PREVALENCE OF SELF-MEDICATION OF ANTIBIOTICS IN CHILDREN AND PARENTAL PERCEPTION AND KNOWLEDGE REGARDING ANTIBIOTIC USE AND RESISTANCE

A Dissertation submitted to the Department of Pharmacy, East West University, Bangladesh, in partial fulfillment of the requirements for the Degree of Bachelor of Pharmacy

Submitted by

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Declaration by the Research Candidate

I, MD. Rakayet Hossain, ID: 2012-3-70-030, hereby declare that the dissertation entitled "Prevalence of self-medication of antibiotics in children and parental perception and knowledge regarding antibiotic use and resistance " submitted by me to the Department of Pharmacy, East West University and in the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy, under the supervision and guidance Ms. Tilka Fannana, Senior Lecturer, Department of Pharmacy, East West University, Dhaka.

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Certificate by the Supervisor

This is to certify that the thesis entitled “Prevalence of self-medication of antibiotics in children and parental perception and knowledge regarding antibiotic use and resistance " submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a record of original and genuine research work carried out by MD. Rakayet Hossain , ID: 2012-3-70-030 during the period 2016 of his research in the Department of Pharmacy, East West University, under the supervision and guidance of me.

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Certificate by the Chairperson

This is to certify that the thesis entitled “Prevalence of self-medication of antibiotics in children and parental perception and knowledge regarding antibiotic use and resistance” submitted to the Department of Pharmacy, East West University for the partial fulfillment of the requirement for the award of the degree Bachelor of Pharmacy is a record of original and genuine research work carried out by MD. Rakayet Hossain, ID: 2012-3-70-030 during the period 2016 of his research in the Department of Pharmacy, East West University.

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Dedication

This research work is dedicated to my beloved parents, honorable faculties and loving friends.

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List of Abbreviation

1	WHO	World Health Organization
2	SM	Self-medication
3	WSMI	World Self Medication Industry
4	OTC	Over the counter
5	BP	Blood pressure
6	CQ	Chloroquine
7	LMIC	Low and middle income countries
8	FDA	United States Food and Drug Administration
9	UR	Uitsluitend Recept
10	UA	Uitsluitend Apotheek
11	UAD	Uitsluitend Apotheek of Drogist
12	AV	Algemene Verkoop
13	NDA	New Drug Application
14	GRAS/E	Drug generally recognized as safe and effective
15	POM	Prescription Only Medication
16	GSL	General Sales List
17	P	Pharmacy medicines
18	CSA	The Controlled Substances Act
19	PGE2	Prostaglandin E2
20	PGD2	Prostaglandin D2
21	(TNF)-α	Tumor necrosis factor
22	IL	Interleukin
23	TXA2	Thromboxane A2
24	ECP	Eosinophil cationic protein
25	GM-CSF	Granulocyte-macrophage colony-stimulating factor
26	SCF	Stem cell factor
27	dsDNA	double-stranded DNA
28	DHFR	Dihydrofolate reductase
29	MRSA	Methicillin-resistant Staphylococcus aureus
30	HIV	Human immunodeficiency virus

Abstract

A survey was conducted in Faridpur, Madaripur and Shariatpur district of Bangladesh which is entitled by "prevalence of self-medication of antibiotics in children and parental perception and knowledge regarding antibiotic use and resistance". The aims and objectives of this research were to identify the prevalence of self-medication with antibiotic to children, to determine parents' knowledge, attitude and practice of self-medication by exploring the knowledge and attitude about self-medication of antibiotics. This survey was based on questionnaire and had a sample size of 276 participants whose children's were suffered from any disease during last six month and had experience in using antibiotics. After this study it is seen that self-medication tendency of parents to their children varies on age, previous experience, sort of disease and monthly net house hold income. Most of the children were suffered from cough and cold. And a number of parents thought their child's health status is fairly poor enough to medicate antibiotic and what's why they self-medicated (39.13%) their children but most of them (59.70%) consulted a physician for appropriate treatment. Majority (64.10%) of the respondents have education level between primary school to school certificates. For the reason of education they haven't current knowledge about how to administered antibiotics and its side-effect. Widely used antibiotics for the self-medicated are amoxicillin (21%), ampicillin (12%) & cefixime (15%), ciprofloxacin (14%) are the most common prescribed antibiotics. When the parents were asked about antibiotic resistance then most of the respondents said that they do not have any idea about antibiotic resistance. But large percentage of them thinks that antibiotics are effective as well as in viral fever and the same antibiotics will be effective in the treatment of same infection in future. Because many of them don't know what is the difference between antibiotic drug and general drug. So, parents should be aware of the resistance of the antibiotic and stopped practicing self-medication of antibiotic in children. And health ministry of government should take proper initiative and ensure the rules and regulation for purchasing and dispensing the antibiotic to prevent the misuse of antibiotic.

Keywords: *Self-medication, antibiotics, prevalence, diseases, health status, antibiotic resistance, viral infection, Knowledge.*

Chapter 1

Introduction

1. Introduction

1.1 Overview:

Self medication is a major form of self-care. Self medication with antibiotics is widespread worldwide. A large number of studies had been done in both developed and developing countries. The use of non-prescribed antibiotics for self-medication raises questions about the risk of inappropriate use of drugs. According to World Health Organization inappropriate use of antibiotics includes improper antibiotic selection, inadequate antibiotic dosage, and insufficient length of use. Self-medication is still an important public health problem throughout the world; since it is a fairly common practice unjustified and inappropriate self-medication results in wastage of healthcare resources and increases resistance of pathogens, drug-drug interactions, and adverse drug reactions. Many studies over worldwide detect inappropriateness regarding the use of self-medicated antibiotics. The inappropriate use of antibiotics cause severe public health problems and also plays a vital role for antibiotics resistance which is worldwide major concern. (Widayati et al., 2011)

A cross-sectional survey was done in Madaripur, Faridpur and Shariatpur of Bangladesh to find out the reasons behind self-medication of antibiotics in children and also in this research we want to know about the parental perception, their knowledge regarding to the use of antibiotics and its resistance. Therefore, the main concern of this research is to inform and create awareness of public about the inappropriate use of antibiotics and improve the safe use of antibiotics in Bangladesh.

1.2 Self-medication (SM):

Once an individual recognized any symptoms of diseases or illness, then that individual made decision about these, does nothing; treat the symptoms without any medicine; self medicate or consult with health practitioners.

The world Health Organization (WHO) states that self-medication may result in certain potential risks for the individual consumer such as incorrect self-diagnosis, failure to seek appropriate medical advice promptly, failure to recognize special pharmacological risks, rare but severe adverse effects, failure to recognize or self-diagnose contraindications, interactions, warnings and precautions, failure to recognize that the same active substance is

already being taken under a different name (different brands may have the same active ingredient), failure to report current self-medication to the prescribing physician (risk of double medication or harmful interaction), failure to recognize or report adverse drug reactions, incorrect route or manner of administration, inadequate or excessive dosage, excessively prolonged drug use and incorrect choice of therapy. (W.H.O, 1998)

1.2.1 Definition of self-medication (SM):

According to The World Health Organization (WHO) had defined self medication as:
"Self-medication is the selection and use of medicines by individuals to treat self-recognized illnesses or symptoms."

In addition to self-manageable diseases, self-managing chronic diseases based on an initial medical assessment is also considered by the WHO as self medication. Further, the WHO states that the medicines used must be legally available without prescription; and safe and effective to be used following the instruction of use printed in the package. The information in the package should also describe other important information to ensure the safe of medicines for self-medication. The information which are leveled on the package are the therapeutic effect, potential side-effects, how to monitor adverse effect, interactions of drug with others medicines and also with the food, contraindications, duration of therapy and dose etc. (W.H.O, 1998)

According to World Self Medication Industry (WSMI), *"Self-medication is the treatment of common health problems with medicines especially designed and labeled for use without medical supervision and approved as safe and effective for such use".*
Self-medication can be defined as the use of drugs to treat self-diagnosed disorders or symptoms, or the intermittent or continued use of a prescribed drug for chronic or recurrent disease or symptoms. In Bangladesh, as in other countries, self-medication is a widespread practice and the majority of medications consumed by the population are sold without medical prescriptions. Medicines for self-medication are often called 'nonprescription' or 'over the counter' (OTC) and are available without a doctor's prescription through pharmacies. In some countries OTC products are also available in supermarkets and other outlets. Medicines that require a doctor's prescription are called prescription products.

