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Original Research Article

Comparative analysis of antibiotics prescription pattern and in vitro antibiotic evaluation of pregnant women attending antenatal in a tertiary hospital in anambra state, Nigeria

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ABSTRACT

Background: Antibiotic prescription pattern is described as a written directive from the physician to the dispenser on how the medication should be administered in order to ensure infection controlled. The aim of this study was to determine the antibiotics prescription pattern among pregnant women attending antenatal care in the Teaching Hospital for over an eighteen months period and a comparative in vitro evaluation of the mostly prescribed antibiotics during antenatal care was also done.

Materials and Methods: Fifty urine samples were collected from pregnant women visiting the same hospital for comparative analysis. Early morning midstream urine samples collected from the pregnant women were cultured on MacConkey and blood agar. The biochemical tests include urease, oxidase, indole, catalase, citrate tests and gram staining. The antibiotic susceptibility pattern was also determined.

Results: A total of three hundred and four (304) patient prescriptions were evaluated, antibiotics prescribed were amoxicillin 93(27%), ampicillin/cloxacillin 15(4%), amoxicillin-Clavulanate 83(24%), ampicillin 3(0.9%), cefpodoxime 11(3.2%), cefixime 5(1.4%), cefuroxime 10(2.9%), erythromycin 28(8.2%), ofloxacin 7(2.0%), levofloxacin 11(3.2%), ciprofloxacin 6(1.7%), clarithromycin 1(0.3%), azithromycin 10(2.9%), clindamycin 1(0.3%), nitrofurantoin 21(6.1%) and metronidazole 39(11.3%). For the in vitro studies, seventy one (71) isolates were identified as follows E.coli 17 (24%) followed by Klebsiella spp 14(20%), Stapyhlococcus spp 13(18%), Streptoccocus spp 12 (17%), Proteus spp 9(13%), and Pseudomonas spp 6 (8%).

Conclusion: The findings of in vitro study confirmed that some of the antibiotics prescribed namely ampicillin/cloxacillin, amoxicillin/clavulanate, cefixime and cefuroxime did not provide infection control which may be due to inappropriate prescription or drug misuse.

1. Introduction

Antimicrobials have been utilized as a human medicine for more than 50 years, either as prophylaxis or treatments, with significant positive effects on human health. The first antibiotic, pyocyanase, which was derived from the cultivation of the microbe Pseudomonas aeruginosa, was discovered by two German researchers, Rudolph Emmerich and Oscar Löw, in the late 1890s. It was used against cholera and typhus but had questionable safety and effectiveness in the patient population (Kourkouta, 2018). Drug-resistant microorganisms have emerged as a result of careless or

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indiscriminate prescribing (Chem et al., 2018).[1–7] The first medication used was penicillin, an antibiotic produced by the penicillium fungus, in 1946. Antibiotics are used to stop or slow the spread of diseases. This medicine is among those that doctors commonly administer, although frequently under the incorrect circumstances, according to the research. For instance, studies have revealed that 85% of all prescribed medications are antibiotics. Although these drugs are routinely used in hospitals, they are frequently prescribed incorrectly, leading to the emergence of bacterial resistance and a rise in treatment costs (Nduka et al., 2022).[8–12]

Studies on prescribing patterns appear to track, assess, and recommend changes to practitioners' prescribing patterns to improve the logic of medical care. Particularly, inappropriate antibiotic prescriptions are more common among hospitalized patients, which contribute to the emergence of antimicrobial resistance (ABR). Special effort is required to stop the emergence and spread of ABR. One of the prescribing guidelines to encourage the sensible use of medications is a prescription. It is also known as a written therapeutic transaction between a prescriber and dispenser. A prescription pattern can also be thought of as a written directive from the physician to the dispenser on how the medication should be administered. It acts as a channel of communication between the doctor who prescribes the medication, the person dispensing it, and the person taking it for prophylaxis (Yilma, 2020). There are numerous variables that can affect (predict) the prescription of antibiotics. Some of these variables include the patient's characteristics, such as low socioeconomic status, age, and co-morbidity; those that affect antibiotics as a result of the doctor, such as the doctor's educational background, experience, and source of new information; and the practice environment, including the organizational setting. Diagnostic uncertainty, perceived patient need and expectation, practice sustainability, influence from medical representatives, and lacking the necessary qualifications are other significant factors that doctors identified that affected antibiotic prescribing .According to a study done in Nigeria, the availability of the drug, the patient's socioeconomic level, and the prescriber's in-service training all have a significant impact on prescription decisions. To create interventions that can successfully increase the use of antibiotics, it is essential to comprehend how doctors prescribe (Chem et al., 2018). In hospitals, prescription errors are an unwelcome reality. Due to the asymmetry of medical information, doctors' default prescription practices frequently result in patients taking incorrect self-medication. Prescription habits vary from doctor to doctor and are often dynamic and unique. Therefore, rather than being research on medical topics, studies on drugs are complex social subjects. We must look at the subjective and objective elements that influence doctors' prescribing patterns in order to improve the quality of prescriptions and the logic of drug use. Studies conducted in the past suggested that their prescription behavior was influenced by variables like gender, age, educational attainment, specialty, work experience, and economic stimulus. Existing research did have some drawbacks, however, as they were all single factor analyses, which would have overlooked the confounding influences on physicians' prescribing patterns. Prescription errors can be found at any stage of the care process, from medicine selection to drug administration(Wang et al., 2013). Numerous studies have demonstrated that pharmaceutical errors cause harm to hospitalized patients, with prescription errors accounting for the majority of these incidents. According to the National Drug Policy (NDP), only registered pharmaceuticals may be distributed and sold across the nation by those who are professionally qualified and licensed. NDP also demonstrate that no medications, other than OTC, should be sold or administered without a prescription (Sultana et al., 2015). Use of antibiotics improperly can increase the need for medical treatment, morbidity, mortality, adverse drug events, and drug resistance (Ahmad et al., 2014). The Centers for Disease Control and Prevention (CDC) revealed that about 70% of pregnant women said they took at least one prescription drug. Amoxicillin is one of the most often prescribed medications during pregnancy. Only 21% of patients were treated based on a collected microorganism culture, according to another study by Omani, and only 63% of prescribed antimicrobial medicines were picked appropriately. 79% of illnesses were also treated empirically in this study.[13–15]

