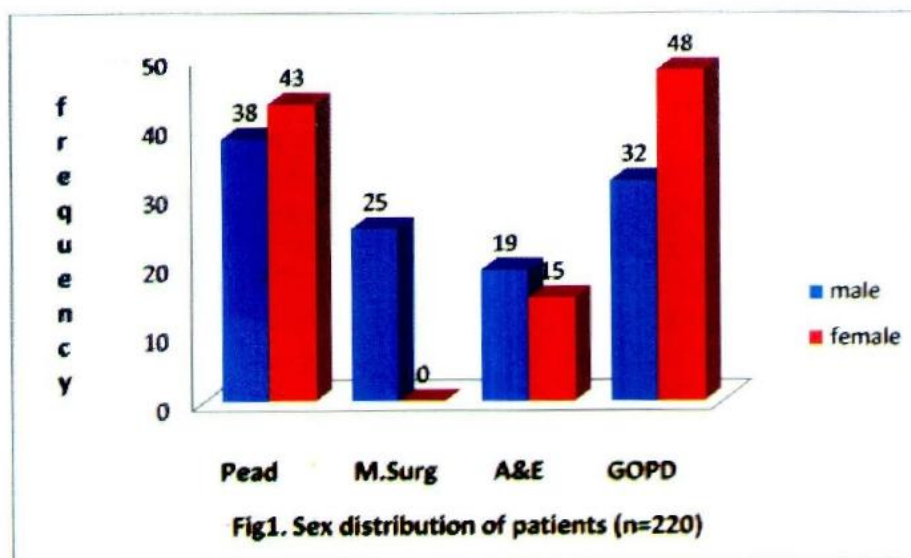
Table 3 Summary of mean duration of treatment

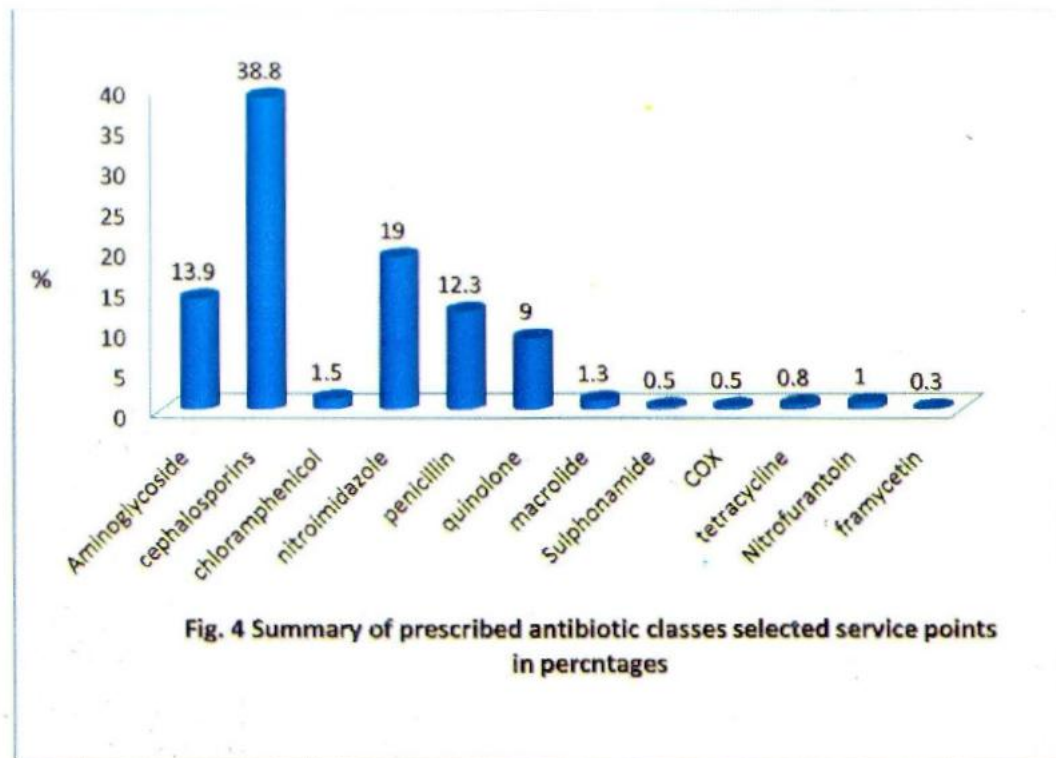
Indicator	Mean duration prescribed for parenteral medications(days)	Mean duration prescribed for oral medications(days)
Peadiatric	4.94 ± 2.62	6.24± 3.72
Range	0-14	0-21
Male Surgical	4.05±2.11	6.90±2.97
Range	1-9	0-14
Accident& Emergency	1.60±0.90	3.19±3.12
Range	0-2	0-10
GOPD	undetermined	6.25±1.93

Range	nil	7-10
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**Table 4 Summary of distribution of antibacterial drugs prescribed**