Self-medication with antibiotics constitute a major form of irrational use of medicine and can cause resistant of microorganisms, failure of treatment, toxicity of medicine, prolonged hospitalization periods and also increase in morbidity. One of the main challenges that have emerged over the decades is the non-prescription use of antibiotics, which reduce the effectiveness of antibiotics in different types of bacterial infection.

1.2.2 Self-medication practice of antibiotic in developed & developing countries:

1.2.2.1 Europe:

Antibiotic drug resistance is a rapidly increasing global problem, and prevalence varying widely among countries. Prevalence of resistance is positively correlated with prescribed outpatient drug use on a national level. However, actual consumption of drugs may also include self-medication, i.e., using drugs obtained without prescription. Other sources of self-medication may include leftover drugs from treatment courses prescribed earlier or drugs obtained from relatives or friends. To date, the information on self-medication with antibiotic drugs in the industrialized world is limited.

From a statistical date of a survey which has been done in 19 European countries: Austria, the Netherlands, Sweden, United Kingdom, Ireland, Denmark, Italy, Malta, Luxembourg, Belgium, Spain, Israel, Romania, Czech Republic, Slovakia, Lithuania, Slovenia, Croatia, and Poland. The aim of this study was to estimate and compare the prevalence of actual self-medication and at risk for self-medication with antibiotic drugs in participating countries. A total of 15,548 subjects were participated in this survey.

Rates of antibiotic drug self-medication among the European regions suggests that cultural and socioeconomic factors play a role, as do disparities in health care systems such as reimbursement policies, access to health care, and drug dispensing policies. Another factor is the acquisition of antibiotic drugs from pharmacies without prescription, which occurred most frequently in eastern European countries. Although over-the-counter sale of antibiotic drugs is illegal in all participating countries, there is clearly a need to enforce the law in some countries.

Antibiotic drug self-medication is a cause for concern in Europe. Even the lowest prevalence, 1 person per 1,000 respondents, implies that 10,000 persons in a population of 10,000,000 are self-medicating annually.

Table 1. 19 European countries.

Northern and western	**Southern**	**Eastern**
Netherlands	Israel	Czech Republic
Sweden	Malta	Slovenia
Denmark	Italy	Croatia
Austria	Spain	Poland
Belgium		Slovakia
Luxemberg		Romania
United Kingdom		Lithuania
Ireland		

Statistical data indicates a high prevalence of self-medication in countries that reported high resistance levels (southern and eastern countries. Even in the countries with low actual self-medication, substantial intended self-medication and drug storage occurs. (Grigoryan et al., 2006)

1.2.2.2 Ibadan, Nigeria:

Self-medication is rampant (53.4%) among the studied population. This result conform that high rate of the practice of self-medication among children in Nigeria. Seven out of ten mothers in this study failed to consult doctor as first action when their children felt ill, due to reasons such as proximity to medicine stores, availability of non-prescribed drugs, competence or seeing patent medicine vendors as major advisers on their illness, low cost or financial constraint and extensive drug advertisement as this study. (Salami and Adesanwo, 2015)

1.2.2.3 Ulaanbaatar, Mongolia:

A study on self-medication of antibiotic in Mongolia; people had used non-prescribed antibiotics to treat symptoms in their child. The prevalence of non-prescribed antibiotic use for young children was high in Ulaanbaatar. Because such use leads to the spread of bacterial

resistance to antibiotics and related health problems, our findings have important implications for public education and the enforcement of regulations regarding the sale of antibiotic in Mongolia. (Schwebke, 2001)

1.2.2.4 Basrah, Iraq:

A survey demonstrated that, a large proportion of the antibiotic drugs were obtained from private pharmacies. The results indicated that the level of education has influence over dose compliance, storage of expired drugs and drugs exchange. A majority of 78% population admitted to practicing self-medication. There are numerous indications of inappropriate storage, self medication, poor compliance and use of drugs that have been kept beyond their expiry date in Basrah, Iraq. (Jassim, 2010)

1.2.3 Reason of self-medication:

Patient or consumers who wish to maintain of this own health are often consult with doctor and make proper diagnosis of the disease and follow the advice. e.g. topical corticosteroid, antifungal and oral contraceptive.

The common reasons could be to cure an ailment, suppress its cause indefinitely to give the body time to completely overcome it or for prevention, prophylaxis, palliation, convenience, postponing a natural event, out of habit or for special purposes. In some cases, the main reasons could be triviality of the symptoms, to save money and time, lack of gravity to go and see a physician because they can take care of themselves or previous medical prescription for related symptoms.

A number of reasons could be counted for self-medication. Strong desire of self care, feeling of sympathy towards family members in sickness, lack of health services, ignorance, misbelieves; extensive advertisement and availability of drugs in other than drug shops are responsible for growing trend of self medication and most importantly weak implementation of regulation related to medicines. For example, many studies showed that limited purchasing power is a major determinant for self-medication with antibiotics among the population in India, Nigeria, the Philippines, Latino adults in the United States of America, and the non-Arab population in the United Arab Emirates. Reasons for self-medication vary between societies, cultures, and types of health services. Studies revealed that the increase in self-medication was due to numerous factors. These included socioeconomic factors, lifestyle, ready access to drugs, the increased potential to manage certain illnesses through self-care, and that medicinal products are greatly available. Self-medication may be practiced as a

consequence of ignorance, poverty and in availability of health facilities. It has been pointed that the main reason for self-medication as reported by the participants was their previous experience on the efficacy of treatment. People tend to diagnose and treat themselves and think that they are having the right drug for the right condition. Another study remarked that reasons cited by patients for practicing self-medication included expediency, convenience, efficacy of medicines, dependability of supply, and cost reduction. It is stated that cost of treatment may have a negative effect on health and that many individuals self-medicate to avoid the long waiting times in facilities and due to inaccessibility of health facilities, cost, and a feeling that the ailment is minor. People believed that physician visits for a diagnosis and prescription were unnecessary when the patient was familiar with the symptom and it had previously responded to antibiotic treatment. Community members who practiced self-medication with prescription drugs got their medicines over-the-counter from community pharmacies and patent medicine stores. Pharmacy staff behavior can be a factor that puts patients at risk for self-medication with antibiotics. Community pharmacies are failing their tasks in enhancing rational use of antibiotics. Such a practice may be a consequence of weak enforcement and control over the legislation and professional standards. Antibiotics are frequently purchased without proper indication, in insufficient quantities, or when contraindicated. Approximately two-thirds of all oral antibiotics worldwide are obtained without a prescription and are irrationally used for diseases such as tuberculosis, malaria, and pneumonia and for mild childhood infections.

Others reasons which also associated with the self-medication are Lack of time, High consultant Fee of Physician, patients wants Quick relief. There are some cases of female in which there is no family support hence they uses self medication. There are some other reasons like wider availability of medicine, greater choice of treatments, and ease of access.

Parents who self-medicate their children are more likely than adults who medicate themselves to say they do so because the illness isn't serious enough to warrant a visit to the doctor.

Parents are also more likely believe that non-prescription medications are just as effective as prescription drugs. Parents who medicate their children states that they do so in order to save money or to avoid a trip to doctor's office. (Bennadi, 2014)

1.2.4 Risk of self-medication:

It is very common in developing countries for people to developed distrust in going to doctors for treatment. This is not surprising considering the vast array of treatment which can be found at local facilities. It can vary from excellent to absolutely appalling. Educated

people can easily fall into a bad habit in Bangladesh of self prescribing and self treating. This is an extremely dangerous practice.