2. Materials and Methods

2.1. Study site and design

The study was conducted in Chukwuemeka odumegwu Ojukwu University Teaching Hospital, located at Amaku in Anambra state Nigeria and was carried out on antibiotics prescription pattern among pregnant women in a tertiary hospital COOU, Amaku.

2.2. Sample Size Determination

According to Glen D. Isreal, Sample size was calculated based on Yamanes study that [Yamane (1967:886)], a simplified formula for proportion. A 95% confidence level and P = .5 are assumed for Equation.

$n = \frac{N}{1+N(e)^2}$ ..... Equation 1

Where n is the sample size,

N Is the population size, and

Is the level of precision

$n = \frac{N}{1+N(e)^2} = \frac{304}{1+304(0.05)^2} = 172 \ Participants$

2.3. Collection of data

All the prescription sheets or folder containing one or more antibiotics from January 2021 to June 2022 were used. The following data was included; Age, sex, antibiotics prescribed, number of antibiotics per prescribed, month of prescription, number of medicine per prescription and dosage prescribed.

2.4. Inclusion criteria

All pregnant women were used in this study. Information on Socioeconomic and demographic history namely: age, gender, and occupation were included.

2.5. Exclusion criteria

Non pregnant women were not used in this study.

2.6. Sample collection and examination

A total of fifty urine samples were collected from the selected pregnant women and each selected pregnant woman was instructed on how to collect midstream urine specimen by a trained personnel. A 20 ml of urine specimen was collected in a sterile screw-capped, wide-mouth cup labeled with a unique sample number, date, and time of collection.

2.7. Ethical consideration

The study protocol was approved by the research and ethical committee of COOUTH, Amaku. Full access to the patient folder and all documents needed for the study was granted

2.8. Sample preparation

All the media used in this present study were prepared according to manufacturer's specifications, and collected samples were innoculated into pates and incubated at 37 °C for 24 hours.

2.9. Isolation and identification of isolates

To obtain pure culture of bacteria streak method was used. Sub-culturing was done using nutrient agar. The Plates were incubated at 37 °C for 24 hours. For bacteria pure cultures were isolated followed by biochemical test to identify the isolates. Biochemical test done using standard methods include Urease test, oxidase test, indole test, catalase test, citrate test and gram staining.

2.10. Antibiotics susceptibility testing

The susceptibility test were performed following the method M2A6 disc diffusion method as recommended by the Clinical and Laboratory standards Institute (CSLI , 2016) using Muller- Hinton agar. The bacteria isolates from the samples were sub-cultured onto a nutrient agar and incubated at 37 °C for 24 hours. The innoculum was standardized by transferring three colonies of the isolates using a sterile wire loop into 3mls of sterile nutrient broth. The suspension was incubated for 3 hours at 37 °C to allow for the growth of test organism till the density was equivalent to the turbidity of 0.05 Mc Farland.

The standard innocula were swabbed onto Muller-Hinton agar plates and the discs were placed on the inoculated plates and pressed firmly onto the agar plates for a complete contact. The bacterial strains were tested against the following discs: Ofloxacin (10μg), Imipenem/cilastain (10μg), Amoxicillin-clavulanic acid (30μg), cefotaxime (30μg) Ceftriaxone Sulbactam(345μg) Gentamycin (10μg), Ampiclox (10μg), Cephalexin (10μg), Nalidixic acid (30μg), Levofloxacin (30μg), Cefixime(5μg), cefuroxime ((30μg).

