Republic of Yemen
Ministry of Higher Education and scientific Research
International Malaysia University
Collage of Medical Sciences
Department of Pharmacy

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
الجامعة الماليزية الدولية
كلية العلوم الطبية
قسم الصيدلة

Evaluation of antibiotic prescribing pattern in pediatrics in Ibb city hospitals and clinics

A Research Project Submitted to the Department of Pharmacy in the International Malaysian University in Partial Fulfillment of the Requirement of Bachelor Degree in pharmacy.

submitted by:

Adam Abd El-khaled Al-Afeef
Ali Ahmed Ali Al-Malk
Hamdi Ali Ismail Al-Daghar
Hassen Mohammed Abdoh Alwan
Hesham Sulaiman Naji Qasem
Nabeel Ali Al-Hamami
Nagemi Al-Garady
Osama Abdulbaset Abdulsalam Hasan
Rashid Ahmed Rasam Al-Seragi
Yaser Ali Abu Alghaithi Mahdaly
Youssef Ahmed Al-Haiasi

Supervision by:

Dr. Ali Nour Alddain

2022-2023

Republic of Yemen
Ministry of Higher Education and scientific Research
International Malaysia University
Collage of Medical Sciences
Department of Pharmacy

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
الجامعة الماليزية الدولية
كلية العلوم الطبية
قسم الصيدلة

Evaluation of antibiotic prescribing pattern in pediatrics in Ibb city hospitals and clinics

A Research Project Submitted to the Department of Pharmacy in the International Malaysian University in Partial Fulfillment of the Requirement of Bachelor Degree in pharmacy.

Submitted by:

Adam Abd El-khaled Al-Afeef
Ali Ahmed Ali Al-Malik
Hamdi Ali Ismail Al-Daghar
Hassen Mohammed Abdoh Alwan
Hesham Sulaiman Naji Qasem
Nabeel Ali Al-Hamami
Nagemi Al-Garady
Osama Abdulbaset Abdulsalam Hasan
Rashid Ahmed Rassam Al-Seragi
Yaser Ali Abu Alghaithi Mahdaly
Youssef Ahmed Al-Haiasi

Approved by advisory committee and examiners

Prof. Dr/ Fuad Asswadi	**internal examiner**
Dr/ Aisha Al-Dherasi	**Examiner**
Dr/ Ali Nour Alddain	**Chairman/ supervisor**

DECLARATION BY STUDENT

CERTIFICATION

We are hereby certifying that we had personally carried out the work depicted In the thesis entitled "' **Evaluation of antibiotic prescribing pattern in pediatrics in Ibb city hospitals and clinics**

No part of the thesis has been submitted for the award of any other degree Diploma prior to this data

Name of the candidate	Signature

Adam Abd El-khaled Al-Afeef **Ali Ahmed Ali Al-Malik**

Hamdi Ali Ismail Al-Daghar **Hassen Mohammed Abdoh Alwan**

Hesham Sulaiman Naji Qasem **Nabeel Ali Al-Hamami**

Nagemi Al-Garady **Osama Abdulbaset Abdulsalam Hasan**

Rashid Ahmed Rassam Al-Seragi **Yaser Ali Abu Alghaithi Mahdaly**

Youssef Ahmed Al-Haiasi

DECLARATION BY GUIDE

Name of the guider; Dr. Ali Nour Alddain

Department : pharmacy

This to certify that in the department of pharmacy of this collage has

international Malaysia university. Ibb. Yemen

The research project entitled " **Evaluation of antibiotic prescribing pattern in pediatrics in Ibb city hospitals and clinics '' Ibb. Yemen.** Was carried out under my direct supervision . no part of thesis was Submitted for the award of any degree or bachelor prior to this data.

Data; 2022-2023 signature………

بسم اللّٰه الر حمن

الر حيم

Dedications

To whom we love

Our … parents

With love and gratitude to our …brothers and sisters

Our … teachers

Our … colleagues

To all our friends, and to all those sincere and good people

Who helped and supported us throughout the study.

ACKNOWLEDGEMENT

It is impossible to convey, in a couple of sentences, our gratitude to many peoples for helping us to learn and who cooperation made this work possible.

We would like to express our gratitude to our supervisor

Dr. Ali Nour Alddain

for his initiating and planning of this work and for his valuable scientific advices, continuous support, his patience, his inspiration, his encouragement, and for his lots of good ideas. Also, we can't find enough words to thank to all who enriched us with all the information required in the field of research methodology. Last but not least, we want to express special thanks for our families.

List of content

SUBJECT	Page
Dedications	I
Acknowledgement	II
List of contents	IV
Abbreviations	V
List of tables	VI
List of figures	VII
Abstract	
CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW	
1. INTRODUCTION	1
1.1. ANTIBACTERIAL AGENTS (ANTIBIOTICS)	2
1.1.1 Antibiotics sources	3
1.1.2 Classification of antibiotics	3
• Penicillins	4
• Cephalosporins	4
• Tetracyclines	4
• Quinolones	4
• Lincomycins	5
• Macrolides	5
• Sulfonamides	5
• Glycopeptide antibiotics	5
• Aminoglycosides	6
• Carbapenems	6
1.1.3. Mechanisms of action of antibiotics	6
• Inhibition of cell wall synthesis	7
• Inhibiter protein synthesis	7
• Inhibit DNA synthesis	8
• Inhibition of enzyme	8
• Alteration of cell membranes permeability	8
1.2. BACTERIAL RESISTANCE AGAINST ANTIBIOTICS	10
1.2.1. Mechanisms of action of bacterial resistance	10
1.2.1.1 Intrinsic factors	11
1.2.1.2. Extrinsic factors (acquired)	12
1.2.1.3. Genetic dependent of resistance	13
1.3. THE AIM OF THE STUDY	16
1.4. PREVIOUS STUDIES	16

CHAPTER 2: METHODOLOGY	
2.1. Study design	19
2.2. Population and samples	19
2.2.1. Population	19
2.2.2. Samples	19
2.3. Tools	19
CHAPTER 3: RESULTS OF THE STUDY	
3. Results of the study	20
CHAPTER 4: DISCUSSION OF THE STUDY	40
CHAPTER 5: CONCLUSION & RECOMMENDATIONS	
4.2. Conclusion	44
4.3. Recommendations	45
REFERENCES	46
Appendix	54

ABBREVIATIONS

Symbol	Name
WHO	World health organization
NIAID	National institute of allergy and infection
MRSA	Methicillin resistant *staphylococcus aureus*
UTIS	Urinary tract infections system
FDA	Food and drug administration
MT	Mycobacteria tuberculosis

List of tables

No.	Subjects	Page
1	Table 1: Summary of antibiotic classifications and their indications	**9**
2	Table 3.1: Personal Information	**20**
3	Table 3.2: History of medical illness	**22**
4	Table 3.3: Previous used antibiotics	**23**
5	Table 3.4: Antibiotics used previously	**24**
6	Table 3.5: Time of treatment with antibiotics	**25**
7	Table 3.6: Parents perception about antibiotics	**26**
8	Table 3.7: Parent satisfaction with physician visit	**28**
9	Table 3.8: Stop therapy when symptoms subside	**29**
10	Table 3.9: Keeping leftovers antibiotic for future use	**30**
11	Table 3.10: Diagnosis of infections in Sample individuals	**31**
12	Table 3.11: Antibiotics prescriptions giving to sample individuals	**32**
13	Table 3.12: Antibiotic prescribed for children aged less than 12 month	**33**
14	Table 3.13: Antibiotic prescribed for children aged from 13 months to 5 years	**35**
15	Table 3.14: Antibiotic prescribed for children aged from 6 years to 12 years	**36**
16	Table 3.15: Antibiotic prescribed for children aged from 13 years to 15 years	**38**

List of figures

No.	Subjects	Page
1	Figure 1: Sex of sample individuals	20
2	Figure 3.2: Ages of sample individuals	21
3	Figure 3.2: History of medical illness	22
4	Figure 3.4: Previous used of antibiotics	23
5	Figure 3.5: Antibiotics used previously	24
6	Figure 3.6: Time of treatment with antibiotics	26
7	Figure 3.7: Parents perception about antibiotics	27
8	Figure 3.8:Parent satisfaction with physician visit	29
9	Figure 3.9: Stop therapy when symptoms subside	30
10	Figure 3.10: Diagnosis of infections in Sample individuals	31
11	Figure 3.11: Antibiotic prescribed for children aged less than 12 month	34
12	Figure 3.12: Antibiotic prescribed for children aged from 13 months to 5 years	36
13	Figure 3.13: Antibiotic prescribed for children aged from 6 years to 12 years	37
14	Figure 3.14: Antibiotic prescribed for children aged from 13 years to 15 years	39

ABSTRACT

Background: Antibiotics are commonly prescribed for hospitalized children. However, only a limited number of studies have evaluated antibiotic use in this population. The current work assessed the indication, prescribing pattern and appropriateness of antibiotics among pediatric patients.

Objective: Our objective of this study was to evaluate the prescribing pattern of antibiotics for children in Ibb city hospitals.

Methods: It is an observational retrospective study of inpatient in the hospitals who were diagnosed with one or more infection that required the use of antibiotics. A total of 250 cases aged from 1 day to 15 years were reviewed. Data collected from patient's companions includes personal information, common antibiotics use related, diagnosis, duration of treatment, correlation between antibiotic prescription and parent's educations, antibiotic was prescribed.

Results: Sample individuals included 250 children, with 58% of them being male and 42% being female. 48% of the sample reported having a history of medical illness, while 52% did not. The most commonly prescribed antibiotic was Ceftriaxone, with 30% of the sample individuals followed by Amoxicillin and clavulanic Acid, with 26.4% while, Azithromycin was the third most commonly prescribed antibiotic, with 20.8% of the sample individuals receiving antibiotics.

Conclusion: we found that" Repeated use of antibiotics because inadequate and correct understanding of the way to use antibiotics, parents lack perception of antibiotics, misunderstanding of antibiotics and their use directions and stopping therapy when their child's symptoms subside suggest leading to the development of antibiotic resistance and may alter the microbe in ways that make individuals more susceptible to infections.

1. INTRODUCTION

Antibiotics are the most common drugs used in the treatment of various infections in the department of pediatrics **(Sabishruthi *et al.*, 2019)**. Antibiotics play a crucial role in the management of infectious diseases **(Sharma *et al.*, 2016)**.

The inevitable result of the extensive use of antimicrobials gives rise to the development of antimicrobial-resistant pathogens, creating an increase in demand for new drugs. An upward trend in the antimicrobial resistance and, concomitantly, the decline in the development of new antimicrobials have impacted the public health and economy. Judicious selection of antimicrobial agents requires proper clinical judgment and a thorough understanding of microbiological and pharmacological factors **(Girma *et al.*, 2018)**. Therefore, rational prescribing practices can resolve the global issue of antibiotic overuse and misuse **(Pradeepkumar *et al.*, 2017)**.

Irrational drug use is a serious global problem and can pilot its course towards morbidity, mortality, and economic burden on the health-care system. World Health Organization (WHO) has reported that over half of all drugs are inappropriately administered, dispensed or sold **(WHO, 2013)**.

Information on drug administration has fallen behind in children and infants than that of adults for various reasons. These include developmental differences that affect the drugs' pharmacodynamics and pharmacokinetic profiles, ethical and financial reasons, research capability, and regulatory guidelines and constraints. Worldwide, inappropriate antimicrobial use in pediatrics has been noted as a common practice **(Al Balushi *et al.*, 2013)**.

A study conducted in the pediatric population in the USA and Canada has indicated an inappropriate antibiotic use of 50% and 85%, respectively. The incidence of medication errors in infants and children is higher than in adults. Research reports on children have pointed towards a high mean number of drugs of **5.5 (Shankar *et al.*, 2006)**.

Proper choice of antibiotics is a complex process that needs careful clinical judgment. WHO has composed a set of core drug use indicators, which assess the performance of prescribers, patients' knowledge and experience at health care facilities and effective functioning of health-care personnel. This evaluation will boost the development of standards for prescribing, single out the problems associated with the understanding of instructions provided by consultants to the patients, and even minimize the financial burden on patients **(Thiruthopu *et al*., 2014)**.

Proper information about antibiotic usage pattern and the pressing need to curtail resistance has become an absolute necessity for a constructive approach to the problems arising due to the inappropriate use of antibiotics, especially among the pediatric population **(Mukherjee *et al*., 2015)**.

1.1. ANTIBACTERIAL AGENTS (ANTIBIOTICS)

Antibacterial agents are chemical compounds used to kill or inhibit the growth of bacteria called (Antibiotics). Strictly speaking, antibiotics are a subgroup of organic anti-infective agents that are derived from bacteria or moulds that are toxic to other bacteria. However, the term antibiotic is now used loosely to include anti-infective produced from synthetic and semisynthetic compounds **(www.hpa.org.uk)**.

The term antibiotic may be used interchangeably with the term antibacterial. However, it is incorrect to use the term antibiotic when referring to antiviral, antiprotozoal and antifungal agents. It is important to remember that antibiotics only work against infections that are caused by bacteria and certain parasites **(Lang *et al*., 2004)**.

They do not work against infections that are caused by viruses (for example, the common cold or flu), or fungi (for example, thrush in the mouth or vagina), or fungal infections of the skin. Occasionally, a viral infection or minor bacterial infection develops into a more serious secondary bacterial infection **(Lang *et al*., 2004)**.

1.1.1 Antibiotics sources

- **History of antibiotics**

Penicillin was the first antibiotic used successfully in treating bacterial infections. Sir Alexander Fleming first discovered it in 1928, but its potential for treatment against infections wasn't recognised until over a decade later when Ernst B Chain, Sir Howard Florey and Norman Heatley produced enough purified penicillin to treat patients with. By the 1950s, a large number of antibiotics were being discovered and manufactured for the treatment of diseases caused by infecting bacteria. Over the last 50 years, antibiotics have transformed the patterns of disease and death **(www.w3.org)**.

1.1.2 Classification of antibiotics

Antibiotics can be classified in several ways. The most common method classifies them according to their chemical structure as antibiotics sharing the same or similar chemical structure will generally show similar patterns of antibacterial activity, effectiveness, toxicity and allergic potential.

Most antibiotics fall into their individual antibiotic classes. An antibiotic class is a grouping of different drugs that have similar chemical and pharmacologic properties. Their chemical structures may look comparable, and drugs within the same class may kill the same or related bacteria (**Surbhi *et al*., 2011)**.

According to **Peters *et al*., (2008**), in the research agenda of the National Institute of Allergy and Infectious Diseases for antimicrobial resistance National Institute of Allergy and Infectious Diseases (NIAID), antibiotics are classed according chemical structure as the following:

- **Penicillins**

Another name for this class is the beta-lactam antibiotics, referring to their structural formula. The penicillin class contains five groups of antibiotics: aminopenicillins, antipseudomonal penicillins, beta-lactamase inhibitors, natural penicillins, and the penicillinase resistant penicillins. Common antibiotics in the penicillin class include: penicillin V potassium, amoxicillin, and amoxicillin/clavulanate (Augmentin) **(Raja *et al.*, 2009)**.