Despite the significant benefits of self medication there are some inherent risks as well. The irresponsible use of over the counter medications can be particularly damaging and this is in fact the biggest risk. The risks of self medication go beyond simple over reliance on drugs and remedies. When individuals with no knowledge or limited knowledge of medicine and health care attempt self treatment, it typically also involves self diagnosis. Health care professionals dedicate their lives to the pursuit of knowledge and after years of studies in medical colleges still depend on medical tests and technology to verify their findings. Self diagnosis is probably the most dangerous aspect of home treatment, as it often downplays more serious conditions that manifest in mild symptoms, at times resulting in fatal delays in much needed medical advice and treatment. With our limited understanding of medicine, the risks of drug interactions and adverse reactions from certain medications and herbs are also very real. (Pavydė et al., 2015)

The risks from irresponsible use of self medication are also worrying because of their implications on our health not just as individuals, but as a species as well. Our over reliance and almost abusive dependence on antibiotics for various conditions for example, has created a variety of drug resistant strains of bacteria. This poses a greater health risk than most of us can even fathom, as a global pandemic resulting from a drug resistant bacteria strain could prove disastrous. (Pavydė et al., 2015)

It's had to strike a balance between self medication that is necessary and the irresponsible use of medications and home remedies. Setting you strict deadlines can help address this problem to a great extent however. In other words, if you find that the ailment in focus does not respond to treatment within a deadline, you should seek immediate medical attention. The length of the deadline would naturally vary, depending on the severity of the symptoms or the severity of the condition they could be symptomatic of. . Self-medication, even for minor ailments, could lead to medical complications. Antimicrobial resistance is a worldwide problem, particularly in Bangladesh where antibiotics are often available without a prescription. The dangers of self-medication could include the following:

1.2.4.1 Misdiagnosing the illness:

A minor health issue which could be resolved easily with the doctor's advice may become a major problem over time. Symptoms may subside temporarily with self-medication, but it would become difficult for a doctor to correctly diagnose and treat later. (Bennadi, 2014)

1.2.4.2 Insufficient dosage:

Incorrect dosage of medicines will not cure and will prolong recovery. On the other hand, over dosage may damage liver, kidneys and other organs. Indiscriminate use of antibiotics: These could, over a long time, lead to antimicrobial resistance. Consequently, the antibiotic may become ineffective when taken in the future. (Bennadi, 2014)

1.2.4.3 Habituation:

You could become addicted to prescription drugs such as antacids, cough syrups and pain relievers etc. (Bennadi, 2014)

1.2.4.4Allergic reactions:

Some antibiotics such as penicillin drugs can cause severe reactions in the body for some people. These could be fatal. (Bennadi, 2014)

1.2.4.5 Risk of stroke:

The most commonly misused medicines are painkillers. Analgesics can induce gastritis and can also increase risk of stroke by four times in patients with high BP. (Bennadi, 2014)

1.2.4.6 Drug interactions:

Some antibiotic drugs and medicines or food may cause drug-to-drug and drug-food interactions and adversely affect the body. This may cause severe health problem and some it may be life-threatening. (Bennadi, 2014)

1.2.4.7 Self-medication by pregnant women:

This could adversely affect the unborn child causing congenital anomalies and birth defects. Unlike other facets of self-care, self-medication involves the intake of drugs, which have the potential to be beneficial or harmful. Their improper use can have serious health implications, especially among children, the aged, and in people with special physiological conditions such as pregnancy and lactation. The government and health authorities must ensure that only safe drugs are made available OTC. Consumers should be given adequate information about their use. (Bennadi, 2014)

1.2.4.8 Others:

Insufficient curative treatment with chloroquine (CQ) for individuals who treat themselves for suspected malaria fever could result in resistance to Plasmodium falciparum – the agent

causing the ailment. Chronic CQ toxicity was important in the causation of heart block in Africa, CQ retinopathy and abnormal ophthalmological findings, cardiac arrhythmia. Stevens–Johnson syndrome following self medication with Fansidar has been reported. With respect to self medications, reported risks associated with the improper use include- gastric irritation, liver toxicity, rebound headache syndrome, milk alkali syndrome. Among the elderly, adverse reaction to drugs are characteristically more frequent and severe as a result of factors including self medication. (Bennadi, 2014)

1.2.5 Benefit of self-medication:

Expected health benefit from self medication depends on perceived effectiveness of self medication. In a world of scarce government and in many countries scarce individual resources, responsible self medication should be a cornerstone of healthcare provision and health policy. Responsible self medication can:

1. Help to prevent and treat symptoms and ailments that do not require a doctor.
2. Reduce the pressure on medical services where health care personnel are insufficient.
3. Increase the availability of health care to populations living in rural or remote areas.
4. Enable patients to control their own chronic conditions.
5. Reduce the healthcare cost

(Pavydė et al., 2015)

These benefits translate into patient and consumer wellness and productivity, economic gain for employers, and cost savings to healthcare budgets through reduced medicine budget cost and reduced physician visits. These conditions aim at ensuring the safety of taking self medicated drugs. They include the following: the drugs used are those indicated for conditions that are self recognizable; the user should know how to take or use the drugs; the effects and possible side effects of the drugs as well as ways of monitoring these side effects are well communicated to the user; possible interactions with other drugs is known by the user; duration of the course of the drugs is known by the user and, when the user must seek professional intervention. (Bennadi, 2014)

1.2.6 Factors influencing self-medication with antibiotics:

Factors which influence health-related behaviors exist in individuals, the community, institutions and nations. For example, patients demand for medicines, their beliefs about effectiveness and safety of medicines supply systems, quality of prescribing, implementation

of essential medicines policies, reimbursement systems and global trade regulations are some of the relevant factors influencing people's behavior related to medicine use.
(Oluyemi, 2015)

1.2.6.1 Socio-demographic and medical factors

Despite a growing research interest in self medication, little information has been available about its major determinants. Individual self care in illness is shaped in the social environment – a major determinant of the type and amount of health care services used. The socio-demographic determinants are age, gender, occupation, education, marital status, religion, race, income and culture. The socio-medical factors may be related to the female reproductive role (pregnancy, breast feeding, and menstruation), psychiatric disturbance, medical states like asthma, migraine and so on. The younger age group engaged in self medication than the older ones. However, some studies revealed no association between age and self medication. Women have above average knowledge about antibiotics and risks of self medication compared to men. They also had a much higher probability of using antibiotics for self medication than men. Factors related to general health status and women's reproductive role influences gender differences in self medication. During breastfeeding, self medication was dictated by the mother and her infant's disorder. However, some studies revealed no association between gender and self medication. Various studies consistently showed that self medication was associated with educational level. For instance, there is a positive correlation between level of education and self medication. The trend of consulting patent medicine dealers for prescription decreases with acquisition of more formal education. While studies showed no correlation between self medication and occupational status, others revealed some association. For instance, employment status affected the pattern of OTC and prescription drugs. The relationship between race and self medication had been documented from various studies. While some studies found little or no association between self medication and social status, others reported that among school aged subjects, social classes of parents has a direct relationship with drug consumption among their children. The influence of culture is common in health related states. (Oluyemi, 2015)

1.2.6.2 Knowledge and beliefs about antibiotics:

An antibiotic is well established as a chemical substance that kills or inhibits the growth of bacteria. But many socio-cultural contexts, antibiotics are thought of as an extraordinary medicine. Antibiotics are even judged to able to prevent any kinds of disease.
(Grigoryan et al., 2008)

1.2.6.3 Over the counter dispensing of antibiotics:

The source of antibiotics used for self medication can be formal drug providers, such as pharmacy, or informal drug vendors. Gees divide informal drug providers in to six categories. The first is a shopkeeper who sells general provisions. The second one is a market trader who sells medicines along with other merchandise in a traditional market. The third is the peddler who travels from village to village. The fourth is a vendor who specializes in the selling medicines. The fifth is personnel of medicine institutions patients. The final category is a pharmacist who sells prescription-only medicines without asking for a prescription.
A country lack of regulatory enforcement of antibiotic provision leads to over-the-counter dispensing. It facilitates overuse of antibiotics including the use of non-prescribed antibiotics for self-medication. (Oluyemi, 2015)

1.2.7 Inappropriate Antibiotic use worldwide:

From 20 to 50 percent of total antibiotic use is estimated to be inappropriate.
“Inappropriate” can mean either of two things:

• The use of antibiotics when no health benefit is possible, such as to treat upper respiratory tract infections caused by viruses; or

• The suboptimal use of antibiotics for responsive conditions, such as the choice of drugs with an unnecessarily broad spectrum, an incorrect dosage or duration, or poor patient adherence to the prescribed treatment.
Substandard antibiotics also contribute to antibiotic consumption with little or no benefit. Also inappropriate is antibiotic nonuse when an antibiotic could improve health, but clearly, the reasons for nonuse are very different. Lack of access and delayed access to antibiotics contribute significantly to morbidity and mortality worldwide. In the year 2013, pneumonia was responsible for an estimated 935,000 deaths in children under five worldwide.