The plates were kept on the work table for 30 minutes to allow for the pre-difussion of antibiotics into the agar. The plates were incubated at 37 °C for 24 hours. The susceptibility of each isolates to each antibiotics were shown by a clear zone of growth inhibition and this was measured using a meter rule in millimeter and the diameter of the zone of inhibition was interpreted using a standard chart (EUCAST, 2023).

3. Results

3.1. Overall antibiotics prescription pattern from january 2021 to june 2022 (n= 344)

Table 1: Overall antibiotics prescription patterns from January 2021 To June 2022 (N= 344) showing antibiotics class, antibiotics name and number of antibiotics prescribed.

Antibiotic Class	Antibiotic Name	n (%)
Penicillin	Amoxicillin+Clavulanate	83(24.0)
	Amoxicillin	93(27.0) 15(4.0)
	Ampicillin+Cloxacillin	3(0.9)
	Ampicillin	
Cephalosporins	Cefixime Cefpodoxime	5(1.5) 11(3.2)
	Cefuroxime	10(2.9)
Fluoroquinolones	Ciprofloxacin	6(1.7) 11(3.2)
	Levofloxacin Ofloxacin	7(2.0)
Macrolides	Erythromycin	28(8.2) 10(2.9)
	Azithromycin	1(0.3)
	Clarithromycin	
Lincosamide	Clindamycin	1(0.3)
Nitroimidazole	Metronidazole	39(11.3)
Miscellaneous	Nitrofurantoin	21(6.1)

KEY: n=number of antibiotics prescribed

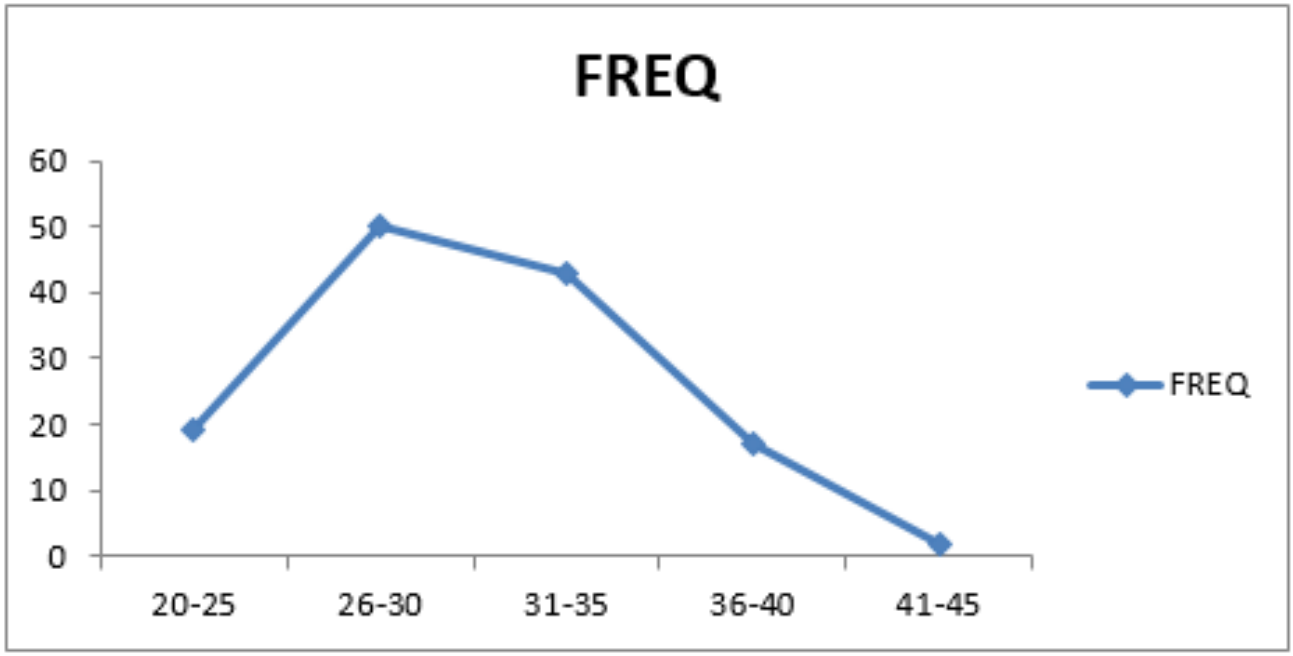

Figure 1: Showing age distribution of pregnant women with bacteriuria from the prescription pattern in COOUTH, Amaku from January 2021 to June 2022.
Note: Antibiotics are mostly prescribed to pregnant women within the age range of 26-30 followed by 35-40.

Table 2: Age distribution of pregnant women that attended laboratory inANC showing that most of the pregnant women that attended clinic were within the age range of 31-35 followed by 20-25 and 36-40.