- **Cephalosporins**

There are five generations of cephalosporins, with increasing expanded coverage to include gram-negative infections. Cephalosporins treat many infections, including strep throat, ear infections, urinary tract infections, skin infections, and meningitis. The fifth generation cephalosporin ceftaroline (Teflaro) is active against methicillin resistant *Staphylococcus aureus* (MRSA). Common medications in this class, like: cefuroxime, ceftriaxone, and cefdinir (**Peters *et al.*, 2008**).

- **Tetracyclines**

Tetracyclines are broad-spectrum against many bacteria and treat conditions such as acne, urinary tract infections (UTIs), intestinal tract infections, eye infections, sexually transmitted diseases, periodontitis (gum disease), and other bacterial infections. The tetracycline class contains well-known drugs such as: doxycycline, tetracycline, and minocycline **(Table 2)** **(www.insidehopkinsmedicine.org)**.

- **Quinolones**

The quinolones, also known as the fluoroquinolones, are a synthetic, bactericidal antibacterial class with a broad-spectrum of activity. The quinolones can be used for difficult-to-treat urinary tract infections when other options are aren't effective, hospital-acquired pneumonia, bacterial prostatitis, and even anthrax or plague **(Pepin *et al.*, 2005)**. The Food and Drug Administration (FDA) issued a strong warning about this class in 2016. Familiar names in the fluoroquinolone class include: ciprofloxacin, levofloxacin, and moxifloxacin **(Table 2)** (**Peters *et al.*, 2008**).

- **Lincomycins**

This class has activity against gram-positive aerobes and anaerobes (bacteria that can live without oxygen), as well as some gram-negative anaerobes. The lincomycin derivatives may be used to treat serious infections like pelvic inflammatory disease, intra-abdominal infections, lower respiratory tract infections, and bone and joint infections. These drugs include: clindamycin, lincomycin **(Dellit *et al.*, 2007)**.

- **Macrolides**

The macrolides can be used to treat community-acquired pneumonia, pertussis (whooping cough), or for uncomplicated skin infections, among other susceptible infections. Ketolides are a newer generation of antibiotic developed to overcome macrolide bacterial resistance. Frequently prescribed macrolides are: azithromycin, clarithromycin, and erythromycin **(Mandell *et al.*, 2007)**.

- **Sulfonamides**

Sulfonamides are effective against some gram-positive and many gram-negative bacteria, but resistance is widespread. Common uses for sulfonamides include UTIs, treatment or prevention of pneumocystis pneumonia, or ear infections (otitis media). Familiar names include: sulfamethoxazole-trimethoprim, sulfasalazine, and sulfisoxazole (combined with erythromycin) **(Tice *et al.*, 2004)**.

- **Glycopeptide antibiotics**

Members of this group may be used for treating methicillin-resistant staphylococcus aureus (MRSA) infections, complicated skin infections, C. difficile-associated diarrhea, and enterococcal infections such as endocarditis which are resistant to beta-lactams and other antibiotics. Common drug names include: dalbavancin, oritavancin, telavancin, vancomycin **(Dellit *et al.*, 2007)**.

- **Aminoglycosides**

Aminoglycosides inhibit bacterial synthesis by binding to the 30S ribosome and act rapidly as bactericidal antibiotics (killing the bacteria). These drugs are usually given intravenously (in a vein through a needle). Common examples in this class are: gentamicin, tobramycin, and amikacin **(Table 2) (Dellit *et al.*, 2007)**.

- **Carbapenems**

These injectable beta-lactam antibiotics have a wide spectrum of bacteria-killing power and may be used for moderate to life-threatening bacterial infections like stomach infections, pneumonias, kidney infections, multidrug-resistant hospital-acquired infections and many other types of serious bacterial illnesses. Members of this class include: imipenem/cilastatin, meropenem, doripenem, and ertapenem **(Tice *et al.*, 2004)**.

1.1.3. Mechanisms of action of antibiotics

Antibacterial action generally falls within one of four mechanisms, three of which involve the inhibition or regulation of enzymes involved in cell wall biosynthesis, nucleic acid metabolism and repair, or protein synthesis, respectively. The fourth mechanism involves the disruption of membrane structure. Many of these cellular functions targeted by antibiotics are most active in multiplying cells **(Chapman, 2003)**.

Since there is often overlap in these functions between prokaryotic bacterial cells and eukaryotic mammalian cells, it is not surprising that some antibiotics have also been found to be useful as anticancer agents. According to **Peters *et al.,* (2008**), the mechanism of antibiotics action is detailed as the following:

- **Inhibition of cell wall synthesis**

The cellular contents in bacteria are surrounded by an inner peptidoglycan cell wall in addition to an inner plasma membrane. Gram- negative bacteria also have an additional outer lipid bilayer. Specific antibacterial interfere with the synthesis of the cell wall, weakening the peptidoglycan scaffold within the bacterial wall, compromising the structural integrity. Since mammalian cells have a plasma membrane but lack the peptidoglycan wall structure, this class of antibacterial selectively targets the bacteria with no significant negative effect on the cells of the mammalian host **(Pucci & Bush, 2013)**.

- **Inhibiter protein synthesis**

Protein synthesis is a complex, multi-step process involving many enzymes as well as conformational alignment. Aminoglycosides are antibiotics that block bacterial protein synthesis interfere with the processes at the 30S subunit or 50S subunit of the 70S bacterial ribosome. The primary steps in the process that are inhibited are:

  - Formation of the 30S initiation complex (made up of mRNA, the 30S ribosomal subunit, and formyl-methionyl-transfer RNA(
  - Formation of the 70S ribosome by the 30S initiation complex and the 50S ribosome.
  - Elongation process of assembling amino acids into a polypeptide **(Aarestrup *et al.,* 2001)**.

- **Inhibit DNA synthesis**

DNA replication requires the activity of a class of enzymes called the topoisomerases. Topoisomerase II (DNA gyrase) relaxes supercoiled DNA molecules and initiates transient breakages and rejoins phosphodiester bonds in superhelical turns of closed-circular DNA of bacteria. This allows the DNA strand to be replicated by DNA or RNA polymerases. Quinolones are a key group of antibiotics that specifically interfere with bacterial topoisomerase II and not mammalian topoisomerases **(Giguère, 2006)**.

- **Inhibition of enzyme**

Some antibiotics inhibit the enzymes involved in bacterial cell wall synthesis, protein synthesis or nucleic acid synthesis. Popular enzyme targets include transpeptidases, transglycosylases, topoisomerases, RNA polymerase and peptidyl transferases **(Weese, 2006)**.

- **Alteration of cell membranes permeability**

Polymyxin B and colistin (polymyxin E) disrupt the cell membrane integrity of Gram-negative bacteria by binding to membrane phospholipids. Eukaryotic cell membranes have phospholipids similar to Gram-negative bacteria, so the polymyxins are most often used clinically as topical antibiotics **(Giguère, 2006)**.

In contrast, the ionophore antibiotics such as monensin and valinomycin tend to be more active against Gram-positive bacteria, which lack the outer cell membranes. Monensin is an ionophore that forms monovalent ion channels in the cell wall of Gram-positive bacteria and allows the free movement of K+ and Na+ ions along their concentration gradients **(Aarestrup *et al.*, 2001)**.

The examples antibiotic of belonging to the mechanism classes are shown in **(Table 1)**.

Table 1: Summary of antibiotic classifications and their indications (www.orthobullets.com).

Class/Mechanism	Drugs	Indications (**Drug of Choice)	Toxicity
Inhibits Cell Wall Synthesis			
Penicillins (bactericidal: blocks cross linking via competitive inhibition of the transpeptidase enzyme)			
Penicillin	Penicillin G Penicillin V Procaine penicillin G. Benzathine penicillin G.	*Strep. pyogenes (Grp.A)***. *Step. agalactiae (Grp.B)***. *C. perfringens (Bacilli)***	Hypersensitivity reaction Hemolytic anemia
Aminopenicillins	Ampicillin Amoxicillin	Above+ ↑Gram-negative: *E. faecalis*** & *E. Coli***	Above
Penicillinase-resistant-penicillins	Methicillin Oxacillin Nafcillin Dicloxacillin	Above+ PCNase-producing *Staph. Aureus*	Above+ Interstitial nephritis
Antipseudomonal penicillins	Carbenicillin Ticarcillin Piperacillin	*Above+* *Pseudomonas aeruginosa***	Above
Cephalosporins (bactericidal: inhibits bacterial cell wall synthesis via competitive inhibition of the transpeptidase enzyme)			
1st generation	Cefazolin Cephalexin	*Staph. aureus*** *Staph. epidermidis*** *E. Coli* & *Klebsiella*	Allergic reaction Coombs-positive anemia (3%)
2nd generation	Cefoxitin Cefuroxime Cefaclor	Above + ↑ Gram-negative	Allergic Reaction ETOH Disulfiram reaction
3rd generation	Ceftriaxone Cefotaxime Ceftazidime **Cefepime (4th generation)**	Above + ↑ Gram-negative *Pseudomonas*	Allergic Reaction ETOH Disulfiram reaction
Other Cell Wall Inhibitors			
Vancomycin **(bactericidal: disrupts peptidegly-can cross-linkage)**	Vancomycin	MRSA** PCN/Cephallegies** *S. aureus* & *S. epidermidis*	Red man syndrome Nephrotoxicity Ototoxicity
Beta-lactamase Inhibitors **(bactericidal: blocking cross linking)**	Clavulanic acid Sulbactam Tazobactam	*S. aureus*** & *S. epidermis*** *E. Coli*** & *Klebsiella***	Hypersensitivity Reaction Hemolytic anemia
Carbapenems	Imipenem Meropenem Doripenem Ertapenem	Broadest activity of any antibiotic (except MRSA, Mycoplasma)	
Aztreonam	Aztreonam	Gram-negative rods and aerobes Hospital-acquired infections	
Polymyxins	Polymyxin B Polymyxin E	Topical Gram-negative infections	
Bacitracin	Bacitracin	Topical Gram-positive infections	
Protein Synthesis Inhibition			
Anti-30S ribosomal subunit			
Aminoglycosides **(bactericidal: irreversib-le binding to 30S)**	Gentamicin -Neomycin Amikacin -Tobramycin Streptomycin	Aerobic Gram-negatives *Enterobacteriaceae* *Pseudomonas*	Nephrotoxicity Ototoxicity
Tetracyclines **(bacteriostatic: blocks tRNA)**	Tetracycline -Doxycycline Minocycline -Demeclocycline	*Rickettsia* *Mycoplasma* *Spirochetes* (Lyme's disease)	Tooth discoloration Impaired growth Avoid in children < 12 age
Anti-50S ribosomal subunit			
Macrolides **(bacteriosta-tic: reversibly bind 50S)**	Erythromycin - Azithromycin Clarithromycin	*Streptococcus & H. influenzae* *Mycoplamsa pneumonia*	Coumadin Interaction (cytochrome P450)
Chloramphenicol **(bacteriostatic)**	Chloramphenicol	*H influenza* & Meningitis Brain abscess	Aplastic Anemia Gray Baby Syndrome
Lincosamide **(bacteriostatic: inhibits peptidyl transferase by interfering with amino acyl-tRNA complex)**	Clindamycin	*Bacteroides fragilis* *S aureus* *Coagulase-negative Staph & Strep* Excellent Bone Penetration	Pseudomembranous colitis Hypersensitivity Reaction
Linezolid **(variable)**	Linezolid	Resistant Gram-positives	
Streptogramins	Quinupristin Dalfopristin	VRE GAS and S. aureus skin infections	
DNA Synthesis Inhibitors			
Fluoroquinolones (bactericidal: inhibit DNA gyrase enzyme, inhibiting DNA synthesis)			

1st generation	Nalidixic acid	*Steptococcus* & *Mycoplasma* *Aerobic Gram +*	Phototoxicity Achilles tendon rupture Impaired fracture healing
2nd generation	Ciprofloxacin Norfloxacin Enoxacin Levofloxacin Ofloxacin	As Above +*Pseudomonas*	as above
3rd generation	Gatifloxacin	As above + Gram-positives	as above
4th generation	Moxifloxacin Gemifloxacin	As above + Gram-positives + anaerobes	as above
Other DNA inhibitors			
Metronidazole **(bacteridical: metabolic products disrupt DNA)**	Metronidazole (Flagyl)	Anaerobics	Seizures Crebelar dysfunction ETOH disulfram reaction
RNA synthesis inhibitors			
Rifampin **(bactericidal: inhibits RNA transcri-ption by inhibiting RNA polymerase)**	Rifampin	*Staphylococcus* *Mycobacterium* (TB)	Body fluid discoloration Hepatoxicity (with INH)
Mycolic acids synthesis inhibitors			
Isoniazid	Isoniazidz	TB & Latent TB	
Folic acid Synthesis Inhibitors			
Trimethoprim/Sulfonamides **(bacteriostatic: inhibition with PABA)**	Trimethoprim/Sulfamethoxazole Sulfisoxazole Sulfadiazine	UTI organisms *Proteus* *Enterobacter*	Thrombocytopenia Avoid in third trimester of pregnancy
Pyrimethamine	Pyrimethamine	Malaria & *T. gondii*	

1.2. BACTERIAL RESISTANCE AGAINST ANTIBIOTICS

During the last decade, antibiotic resistance by various mechanisms has increased worldwide in bacterial pathogens leading to treatment failures in human and animal infectious diseases **(Keyes *et al.*, 2003)**. Resistance against antibiotics by pathogenic bacteria is a major concern in the anti-infective therapy of both humans and animals. Bacteria are able to adapt rapidly to new environmental conditions such as the presence of antimicrobial molecules and, as a consequence, resistance increases with the antimicrobial use **(Guardabassi & Courvalin, 2006).**

Serious concerns about bacterial drug resistance from nosocomial, communityacquired and food-borne pathogens have been growing for a number of years and have been raised at both national and international levels **(Luangtongkum *et al.*, 2006)**.

1.2.1. Mechanisms of action of bacterial resistance

The antibiotics have multiple target sites against microbial cells. Thus, the emergence of general bacterial resistance is unlikely to be caused either (i) by a specific modification of a target site or (ii) by a by-pass of a metabolic process. It emerges from a mechanism/process causing the decrease of the intracellular concentration of biocide under the threshold that is harmful to the bacterium. Several mechanisms based on this principle (mode of action) have been well-described including change in cell envelope, change in permeability, efflux and degradation. It is likely that these mechanisms operate synergistically although very few studies investigating multiple bacterial mechanisms of resistance following exposure to a biocide have been performed **(Keyes *et al.*, 2003)**.

The efficacy of antibiotics depends on a range of intrinsic and extrinsic factors **(Fraud *et al.*, 2008)**.

1.2.1.1 Intrinsic factors

Intrinsic factors are characteristics of the antibiotics agent and its application. Concentration and contact time are crucial. Furthermore, the combination of contact time and concentration determines the result in term of microbial reduction. This is called the CT concept, and within certain limits of time and concentration, there is a relationship with a defined constant characterizing efficacy. Thus the same result could be obtained with a high concentration of disinfectant during a short contact time, or a lower concentration during a longer contact time. The stability of the active compounds of the biocide in the environment also influences the efficacy **(John & James, 1999)**.