An estimated 80 percent of all antibiotics are used outside hospitals—in outpatient settings such as clinics, health posts, and private physicians' offices. Community use also includes antibiotics purchased by or for consumers directly, without prescription. Although prescription-only laws exist in most countries (for at least some antibiotics), they are not enforced in most LMICs and some high-income countries. Nonprescription use of antibiotics can range from 19 percent to well over 90 percent outside the United States and Europe.

In rural and urban pharmacies in Vietnam, 88 to 91 percent of all antibiotic sales in a sample of pharmacies in 2010 were without a prescription.

Similarly, in Saudi Arabia and Syria, 78 percent and 87 to 97 percent of pharmacies, respectively, dispensed antibiotics without a prescription. (Van Boeckel et al., 2014)

1.2.7.1 Antibiotics in the community

Providers also play a role in driving inappropriate antibiotic use in the community. Antibiotics are routinely prescribed for infections that are not caused by bacteria, such as for malaria, acute diarrhea, influenza, uncomplicated viral respiratory tract infections, and other viral infections. This may occur because of an absence of clinical training and guidelines on antibiotic treatment available to physicians, or because of a lack of diagnostics and trained personnel to conduct testing and identify the cause and susceptibility of the infection.

Private pharmacies in India dispense a wider variety of antibiotics than do public pharmacies. Patterns of use in the private sector, at both retail pharmacies and private clinics, were similar. Newer antibiotics such as cephalosporins and fluoroquinolones were often used more than older ones such as cotrimoxazole and tetracyclines. At public facilities, while the newer members from each class of antibiotic were also used, there was greater use of older antibiotics—co-trimoxazole, tetracyclines, and narrow-spectrum penicillins—than in the private sector. Patient demand can affect drug selection as well: in South India, a hospital pharmacy stocked 25 brands of cotrimoxazole in response to customers' requests for specific name-brand products. (Abasaeed et al., 2009)

1.3 OTC:

OTC drugs are non-prescription drugs that are not normally covered by a Medicare Prescription Drug Plan. Over‑the‑Counter (OTC) medications are legal, non‑prescription substances taken for the relief of discomforting symptoms. These medications come in a variety of forms, including capsules, powders, tablets, and liquids, and can be used as fever

reducers, to relieve pain and the symptoms of colds, flu, and allergy symptoms; appetite suppressants; bowel preparations; sleeping aids; and stimulants. OTC medications, while deemed "safe" to use without the oversight of a physician, can also come with a variety of side effects, and if taken improperly, can pose significant health and safety risks both to the individuals taking the medications and, in some cases, those around them. The use of over the counter drugs allows the patient to have greater access to a variety of drugs available in the market to treat some medical conditions. In addition, it allows the patient to save money, because they usually cost less than other drugs. Over the counter drugs are drugs approved by the United States Food and Drug Administration (FDA) and have proven to be safe and effective. However, inappropriate use of them can lead to harmful effects. As mentioned, side effects can take the form of very mild to extremely severe.

Examples of these potential side effects are agitation, anxiety, and blurred vision; breathing difficulty, chest pain and/or tightness; confusion, dizziness, disorientation, double vision, and drowsiness; severe headache, hyperventilation, insomnia, light headedness; muscle cramps/spasms, nausea and vomiting; nervousness, heart palpitations, and rapid or irregular heart beat. Over the Counter Medication Guide classifies over the counter drugs by category according to the condition they are used for. For example, drugs to treat cough and congestion are classified under the category Cough / Cold / Allergy Combinations.

(Center and Evaluation, 2016) (Inlander et al., 1999)

1.3.1 Regulation in countries for OTC drugs:

1.3.1.1 Canada

In Canada, there are four drug schedules:

Schedule 1: Require a prescription for sale and are provided to the public by a licensed pharmacist.

Schedule 2: Do not require a prescription, but require an assessment by a pharmacist prior to sale. These drugs are kept in an area of the pharmacy where there is no public access and may also be referred to as "behind-the-counter" drugs.

Schedule 3: Do not require a prescription, but must be kept in an area under the supervision of a pharmacist. These drugs are kept in an area of the retail outlet where self-selection is possible, but a pharmacist must be available to assist in the self-selection of medication if required.

Unscheduled: Do not require a prescription and may be sold in any retail outlet.

All medications outside of Schedule 1 may be considered an OTC drug, as they do not require prescriptions for sale. While the National Association of Pharmacy Regulatory Authorities provides recommendations on the scheduling of drugs for sale in Canada, each province may determine their own scheduling. (NAPRA, 2016)

1.3.1.2 The Netherlands

In the Netherlands, there are four categories:
UR (Uitsluitend Recept): Prescription only
UA (Uitsluitend Apotheek): Pharmacist only
UAD (Uitsluitend Apotheek of Drogist): Pharmacist or drugstore only
AV (Algemene Verkoop): Can be sold in general stores.
A drug that is UA can be sold OTC, but only by pharmacists. The drug can be on the shelves like any other product. Examples are domperidone, 400 mg ibuprofen up to 50 tablets and dextromethorphan. A drug that is UAD can also be sold at drugstores: drugstores in The Netherlands are stores where no prescription can be filed and there is only a relatively small selection of popular drugs like painkillers and cough medicine. The drugs are usually on the shelves and the store also sells items like toys, gadgets, perfumes and homeopathic products. The drugs in this category have limited risk and addiction potential.Examples are naproxen and diclofenac in small amounts, cinnarizine, 400 mg ibuprofen up to 20 tablets and also 500 mg paracetamol up to 50 tablets. Drugs in the AV category can be sold at supermarkets, gas stations, etc. and include only drugs with minimal risk to the public, like paracetamol up to 20 tablets, 200 mg ibuprofen up to 10 tablets, cetirizine and loperamide. (NAPRA, 2016)

1.3.1.3 United States

In the United States, the manufacture and sale of OTC substances is regulated by the Food and Drug Administration. The FDA requires that all “new drugs” obtain a New Drug Application (NDA) before entering interstate commerce, but the act exempts any drugs generally recognized as safe and effective (GRAS/E) from this requirement. To deal with the vast number of OTC drugs that were already on the market before the requirement that all drugs obtain an NDA, the FDA created the OTC monograph system to review classes of drugs and categorize them as GRAS/E after review by expert panels. This meant that certain classes of OTC drugs would not be required to obtain an NDA and could remain on the market if they conformed to the monograph guidelines for doses, labeling, and warnings which are finalized in the Code of Federal Regulations.

Thus, in the United States an OTC drug product is allowed to be marketed either pursuant to an FDA monograph; or pursuant to an NDA for products that do not fit within a specific monograph. There is also the possibility that certain OTC drug products are marketed under the grandfather provisions of the Federal Food, Drug, and Cosmetic Act, but FDA has never formally acknowledged that any legitimate grandfather OTC drug exists.

Examples of OTC substances approved in the United States are sunscreens, anti-microbial and anti-fungal products, external and internal analgesics such as lidocaine and aspirin, psoriasis and eczema topical treatments, anti-dandruff shampoos containing coal tar, and other topical products with a therapeutic effect.

The Federal Trade Commission regulates advertising of OTC products. This is in contrast to prescription drug advertising, which is regulated by the FDA.