Age of the pregnant women	Frequency	Percentage (%)
20-25	13	26
26-30	9	18
31-35	14	28
36-40	13	26
41-45 Total	1 50	2 100

3.2. Age distribution of pregnant women with bacteriuria from the prescription pattern

3.3. Age distribution of pregnant women that attended laboratory in ANC

3.4. Colony and biochemical test result

3.5. Frequency of isolates

3.6. Antibiotics sensitivity result

Table 3: Colony features and biochemical test results on mac Conkey agar

S/N	MCA(Colony Features)	CAT	CIT	UREA	Ind	OXI	Gram Stain	Probable organism
U2	Pink, entire,dry,circular	+	+	-	-	-	-	Klebsiella spp
U3	Red, Circular,moist,entire	+	+	-	+	-	-	E. coli
U5	Colourless,round, flat	+	+	+	-	+	-	Pseudomonas spp
U6	Colourless,round, flat	+	+	+	-	+	-	Pseudomonas spp
U7	Red, Circular,moist,entire	+	+	-	+	-	-	E. coli
U8	Red, Circular,moist,entire	+	+	-	+	-	-	E.coli
U9	Cream,entire,moist	+	+	+	+	-	-	Proteus spp
U10	Cream,entire,moist	+	+	+	-	-	-	Proteus spp
U11	Pink, entire,dry,circular	-	+	+	-	+	-	Klebsiella spp
U13	Red, Circular,moist,entire	+	+	-	+	_	-	E.coli
U14	Red, Circular,moist,entire	-	+	-	+	-	-	E. coli
U15	Pink, entire,dry,circular	+	+	+	-	-	-	Klebsiella spp
U16	Colourless,round, flat	+	+	+	-	+	-	Pseudomonas spp
U17	Pink, entire,dry,circular	+	+	-	-	-	-	Klebsiella spp
U18	Pink, entire,dry,circular	+	+	-	-	-	-	Klebsiella spp
U22	Pink, entire,dry,circular	+	+	-	-	+	-	Klebsiella spp
U23	Pink, entire,dry,circular	+	-	+	+	-	-	Klebsiella spp
U24	Cream,entire,moist	+	+	+	+	-	-	Proteus spp
U26	Cream,entire,moist	+	+	+	-	-	-	Proteus spp
U28	Cream,entire,moist	+	-	+	+	-	-	Proteus spp
U31	Red, Circular,moist,entire	+	-	-	+	-	-	E.coli
U32	Pink, entire,dry,circular	+	+	+	+	-	-	Klebsiella spp
U33	Red, Circular,moist,entire	+	+	-	+	-	-	E.coli
U34	Red, Circular,moist,entire	+	+	-	+	-	-	E.coli
U35	Pink, entire,dry,circular	+	+	+	-	-	-	Klebsiella spp
U36	Cream,entire,moist	+	-	+	-	-	-	Proteus spp
U37	Red, Circular,moist,entire	+	+	-	+	-	-	E.coli
U38	Cream,entire,moist	+	+	+	-	-	-	Proteus spp
U39	Pink, entire,dry,circular	+	+	-	-	-	-	Klebsiella spp
U40	Red, Circular,moist,entire	+	-	-	+	-	-	E.coli
U42	Red, Circular,moist,entire	+	-	-	+	-	-	E.coli
U44	Red, Circular,moist,entire	+	-	-	+	-	-	E.coli
U46	Colourless,round, flat	-	+	+	+	-	-	Pseudomonas spp
U48	Cream,entire,moist	+	+	+	+	-	-	Proteus spp
U50	Cream,entire,moist	+	-	+	+	-	-	Proteus spp