- **Mechanisms of intrinsic resistance**

Most of the antibacterial resistance which is now making it difficult to treat some infection diseases is due to the extensive use and misuse of antibacterial drugs which have favored the emergence and survival of resistant strains of micro-organisms. Drug-resistant strains are common among *staphylococci*, *gonococci*, *meningococci*, *pneumococci*, *enterococci*, Gram negative bacteria (e.g., *salmonella, shigella, klebsiella*, *pseudomonas*) and *M. tuberculosis* **(Doern, 1995)**. Bacteria become resistant to antibiotics by a number of mechanisms, the commonest being:

- Production of enzymes which inactivate or modify antibiotics,
- Changes in the bacterial cell membrane permeability, so preventing the uptake of an antibiotic.
- Modification of the target receptor so that it no longer interact with the antibiotic.
- Exportation of drug from bacteria.
- Development of metabolic pathways by bacteria which enable the set of antibacterial action to be bypassed.

The most described intrinsic resistance mechanism is changes in the permeability of the cell envelope, also referred to as "permeability barrier". This is not only found in spores, but also in vegetative bacteria such as mycobacteria and to some extent in Gram-negative bacteria. The permeability barrier limits the amount of an antibiotic that enters the cell, thus decreasing the effective antibiotic concentration. In mycobacteria the presence of a mycoylacylarabino-galactan layer accounts for the impermeability to many antimicrobials**.** In addition, the presence and composition of the arabinogalactan/arabinom-annan cell wall also plays a role in reducing the effective concentration of antibiotic that can penetrate within mycobacteria **(Forbes *et al.*, 1998)**.

1.2.1.2. Extrinsic factors (acquired)

Extrinsic factors derive from the environment during application. The temperature of the environment is important, as most substances have a lower efficacy at low temperatures. The presence of proteins reduces efficacy as they interact with the substance. The mode of contact also influences the efficacy, as does the contact time (mechanical effects). The pH is another important factor. The concentration of the microorganisms, the age of the bacterial community and protection by attachment on particulate matter, and the presence of biofilms play an increasingly important role)**Russell, 2002)**.

- **Mechanisms of extrinsic (acquired) resistance**

The development of bacterial resistance through acquired mechanisms such as mutation and the acquisition of resistant determinants are of concern since a bacterium that was previously susceptible can become insusceptible to a compound or a group of compounds)**Russell, 2002)**. The acquisition of resistant genes has been well described in the literature **(Chapman, 2003)**. and it is particularly important to consider this as it might confer cross or co-resistance on occasion **(Bjorland *et al.*, 2001)**.

1.2.1.3. Genetic dependent of resistance

New genetic material is acquired by the transfer of resistant genes, (located on plasmids and transposons) from one bacterium to another. Some plasmids encode for resistance to several antibiotics and can be transferred between bacterial species, (e.g., from *Escherichia coli* to *Shigella dysenteriae*). To acquire the new properties bacteria must undergo a genetic change. Such a genetic change may occur by mutation or by acquisition of new genetic material. **(Noppe-Leclercq *et al.*, 1999)**.

A) Chromosomal dependent resistance

Chromosomal resistance is resulting to a mutation in the gene that codes for either the target of the drug or the transport system in the membrane that controls the uptake of the drug. The frequency of spontaneous mutations usually is much lower than the frequency of acquisition of resistance plasmids. Therefore, chromosomal resistance is less of a clinical problem than is plasmid-mediated resistance **(Levinson, 2004)**.

B) Plasmid-Mediated Resistance

Plasmid-mediated resistance is very important from a clinical point of view for three reasons:

***** It occurs in many different species, especially gram-negative rods.

***** Plasmids frequently mediate resistance to multiple drugs.

*****Plasmids have a high rate of transfer from one cell to another, usually by conjugation.

Resistance plasmids (resistance factors, R factors) are extra-chromosomal, circular, double-stranded DNA molecules that carry the genes for a variety of enzymes that can degrade antibiotics and modify membrane transport systems. R factors may carry one antibiotic resistance gene or may carry two or more of these genes. In addition to producing drug resistance, R factors have two very important properties:

(1) They can replicate independently of the bacterial chromosome; therefore, a cell can contain many copies; and **(2)** they can be transferred not only to cells of the same species but also to other species and genera **(Levinson, 2004)**.

C) Transposon-mediated resistance

Transposons are genes that are transferred either within or between larger pieces of DNA such as the bacterial chromosome and plasmids. Transposons are flanked by short regions of almost identical DNA sequence known as repeats. These repeats are thought to function as recognition sequences for enzymes involved in transposition (the ability of transposons to transfer and integrate into the recipient DNA molecule).

The central region of the transposon often codes for antibiotic resistance genes. The ability of transposons to mobilize from one DNA molecule to another has led to them being referred to as jumping genes **(Levinson, 2004)**.

- **Non-genetic resistance**

There are several non-genetic explanations for the failure of drugs to prevent the growth of bacteria:

1) Bacteria can be in a resting state i.e. not growing; they are therefore insensitive to cell wall inhibitors such as penicillins and cephalosporins. Similarly, *M. tuberculosis* can remain dormant in tissues for many years, during which time it is insensitive to drugs. If host defenses are lowered and the bacteria begin to multiply, they are again susceptible to the drugs, indicating that a genetic change did not occur.

2) Bacteria can be walled off within an abscess cavity that the drug cannot penetrate effectively. Surgical drainage is therefore a necessary adjunct to chemotherapy.

3) The presence of foreign bodies makes successful antibiotic treatment more difficult. This applies to foreign bodies such as surgical implants and catheters as well as materials that enter the body at the time of penetrating injuries, such as splinters and shrapnel.

4) Under certain circumstances, organisms that would ordinarily be killed by penicillin can lose their cell walls, survive as protoplasts, and be insensitive to cell-wall-active drugs. Later, if such organisms resynthesize their cell walls, they are fully susceptible to these drugs.

5) Several artifacts can make it appear that the organisms are resistant, e.g., administration of the wrong drug or the wrong dose or failure of the drug to reach the appropriate site in the body. "A good example of the latter is the poor penetration into spinal fluid by several early-generation cephalosporin". Failure of the patient to take the drug (non-compliance, nonadherence) is another artifact **(Levinson, 2004)**.

1.3. THE AIM OF THE STUDY

The objective of this study was to evaluate the prescribing pattern of antibiotics for children in Ibb city hospitals.

1.4. PREVIOUS STUDIES

Palikhe, (2004), conducted a study objective studying the Prescribing Pattern of Antibiotics in Pediatric Hospital .A retrospective study of one and half month's duration was undertaken during November- December of 2003.A total number of 121 patients were taken for the study. Result arrived, the average number of drugs per patient was 5.01±1.36 and antibiotics per patient was 2.41±1.02. Antibiotics were prescribed at least once for 93 percent of hospitalized children although only few of the patients receiving antibiotics had a proven bacterial infection. Among 121 patients clinically diagnosed with infectious diseases and treated with antibiotics, specimens were taken for culture in only 24 cases i.e. (19.8%) to identify pathogenic organisms. Only 13 specimens showed positive culture results. Infants less than 1 year received antibiotics more frequently than 1-5 and 5-12 years (40, 31 and 29%, P<0.001). Seventy-five percent of the total antibiotics were administered parenterally. Cephalosporin was the top most frequently prescribed antibiotics followed by penicillin group. Significant difference was found between age group of patient and disease **(Palikhe, 2004)** .

And *Chaw et al., (2018),* conducted a study objective Antibiotic use on paediatric inpatients in a teaching hospital. a retrospective analysis of paediatric inpatient data at The Edward Francis Small Teaching Hospital in Banjul, The Gambia. We extracted relevant data from the admission folders of all patients (aged > 28 days to 15 years) admitted in 2015 (January– December), who received at least one antibiotic for 24 h. Result arrived Over half of the admitted patients received at least one antibiotic during admission. The clinical diagnoses included an infectious disease for 398/496, 80.2% of the patients on antibiotics, pneumonia being the most common (184/496, 37.1% **(Chaw *et al.*, 2018)**.

And *Choudhury and Bezbaruah, (2013)* conducted a study objective to determine the antibiotic prescriptions pattern and to analyze the rationale use of antibiotic in Pediatric in-patient department of hospital observational and prospective study was carried out for 1 month duration between April to May 2011. The details of the patients were being recorded in a specific format and results were analyzed by descriptive statistic and expressed as mean ±SD. Out of 200 patients, 132 prescriptions received antibiotics, where 77 were male child and 55 were female child. The duration of antibiotic therapy was 6.05 ± 3.45 days and length of hospitalization was 8.91±5.35. In our study **(Choudhury and Bezbaruah, 2013)**.

And *Al-Ghazali et al., (2017)*, conducted a study objective was to determine the prescriptions pattern of antibiotic in paediatric in-patient department of The method was prospective and observational study which was carried out for 2 months duration between March- April 2015. Patient's data was being recorded in a specific format and results were analysed by descriptive statistic and expressed as mean ± SD. The result was out of 148 patients, 95 prescriptions were taken antibiotics, where 59 were male child and 36 were female child. The most prevalent diseases among studied patients was bronchitis (27.4%) followed by asthma (15.8%), and lower respiratory tract infection (9.5%). Cephalosporin (51.5%) was found to be widely prescribed antibiotic followed by penicillin (25.3), aminoglycosides (13.4), metronidazole (5.7%), vancomycin (2.6%), and azithromycin **(Al-Ghazali *et al.*, 2017)**.

And *Sriram et al. (2008)*, conducted a study objective was to assess the antibiotic use in pediatric patients. The study the period of eight months from May 2007 to December 2007. During the study period, all inpatients of the pediatric ward that were prescribed with antibiotics were screened. The study result showed that there were a total of 214 (52.5%) cases prescribed with antibiotics. The major disorders for which antibiotics were prescribed included acute gastroenteritis (15%), lower respiratory tract infections, (14.5) upper respiratory tract infections (13.5%) and pyrexia of unknown origin (13.5%).The most commonly prescribed antibiotic class was cephalosporins (68.2%). The most frequently prescribed antibiotic was cefuroxime (22.9%) and the commonly used antibiotic combination was cephalosporin with aminoglycoside (6.5%). The study result showed that ampicillin was the antibiotic used commonly to treat acute gastroenteritis (75%); cefuroxime for both lower respiratory tract infections (81.3%) and asthma (50%); amoxicillin/ clavulanate potassium for both upper respiratory tract infections (41.4%) and pyrexia of unknown origin (34.5%); ceftriaxone/sulbactum for both acute otitis media and seizure disorder (69.2%) respectively **(Sriram *et al.*, 2008)**.

And *Sabishruthi, (2019),* was to evaluate the prescribing patterns of drugs with cost analysis in pediatric inpatients at tertiary care hospital. Study carried out in pediatric inpatients with a sample of 180 patients based on age, inclusion, and exclusion criteria for period of 3 months. Results: of 180 patients data were collected, the results show that majority of gender admitted in the hospital were male children 94 (52%) and many are from age group of early childhood (2–5 years) 67 (37%). Respiratory tract infections are diagnosis most commonly analyzed and off overall 236 prescribed antibiotics cephalosporins 86 (43%) and combination of amoxicillin + clavulanic acid 25 (71%) is the class of antibiotics prescribed higher than other class of drugs **(Sabishruthi *et al.*, 2019)**.

CHAPTER II

METHODOLOGY OF THE STUDY

Chapter II:

Methodology of the Study

2.1. Study design

This study will be observational retrospective study to evaluate the prescribing pattern of antibiotics for children in Ibb city hospitals.

2.2. Population and Samples

2.2.1. Population

Infected children patients in Ibb city hospitals and pediatric clinics.

2.2.2. Samples

250 cases of infected patients of male and female children aged between 1 day to 15 years in Ibb city hospitals and pediatric clinics (Al- Thawrah Hospital – Al-Ameen Hospital - Pediatric & Maternal Hospital – Al- Hikmah Clinic).

2.3. Tools

Questionnaire includes personal information, common antibiotics use related, diagnosis, duration of treatment, correlation between antibiotic prescription and parent's educations, antibiotic was prescribed.

2.4. Statistical Analysis

The data were analyzed using a statistical package of social science program (SPSS).

CHAPTER III

RESULTS OF THE STUDY

3. Results of the study

3.1. Personal Information

Table 3.1: Personal Information

Sex of sample individuals

Male		Female		Total
No.	%	No.	%	250
145	58%	105	42%	

Ages of sample individuals

≤ 1 Year		1-5 years		6-12 years		From 13-15 years	
NO	%	NO	%	NO	%	NO	%
108	**43.2%**	67	**26.8%**	66	**26.4%**	9	**3.6**

The results presented in Table 3.1 provide some basic demographic information about the sample population for this study. The table shows that the sample individuals included 250 childlren, with 58% of them being male and 42% being female **(Figure 3.1)**.

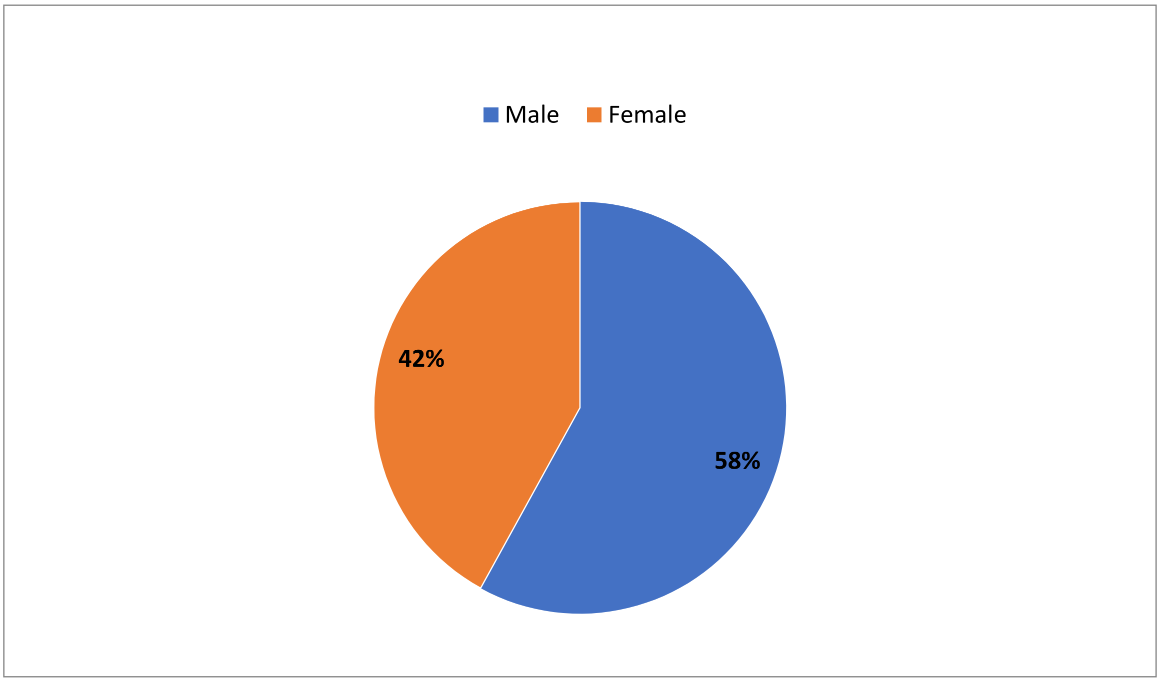

Figure 3.1: Sex of sample individuals

In terms of age, the majority of the sample (43.2%) was aged less than or equal to one year, followed by 1-5 years (26.8%), 6-12 years (26.4%), and only 3.6% of the sample was aged between 13-15 years **(Figure 3.2)**.