The FDA requires that OTC products are labeled with an approved "Drug Facts" label to educate consumers about their medications. These labels comply with a standard format and are intended to be easy for typical consumers to understand. Drug Facts labels include information on the product's active ingredient, indications and purpose, safety warnings, directions for use, and inactive ingredients. (Jasper, 2004)

1.3.1.4 United Kingdom

In the United Kingdom, medication is governed by the Medicines Regulations 2012. Medication will fall into one of three categories:

1. Prescription Only Medication (POM), which are legally available only with a valid prescription from a prescriber. A pharmacist has to be on the premises for POM medicines to be dispensed, required by law. The medicine has been specifically prescribed for the patient holding the prescription, so it is considered safe for only the recipient to take. Just a small example of these includes most antibiotics and all antidepressants or antidiabetic medications. Drugs included as POM are high-strength painkillers such as Oxycodone and Tramadol, medications such as Sildenafil (Viagra) and Diazepam (Valium), and certain topical preparations such as corticosteroids. These medicines are often sold by drug dealers, especially those marked as "CD POM," which are controlled due to abuse risk such as Diconal, Temazepam, and Methadone.

2. General Sales List (GSL), available off the shelf with no pharmacy training required to sell. In general, they are considered safe for most people when taken correctly. Examples of these include 16-packs (or less) of painkillers such as paracetamol and ibuprofen as well as a

host of other safe medications such as small pack sizes of antiallergy tablets, laxative medication, and skin creams.

3. Pharmacy Medicines are medicines which are legally neither a POM nor GSL medication. These can be sold from a registered pharmacy but should not be available for self-selection (although directions to discuss a 'P' product may be allocated shelf space with associated GSL items). 'P' medications are reserved from the GSL list as they are either associated with a need for advice on use, or used in conditions which may require referral to a medical prescriber. Suitable trained counter assistants may sell a 'P' medication under the supervision of a pharmacist and will ask questions to determine if the customer needs to be referred for a discussion with a pharmacist. Some 'POM' medicines are available for use in certain situations and doses as 'P' medicines. (Center and Evaluation, 2016)

1.4 Prescription Drugs:

A prescription is an order that is written the physician to tell the pharmacist what medication you want your patient to take. The basic format of a prescription includes the patient's name and another patient identifier, usually the date of birth. It also includes the meat of the prescription, which contains the medication and strength, the amount to be taken, the route by which it is to be taken and the frequency etc.

A prescription drug is a pharmaceutical drug that legally requires a medical prescription to be dispensed. In contrast, over-the-counter drugs can be obtained without a prescription. The reason for this difference in substance control is the potential scope of misuse, from drug abuse to practicing medicine without a license and without sufficient education. Different jurisdictions have different definitions of what constitutes a prescription drug. "Rx" is used as a short form for prescription. (Jordan, 2008)

1.4.1 Regulation of antibiotic prescribing

- Prescribe an antibiotic only when there is likely to be a clear clinical benefit
- Do not prescribe an antibiotic for a simple cold or viral sore throat
- Advise the patient on the normal duration of the illness
- Offer advice/treatment on the management of symptoms e.g. fever
- An immediate antibiotic prescription should be offered if the patient is: Systemically very unwell or is at risk of serious complications because of pre-existing co morbidity
- Use tried and tested, simple, cheap, narrow spectrum antibiotics first

- Save new, broader spectrum antibiotics for non-responding or resistant infections
- Individuals who have experienced anaphylaxis, rash or urticaria immediately after penicillin administration are at increased risk of immediate hypersensitivity to penicillin and should not receive a beta-lactam antibiotic
- Avoid repeated use of topical antibiotics, as they select for resistant organisms
- Avoid certain antibiotics in pregnancy, e.g. tetracyclines, quinolones, metronidazole, trimethoprim (in first trimester), nitrofurantoin (at term) and aminoglycosides
- Offer a deferred prescription to equivocal cases
- Take account of patient's size/weight when selecting the dose of antibiotic
- Where a best guess therapy has failed or special circumstances exist, microbiology advice should be obtained.

(Ahmed and Islam, 2012) (Sharfaraj, 2013)

1.4.2 Regulation in countries for prescription drugs:

1.4.2.1 United Kingdom:

In the United Kingdom the Medicines Act 1968 and Prescription Only Medicines (Human Use) Order 1997 contain regulations that cover the supply of sale, use and production of medicines.

There are three categories of medicine:

1. Prescription-only medicines (POM), which can be sold by a pharmacist if prescribed by a prescriber.
2. Pharmacy medicines (P), which may be sold by a pharmacist without prescription.
3. General sales list (GSL) medicines that may be sold without a prescription in any shop.

(Jordan, 2008)

1.4.2.2 United States:

In the United States, the Federal Food, Drug, and Cosmetic Act define what requires a prescription. In general, prescription drugs are authorized by physicians, physician assistants, nurse practitioners, and other APRNs, veterinarians, dentists, and optometrists. In general, it is required that an MD, DO, PA, OD, DPM, NMD, ND, DVM, DDS, or DMD, some psychologists, clinical pharmacists, nurse practitioners, and other APRNs write the prescription; basic level registered nurses, medical assistants, emergency medical technicians,

most psychologists, and social workers as examples, do not have the authority to prescribe drugs.

The Controlled Substances Act (CSA) was enacted into law by the Congress of the United States in 1970. The CSA is the federal U.S. drug policy under which the manufacture, importation, possession, use and distribution of certain substances is regulated.

The safety and effectiveness of prescription drugs in the US is regulated by the federal Prescription Drug Marketing Act of 1987. The Food and Drug Administration (FDA) is charged with implementing this law. (Temin and Temin, 1990)

1.5 Disease of Children:

1.5.1 Pneumonia:

Pneumonia (from the Greek *pneuma*, "breath") is a potentially fatal infection and inflammation of the lower respiratory tract (i.e., bronchioles and alveoli) usually caused by inhaled bacteria. (Suárez, 2012)

1.5.1.1 Types of Pneumonia:

a. Bronchopneumonia
b. Lobar pneumonia

1.5.1.2 Pathophysiology of Pneumonia:

Bacteria commonly enter the respiratory tract but, due to multiple defense mechanisms, do not normally cause pneumonia. When pneumonia does occur, it usually is the result of an exceedingly virulent microbe, a large "dose" of bacteria, and/or impaired host defense

When microorganisms evade upper respiratory defense mechanisms, the alveolar macrophage is capable of removing most infectious agents without triggering a significant inflammatory or immune response. However, if the microbe is virulent or present in sufficiently high numbers, it can overwhelm macrophages and result in a full-scale activation of systemic defense mechanisms. These mechanisms include the release of multiple chemical mediators of inflammation, infiltration of white blood cells, and activation of the immune response. Tight adherence of some bacteria (e.g., *Pseudomonas*) to the tracheal lining and biofilm of an endotracheal tube makes clearance of these microbes from the airways difficult and accounts, in part, for their highly virulent nature.

In non-hospitalized people, bacteria reach the lung by one of four routes:

1. Inhalation of microorganisms that have been released into the air when an infected individual coughs or sneezes
2. Aspiration of bacteria from the upper airways
3. Spread from contiguous infected sites
4. Hematogenous spread

When bacteria enter the lower respiratory tract, they adhere to the walls of bronchi and bronchioles, multiply extracellularly, and trigger inflammation. Clinical risk factors that favor colonization of the lower airways include antibiotic therapy that alters the normal bacterial flora, diabetes, smoking, chronic bronchitis, and viral infections. With the onset of inflammation, alveolar air spaces fill with an exudative fluid (i.e., rich in protein). Inflammatory cells (first neutrophils during the acute phase, later macrophages and lymphocytes during the chronic phase) subsequently invade the walls of the alveoli. Bacterial pneumonia may be associated with significant hypoxemia and hypercapnia because thick, inflammatory exudate (or *pus*) collects in the alveolar spaces and interferes with the diffusion of oxygen and carbon dioxide. Alveolar exudate tends to solidify—a process known as *consolidation*—and expectoration of infected phlegm becomes difficult. *Legionella, Mycoplasma,* and *Chlamydia* are examples of *atypical* bacterial agents in that they produce patchy inflammatory changes in the lungs (i.e., *bronchopneumonia*). The remaining typical bacterial causes of pneumonia produce widespread inflammation throughout one or more lobes of the lung (i.e., *lobar pneumonia*). Colonization of the pharynx and, possibly, the stomach with bacteria is the most important factor in the pathophysiology of hospital-acquired pneumonia, followed closely by aspiration of infected secretions into the lower airways. Pharyngeal colonization is promoted by several exogenous factors: instrumentation of the upper airways with contaminated nasogastric or endotracheal tubes, contamination by dirty hands, and treatment with broad-spectrum antibiotics that promote the emergence of drug-resistant bacteria. Certain patient characteristics (e.g., malnutrition, advanced age, altered consciousness, swallowing disorders, immunodeficiency) are also major contributing factors.