Table 4: Colony features and biochemical test result on Blood agar

S/N	Blood Agar (Colony Features)	CAT	CIT	UREA	IND	OXI	Gram Stain	Probable Organism
U1	Circular,yellow,opaque,β-hemolysis	+	+	-	+	-	+	Staphylococcus spp
U2	Circular,yellow,opaque,β-hemolysis	+	+	+	-	-	+	Staphylococcus spp
U3	Green,circular,moist ,non-hemolysis	+	+	-	+	-	-	E.coli
U4	Circular,yellow,opaque,β-hemolysis	+	+	+	-	-	+	Staphylococcus spp
U6	Gray,irregular,β-hemolysis	-	+	+	-	+	-	Pseudomanas spp
U7	Circular,yellow,opaque,β-hemolysis	+	+	+	-	-	+	Staphylococcus spp
U9	Green,circular,moist ,non-hemolysis	+	+	-	+	-	-	E.coli
U11	Circular,yellow,opaque,β-hemolysis	+	+	-	-	-	+	Staphylococcus spp
U12	Circular,yellow,opaque,β-hemolysis	+	+	-	-	-	+	Staphylococcus spp
U14	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U16	Green,circular,moist ,non-hemolysis	+	+	-	+	-	-	E.coli
U17	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U18	Gray, moist,non-hemolysis	-	+	+	-	-	-	Klebsiella spp
U19	Gray, moist,non-hemolysis	-	+	+	-	-	-	Klebsiella spp
U20	Gray,irregular,β-hemolysis	+	+	+	-	+	-	Pseudomanas spp
U21	Gray, moist,non-hemolysis	+	+	-	-	-	-	Klesiella spp
U22	Gray, moist,non-hemolysis	-	+	+	-	-	-	Klesiella spp
U23	Gray,moist,β-hemolysis	+	+	+	-	+	+	Streptococcus spp
U24	Circular,yellow,opaque,β-hemolysis	+	+	-	-	-	+	Staphylococcus spp
U25	Gray,moist,β-hemolysis	-	+	+	-	+	+	Streptococcus spp
U27	Green,circular,moist ,non-hemolysis	+	+	+	+	-	-	E.coli
U28	Circular,yellow,opaque,β-hemolysis	+	+	-	-	-	+	Staphylococcus spp
U30	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U32	Circular,yellow,opaque,β-hemolysis	+	+	+	-	-	+	Staphylococcus spp
U35	Circular,yellow,opaque,β-hemolysis	+	+	+	-	+	+	Staphylococcus spp
U36	Green,circular,moist ,non-hemolysis	+	+	-	+	-	-	E.coli
U37	Gray,moist,β-hemolysis	-	+	-	-	+	+	Streptococcus spp
U38	Circular,yellow,opaque,β-hemolysis	+	+	+	-	+	+	Staphylococcus spp
U41	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U43	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U45	Gray,moist,β-hemolysis	-	+	-	-	-	+	Streptococcus spp
U46	Circular,yellow,opaque,β-hemolysis	+	+	+	-	+	+	Staphylococcus spp
U47	Gray,moist,β-hemolysis	-	+	+	-	-	+	Streptococcus spp
U48	Circular,yellow,opaque,β-hemolysis	+	+	-	-	-	+	Staphylococcus spp
U49	Gray,moist,β-hemolysis	+	+	+	-	-	+	Streptococcus spp
U50	Gray,moist,β-hemolysis	+	+	-	-	+	+	Streptococcus spp

Key: Bld –Blood agar; IND-Indole test; CIT-Citrate utilization test; CAT-Catalase test; OXI- Oxidase test; UREA-Urease test; GRAM STAIN-Gram staining;+ positive;-negative

Table 5: Percentage frequency of probable organisms from isolates.

Probable Organism	Frequency of isolates (%)
E.coli	(24) 17
Klebsiella spp	(20) 14
Staphylococcus spp	(18) 13
Streptococcus spp	(17) 12
Proteus spp	(13) 9
Pseudomonas spp	(8) 6
Total Number of Probable Organism	(100) 71

Table 6: antibiotics sensitivity test result (Inhibition Zone diameter measured in mm)

S/N	Probable Organism	ACX	AUG	ZEM	CXM	OFX	LBC	NF
1	Klebsiella spp	0	0	0	0	0	10	0
2	E.coli	0	0	0	0	12	20	0
3	Pseudomonas spp	0	0	5	0	0	11	0
4	Pseudomonas spp	10	0	0	0	26	20	5
5	E.coli	0	0	0	0	0	0	0
6	E.coli	0	0	0	0	15	20	0
7	Proteus spp	0	0	0	0	0	0	0
8	Proteus spp	0	5	0	6	0	0	0
9	Klebsiella spp	0	0	0	0	11	0	14
10	E.coli	0	0	0	0	0	10	0
11	E.coli	0	0	0	0	24	13	25
12	Klebsiella spp	0	0	0	0	27	20	13
13	Pseudomonas spp	0	8	0	0	15	19	9
14	Klebsiella spp	0	0	0	0	11	10	0
15	Klebsiella spp	0	0	0	0	0	0	0
16	Klebsiella spp	5	0	0	0	35	30	18
17	Klebsiella spp	0	0	0	0	35	32	15
18	Proteus spp	0	0	0	0	0	0	0
19	Proteus spp	0	0	0	0	23	21	0
20	Proteus spp	0	0	0	0	18	15	11
21	E.coli	0	0	0	11	22	21	0
22	Klebsiella spp	0	0	0	0	19	24	0
23	E.coli	0	0	0	0	15	10	12
24	E.coli	18	0	0	0	23	22	11
25	Klebsiella spp	0	0	10	0	23	21	11
26	Proteus spp	0	0	0	0	25	24	0
27	E.coli	0	0	0	0	22	23	0
28	Proteus spp	0	0	0	0	20	21	0
29	Klebsiella spp	0	0	0	0	20	23	0
30	E.coli	0	0	0	0	20	21	13
31	E.coli	0	0	0	0	29	30	0
32	E.coli	0	0	0	0	11	10	0
33	Pseudomonas spp	0	0	0	0	25	17	21
34	Proteus spp	7	0	0	0	20	23	0
35	Proteus spp	0	0	0	0	0	0	0
36	Staphylococcus spp	0	0	0	0	0	5	0
37	Staphylococcus spp	0	0	0	0	22	16	25
38	E.coli	0	0	0	12	0	0	0
39	Staphylococcus spp	0	0	0	0	22	28	15
40	Pseudomonas spp	0	0	0	0	14	20	0
41	Staphylococcus spp	0	0	0	0	10	13	0
42	E.coli	0	9	0	0	15	25	0
43	Staphylococcus spp	0	0	0	0	18	22	10
44	Staphylococcus spp	0	0	0	0	0	0	0
45	Streptococcus spp	0	0	0	0	18	10	15
46	E.coli	0	0	0	0	25	30	10
47	Streptococcus spp	0	0	0	0	20	23	0
48	Klebsiella spp	0	0	0	0	15	24	14
49	Klebsiella spp	0	0	0	0	0	0	0
50	Pseudomonas spp	0	0	0	0	10	13	15