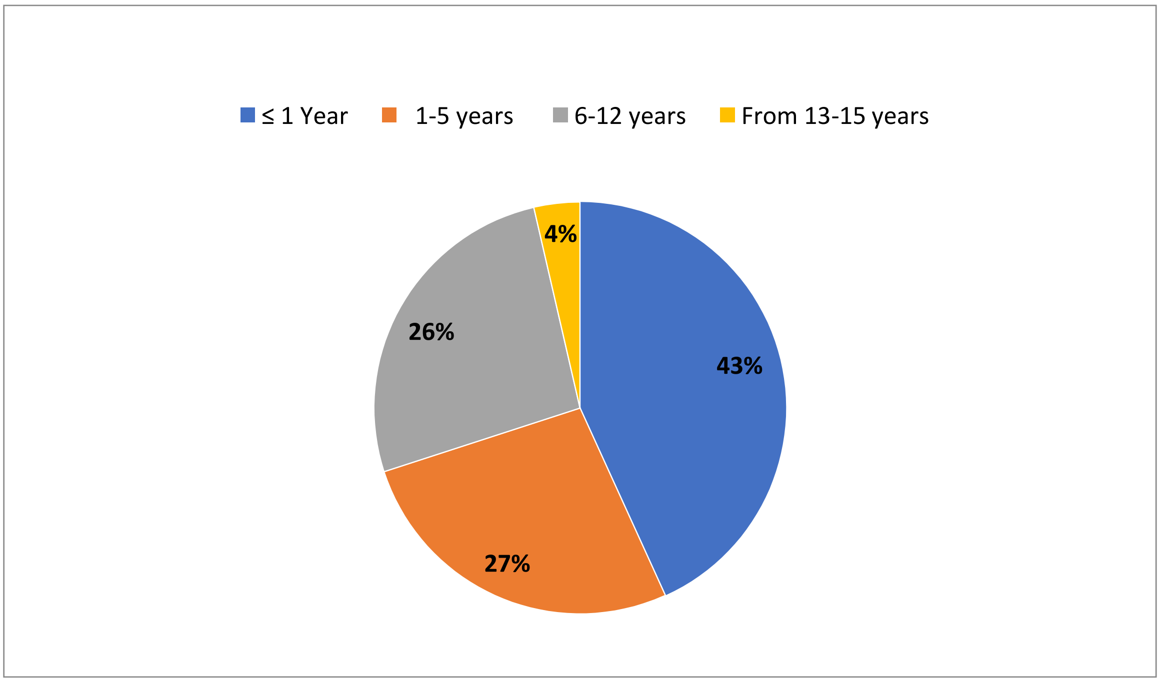

Figure 3.2: Ages of sample individuals

These results are important because they provide a description of the characteristics of the population under study, which is necessary for generalization and comparison with other populations.

In addition, the age distribution of the sample is heavily skewed towards younger children, with a majority of the sample being less than one year old. This may limit the generalizability of the study's findings to older children, who may have different patterns of antibiotic prescribing.

Overall, the results presented in Table 3.1 provide a useful baseline description of the personal information of the sample population for this study, but should be interpreted with caution and in the context of the study's limitations.

3. 2. History of medical illness

Table 3.2: History of medical illness

YES				NO History of medical illness			
Number		Percent %		Number		Percent %	
120		48%		130		52%	
Male		Female		Male		Female	
No	%	No.	%	No	%	No	%
63	52.5%	57	47.5%	82	63.1%	48	36.9%

The results presented in Table 3.2 describe the history of medical illness among the sample population. The table shows that 48% of the sample reported having a history of medical illness, while 52% did not.

The table also provides a breakdown of these results by gender. It shows that among the male sample population, 52.5% reported a history of medical illness while 63.1% did not. Among the female sample population, 47.5% reported a history of medical illness while 36.9% did not **(Figure 3.3)**.

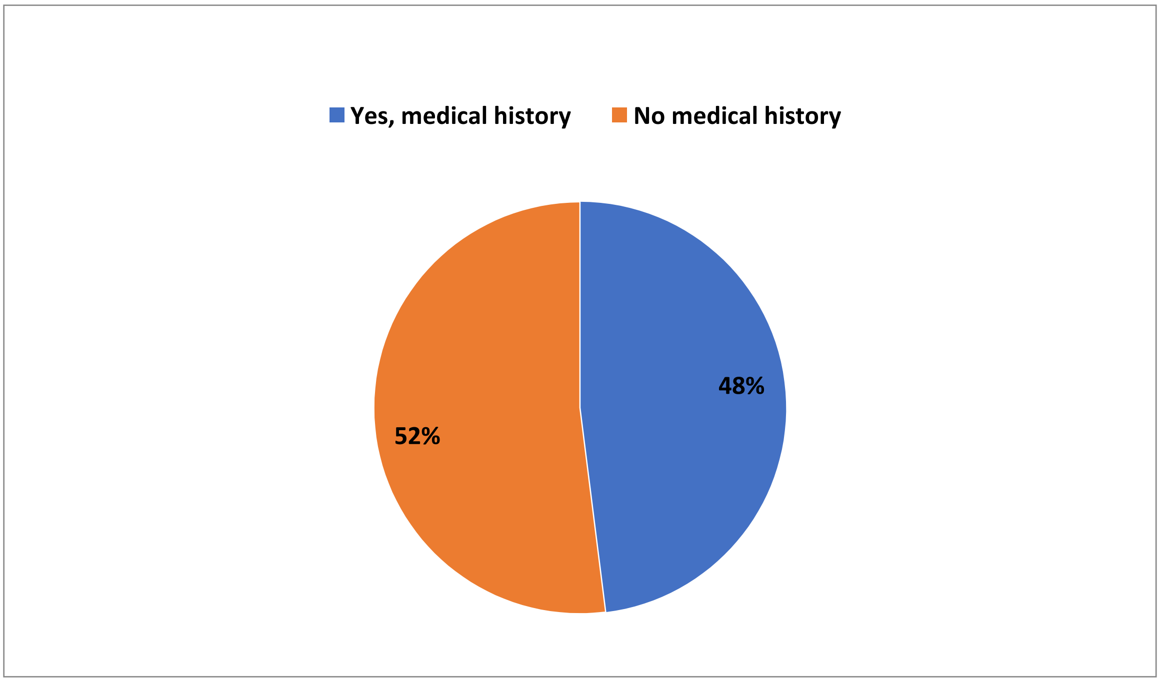

Figure 3.3: History of medical illness

These results are important because they provide insight into the health status of the sample population and may help explain patterns of antibiotic prescribing. For example, children with a history of medical illness may be more likely to receive antibiotics due to increased susceptibility to infections.

3.3. Previous used of antibiotics

Table 3.3: Previous used antibiotics			
Yes		No	
Number	Percent %	Number	Percent %
121	48.4 %	129	51.6%

The results presented in Table 3.3 describe whether or not the sample population had previously used antibiotics. The table shows that 48.4% of the sample had used antibiotics previously, while 51.6% had not **(Figure 3.4)**.

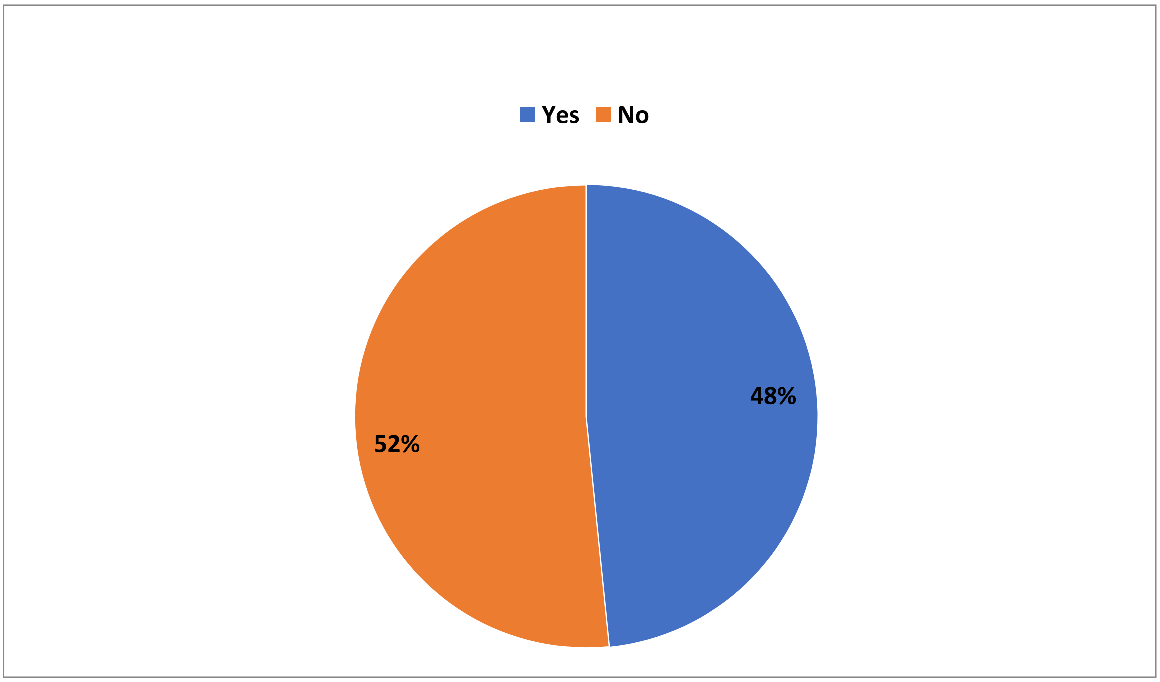

Figure 3.4: Previous used of antibiotics

These results are important because they provide insight into the past experiences of the sample population with antibiotics. Previous antibiotic use can have implications for future prescribing patterns, as repeated exposure to antibiotics can lead to the development of antibiotic resistance and may alter the microbe in ways that make individuals more susceptible to infections.

3. 4. Antibiotics used previously

Table 3.4: Antibiotics used previously n=121

Antibiotic	Number	Percent %
Ceftriaxone	**71**	**58.7%**
Amoxicillin	**60**	**49.6%**
Amoxicillin and clavulanic Acid	**21**	**17.4%**
Metronidazole	**18**	**14.9%**
Sulfamethoxazole	**9**	**7.4%**
Gentamycin	**3**	**2.5%**
Azithromycin	**1**	**0.8%**

The results presented in Table 3.4 describe the antibiotics that were used previously by the sample population who reported previous use of antibiotics. The table shows that out of 121 individuals who reported previous use of antibiotics, 58.7% had used ceftriaxone, 49.6% had used amoxicillin, and 17.4% had used amoxicillin and clavulanic acid.

The other antibiotics listed in the table were used less frequently, with metronidazole, Sulfamethoxazole, gentamycin, and azithromycin being used by 14.9%, 7.4%, 2.5%, and 0.8% of the sample population, respectively **(Figure 3.5)**.

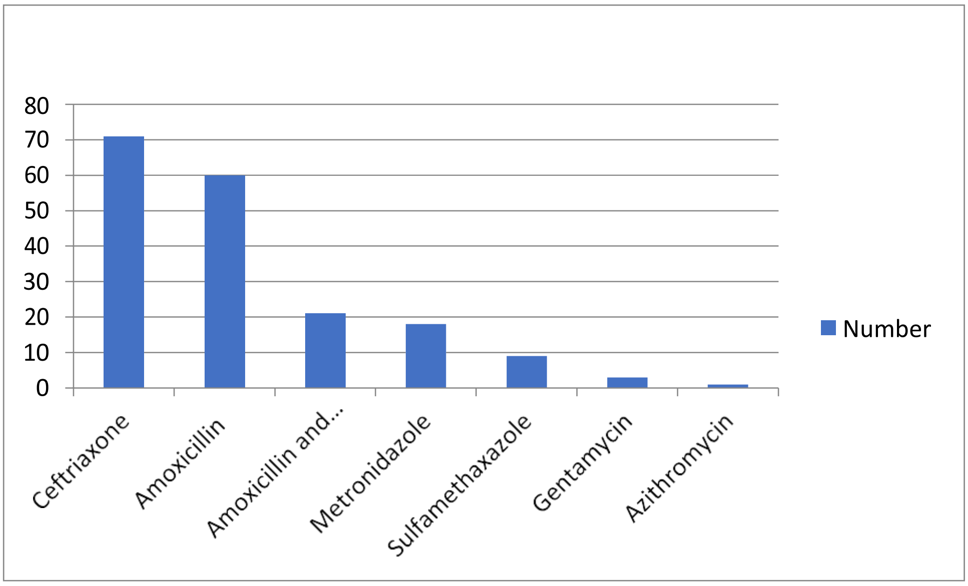

Figure 3.5: Antibiotics used previously

These results are important because they provide information on the specific antibiotics that have been previously used by the sample population. This information can help identify patterns of antibiotic use and potentially explain the prevalence of certain resistant bacterial strains in the hospital.

3.5. Time of treatment

Table 3.5: Time of treatment with antibiotics

Time per day	Number	Percent %
5 days	152	60.8%
7 days	34	13.6%
3 days	15	6%
4 days	14	5.6%
8 days	12	4.8%
6 days	10	4%
10 days	8	3.2%
21 days	5	2%
Total	250	100%

The results presented in Table 3.5 provide information on the duration of antibiotic treatment received by the sample population. The table shows that the most common duration of antibiotic treatment was 5 days, with 60.8% of individuals receiving antibiotics for this length of time. The second most common duration was 7 days, with 13.6% of individuals receiving antibiotics for this length of time. Smaller proportions of individuals received antibiotics for shorter or longer durations. For example, 6% of individuals received antibiotics for 3 days, while 5.6% received antibiotics for 4 days. Only 3.2% of individuals received antibiotics for 10 days or more **(Figure 3.6)**.

It is important to note that the recommended duration of antibiotic treatment can vary widely depending on the type of infection being treated and the specific antibiotic being used. However, the results presented in Table 3.5 may still provide useful information on potential patterns of antibiotic prescribing.

For example, if a large proportion of individuals are receiving antibiotics for durations longer than what is recommended for their specific infection, it may suggest that antibiotics are being overprescribed. Conversely, if a large proportion of individuals are receiving antibiotics for durations shorter than what is recommended, it may suggest that antibiotics are being under prescribed.