Pneumococcal pneumonia remains the most common type of bacterial pneumonia and its pathophysiology has been extensively studied. The initial step in the development of this disease is the attachment of *S. pneumoniae* to cells of the nasopharynx and subsequent colonization. Colonization alone, however, does not cause clinical manifestations of illness because perfectly healthy people can harbor the microbe without evidence of infection.

Factors that permit pneumococci to spread beyond the nasopharynx include the virulence of the strain, impaired host defense mechanisms, and viral infections of the respiratory tract. Viruses can damage respiratory tract lining cells, enhance bacterial adherence, and increase the production of mucus, which protects pneumococci from phagocytosis. In the alveoli, pneumococci infect type II alveolar cells and adhere to alveolar walls, causing an outpouring of fluid, red and white blood cells, and fibrin from the circulation, which, in turn, results in consolidation of the lung. Fluid in the lower airways creates a medium for further multiplication of bacteria and aids in the spread of infection through pores of Kohn into adjacent regions of the lung. (Alcón, Fàbregas, and Torres, 2005)

1.5.1.3 Treatment of Pneumonia:

- Streptococcus pneumonia Penicillin-susceptible strains: penicillin G, amoxicillin
- Penicillin-resistant strains: macrolides, cephalosporins, doxycycline, fluoroquinolones, clindamycin, vancomycin, linezolid,

(Suárez, 2012)

1.5.2 Fever:

Fever, also known as pyrexia and febrile response, is defined as having a temperature above the normal range due to an increase in the body's temperature set point.

1.5.2.1 Types of Fever:

1. Continuous fever: Temperature remains above normal throughout the day and does not fluctuate more than 1 °C in 24 hours.
2. Intermittent fever: The temperature elevation is present only for a certain period, later cycling back to normal.
3. Remittent fever: Temperature remains above normalthroughout the day and fluctuates more than 1 °C in 24 hours.
4. Pel-Ebstein fever: A specific kind of fever associated with Hodgkin's lymphoma, being high for one week and low for the next week and so on.

1.5.2.2 Pathophysiology of Fever:

Temperature is ultimately regulated in the hypothalamus. A trigger of the fever, called a pyrogen, causes a release of prostaglandin E2 (PGE2). PGE2 then in turn acts on the

hypothalamus, which generates a systemic response back to the rest of the body, causing heat-creating effects to match a new temperature level. In many respects, the hypothalamus works like a thermostat. When the set point is raised, the body increases its temperature through both active generation of heat and retention of heat. Peripheral vasoconstriction both reduces heat loss through the skin and causes the person to feel cold. If these measures are insufficient to make the blood temperature in the brain match the new set point in the hypothalamus, then shivering begins in order to use muscle movements to produce more heat. When the hypothalamic set point moves back to baseline either spontaneously or with medication, the reverse of these processes (vasodilation, end of shivering and nonshivering heat production) and sweating are used to cool the body to the new, lower setting. This contrasts with hyperthermia, in which the normal setting remains, and the body overheats through undesirable retention of excess heat or over-production of heat. Hyperthermia is usually the result of an excessively hot environment (heat stroke) or an adverse reaction to drugs. Fever can be differentiated from hyperthermia by the circumstances surrounding it and its response to anti-pyretic medications. (Craft, Gordon, and Tiziani, 2010)

1.5.2.3 Treatment of Fever:

Medications that lower fevers are called *antipyretics*. The antipyretic ibuprofen is effective in reducing fevers in children. It is more effective than acetaminophen (paracetamol) in children. Using both paracetamol and ibuprofen at the same time or alternating between the two is more effective at decreasing fever than using only paracetamol or ibuprofen.
(Craft, Gordon, and Tiziani, 2010)

1.5.3 Common Cold:

The term “common cold” refers to a mild upper respiratory viral illness. It is self-limited therefore it will go away without treatment. It is the most frequent acute illness in the United States. It is separate and a distinctly different illness than influenza, throat infection, bronchitis, sinusitis, pertussis, and allergic rhinitis. The average person has two or three colds a year.

Colds are caused by many viruses, which cause similar symptoms. The same virus can cause another cold after re-exposure. However, the second illness is usually milder and lasts for a shorter period of time. Seasonal patterns may be seen for some of the viruses.
(Silverstein et al., 1994)

1.5.3.1 Treatment of Common Cold:

Symptomatic therapy is the only thing necessary for treating the common cold as it is a self-limited infection (meaning it will go away with time). Antibiotics are not effective and should not be prescribed unless there is convincing evidence of the presence of a bacterial infection. (Silverstein et al., 1994)

1.5.4. Angina & Acute tonsillitis:

Angina and acute tonsillitis are acute inflammations of the palatine tonsils. They occur readily in children and young adults (rarely in babies under 18 months of age), but may also be observed in adults at any age. Depending on the patient's age, 50 to 90% of angina cases are of viral origin (adenovirus, *Influenza* virus, respiratory syncytial virus, and *para-influenza* virus, etc.).

Among the bacterial agents responsible for angina, Group A b-hemolytic streptococcus is often the first to be found. (Jenkins, 1935)

1.5.4.1 Treatment of Angina & Acute tonsillitis:

- B -lactams: penicillin V ,ampicillin,
- Oral first-generation cephalosporins (cefaclor, cefadroxil, cefalexin, cefatrizine, cefradine, and loracarbef).
- Macrolides are only used as an alternative to b-lactam treatment

(Wilkinson, 1834)

1.5.5 Nasal congestion:

Nasal congestion or obstruction is one of the most frequent symptoms encountered in primary care and specialist clinics, and it is often the predominant symptom in upper respiratory tract disorders, such as-

- allergic rhinitis,
- rhinosinusitis,
- nonallergic rhinitis, and
- nasal polyposis.

Additionally, nasal congestion is also a common symptom in otitis media and asthma, and it can contribute to the onset or worsening of sleep disturbances, including obstructive sleep apnea. (Naclerio, 2010)

1.5.5.1 Allergic rhinitis

The prevalence of allergic rhinitis is increasing worldwide, occurring in 10% to 30% of adults and up to 45% of children.9–11 Nearly 50% of patients with allergic rhinitis
experience symptoms for 4 months of the year, and nasal congestion is frequently the predominant symptom. Other symptoms of allergic rhinitis include nasal itching, rhinorrhea, and sneezing, as well as ocular itching, redness, and tearing.

Although inflammation and tissue swelling/edema are frequent components of other common upper respiratory tract disorders, such as rhinosinusitis, the underlying inflammatory mechanisms have been primarily studied in the setting of allergic rhinitis. Symptoms of allergic rhinitis, including nasal congestion, are primarily due to a combination of the early and late-phase allergic inflammatory response. In a sensitized host, an antigen comes into contact with the nasal mucosa, leading to crosslinking of immunoglobulin E (IgE) receptors on mast cells. This results in degranulation of these cells and the release of histamine and proteases from preformed granules. In addition, an array of early-phase proinflammatory molecules are synthesized and released, most notably leukotrienes, prostaglandins, tumor necrosis factor (TNF)-α, and interleukin (IL)-4.13,19,20 Release of these inflammatory mediators leads to swelling/edema and fluid secretion, resulting in congestion as well as other nasal symptoms. A large body of literature supports a role for leukotrienes as mediators in allergic rhinitis. Cysteinyl leukotrienes can be recovered in nasal secretions after exposure to natural allergens and at elevated concentrations in allergic rhinitis with increased allergen dose exposure.Challenge with cysteinyl leukotriene also increases nasal airway resistance. In addition, cysteinyl leukotrienes may facilitate the maturation of eosinophil precursors and act as eosinophil chemoattractants, promoters of eosinophil adhesion, and inhibitors of eosinophil apoptosis. Like leukotrienes, thromboxanes are arachidonic acid derivatives, released from mast cells and other inflammatory cells, that are found in nasal lavage fluid samples following nasal allergen challenge. In animal models, TXA2 agonists increase nasal airway resistance and vascular permeability. TXA2 receptor antagonists have also been shown to improve congestion in animals and reduce nasal mucosal swelling in AR patients following allergen challenge. Prostaglandin D2 (PGD2) is the major prostanoid produced in the acute phase of allergic reactions, and it is thought to be associated with hypertrophic inflammation in the nose and recruitment of eosinophils. A number of other biomarkers of inflammation, including tryptase, N-alpha-tosyl L-arginine methyl ester (TAME)-esterase and eosinophil cationic protein (ECP), are also detectable in the nasal mucosa within minutes