Continued on next page

Table 6 continued

51	Klebsiella spp	0	0	0	0	9	15	0
52	Klebsiella spp	0	0	0	0	5	0	0
53	Streptococcus spp	0	0	0	0	16	20	13
54	Staphylococcus spp	0	0	0	10	0	15	0
55	Streptococcus spp	0	0	0	0	15	20	12
56	E.coli	0	0	0	0	10	15	0
57	Staphylococcus spp	0	0	0	0	19	20	9
58	Streptococcus spp	0	0	8	0	20	10	15
59	Staphylococcus spp	0	0	0	0	0	0	0
60	Staphylococcus spp	0	0	0	0	15	19	7
61	E.coli	0	0	0	0	22	25	10
62	Streptococcus spp	0	0	0	5	10	15	0
63	Staphylococcus spp	0	0	0	0	0	0	0
64	Streptococcus spp	0	0	0	10	12	15	10
65	Streptococcus spp	0	0	0	0	24	28	10
66	Streptococcus spp	0	0	0	0	9	12	0
67	Staphylococcus spp	0	10	0	0	17	5	12
68	Streptococcus spp	0	0	0	0	25	26	0
69	Staphylococcus spp	0	0	0	0	0	0	0
70	Streptococcus spp	0	0	0	0	18	12	15
71	Streptococcus spp	0	0	0	0	22	19	12

Key : AUG-Amoxicillin –Clavulanate (30ug); OFX- Ofloxacin (5ug); NF- Nitrofurantoin (300ug); ZEM- Cefixime (5ug); LBC-Levofloxacin (5ug); ACX-Ampiclox (10ug); CXM-Cefuroxime(30ug)

NB: The result of antibiotics sensitivity test above was interpreted using the European Committee on Antimicrobial Susceptibility Testing Breakpoint tables for interpretation of zone diameters EUCAST) 2023.

4. Discussion

The study was designed to ascertain the prevalence antibiotic prescription among pregnant women attending Antenatal care. Appropriate drug utilization contributes immensely to a global reduction in morbidity and mortality as a result of its medical, social, and economic benefits (Nduka et al., 2022).

Eighteen months prescriptions were studied and the data entered into the data entry forms designed for the study. A total of three hundred and four (304) patient prescriptions were successfully evaluated with antibiotics prescription on it. Overall antibiotics prescribed were amoxicillin 93(27%), ampicillin/cloxacillin 15(4%), amoxicillin-Clavulanate 83(24%), ampicillin 3(0.9%), cefpodoxime 11(3.2%), cefixime 5(1.4%), Cefuroxime 10(2.9%), Erythromycin 28(8.2%), Ofloxacin 7(2.0%), Levofloxacin 11(3.2%), Ciprofloxacin 6(1.7%), clarithromycin 1(0.3%), azithromycin 10(2.9%), clindamycin 1(0.3%), nitrofurantoin 21(6.1%) and metronidazole 30(11.3%). The most frequently prescribed antibiotic class was penicillin (55%) and amoxicillin(27%) was the most prescribed antibiotics followed by macrolides(11.4), while the most frequent antibiotic combination was ciprofloxacin + metronidazole (11%) and mono antibiotics therapy was (89%) which is in line with the study in Tanzania by (Khalfan et al., 2021; Okoro et al., 2019), 357 patients who received an antibiotic prescription, the most commonly prescribed antibiotic class was the penicillins (51.3%) followed by the nitroimidazoles (14.0%). The highest antibiotics prescription rate was recorded in the second quarter of the year.

Majority of antibiotics prescribed to the patients belong to FDA category B (75%) and Category C (25%) only. No antimicrobials from category A , D and X were documented in this study which tallied with studies performed in Saudi Arabia by (Baraka et al., 2021), the majority of antimicrobial drugs prescribed to our participants belong to FDA category B (66.4%), followed by category C (32.6%) and category D (1.0%), which is considered harmful according to FDA recommendations.