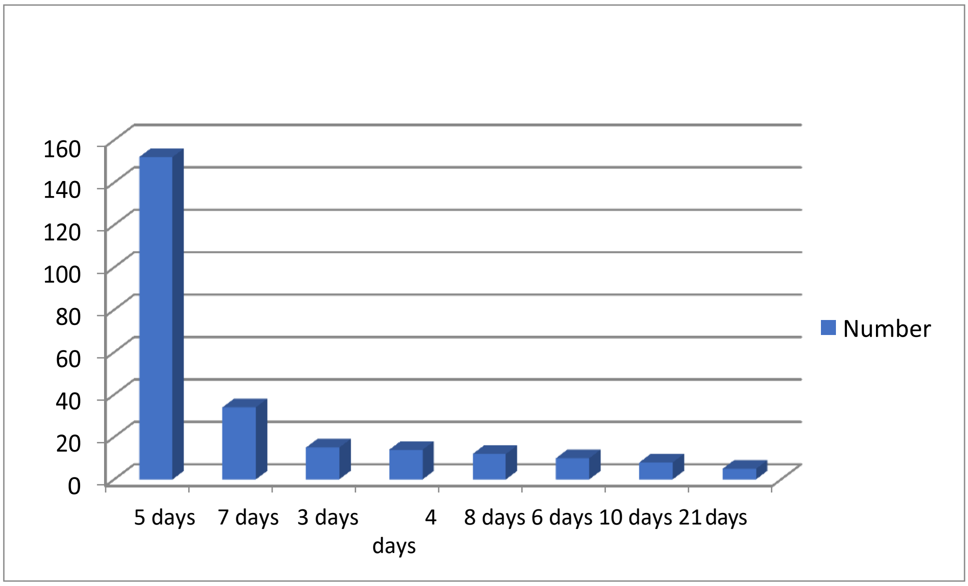

Figure 3.6: Time of treatment with

Overall, the results presented in Table 3.5 provide important information on the duration of antibiotic treatment received by the sample population, but should be interpreted in the context of the specific infections being treated and the types of antibiotics being used. Further investigation is needed to determine how these patterns of antibiotic prescribing may impact the development of antibiotic resistance This finding is consistent with the evaluation on prescribing pattern of antibiotics in pediatric inpatients at tertiary care hospital **(Sabishruthi *et al.*, 2019)**.

3.6. Parents perception about antibiotics

Table 3.6: Parents perception about antibiotics

Degree of perception	Number	Percent %
Very good	141	56.4%
Slightly good	37	14.8%
No perception	72	28.8%

The results presented in Table 3.6 provide information on the parents' perception of antibiotics. The table shows that the majority of parents (56.4%) had a very good perception of antibiotics. This suggests that these parents have a positive view of antibiotics and believe that they are effective in treating their children's illnesses.

A smaller proportion of parents (14.8%) had a slightly good perception of antibiotics, indicating that they may have some reservations or concerns about the use of antibiotics. Finally, 28.8% of parents had no perception of antibiotics, which could suggest that they may not have a clear understanding of what antibiotics are and how they use **(Figure 3.7)**.

It is important to note that parents' perception of antibiotics can influence their expectations for treatment and their likelihood of requesting antibiotics from healthcare providers. Thus, understanding parents' perceptions of antibiotics can be useful in developing strategies to improve the appropriate use of antibiotics.

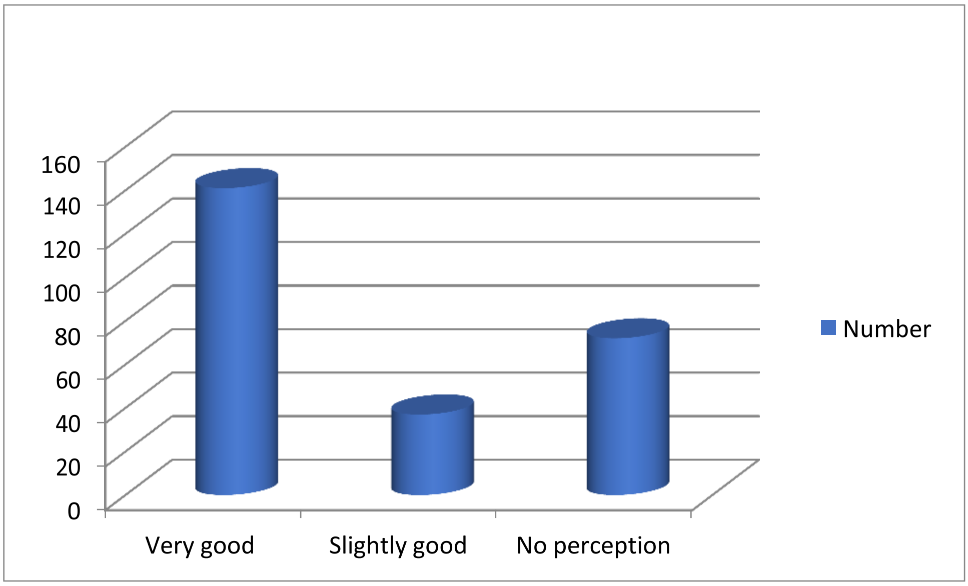

Figure 3.7: Parents perception about antibiotics

The high proportion of parents with a very good perception of antibiotics may suggest that there is a need for education on the appropriate use of antibiotics, including the risks associated with overuse and the importance of completing a full course of treatment. On the other hand, the relatively low proportion of parents with a slightly good perception may suggest that efforts to promote the appropriate use of antibiotics are having some impact.

Overall, the results presented in Table 3.6 provide important information on parents' perception of antibiotics and can be used to develop interventions to improve the appropriate use of antibiotics **(Sharma *et al.*, 2016)**.

3.7. Parent satisfaction with physician visit

Table 3.7: Parent satisfaction with physician visit

Satisfaction degree	Number	Percent %
Very good	162	64.8%
Slightly good	42	16.8%
No satisfaction	46	18.4%
Total	250	100%

The results presented in Table 3.7 provide information on the parent's satisfaction with the physician's visit. The table shows that the majority of parents (64.8%) reported a very good satisfaction degree with the physician's visit. This suggests that the majority of parents were satisfied with the care provided by the physician during the visit. A smaller proportion of parents (16.8%) reported a slightly good satisfaction degree, indicating that they may have had some concerns or reservations about the care provided. Finally, 18.4% of parents reported no satisfaction with the physician's visit. This may suggest that these parents were dissatisfied with the care provided by the physician during the visit **(Figure 3.8)**.

It is important to note that parental satisfaction with physician visits is an important aspect of healthcare quality. Satisfied parents are more likely to adhere to treatment recommendations and follow up with healthcare providers. On the other hand, dissatisfied parents may be less likely to follow through with treatment recommendations or seek care in the future.

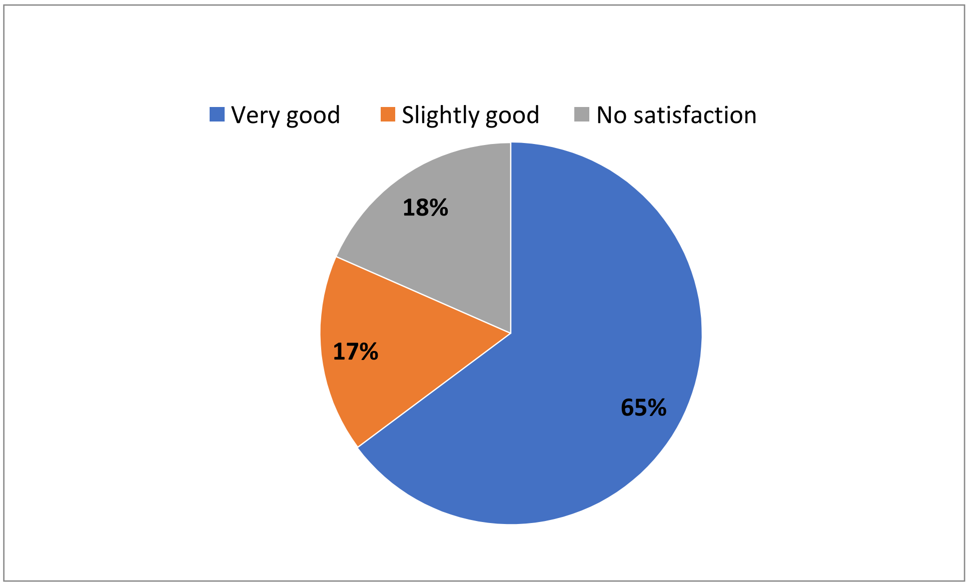

Figure 3.8: Parent's satisfaction with physician visit

Overall, the results presented in Table 3.7 suggest that the majority of parents were satisfied with the care provided by the physician during the visit. However, the proportion of parents reporting no satisfaction highlights the need for healthcare providers to be attentive to parental concerns and ensure that parents are fully satisfied with the care provided **(Pradeepkumar *et al.*, 2017)**

3. 8. Stop therapy when symptoms subside

Table 3.8: Stop therapy when symptoms subside

	Number	Percent %
Yes	**193**	**77.2%**
No	**57**	**22.8%**
Total	**250**	**100%**

The results of Table 3.8 indicate that out of the 250 sample individuals, 193 (77.2%) of the parents reported that they stop antibiotic therapy when their child's symptoms subside, while 57 (22.8%) of them did not **(Figure 3.9)**.

This finding is consistent with previous studies that have shown a higher prevalence of miss use of antibiotic **(Thiruthopu *et al.*, 2014)**.

This suggests that a significant proportion of parents understand the importance of stopping antibiotics once their child's symptoms have resolved, which is a negative finding in terms of antibiotic resistance. However, it is unclear from this table whether those who did not stop therapy when symptoms subsided did so because they misunderstood the instructions or for other reasons. Further investigation into this issue may be warranted.

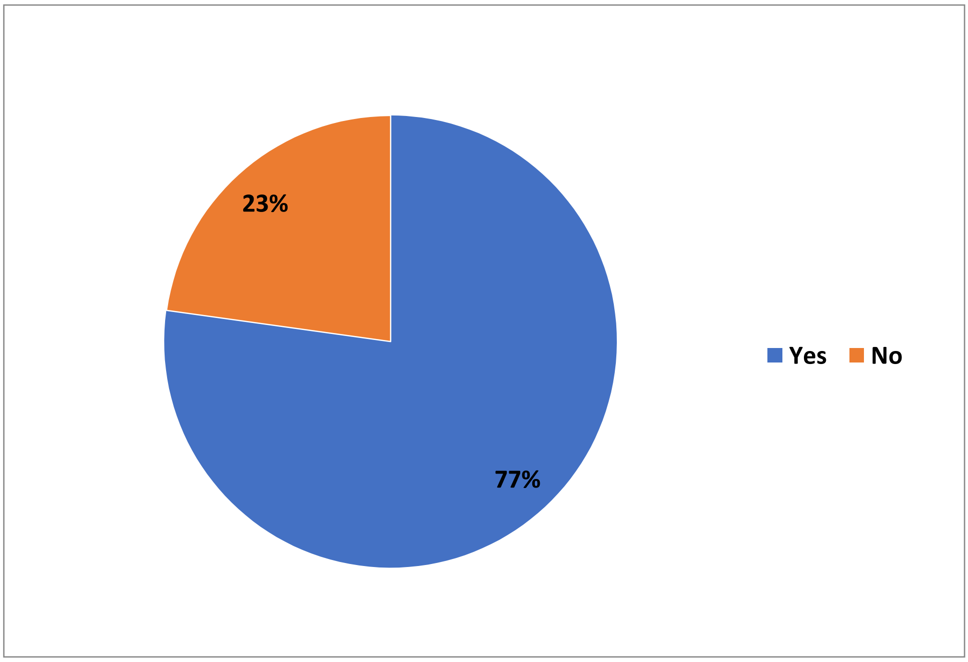

Figure 3.9: Stop therapy when symptoms subside

3. 9. Keeping leftovers antibiotic for future use

Table 3.9: Keeping leftovers antibiotic for future use		
	Number	**Percent %**
Yes	**79**	**31.6%**
No	**171**	**68.4%**
Total	**250**	**100%**

The results of Table 3.9 indicate that out of the 250 sample individuals, 79 (31.6%) of the parents reported that they keep leftover antibiotics for future use, while 171 (68.4%) of them did not. This finding is concerning as it suggests a lack of understanding about the proper use and disposal of antibiotics, which can contribute to antibiotic resistance. It is important for healthcare providers to educate parents about the risks associated with keeping leftover antibiotics and to provide clear instructions on how to properly dispose of them **(WHO, 2013)**.

3.10. Diagnosis of infections in Sample individuals

Table 3.10: Diagnosis of infections in Sample individuals

Diagnosis	Number	Percent %
Upper Respiratory tract infections	**109**	**43.6%**
Gastrointestinal tract infections	**96**	**38.4%**
Lower Respiratory tract infections	**90**	**36%**
Urinary tract infections	**24**	**9.6%**
Surgery case	**18**	**7.2%**
Skin and soft tissue infections	**9**	**3.6%**
CNS infections	**9**	**3.6%**
Bone Infections	**9**	**3.6%**
Others	**9**	**3.6%**

The results presented in Table 3.10 show the diagnosis of infections in the sample individuals. The most common diagnosis was upper respiratory tract infections, accounting for 43.6% of the cases, followed by gastrointestinal tract infections (38.4%) and lower respiratory tract infections (36%). Urinary tract infections, surgery cases, skin and soft tissue infections, CNS infections, bone infections, and other infections were less common, each accounting for less than 10% of the cases **(Figure 3.10)**. These results provide some insights into the types of infections that are commonly treated with antibiotics in children at Ibb City Hospital.

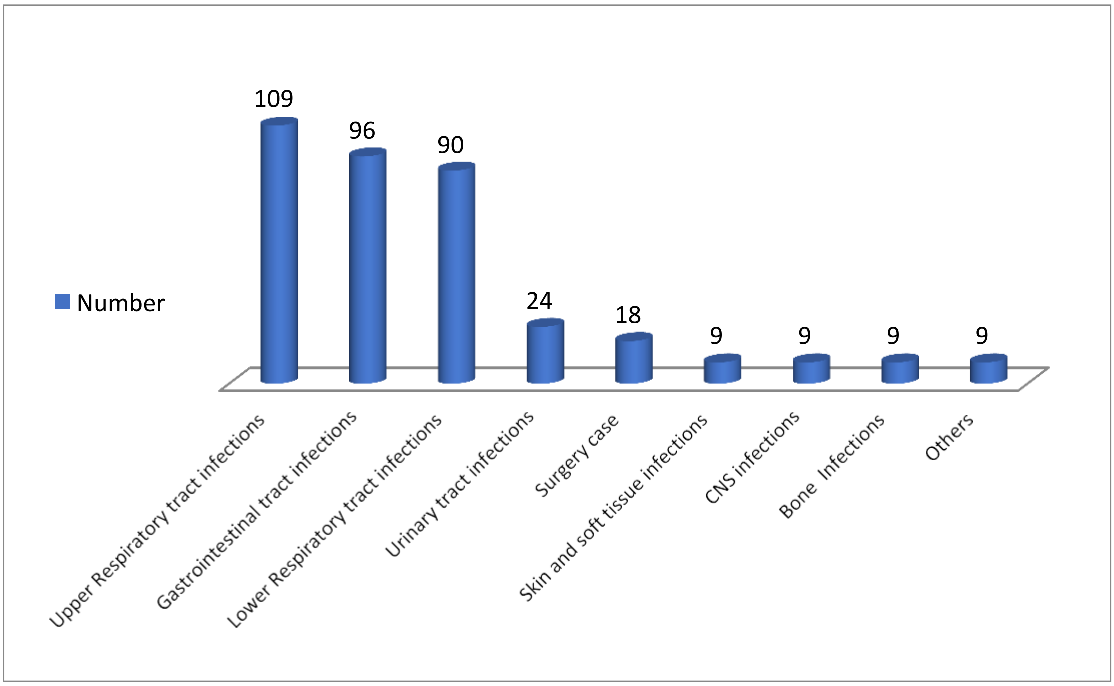

Figure 3.10: Diagnosis of infections in Sample individuals

3.11. Antibiotics prescriptions giving to sample individuals

Table 3.11: Antibiotics prescriptions giving to sample individuals n=250

Dispensed Antibiotic	Number	Percent %
Ceftriaxone	75	30%
Amoxicillin and clavulanic Acid	66	26.4%
Azithromycin	52	20.8%
Amoxicillin	33	13.2%
Erythromycin	21	8.4%
Sulfamethoxazole	21	8.4%
Cefotaxime	18	7.2%
Metronidazole	18	7.2%
Cefuroxime	12	4.8%
Cefepime	6	2.4%
Gentamycin	6	2.4%
Trimethoprim	6	2.4%
Ampicillin	3	1.2%
Cloxacillin	3	1.2%
Pipracillin + tazobactam	3	1.2%
Clarithromycin	3	1.2%
Amikacin	3	1.2%

The results from Table 3.11 show the antibiotics that were prescribed to the sample individuals in the study. The most commonly prescribed antibiotic was Ceftriaxone, with 30% of the sample individuals receiving this medication. The second most commonly prescribed antibiotic was Amoxicillin and clavulanic Acid, with 26.4% of the sample individuals receiving this medication. Azithromycin was the third most commonly prescribed antibiotic, with 20.8% of the sample individuals receiving this medication.