to hours after allergen challenge. These mediators stimulate the early phase response and also lead to increased venous engorgement, which results in concomitant

rhinorrhea and nasal congestion. The chronic, late-phase inflammatory response involves cellular infiltration, which sustains tissue swelling and edema, further exacerbating congestion. As a result of cytokine or mediator release, the nasal mucosa becomes infiltrated with inflammatory cells including eosinophils, neutrophils, basophils, mast cells, and lymphocytes, that sustain and exacerbate the nasal mucosal inflammatory reaction. Eosinophils are the predominant cell type in the chronic inflammatory processes that characterize the late-phase allergic response, and they release a broad array of proinflammatory mediators, including cysteinyl leukotrienes, ECP, eosinophil peroxidase, and major basic protein. These cells may also serve as a major source of IL-3, IL-5, granulocyte-macrophage colony-stimulating factor (GM-CSF), and IL-13.20 IL-5 is an eosinopoietic cytokine that promotes eosinophil differentiation and maturation within the bone marrow. Circulating eosinophils are increased in number in subjects with allergic disorders, and infiltration at the site of provocation has been generally attributed to influx of mature cells. However, there appears to be a subset of eosinophil progenitor cells that undergo local maturation in the nasal mucosa, also in an IL-5-dependent fashion. Eosinophil infiltration has been demonstrated to have a significantly negative correlation with nasal airflow in patients with allergic rhinitis. The cellular infiltration of the late-phase response also primes the mucosa for additional antigen exposure and increases the response to it, thus further exacerbating symptoms upon continued exposure (eg, as the allergy season progresses). In addition to eosinophils, other inflammatory cells, eg, basophils, mast cells, T cells, also accumulate within the nasal epithelium during the late-stage response. Leukocyte activation, with subsequent migration to sites of inflammation, leads to changes in the cell membrane (eg, increased integrin expression) that result in adhesion to the endothelial surface. Survival of cells that have been recruited and migrated to sites of inflammation, particularly eosinophils and mast cells, is enhanced by epithelial generation of GM-CSF, IL-5, and stem cell factor (SCF). Cultured nasal epithelial cells have been shown to generate SCF in vitro, and levels of this growth factor are increased in nasal lavage fluids from patients with seasonal allergic rhinitis. TNF-α is a key inflammatory mediator of the late-phase response, and its levels have been shown to be dramatically increased beginning at about 1 hour after allergen challenge. Plasma exudation and preferential upregulation of neutrophils over eosinophils during the late phase are characteristic of the response to TNF-α.32 This cytokine has been demonstrated to activate T cells, endothelial cells, fibroblasts,

and macrophages to express cell surface receptors and to release additional inflammatory cytokines. TNF-α also increases the expression of cell adhesion molecules (intercellular adhesion molecule 1 [ICAM-1] and vascular cell adhesion molecule 1 [VCAM-1]).19 Proinflammatory interleukins (IL-1β, IL-6, and IL-8) are elevated in patients with allergic rhinitis and have been shown to promote the activation of immune cells as well as to enhance expression of receptors for cell adhesion molecules (eg, selectins, integrins). These events, along with IgE synthesis and eosinophil/basophil priming, collectively contribute to inflammation, venous engorgement, nasal hyperreactivity, and symptoms of allergic rhinitis, including congestion.Nonallergic rhinitis (that which is not mediated by an IgE response) includes infectious rhinitis, vasomotor rhinitis, nonallergic rhinitis with eosinophilia syndrome (NARES), and hormonal rhinitis (that precipitated by pregnancy and menstrual irregularities). In particular, significant nasal congestion may be present with pregnancy-related rhinitis. (Naclerio, 2010)

1.5.5.2 Rhinosinusitis:

Rhinosinusitis is now the accepted term for a group of disorders characterized by inflammation of the mucosa of the nasal passages and paranasal sinuses. Although the term itself is specific, rhinosinusitis may be due to an array of etiologic agents, including microorganisms; noninfectious, nonimmunologic causes; and allergic and nonallergic immunologic inflammation. The most common cause of rhinosinusitis is viral infection (often referred to as the common cold). A large body of research supports the view that symptoms of the common cold are not due to direct cytopathic effects of the viral infection. Rather, it appears that viral infection stimulates inflammatory pathways that, once activated, tend to prolong symptoms even after viral replication has been ablated. In addition, an estimated 0.5% to 2% of cases of viral rhinosinusitis are complicated by secondary bacterial infections. Regardless of etiology, rhinosinusitis is typically classified as acute or chronic, depending on duration of symptoms. Although microorganisms play a predominant role in the etiology of acute rhinosinusitis, the role of infection in patients with chronic rhinosinusitis is controversial (although in a subset of chronic rhinosinusitis patients, fungi may play a role). Furthermore, allergic and immunologic factors have also been shown to be associated with the development of rhinosinusitis; eg, perennial allergic rhinosinusitis is a documented predisposing condition for acute bacterial rhinosinusitis. The pathogenesis of rhinosinusitis, like that of allergic rhinitis, includes secretion of proinflammatory cytokines. In patients with acute rhinosinusitis, levels of inflammatory cytokines and total protein are significantly

increased in nasal lavage fluid compared with healthy controls. Kinin levels have also been found to be markedly increased inthe nasal secretions of patients with acute viral rhinosinusitis and elevated levels of IL-1, IL-6, and IL-8 have also been detected in the nasal secretions of these patients. Kinins can act on blood vessels to cause vascular leakage and/or engorgement, and they also stimulate afferent nerve fibers in the nasal mucosa, leading to hyperresponsiveness. In addition, TNF-α and other proinflammatory cytokines are elevated during the course of naturally acquired acute viral upper respiratory tract infection. Similar to allergic rhinitis, acute rhinosinusitis is also associated with significantly increased infiltration of inflammatory cells, including neutrophils and T cells, in the nasal epithelium and lamina propria. The pathophysiology of chronic rhinosinusitis is not fully understood; however, the cytokine and mediator profile in this condition closely resembles the profile found in acute rhinosinusitis, with the exception of a small but significant increase in ECP. Nasal tissue samples taken from patients with chronic rhinosinusitis have been shown to have increased levels of leukotrienes C4, D4, and E4 and higher levels of markers of eosinophilic inflammation, such as ECP. In addition, a number of studies have reported that markers of atopy are more prevalent in populations with chronic rhinosinusitis. Although the role of allergy in chronic rhinosinusitis remains controversial, it has been postulated that swelling of the nasal mucosa in allergic rhinitis may restrict ventilation and obstruct sinus ostia, leading to mucus retention and infection. (Tomassen et al., 2011)

1.5.5.3 Treatment of Nasal congestion:

- Antihistamines
- Decongestants
- Cortisone-like drugs (corticosteriods) are powerful decongestants.

(Tomassen et al., 2011)

1.5.6 Diarrhea

• World Health Organization: 3 or more loose or liquid stools per day

• Abnormally high fluid content of stool

> 200-300 gm/day

1.5.6.1 Classification of Diarrhea:

1. Acute- if 2 weeks (less than 2 weeks)
2. Persistent- if 2 to 4 weeks

3. Chronic- if 4 weeks in duration (more than 4 weeks)

(Shimizu, 1994)

1.5.6.2 Pathophysiology of Diarrhea:

Categories of diarrhea-

1. Secretory
2. Osmotic
3. Exudative (inflammatory)
4. Motility-related

(Shimizu, 1994)

1.5.6.2.1 Osmotic Diarrhea:

• Excess amount of poorly absorbed substances that exert osmotic effect……water is drawn into the bowels……diarrhea

• Stool output is usually not massive

• Fasting improve the condition.