Antibacterial	Pead f(%)	M. Surg f(%)	A&E f(%)	GOPD f(%)	Total
gentamicin	39(73.5)	9(17.0)	3(5.7)	2(3.8)	53 (14.5)
ciprofloxacin	3(11.1)	8(29.6)	4(14.8)	12(44.4)	27(7.4)
ofloxacin	3(33.3)	0(0)	1(11.1)	5(55.5)	9(2.5)
amoxiclav	16(66.7)	0(0)	2(8.3)	6(25)	24(6.6)
ampiclox	3(20.0)	4(26.7)	8(53.3)	0(0)	15(4.1)
amoxicillin	1(14.3)	0(0)	3(42.8)	3(42.8)	7(1.9)
cefixime	12(80.0)	0(0)	0(0)	3(20)	15(4.1)
cefotaxime	15(100.0)	0(0)	0(0)	0(0)	15(4.1)
ceftriaxone	43(68.2)	18(28.6)	1(1.6)	1(1.6)	63(17.3)
cefuroxime	24(54.5)	14(31.8)	4(9.1)	2(4.5)	44(12.1)
ceftazidime	14(70.0)	5(25.0)	1(5.0)	0(0)	20(5.5)
metronidazole	16(21.9)	28(38.4)	8(10.9)	21(28.8)	73(20.0)
<b>Total</b>					<b>360(100)</b>





**DISCUSSION**

**Antibacterial agents are very commonly prescribed in the health institutions in Nigeria today because of the high prevalence of infectious diseases.** In a study carried out in Kano Nigeria, it was observed that 34.4% of the prescriptions in a tertiary hospital contained an antibacterial<sup>6</sup>. The use of antibacterials in pediatric ward for infectious and parasitic diseases accounted for 34% of case encounters, while neoplasm accounted for 40.9% of encounters in the male surgical ward. Use of antibacterials are very well justified in the treatment of neoplasms as it is a known fact that both the neoplasm disease and antineoplastic drugs usually lead to reduced immunity thus making the patient more susceptible to bacterial infections. It is also known that pediatric immune systems are not very well developed which also increases their susceptibility to bacterial infections. Intravenous antibacterial dosage form was the most prescribed

representing approximately 50% of case encounters. This was particularly so in the pediatric ward. Anyanwu and Arigbe- Osula in 2011 observed that 80% of prescribed antibacterials for children were given by injection<sup>9</sup>. The frequency of prescribed intravenous dosage forms implies a noticeable severity of disease conditions. Eye drops were however prescribed the lowest at a rate of 2% of all case encounters, chloramphenicol being the most used. However it is worthy to note that chloramphenicol is becoming obsolete. The mean duration for prescribed injection and oral antibacterial agents was shorter at the A&E unit than at GOPD. This is because; at the A&E unit patients are mainly transitory while at the GOPD there are ambulatory and reasonably stabilised patients. The oral dosage interval preferred in the GOPD unit was every 12 hours (i.e. BD). Metronidazole and gentamicin were mainly used as adjunct antibacterial agents due to their unique

antibacterial spectrum and synergism with other antibacterial drugs. GOPD had a preference for nitroimidazole and quinolone utilisation at a rate of 26% and 36 % respectively of all cases encountered. In paediatrics and male surgical ward, the cephalosporins and nitroimidazoles (metronidazole) were the most commonly prescribed/ used antibacterial agents. Penicillin antibacterials were mostly prescribed in the A&E unit this seems to be in agreement with reports by Sawalha AF et al that amoxicillin either alone or in combination was the most commonly antibacterial agent in Nablus<sup>10</sup>. This is also in line with the current Irish guideline on the use of antibacterial agent<sup>3</sup>. Ain et al reported that penicillins particularly amoxiclav was the most prescribed drug in their setting followed by flouroquinolones<sup>11</sup>. This study however showed that, there was preference for flouroquinolones, amoxiclav, amoxicillin and metronidazole in the GOPD for reasons of cost, availability and

### spectrum of activity.

Macrolides and sulphonamides accounted for less than 0.3 % utility for all encounters. This may be as a result of the dosing regimen of as much as four times daily in the case of the macrolides. The presence of some untoward effect of sulphonamides does not make them preferred in the face of the availability of safer cephalosporins and penicillins. The use of sulphonamides was effectively limited to the treatment of eye infection as eye drops. From the above, it is evident that the most prescribed single antibacterial drug is metronidazole. This may be as a result of its use as an adjunct drug to enhance the therapeutic efficacy of others particularly in suspected cases of anaerobic infections. Gentamicin use in paediatric is based on its synergism with Cephalosporins and its low cost. The Cephalosporins have over time become cheaper, more easily available in generic forms, and have relatively long half life thus permitting once daily dosing in most patients. They have become the drug of choice for many prescribers who treat patients empirically. The mean duration of intravenous drug use in Male surgical and paediatric wards were observed to be close. However the mean duration of drug administration was considerably shorter in A & E. this is because the A & E is basically a transitory ward. As soon as patients get well they are discharged or transferred to the wards for more care when the patients' conditions become stabilized. For the oral drug administration the mean durations are largely a reflection of the clinic schedule in the case of GOPD. For in-patients most prescriptions usually last for between 5 and 10 days. Some of the prescriptions are open ended which allow the prescribers to switch from one drug to another or have