It is worth noting that some of the antibiotics prescribed, such as Cefotaxime, Metronidazole, and Cefepime, are typically reserved for more serious infections and may indicate that the sample individuals had more severe illnesses. The prescribing of multiple antibiotics to some individuals also suggests that they may have had multiple infections or comorbidities.

This finding is consistent with the prevalence of Antibiotic usage pattern among inpatients of a pediatric ward in a tertiary care hospital in Eastern India **(Mukherjee *et al.*, 2015)**. It is difficult to make conclusions about the appropriateness of the antibiotic prescribing patterns without more information on the specific indications for each prescription. However, the high use of broad-spectrum antibiotics such as Ceftriaxone and Amoxicillin and clavulanic Acid may contribute to the development of antibiotic resistance and should be monitored carefully.

3.12. Antibiotic dispensed according to age of sample individuals

3.12.1. Antibiotic prescribed for children aged less than 12 month

Table 3.12: Antibiotic prescribed for children aged less than 12 month n=108

Antibiotic	Number	Percent %
Amoxicillin and clavulanic Acid	**30**	**27.8%**
Azithromycin	**22**	**20.4%**
Amoxicillin	**21**	**19.4%**
Ceftriaxone	**21**	**19.4%**
Cefotaxime	**15**	**13.9%**
Sulfamethaxazole	**9**	**8.3%**
Erythromycin	**6**	**5.6%**
Cefuroxime	**6**	**5.6%**
Metronidazole	**6**	**5.6%**
Ampicillin	**3**	**2.8%**
Cloxacillin	**3**	**2.8%**
Pipracillin + tazobactam	**3**	**2.8%**
Clarithromycin	**3**	**2.8%**
Trimethoprim	**3**	**2.8%**

Based on the results presented in Table 3.12, it can be seen that for children aged less than 12 months, the most commonly prescribed antibiotics were Amoxicillin and clavulanic acid (27.8%), Azithromycin (20.4%), and Amoxicillin (19.4%). Ceftriaxone and Cefotaxime were also frequently prescribed, with both accounting for 19.4% of prescriptions. Sulfamethaxazole, Erythromycin, Cefuroxime, Metronidazole, Ampicillin, Cloxacillin, Pipracillin + tazobactam, Clarithromycin, and Trimethoprim were prescribed less frequently, accounting for less than 10% of prescriptions each **(Figure 3.11)**.

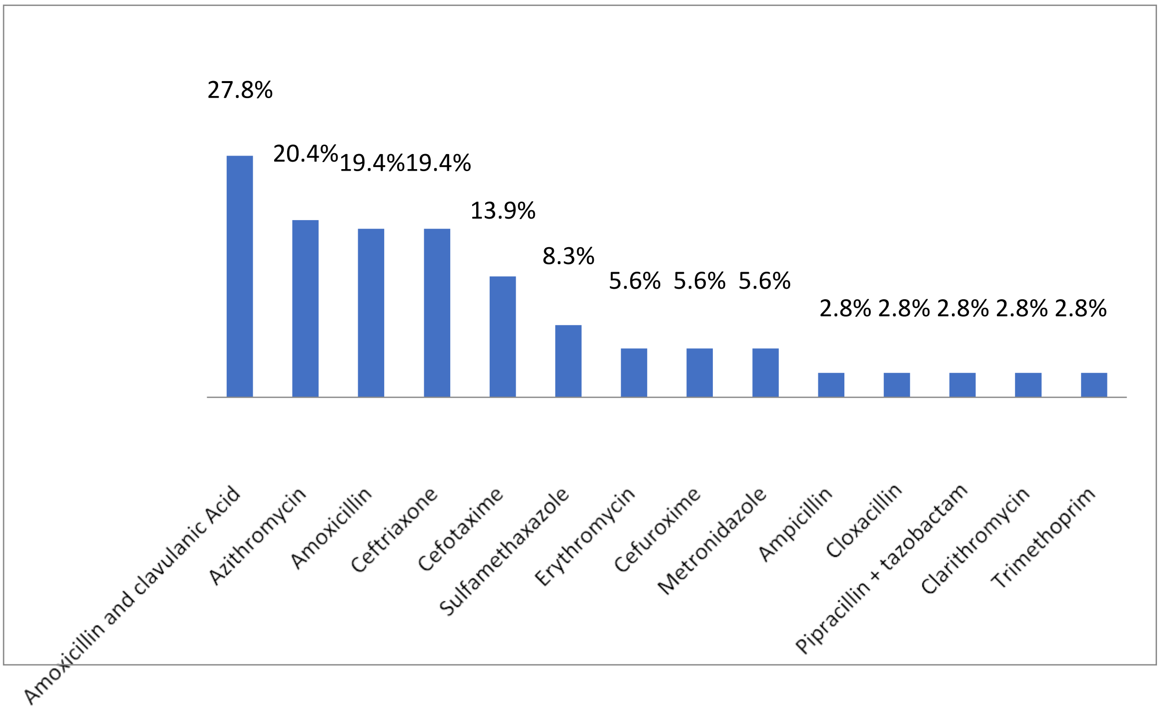

Figure 3.11: Antibiotic prescribed for children aged less than 12 month

These findings are somewhat unexpected as Assessment of antibiotic prescribing pattern in pediatric patients: A cross-sectional hospital-based survey **(Pradeepkumar *et al.*, 2017)**. It's important to note that these results only represent the prescribing pattern in the Ibb City Hospital and may not be representative of other hospitals or healthcare settings. Additionally, further analysis would be necessary to determine whether these prescribing patterns are appropriate and effective in treating the medical conditions of the children in this population.

3.12.2. Antibiotic prescribed for children aged from 13 months to 5 years

Table 3.13: Antibiotic prescribed for children aged from 13 months to 5 years n=67

Antibiotic	Number	Percent %
Ceftriaxone	**24**	**35.8%**
Azithromycin	**18**	**26.9%**
Amoxicillin and clavulanic Acid	**15**	**22.4%**
Erythromycin	**9**	**13.4%**
Amoxicillin	**6**	**9.0%**
Sulfamethaxazole	**6**	**9.0%**
Cefuroxime	**3**	**4.5%**
Cefotaxime	**3**	**4.5%**
Cefepime	**3**	**4.5%**
Gentamycin	**3**	**4.5%**
Trimethoprim	**3**	**4.5%**
Metronidazole	**3**	**4.5%**

Table 3.13 shows the antibiotics prescribed for children aged from 13 months to 5 years. The table lists 12 antibiotics, with Ceftriaxone being the most frequently prescribed antibiotic (35.8%). Azithromycin and Amoxicillin and clavulanic acid were the next most commonly prescribed antibiotics at 26.9% and 22.4% respectively. Erythromycin was prescribed for 13.4% of the children, while the rest of the antibiotics were prescribed for less than 10% of the children.

It is worth noting that some of the antibiotics listed in Table 3.13 were also prescribed for children aged less than 12 months, such as Amoxicillin and clavulanic acid, Azithromycin, and Sulfamethaxazole. This suggests that certain antibiotics are commonly prescribed for both age groups.

It is also interesting to compare the results of Table 3.13 with Table 3.12, which shows the antibiotics prescribed for children aged less than 12 months. Ceftriaxone was also the most frequently prescribed antibiotic for this age group, followed by Amoxicillin and clavulanic acid, and Azithromycin. However, the frequency of the antibiotics prescribed for the two age groups is different, with Ceftriaxone being prescribed more frequently for children aged from 13 months to 5 years compared to those aged less than 12 months **(Figure 3.12)**.

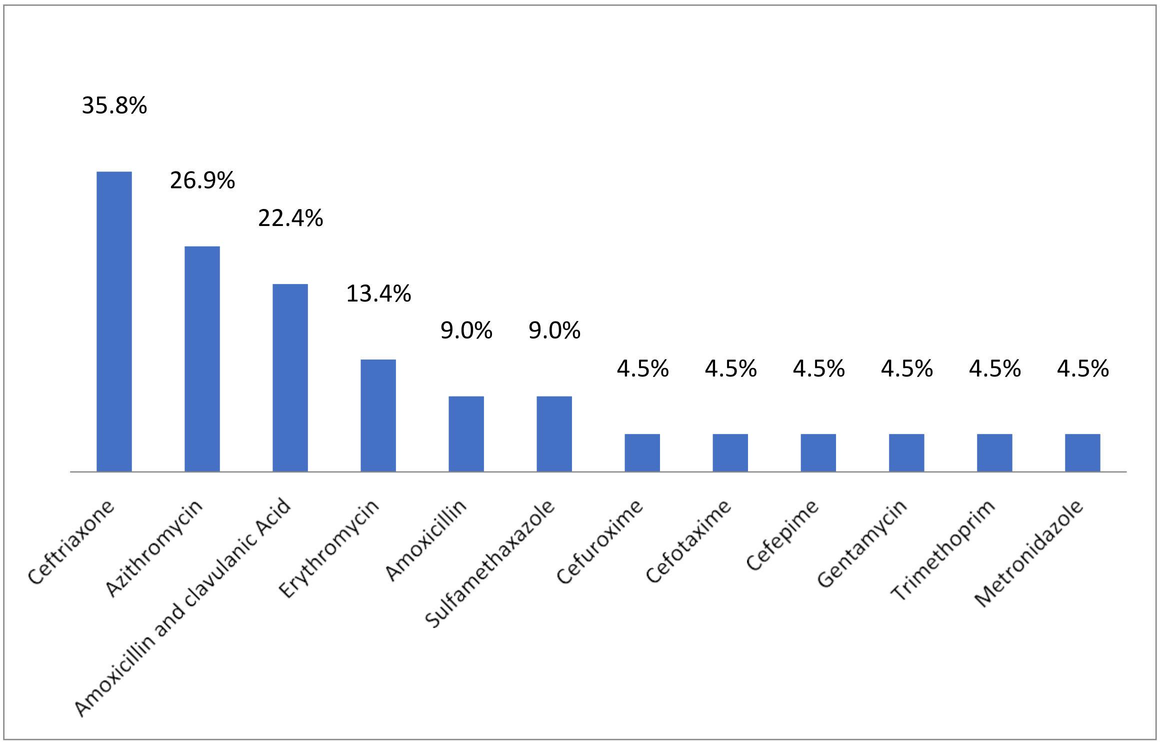

Figure 3.12: Antibiotic prescribed for children aged from 13 months to 5 years

Overall, the results suggest that there is a certain set of antibiotics commonly prescribed for children in this age range, with some variations in frequency depending on the age group. However, it is important to note that further analysis is needed to determine the appropriateness and effectiveness of these antibiotics in treating the specific illnesses of the children.

3.12.3. Antibiotic prescribed for children aged from 6 years to 12 years

Table 3.14: Antibiotic prescribed for children aged from 6 years to 12 years n=66

Antibiotic	Number	Percent %
Ceftriaxone	**27**	**40.9%**
Amoxicillin and clavulanic Acid	**15**	**22.7%**
Azithromycin	**12**	**18.2%**
Amoxicillin	**6**	**9.1%**
Erythromycin	**6**	**9.1%**
Sulfamethaxazole	**6**	**9.1%**
Metronidazole	**6**	**9.1%**
Cefepime	**3**	**4.5%**
Gentamycin	**3**	**4.5%**

Amikacin	**3**	**4.5%**

The results show that for children aged less than 12 months, the most commonly prescribed antibiotic was Amoxicillin and clavulanic acid (27.8%), followed by Azithromycin (20.4%), Amoxicillin (19.4%), and Ceftriaxone (19.4%). For children aged from 13 months to 5 years, Ceftriaxone was the most commonly prescribed antibiotic (35.8%), followed by Azithromycin (26.9%) and Amoxicillin and clavulanic acid (22.4%). For children aged from 6 years to 12 years, Ceftriaxone was again the most commonly prescribed antibiotic (40.9%), followed by Amoxicillin and clavulanic acid (22.7%) and Azithromycin (18.2%) **(Figure 3.13)**.

It is worth noting that Ceftriaxone is a broad-spectrum antibiotic and is commonly used to treat serious bacterial infections. Its frequent use in these age groups could indicate a higher incidence of bacterial infections in these populations, or it could reflect the prescribing habits of physicians. Additionally, the frequent use of Amoxicillin and clavulanic acid in children aged less than 12 months and those aged from 6 years to 12 years could indicate a preference for this antibiotic due to its effectiveness against a range of bacterial infections.

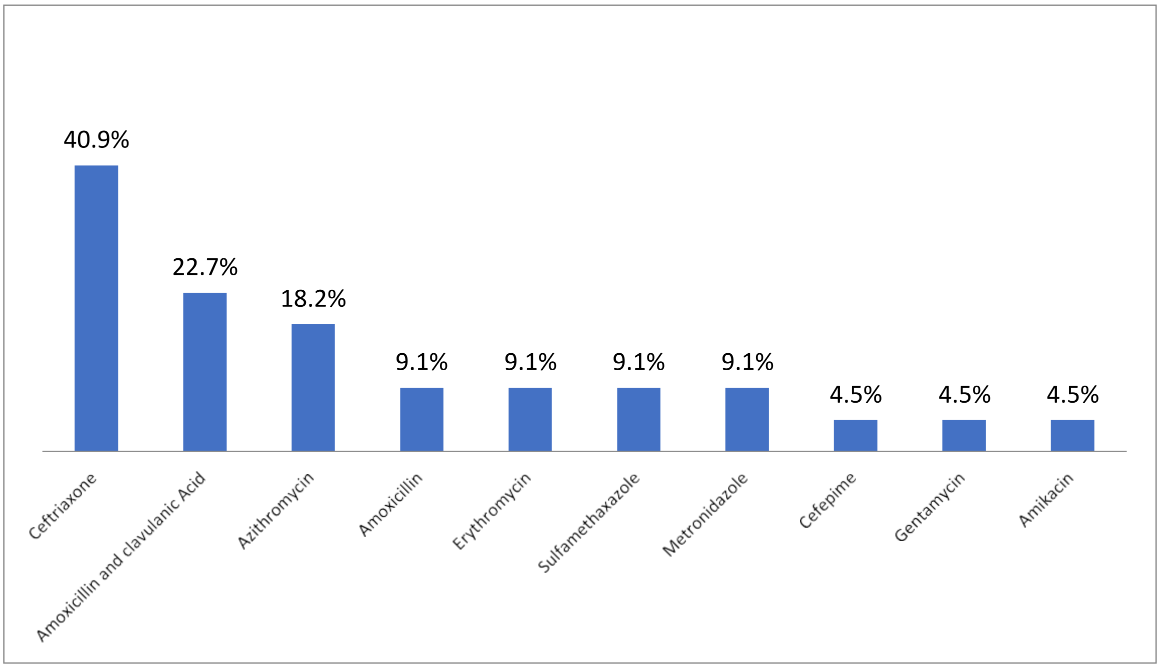

Figure 3.13: Antibiotic prescribed for children aged from 6 years to 12 years

Overall, the results suggest that there is a variation in the antibiotics prescribed for different age groups, with Ceftriaxone being the most commonly prescribed antibiotic across all three age groups. The reasons for this variation could be due to differences in the incidence of bacterial infections in different age groups, the severity of the infections, or the prescribing habits of physicians **(Sharma *et al.*, 2016)**.