From this study, majority of the patient‘s age written on the folder was AD (adult) (60%), in Nigeria adulthood is classified from 18+.The significant age group falls between 26-30 years. From table 1 above, most of the antibiotics were prescribed thrice daily (65%) in COOUTH, Amaku, followed by 38% given twice daily and 3% given once daily, which is contrary to the studies done in Onitsha, most of antibiotics were prescribed twice daily (64.7%) to pregnant women in general hospital, Onitsha. A total of 60 (20.0%) prescription were given thrice daily, 34 (11.3) once daily and 12 (4.0%) four times daily,(Ogbonna et al., 2019). Most of the antibiotics were given within the range of three to ten days which includes five days (61%), seven days (35%), three days (2%), four days (1%), and ten days (0.9%).

In this study, Out of 50 samples collected 71 isolates were obtained which Gram negative bacterial isolate were more prevalence than gram positive bacterial isolates in agreement with the studies in Ethiopia by (Tula et al., 2020), Gram-negative bacteria isolates were more prevalent than Gram-positive bacteria isolates (77.8% vs. 22.2%). The most common uropathogen identified in this study was E.coli 17 (24%) followed by Klebsiella spp 14(20%), Stapyhlococcus spp 13(18%), Streptoccocus spp 12 (17%), Proteus spp 9(13%), Pseudomonas spp 6 (8%) and E. coli was the most common bacteria isolated in this study,it is equally in line with the studies by (Tula et al., 2020), in this study was E. coli was most predominant(47.8%). The major contributing factor for isolating higher E. coli is due to urine stasis in pregnancy, which favors E. coli strain colonization (Tula et al., 2020).

Result of antimicrobial susceptibility test for the isolates respectively using multi-disc antibiotics (gram negative) were analyzed using European Committee on Antimicrobial Susceptibility Testing (EUCAST-2023) standard breakpoints. Drugs used in this study include amoxicillin –clavulanate, ofloxacin, nitrofurantoin, cefixime, levofloxacin, ampicillin/cloxacillin, cefuroxime.

For E.coli, 100% of the isolates were resistance to Ampicillin/cloxacillin, Amoxicillin –clavulanate,Cefixime, Cefuroxime. Ofloxacin had 58% resistance, 23% intermediate and 17% susceptibility on the isolates. Nitrofurantoin had 76% resistance and 23% susceptibility. Levofloxacin had better activity against the isolates as 29% susceptibility, 23% Intermediate, and 47% resistance to the isolates, contrary to the study done by (Tazebew,2012.),that Nitrofurantoin was the most effective drug against E.coli with sensitivity rate of 93.7%.

For Klebsiella spp, 100% of the isolates were resistance ampicillin/cloxacillin, amoxicillin –clavulanate, Cefixime, cefuroxime. Ofloxacin had 71% resistance, 7% intermediate and 21% susceptibility. Nitrofurantoin had 71% reistance and 29% susceptibility in the isolates. Levofloxacin also had a better activity against the isolates with 50% resistance, 14% intermediate and 35% susceptibility, which is in line the study done by(Ochei et al., 2018), gram negative bacteria were found to be most resistant to amoxicillin –clavulanate (100%).

For Proteus spp, 100% of the isolates were resistance to ampicillin/cloxacillin, amoxicillin –clavulanate, cefixime, cefuroxime. Ofloxacin had 78% resistance, 11% intermediate and 11% susceptibility while Nitrofurantoin had 77% resistance and 22% susceptibility. Levofloxacin showed improved action against the isolates with 56% resistance, 22% intermediate and 22% susceptibility, it is contrary to the study done by(Press, 2013), cephalosporins had a remarkable antibiotic sensitivity pattern of 87.3% for cefpodoxime and 66.7% for ceftriaxone.

For Pseudomonas spp, 100% of the isolates were resistance to ampicillin/cloxacillin, amoxicillin –clavulanate, cefixime and cefuroxime. Ofloxacin and Nitrofurantoin are unsuitable for the treatment of systemic infection caused by the organism according to EUCAST-2023. Levofloxacin had 50% intermediate and 50% resistance, which is contrary to the study done by (Press, 2013), cephalosporins had a remarkable antibiotic sensitivity pattern of 87.3% for cefpodoxime and 66.7% for ceftriaxone.

For Staphylococcus spp, 100% of the isolates were resistance to ampicillin/cloxacillin, amoxicillin –clavulanate, cefixime and cefuroxime. According to EUCAST-2023, Ofloxacin have been removed since in systemic infections with staphylococci the agent is inferior to other fluoroquinolones. Levofloxacin had 92% resistance and 8% susceptibility. Nitrofurantoin had 67% resistance and 33% susceptibility on the isolates, which is contrary to (Tazebew, 2012), S. aureus was also have shown resistance to most antibiotic but sensitive to amoxicillin-clavulnic acid (100%).