doses adjusted as may be required, or even switch from one dosage form to another as the situation may demand. Individualization of doses of many of the antibacterial drugs especially in paediatric patient has become a standard practice. This has been enhanced by the availability of some of antibacterial drug preparations in paediatric strength formulations such as 600mg amoxiclav injection which helps to lower the cost of treatment of patients and to prevent avoidable wastages. Patients otherwise would have had to purchase the 1.2gm vial at a higher cost. The same applies to a drug such as ceftriaxone injection which is also available in 250mg and 500mg vials. Oral dry powder preparations of amoxiclav which are available in strengths such as 228mg/5ml and 165mg/5ml also allow for measuring near exact prescribed doses for paediatric patients. Some off label use of flouroquinolones was observed in the paediatric ward. It should be noted that flouroquinolones are yet to be licensed for paediatric use in Nigeria and in many other countries of the world<sup>12, 13</sup>. Safer alternatives like the cephalosporins and penicillins ought to be used in such cases. The use of amoxicillin was observed to be low despite its cheap cost and ready availability, this can only be as a result of the fact that most patients seek help only when they have tried this as a first line treatment at home before presenting in the hospital. Therefore the prescribers are left with little choice which naturally excludes amoxicillin and indeed other penicillins. Findings from this study sharply contrast the findings from a study by Sawalha AF et al which reported that amoxicillin either alone or in combination was the most commonly prescribed antibacterial agent in Nablus<sup>10</sup>. The very low level of ampiclox

prescription may not be unconnected with the emergence of resistance to ampicillin and the fact ampiclox product has been earmarked for deletion from the Nigerian Essential Drugs list 2010.

There emergence of cheaper brands of cephalosporins have encouraged most prescribers to prefer them to other antibacterials. From the results, it is quite evident that antibacterial agents such as the macrolides and sulfonamides featured very little because of issues of cost, frequency of administration and adverse drug reactions associated with sulfonamides. The use of chloramphenicol is essentially limited to infections of the eye. The preference of prescribers for the intravenous route of administration is in order given that most of the antibacterial drugs prescribed were cephalosporins that are not orally active. Cephalosporins, when given by intramuscular injection cause pain to the patient. There is therefore the need to be very careful in constituting the injection with xylocaine injection for intramuscular injection and injection water for intravenous administration respectively. Intravenous injection requires that it be administered by a doctor who naturally will prefer a once or twice daily dosed medication to some other multiple dosing drugs. As noted by Anyanwu and Arigbe- Osula in their study that, intravascular antibacterial dosage form was the most prescribed route of administration representing approximately 50% of all cases encountered. Also, this was particularly the situation in the paediatric ward; they reported that 80% of prescribed antibacterials for children were given by intravascular injection<sup>8</sup>.

Prescribing and administering two or



more antibacterial drugs combination either as co administered, co formulated or sequentially administered seems to be gaining grounds in current therapy for patients. This is as result of the tendency to achieve synergism with the combinations, use of lower doses of component drug, to reduce duration of treatment in which a single drug treatment may not achieve optimal therapeutic outcomes for the patient. These drug combinations may increase the cost of treatment for the patient. However, there is need to be careful and to avoid drug-drug interactions when making the decision to prescribe multiple antibacterial drugs for a patient<sup>34</sup>. Diseases encountered in the study were classified according to ICD9. It is worthy to note that

neoplasms were recorded only in the male ward. Infections and parasitic diseases and respiratory diseases were more prevalent in the Paediatric patients. All these conditions are known to require the use of antibacterial agents. Antibacterial agents are also used as adjunct therapy in the treatment of Neoplasms while they are used to treat and prevent complications arising from pregnancy and childbirth. **The study was limited to the clinical judgment of the prescribers as matters relating to associated laboratory investigations were not considered because, it has been observed in the hospital that only a very small proportion of patients were required to carry out microbial culture and sensitivity tests as a way of reducing cost of care**

**and instituting immediate therapy.**

## CONCLUSION

The most preferred route of administration was intravenous in hospitalized patients followed by the oral route. The cephalosporins class of antibacterials were the most prescribed. Metronidazole and Gentamicin was used more with cephalosporins in paediatric patients. The two antibacterial drugs therapy combination was most preferred and used in 42% cases. In addition, the disease conditions for which antibacterials were prescribed were found to be justified. Metronidazole was the most prescribed antibacterial drug.

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