3.12.4. Antibiotic prescribed for children aged from 13 years to 15 years

Table 3.15: Antibiotic prescribed for children aged from 13 years to 15 years n=9

Antibiotic	Number	Percent %
Amoxicillin and clavulanic Acid	**6**	**66.7%**
Cefuroxime	**3**	**33.3%**
Ceftriaxone	**3**	**33.3%**
Metronidazole	**3**	**33.3%**

The results of Table 3.15 indicate that for children aged from 13 months to 5 years, the most commonly prescribed antibiotics were Ceftriaxone (35.8%), Azithromycin (26.9%), and Amoxicillin and clavulanic Acid (22.4%). These results suggest that physicians may choose to prescribe stronger antibiotics such as Ceftriaxone when treating younger children who may be more vulnerable to infections.

Table 3.15 shows that for children aged from 6 years to 12 years, Ceftriaxone was the most commonly prescribed antibiotic (40.9%), followed by Amoxicillin and clavulanic Acid (22.7%) and Azithromycin (18.2%). These results suggest that physicians may continue to prescribe Ceftriaxone for this age group as it was also commonly prescribed for younger children.

Table 3.15 indicates that for children aged from 13 years to 15 years, the most commonly prescribed antibiotics were Amoxicillin and clavulanic Acid (66.7%), Cefuroxime (33.3%), and Ceftriaxone (33.3%). These results suggest that physicians may choose to prescribe Amoxicillin and clavulanic

Acid more frequently for this age group than for younger children, and that they may also continue to prescribe Cefuroxime and Ceftriaxone **(Figure 3.14)**.

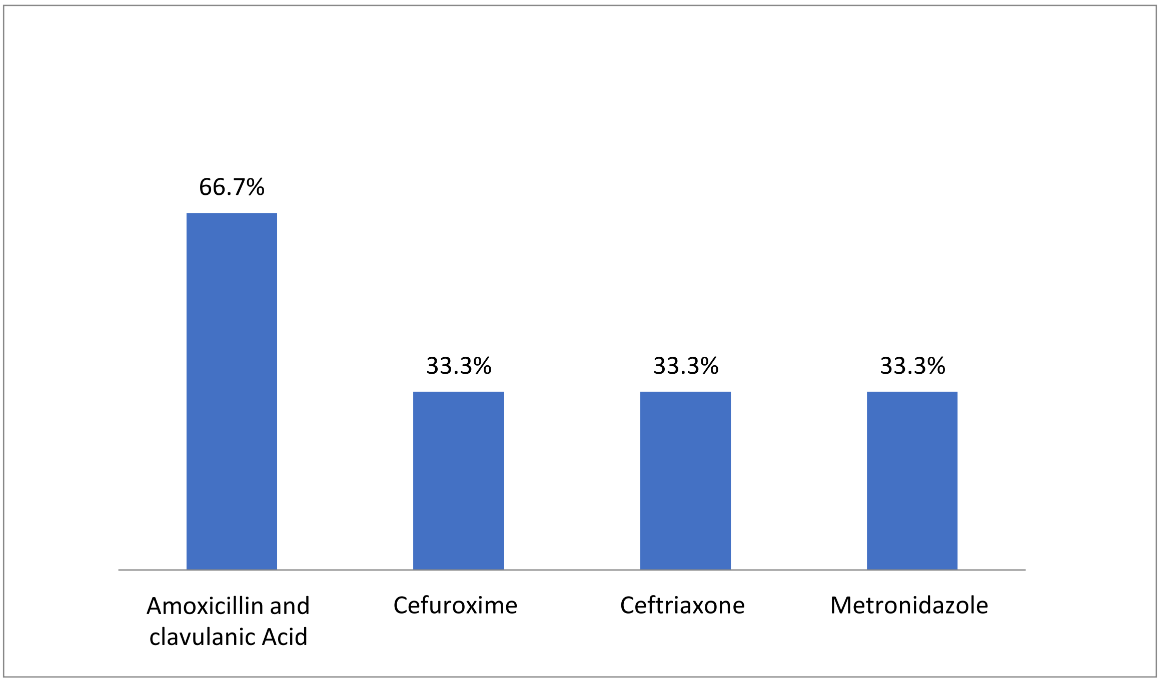

Figure 3.14: Antibiotic prescribed for children aged from 13 years to 15 years

Overall, the results suggest that there may be differences in antibiotic prescribing patterns based on age, with physicians potentially choosing stronger antibiotics for younger children and relying on certain antibiotics such as Ceftriaxone across all age groups. However, it's important to note that these results are based on a single hospital's data and may not be representative of prescribing patterns in other healthcare settings **(Al Balushi *et al.*, 2013)**.

CHAPTER IV

DISCUSSION OF THE STUDY

CHAPTER IV: RESULTS OF THE STUDY

5.1. Discussion of the study

Prescribing pattern is one of the components of the medical audit which helps the prescribers to achieve rational and cost-effective medical care. Most of the infectious diseases need antibiotic treatments. In these study patients prescription pattern of antibiotics. The number of male pediatric patients [58%more than the number of female patients [42%]. Similar results were found in the studies conducted by **(Palikhe, 2004)** (males-61.9% and female-38.1%) and **(Kolar and Hromadova, 2007)**, (males-58.2% and females-48.1%).

In this study, more number of patients belonged to the age group of <=1 years. This is very natural because in this age, the children's attitude will be more and immune power will be less. Similar type of percentages was observed in the children of age groups 1-5 years and 6-12years. Compared to results were obtained in the study conducted by **(Kolar and Hromadova, 2007)**. Previous drug history was found in 48.4% of patient's lead to increase resistance of antibiotics. The same study by **(Palikhe, 2004)**, percent 38.8%of patients.

Here current study results revealed that the most common cause of prescription of antibiotic respiratory infections (79.6%) following by gastrointestinal tract infections45%. with URTIs being more prevalent than LRTIs. Acute respiratory infections are the leading cause of children's hospitalization worldwide, including Malaysia **(Chaw *et al.*, 2018)**

These results are in agreement with previous studies show acute respiratory infection such as bronchitis is common prescription of antibiotics **(Choudhury and Bezbaruah, 2013; da Cunha *et al.*, 2003)**.

In addition, 1.9 million children worldwide die each year from acute respiratory illnesses, many of which are Lower Respiratory Infections (LRIs) reported by **(Klig and Shah, 2005)**.This is because children have an immature immune system and are usually surrounded by peers who could carry infections .

The time period which data collected for current study in February and march were most seasonal for prevalence of respiratory infection disease, very important to consideration the difference in the time period during conducted studies reported by **(Feleke *et al.*, 2013)**.

Antimicrobials are among the most commonly prescribed drugs in hospitals and in developed countries around 30% of the hospitalized patients are treated with these drugs **(Feleke *et al.*, 2013)**.

In this study, the most commonly prescribed antibiotic was Ceftriaxone, with 30% of the sample individuals receiving this medication. The second most commonly prescribed antibiotic was Amoxicillin and clavulanic Acid, with 26.4% of the sample individuals receiving this medication. Azithromycin was the third most commonly prescribed antibiotic, with 20.8% of the sample individuals receiving this medication. These results are in agreement with previous studies **(Al-Ghazali *et al.*, 2017; Choudhury and Bezbaruah, 2013)**.

In this study we showed that Ceftriaxone was the most frequently prescribed antibiotic and amoxicillin the second most commonly prescribed antibiotic. Similar study by Rajeswari R et al revealed that cefuroxime as the most commonly prescribed antibiotics followed by Ceftriaxone/Sulbactam combination and Ceftriaxone alone ranked 5th by **(Sriram *et al.*, 2008)**.

The higher prescription rate of cephalosporin could be attributed to its broad spectrum of activity and tolerance across all age group, and higher prescription rate of ceftriaxone due to antibacterial activity against most gram-positive and gram-negative bacteria, including several strains resistant to other antibiotics, and recommended for serious infections caused by susceptible microorganisms **(Van der *et al.*, 2001; Feleke *et al.*, 2013)**.

However, the high use of broad-spectrum antibiotics such as Ceftriaxone and Amoxicillin and clavulanic Acid may contribute to the development of antibiotic resistance and should be monitored carefully.

In our study, varying percentage of antibiotics prescription to Pediatric patients. These results in agreement with previous study conducted by **(Palikhe, 2004; Sriram *et al.*, 2008)**.

In contrast, others studies have shown single antibiotics have received high with previous study reported by **(Khaled *et al.*, 2013; Feleke *et al.*, 2004)**. This difference in antimicrobial prescription may be hospital protocol from one region to another. Our study has limitations by the fact that we relied on small sample size that may compromise the generalizability of the findings. The other disadvantage of our current study is short time so that it was difficult to know every point that need to be addressed.

5.2. Limitations of present study.

Our study had certain limitations:

1. The study used only 250 prescriptions for analysis, and that's a small number. Also, the study period was short.
2. Some patients do not give information
3. The lack of full cooperation on the part of the health staff in the hospital with the exception of some doctors, and the difficulty of analyzing some medical prescriptions due to the method of writing prescriptions.

CHAPTER V

CONCLUSION & RECOMMENDATIONS

CHAPTER IV

Conclusion & Recommendations

4.1. Conclusion

From the results of our study we can conclude that

1. Sample individuals included 250 children, with 58% of them being male and 42% being female. 48% of the sample reported having a history of medical illness, while 52% did not.
2. The most common diagnosis case was upper respiratory tract infections, followed by gastrointestinal tract infections and lower respiratory tract infections.
3. The most commonly prescribed antibiotic was Ceftriaxone, with 30% of the sample individuals followed by Amoxicillin and clavulanic Acid, with 26.4% while, Azithromycin was the third most commonly prescribed antibiotic, with 20.8% of the sample individuals receiving antibiotics.
4. Repeated use of antibiotics, parents lack perception of antibiotics, misunderstanding of antibiotics and their use directions and stopping therapy when their child's symptoms subside suggest leading to the development of antibiotic resistance and may alter the microbe in ways that make individuals more susceptible to infections.

4.2. Recommendations

From the results of our study we recommended the following:

1. Further investigation is needed to determine how these patterns of antibiotic prescribing may impact the development of antibiotic resistance.
2. Healthcare providers to educate parents about the risks associated with keeping leftover antibiotics and to provide clear instructions on how to properly dispose of them to minimize antibiotics resistance.
3. Rises parents' perception of antibiotics to improve the treatment by following direction of use in proper ways.
4. Further analysis would be necessary to determine whether these prescribing patterns are appropriate and effective in treating the medical conditions of the children in this population.

REFERENCES

References

Aarestrup, F.M., Seyfarth, A.M., Emborg, H.D., Pedersen, K., Hendriksen, R.S., and Bager, F. (2001). Effect of abolishment of the use of antimicrobial agents for growth promotion on occurrence of antimicrobial resistance in fecal enterococci from food animals in denmark. *Antimicrobial Agents and Chemotherapy*. 45(7):2054-2059.

Al Balushi KA, Al-Sawafi F, Al-Ghafri F, Al-Zakwani I. Drug utilization pattern in an Omani pediatric population. J Basic Clin Pharm 2013;4:6872.

Al-Ghazali, M. A. A., Alakhali, K. M., & Alawdi, S. M. (2017). Study of Antibiotics prescribing pattern in paediatric patients of Thamar province. Republic of Yemen. J Appl Pharm, 9(247), 2.

Antibiotic Guidelines (2015-2016): Treatment Recommendations for Adult Inpatients The Johns Hopkins Hospital Antimicrobial Stewardship Program. https://www.insidehopkinsmedicine.org/amp.

Bjorland ,J., Sunde, M., Waage, S. (2001). Plasmid-borne smr gene causes resistance to quaternary ammonium compounds in bovine Staphylococcus aureus. Journal of Clinical Microbiology. 39:3999-4004.

British Infection Association and Health Protection Agency. Management of infection guidance for primary care for consultation and local adaptation, 2012. *Public Health England*. Available from: https://www.hpa.org.uk

REFERENCES

Chapman, J.S. (2003). Disinfectant resistance mechanisms, cross-resistance, and co-resistance. *International Biodeterioration & Biodegradation*. 51:271-6.

Chaw, P.S.; Schlinkmann, K.M.; Raupach-Rosin, H.; Karch, A.; Pletz, M.W.; Huebner, J.; Nyan, O.; Mikolajczyk, R. Antibiotic use on paediatric inpatients in a teaching hospital in the Gambia, a retrospective study. Antimicrob Resist Infect Control. Antimicrob.Resist. Infect. Control 2018, 7, 82.

Choudhury DK, Bezbaruah BK (2013) Antibiotic prescriptions pattern in paediatric in-patient department Gauhati medical college and hospital,Guwahati. J App Pharm Sci 3: 144.

da Cunha A, Amaral J, Silva MA (2003) Inappropriate antibiotic prescription to children with acute respiratory infection in Brazil. Ind Pediatr 40: 7-12.

Dellit, T.H., Owens, R.C., and McGowan, J.E. (2007). Infectious Diseases Society of America and the Society for Healthcare Epidemiology of America guidelines for developing an institutional program to enhance antimicrobial stewardship. *Clinical of Infectious Diseases*. 44(2):159-177.

Dellit, T.H., Owens, R.C., McGowan, J.E. Gerding, D.N., Weinstein, R.A., Burke, J.P., Huskins, W.C., Paterson, D.L., Fishman, N.O., Carpenter, C.F., Brennan, P.J., Billeter, M., and Hooton, T.M. (2007). Infectious Diseases Society of America: Society for Healthcare Epidemiology of America. *Clinical of Infectious Diseases*. 15; 44(2):159-77.

Doern, G.V. (1995). Susceptibility tests of fastidious bacteria. Manual of Clinical Microbiology, 6th edition. Murray, P.R., Baron, E.J., Pfaller, M.A., Tenover, F.C., Yolken, R. *American Society for Microbiology*. Washington. P. 1342-1349.

Feleke M, Yenet W, Lenjisa JL (2013) Prescribing pattern of antibiotics in Paediatric wards of Bishoiu Hospital, East Ethiopia. Int J Basic Clin Pharmacol 2: 718.

Forbes, B.A., Sahm, D.F., and Weissfeld, A.S. (1998). Bailey And Scott's Diagnostic Microbiology, 10th edn. Mosby Inc., St. *Louis Missouri*, USA.