For Streptococcus spp, 100% of the isolates were resistance to ampicillin/cloxacillin, amoxicillin –clavulanate, cefixime and cefuroxime. Ofloxacin is unsuitable for the treatment of systemic infection caused by the organism according to EUCAST-2023.Levofloxacin had 50% resistance, 41% intermediate and 9% susceptibility. Nitrofurantoin had 67% resistance and 33% susceptibility on the isolates, which is in line by the study, (Nteziyaremye et al., 2020) that Nitrofurantoin has sensitivity level of (38.5%). The possible explanation of to ampicillin/cloxacillin, amoxicillin –clavulanate and cefixime and cefuroxime resistance might be due to their extensive use in the health facilities.

It was discovered in the study that levofloxacin had greater activity more than other antibiotics in gram negative isolates which is in alignment with the studies done in Abakiliki, Nigeria. The antibiotic with the overall highest sensitivity pattern in this study was levofloxacin which is a quinolone. This is similar to other reports where quinolones were the most effective and sensitive antibiotics to the organisms causing UTI(Press, 2013) while nitrofurantoin had greater activity on gram positive isolates, it also aligned with studies done in Abakiliki, nitrofurantoin showed a good sensitivity pattern to S. aureus (60%) and P. mirabilis (50.4%), even though the overall sensitivity was poor (33.7%). Other studies have demonstrated increased sensitivity of nitrofurantoin to bacterial isolates from urine of pregnant women with or without symptoms of UTI. Hence, recommendation of nitrofurantoin as a first line drug has also been made in such studies (Press, 2013). Our study points out that nitrofurantoin was more susceptible to uropathogens than the most commonly prescribed drugs, and this is interesting considering the fact that there have been debates to have it phased out. Literature study reviews that there is a need to resurface old drugs as they would actually be more effective, some of these drugs such as nitrofurantoin and fosfomycin, i.e., specifically for resistant uropathogens (Yeta et al., 2021) Quinolones are expensive and have been associated with teratogenicity in first trimester and risk of auditory and vestibular toxicity in the fetus in later trimesters, and are therefore contraindicated in pregnancy. However, for recurrence and persistent UTI, quinolones could be used with caution in late pregnancy or postpartum after counseling, especially if it is the only sensitive drug, as it is also secreted in breast milk(Press, 2013). Gram positive and negative bacteria were found to be most resistant to amoxicillin –clavulanate (100%) (Ochei et al., 2018).

In the study, most the patients were business women (40%) followed by other civil servants (16%), Teacher (10%), hairdresser and seamstress (8%), students (6%), Cleaner (4%), and lastly house wife, chef, Computer Operator and banker had (1%) respectively which was contrary to studies done in Rupandehi by (Chaudhary and Bhusal, 2020),most of the patients were housewife (59.80%) followed by others (19.60%), farmer (9.80%), teacher (7.84%) and business (2.94%) The age group of pregnant women with significant bacterial growth from urine was 31-35 (28%) followed by 20-25 and 36-40(26%), 26-30 (18%) and 41-45 (2%) which is contrary to studies done in Nigeria by (Idris et al., 2014), over half of the pregnant women with significant bacterial growth from urine was in the age group 21-30 years, while those less than or equals to 20years had the least frequency (4.4%).

In our study, UTI is mostly found in the pregnant women of third trimester (84%) followed by second trimester (10%) and lastly first trimester (6%), which was centrally, to studies done in Rupandehi by (Chaudhary and Bhusal, 2020),UTI is mostly found in the pregnant women of second trimester (46.08%) followed by first trimester (32.35%) and third trimester (21.56%). In addition to this, this level of resistance could be attributed to easy access to antibiotics over the counter in developing countries like Nigeria. Additionally, the initial use of antibiotics before the laboratory results of antimicrobial susceptibility can be an attribution to the high resistance levels

5. Conclusion

This study shows that the antibiotics prescription pattern among pregnant women in COOUTH, Amaku includes amoxicillin, amoxicillin-Clavulanate, levofloxacin, metronidazole etc, and the total number of antibiotics prescribed where determined and it was actualized that isolates were resistant to most frequently prescribed antibiotics which could be due to excessive or unnecessary use of those antibiotics among pregnant women but there is greater activity in levofloxacin, ofloxacin and nitrofurantoin.

The knowledge of the antimicrobial susceptibility pattern of UTI pathogens is very important for the clinician to select and use the most effective antimicrobial agent for the treatment of a patient with UTI (Tula et al., 2020).

6. Recommendation

To reduce antimicrobial resistance in hospitals, interventions should be put in place such as monitoring the use of antibiotics, evaluating prescription patterns, developing and implementing antimicrobial stewardship to suit the peculiar needs of the hospital amongst others (Nduka et al., 2022). Consequently, the need for the development and enforcement of antibiotic policies and proper antibiotic stewardship in developing countries cannot be overemphasized (Yeta et al., 2021).

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8. Conflict of Interest

None.

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