Fraud, S., Campigotto, A.J., Chen, Z., and Poole, K. (2008(. MexCD-OprJ multidrug efflux system of Pseudomonas aeruginosa: involvement in chlorhexidine resistance and induction by membrane-damaging agents dependent upon the AlgU stress response sigma factor. *Journal of Antimicrobial Agents Chemotherapy*. 52:4478-82.

Giguère, J.F., Boerlin, P. and White, D.G. (2006). Antimicrobial Resistance and its Epidemiology. Antimicrobial therapy in Veterinary Medicine 4th edn , Prescott, J.D., Baggot, R.D., Walker. M.I., and Dowling, P.M, eds. *Blackwell Publishing*, Ames Iowa, USA.

Giguère, S. (2006). Antimicrobial Drug Action and Interaction: An Introduction. Antimicrobial therapy in Veterinary Medicine 4th edn. Giguère, J.F, Prescott, J.D., Baggot, R.D., Walker, M.I., and Dowling, P.M. eds. *Blackwell Publishing*. Ames Iowa, USA.

Girma S, Sisay M, Mengistu G, Amare F, Edessa D. Antimicrobial utilization pattern in pediatric patients in tertiary care hospital, eastern Ethiopia: The need for antimicrobial stewardship. Hosp Pharm 2018;53:44-54.

REFERENCES

Guardabassi. L. and Courvalin, P. (2006). Modes of Antimicrobial Action and Mechanisms of Bacterial Resistance. Antimicrobial Resistance in Bacteria of Animal Origin. Aarestrup, F.M, ed. *ASM Press*. Washington DC, USA.

https://www.orthobullets.com/basic-science/9059/antibiotic-classification-and-mechanism

https://www.w3.org/1999/xhtmlarticles.mercola.com/sites/articles/pingback.aspxarticles.mercolacom/sites/articles/archive/2015/02/04/3-sourcesantibiotics.asp

John, D.T. and James, H.J. (1999). Antimicrobial susceptibility testing: General considerations. Manual of clinical microbiology, 7th edition, Murray, P.R., Baron, E.J., Pfaller, M.A., Tenover, F.C., Yolken, R. *American Society for Microbiology*. Washington. 1469-1473.

Keyes, K., Lee, M.D, Maurer, J.J. (2003). Antibiotics: Mode of Action, Mechanisms of Resistance and Transfer. Microbial Food Safetry in Animal Agriculture Current Topics. Torrence, M.E. and Isaacson, R.E. eds. *Iowa State Press*, Ames, Iowa, USA.

Klig JE, Shah NB (2005) Pediatrics: current issues in lower respiratory infections in children. Curr Opin Pediatr 17: 111-118.

Kolar JV, Hromadova R. Analysis of antibiotic utilization in hospitalized paediatric patients. J Chin Clin Med, 2007;2:496-504.

Lang, S., Morris, A., Taylor, S,. and Arroll, B. (2004). Management of common infections in general practice: Part 2. *New Zealand Formulary Physician*. 31(4):258-60.

REFERENCES

Lang, S., Morris, A., Taylor, S., and Arroll, B. (2004). Management of common infections in general practice: Part 1. *New Zealand Formulary Physician*. 31(3):176-8.

Levinson W, 2004, Antimicrobial Drugs: Resistance. *Medical Microbiology and Immunology*. 8th edn, p. 82-89.

Luangtongkum, T., Morishita, T.Y., Ison, A.J., Huang, S., McDermott, P.F., and Zhang, Q. (2006). Effect of Conventional and Organic Production Practices on the Prevalence and Antimicrobial resistance of Campylobacter spp. In Poultry. Applied and Environmental Microbiology 72(5):3600-3607.

Mandell, L.A., Wunderink, R.G., and Anzueto, A. (2007). Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clinical of Infectious Diseases*. 44(2):27- 72.

Moorthi C, Paul PR, Srinivasan A, Senthil CK (2011) Irrational use of antibiotics in paediatric prescriptions: A pilot study at community pharmacy in Erode City. Der Pharmacia Lettre 3: 171-177.

Mukherjee S, Sen S, Era N, Biswas A, Datta K, Tripathi SK. Antibiotic usage pattern among inpatients of a paediatric ward in a tertiary care hospital in Eastern India. Int J Res Med Sci 2015;3:3681-6.

Noppe-Leclercq, I., Wallet, F., Haentjens, S., Courcol, R., and Simonet, M. (1999). PCR detection of aminoglycoside resistance genes: a rapid molecular typing method for Acinetobacter baumannii. *Research Journal of Microbiology.* 150:317–322.

REFERENCES

Palikhe N. Prescribing pattern of antibiotics in paediatric hospital of Kathmandu valley. Kathmandu Univ Med J 2004;2:6-12.

Pepin, J., Saheb, N., and Coulombe, M.A. (2005). Emergence of fluoroquinolones as the predominant risk factor for clostridium difficile-associated diarrhea: a cohort study during an epidemic in Quebec. *Clinical of Infectious Diseases*. 41(9):1254-1260.

Peters, N.K., Dixon, D.M., Holland, S.M., and Fauci, A.S. (2008).The research agenda of the National Institute of Allergy and Infectious Diseases for antimicrobial resistance. *The Journal of infectious diseases*. 197(8):1087-1093.

Pradeepkumar B, Alameri T, Narayana G, Reddy YP, Ramaiah JD. Assessment of antibiotic prescribing pattern in pediatric patients: A cross-sectional hospital-based survey. CHRISMED J Health Res 2017;4:235.

Pucci, M.J. and Bush, K. (2013). Investigational antimicrobial agents of 2013. *Clinical microbiology reviews*. 26(4):792-821.

Raja, A.S., Lindsell, C.J., Bernstein, J.A., Codispoti, C.D., Moellman, J.J. (2009). The use of penicillin skin testing to assess the prevalence of penicillin allergy in an emergency department setting. *Annals of Emergency Medicine*. 54(1):72-77.

Russell, A.D. (2002). Antibiotic and biocide resistance in bacteria: comments and conclusion. *Journal of Applied Microbiology*. 92(l):171-3.

Sabishruthi S, Kavitha S, Nathan B, Priyanka, A. (2019). An Evaluation On Prescribing Pattern Of Antibiotics In Paediatric Inpatients At Tertiary Care Hospital. Asian J Pharm Clin Res, Vol 12, Issue 12, 2019, 53-57.

REFERENCES

Sabishruthi, S., Kavitha, S., JAGAN NATHAN, B., KALICHETI, P., & Arshath, A. (2019). An Evaluation on Prescribing Pattern of Antibiotics in Paediatric Inpatients at Tertiary Care Hospital. Asian J Pharm Clin Res, 12(12), 53-57.

Shankar PR, Upadhyay DK, Subish P, Dubey AK, Mishra P. Prescribing patterns among paediatric inpatients in a teaching hospital in western Nepal. Singapore Med J 2006;47:261-5.

Sharma S, Bowman C, Alladin-Karan B, Singh N. Antibiotic prescribing patterns in the pediatric emergency department at Georgetown public hospital corporation: A retrospective chart review. BMC Infect Dis 2016;16:170.

Sriram S, Mathew Leo, Manjula Devi AS, Rajalingam B, Ramkumar K, Rajeswari R. Assessment of Antibiotic Use in Pediatric Patients at a Tertiary care Teaching Hospital. Indian J Pharm Pract. 2008;1(1).

Surbhi, L., Christine, L.,T, and Randall, S.E. (2011). General Principles of Antimicrobial Therapy. *US National Library of Medicine*. 86(2): 156–167.

Thiruthopu NS, Mateti UV, Bairi R, Sivva D, Martha S. Drug utilization pattern in south Indian pediatric population: A prospective study. Perspect Clin Res 2014;5:178-83.

Tice, A.D., Rehm, S.J., Dalovisio, J.R., Bradley, J.S., Martinelli, L.P., Graham, D.R., Gainer, R.B., Kunkel, M.J., Yancey, R.W., and Williams, D.N. (2004). Practice guidelines for outpatient parenteral antimicrobial therapy. *Clinical of Infectious Diseases*. 38(12):1651-1672.

Van der Meer JWM, Gyssens IC (2001) Quality of antimicrobial drug prescription in hospital. Clin Microb Inf 7: 12-15.

REFERENCES

Weese, J.S. (2006). Prudent Use of Antimicrobials. Antimicrobial therapy in Veterinary Medicine 4th edn. Giguère, J.F., Prescott, J.D., Baggot, R.D., Walker, M.I., and Dowling, P.M., eds. *Blackwell Publishing*. Ames Iowa, USA.

WHO. How to investigate drug use in health facilities: selected drug use indicators, Geneva: World Health Organization; 2010. WHO/DAP/93.

Appendix

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
الجامعة الماليزية الولية

المستوى / الخامس
القسم/صيدلة

إستمارة إستبيان

الاخ... .المحترم

تحية طيبة وبعد

يعد هذاء الاستبيان جزء رئيسي من أجزاء البحث حول موضوع

[تقيم نمط وصف المضادات الحيوية في الاطفال في

المستشفيات الخاصة والعامة لمدنية اب لعام٢٠٢٣م]

وذلك كجزء من المتطلبات المكملة لنيل شهادة البكالاريوس في قسم الصيدلة

ويعتمد نجاح الباحثون على تعاونكم من خلال الاجابة على الفقرات الواردة على

نحو من الدقة والموضوعية والصراحة التى عهدناها فيكم.

علماً بان اجابتكم ستكون موضوع الاهتمام والسرية التامة ولن تستخدم الا لاغراض

البحث العلمي فقط.

شاكرا ومقدرا لكم تجاوبكم باستقطاع جزء من وقتكم وتعاونكم لنجاح

هذه الدراسة.

وتقبلو فائق التحية والتقدير

المعلومات الشخصية عن الطفل المريض :-

1- العمر:-

٢- الجنس ☐ ذكر

☐ انثى

3- الوزن :- كجم

سؤال متعلق باستخدام المضادات الحيوية الشائعة.

رقم	سؤال	نعم	لا
1-	هل يوجد تاريخ مرضي للطفل		
٢-	هل تناول طفلك المضادات الحيوية من قبل؟ -نعم ....أي مضاد حيوي استخدمته؟ ١ ٢ ٣		
-			

التشخيص :-

عدوى الجهاز التنفسي العلوي	
عدوى الجهاز التنفسي السفلي	
التهاب المسالك البولية	
عدوى الجلد والأنسجة الرخوة	
حالات جراحية	
عدوى الجهاز العصبي المركزي	
عدوى العظام	
عدوى الجهاز الهضمي	

الفترة الزمنية للعلاج بالمضادات الحيوية	

العلاقة بين وصفة المضادات الحيوية والثقافة عند الآباء

	جيد جدا	ضعيف	غير معروف
تصور الوالدين لاستخدام المضادات الحيوية			
رضا الوالدين عن زيارة الطبيب			

	نعم	لا
هل توقفت عن العلاج بمجرد أن تهدأ الأعراض؟		
هل تحتفظ ببقايا المضادات الحيوية لاستخدامها في المستقبل		

وصفة طبية

فترة الاستخدام	التركيز	الجرعة	الاسم العلمي	الاسم التجاري
			أموكسيسيلين	
			أمبيسلين	
			كلوكسا سيلين	
			بنزيل بنسلين	
			فينوكسي ميثيل بنسلين	
			أموكسيسيلين + كلافولانيك	
			بيبيراسيلين + تازوباكتام	
			أزيثروميسين	
			كلاريثروميسين	
			الاريثروميسين	
			سيفوروكسيم	

			سيفترياكسون	
			سيفتازيديم	
			سيفوتاكسيم	
			سيفيبيمي	
			الجنتاميسين	
			أميكاسين	
			كاربابينيم	
			Meropenem	
			سلفاميثوكسازول	
			تريميثوبريم	
			فانكومايسين	
			كليندامايسين	
			ميترونيدازول	

الخلاصة

خلفية: توصف المضادات الحيوية عادة للأطفال في المستشفيات. ومع ذلك ، قام عدد محدود فقط من الدراسات بتقييم استخدام المضادات الحيوية في هذه الفئة من السكان. قام العمل الحالي بتقييم مؤشر المضادات الحيوية ونمط وصفها ومدى ملاءمتها بين مرضى الأطفال .

الهدف: كان هدفنا من هذه الدراسة هو تقييم نمط وصف المضادات الحيوية للأطفال في مستشفيات مدينة إب.

الطريقة: هي دراسة استعادية قائمة على الملاحظة للمرضى الداخليين في المستشفيات الذين تم تشخيص إصابتهم بعدوى واحدة أو أكثر تتطلب استخدام المضادات الحيوية. تم استعراض ما مجموعه ٢٥٠ حالة تتراوح أعمارهم بين يوم واحد و ١٥ سنة. تتضمن البيانات التي تم جمعها من مرافقي المريض المعلومات الشخصية ، والاستخدام الشائع للمضادات الحيوية ذات الصلة ، والتشخيص ، ومدة العلاج ، والعلاقة بين وصفة المضادات الحيوية وتعليم الوالدين ، وتم وصف المضادات الحيوية لهم.

النتائج: شمل أفراد العينة ٢٥٠ طفلا ، ٥٨٪ منهم من الذكور و ٤٢٪ من الإناث. أفاد ٤٨٪ من العينة أن لديهم تاريخا من المرض الطبي ، في حين أن ٥٢٪ لم يفعلوا ذلك. كان المضاد الحيوي الأكثر شيوعا هو سيفترياكسون ، حيث كان ٣٠٪ من أفراد العينة يليه أموكسيسيلين وحمض كلافولانيك ، بنسبة ٢٦,٤٪ بينما كان أزيثروميسين ثالث أكثر المضادات الحيوية الموصوفة شيوعا ، حيث تلقى ٢٠,٨٪ من أفراد العينة المضادات الحيوية.

الخلاصة: وجدنا أن " الاستخدام المتكرر للمضادات الحيوية بسبب الفهم غير الكافي والصحيح لطريقة استخدام المضادات الحيوية ، يفتقر الآباء إلى إدراك المضادات الحيوية ، وسوء فهم المضادات الحيوية واتجاهات استخدامها وإيقاف العلاج عندما تهدأ أعراض طفلهم تشير إلى تطور مقاومة المضادات الحيوية وقد تغير الميكروب بطرق تجعل الأفراد أكثر عرضة للعدوى.

Republic of Yemen
Ministry of Higher Education and scientific Research
International Malaysia University
Collage of Medical Sciences
Department of Pharmacy

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
الجامعة الماليزية الدولية
كلية العلوم الطبية
قسم الصيدلة

تقييم نمط وصف المضادات الحيوية في طب الأطفال في مستشفيات وعيادات مدينة إب

مشروع بحثي مقدم لقسم الصيدلة في الجامعة الماليزية الدولية كجزئي من متطلبات الحصول على درجة البكالوريوس في الصيدلة

المقدم بواسطة:
ادم عبد الخالق العفيف
علي احمد علي الملك
حمدي علي إسماعيل محسن الدغار
حسن محمد عبده علوان
هشان سليمان ناجي قاسم
نبيل علي عي الحمامي
نجمي الجرادي
أسامة عبدالباسط عبدالسلام حسان
رشيد احمد رسام السراجي
ياسر علي ابوالغيث مهدلي
يوسف اخمد الحياسي

اشراف :
د. علي نور الدين

2022-2023