• Stool osmotic gap is high, > 125 mOsm/kg Can be the result of

1. Malabsorption in which the nutrients are left in the lumen to pull in water e.g. lactose intolerance.
2. Osmotic laxatives.

Laxatives: are foods, compounds or drugs taken to loosen the stool.

Sufficiently high doses of laxatives may cause diarrhea.

(Shimizu, 1994)

1.5.6.2.2 Secretory Diarrhea:

• There is an increase in the active secretion of water.

• High stool output

• Lack of response to fasting

• Stool osmotic gap < 100 mOsm/kg

• The most common cause of this type of diarrhea is a bacterial toxin (E. coli , cholera) that stimulates the secretion of anions.

• Other causes:

– Enteropathogenic virus e.g. rotavirus and norwalk virus

– Also seen in neuroendocrine tumours (carcinoid tumor, gastrinomas)

(Shimizu, 1994)

1.5.6.2.3 Exudative (inflammatory) Diarrhea:

• Results from the outpouring of blood protein, or mucus from an inflamed or ulcerated mucosa.

• Presence of blood and pus in the stool.

• Persists on fasting

• Occurs with inflammatory bowel diseases, and invasive infections e.g. *E. coli, Clostridium difficile* and *Shigella***.**

(Shimizu, 1994)

1.5.6.2.4 Motility-related Diarrhea:

• Caused by the rapid movement of food through the intestines (hypermotility).

• Irritable bowel syndrome (IBS) – a motor disorder that causes abdominal pain and altered bowel habits with diarrhea predominating. Occurs with stress and neurological disorders and diagnosed by exclusion of bacterial, viral infections and malabsorption.

(Shimizu, 1994)

1.5.6.3 Treatment of Diarrhea:

1.5.6.3.1 Prevention-

-Sanitation

-Drinking water

-Vaccination against rotavirus

-Oral Rehydration solution

-Zinc tablet

(Shimizu, 1994)

1.5.6.3.2 Medication

-Bismuth subnitrate

-Loperamide

-If severe diarrhea with presence of microorganisms then antibiotics are used

(Shimizu, 1994)

1.7 Antibiotic Drugs:

Drugs that destroy microbes, prevent their multiplication or growth, or prevent their pathogenic action – Differ in physical, chemical, pharmacological properties

- Differ in antibacterial spectrum of activity
- Differ in their mechanism of action

1.7.1 Antibiotic Classification:

Grouped by Structure and Function

Five functional groups cover most antibiotics

1. Inhibitors of cell wall synthesis-
   – Penicillins
   – Cephalosporins
   – Monobactams (aztreonam)
   – Carbapenams
   – Glycopeptides (vancomycin)
2. Inhibitors of protein synthesis-
   – Aminoglycosides
   – Tetracyclines
   – Glycylcycline (tigecycline)
   – Macrolides (azithromycin, clarithromycin)
   – Lincosamides (clindamycin)
   – Streptogramins (quinapristin/dalfopristin)
   – Oxazolidinones (linezolid)
   – Chloramphenicol
3. Anti-metabolites-
   – Trimethoprim
   -Sulfonamides
4. Inhibitors of nucleic acid synthesis-
   – Rifamycins
   – Quinolones
5. Miscellaneous-

– Metronidazole

– Lipopeptides (Daptomycin)

– Polymyxins

1.8 Mechanism of antibiotic resistance:

Antibiotics underpin modern medicine; their use has reduced childhood mortality and increased life expectancy, and they are crucial for invasive surgery and treatments such as chemotherapy. However, the number of infections caused by multidrug-resistant bacteria is increasing globally, and the spectre of untreatable infections is becoming a reality. The most recent World Economic Forum Global Risks reports have listed antibiotic resistance as one of the greatest threats to human health. It is estimated that in Europe 25,000 people die each year as a result of multidrug-resistant bacterial infections and that this costs the European Union economy €1.5 billion annually1. In the United States more than 2 million people are infected with antibiotic-resistant bacteria annually, with 23,000 deaths as a direct result. In addition to increased resistance to existing agents, there is a lack of new antibiotics in development. The word antibiotic has become synonymous with 'antibacterial drug': therefore, in this article the term antibiotic has been used throughout.

Microorganisms have existed on the earth for more than 3.8 billion years and exhibit the greatest genetic and metabolic diversity. They are an essential component of the biosphere and serve an important role in the maintenance and sustainability of ecosystems. It is believed that they compose about 50% of the living biomass. In order to survive, they have evolved mechanisms that enable them to respond to selective pressure exerted by various environments and competitive challenges.

Antibiotics were discovered in the middle of the nineteenth century and brought down the threat of infectious diseases which had devastated the human race. However, soon after the discovery of penicillin in 1940, a number of treatment failures and occurrence of some bacteria such as staphylococci which were no longer sensitive to penicillin started being noticed. This marked the beginning of the error of antimicrobial resistance.

Prior to the 1990s, the problem of antimicrobial resistance was never taken to be such a threat to the management of infectious diseases. But gradually treatment failures were increasingly being seen in health care settings against first-line drugs and second-line drugs or more. Microorganisms were increasingly becoming resistant to ensure their survival against the arsenal of antimicrobial agents to which they were being bombarded. They achieved this

through different means but primarily based on the chemical structure of the antimicrobial agent and the mechanisms through which the agents acted. The resistance mechanisms therefore depend on which specific pathways are inhibited by the drugs and the alternative ways available for those pathways that the organisms can modify to get a way around in order to survive. (Byarugaba, 2004)

Resistance can be described in two ways:
a) Intrinsic or natural whereby microorganisms naturally do not posses target sites for the drugs and therefore the drug does not affect them or they naturally have low permeability to those agents because of the differences in the chemical nature of the drug and the microbial membrane structures especially for those that require entry into the microbial cell in order to effect their action or
b) Acquired resistance whereby a naturally susceptible microorganism acquires ways of not being affected by the drug.
(Byarugaba, 2004)

1.8.1 Resistance to β-Lactam Antibiotics:

β-Lactam antibiotics are a group of antibiotics characterized by possession of a β-lactam ring and they include penicillins, cephalosporins, carbapenems, oxapenams, and cephamycins. The penicillins are one of the most commonly used antibiotics in developing countries because of their ready availability and relatively low cost. The β-lactam ring is important for the activity of these antibiotics which results in the inactivation of a set of transpeptidases that catalyze the final cross-linking reactions of peptidoglycan synthesis in bacteria. The effectiveness of these antibiotics relies on their ability to reach the penicillin-binding protein (PBP) intact and their ability to bind to the PBPs. Resistance to β-lactams in many bacteria is usually due to the hydrolysis of the antibiotic by a β-lactamase or the modification of PBPs or cellular permeability. β-Lactamases constitute a heterogenous group of enzymes which are classified according to different ways including their hydrolytic spectrum, susceptibility to inhibitors, genetic localization (plasmidic or chromosomal), and gene or amino acid protein sequence. The functional classification scheme of β-lactamases proposed by Bush, Jacoby and Medeiros (1995) defines four groups according to their substrate and inhibitor profiles:

Group 1 are cephalosporinases that are not well inhibited by clavulanic acid;

Group 2 are penicillinases, cephalosporinases, and broad-spectrum β-lactamases that are generally inhibited by active site-directed β-lactamase inhibitors;

Group 3 are metallo-β-lactamases that hydrolyze penicillins, cephalosporins, and carbapenems and that are poorly inhibited by almost all β-lactam-containing molecules;

Group 4 are penicillinases that are not well inhibited by clavulanic acid.
(Blair et al., 2014)

1.8.2 Tetracycline Antibiotics Resistance:

Tetracyclines are another of the very commonly used antimicrobial agents in both human and veterinary medicine in developing countries because of their availability and low cost as well as low toxicity and broad spectrum of activity. The tetracyclines were discovered in the 1940s. They inhibit protein synthesis by preventing the attachment of aminoacyl-tRNA to the ribosomal acceptor (A) site. They are broad-spectrum agents, exhibiting activity against a wide range of gram-positive and gram-negative bacteria, atypical organisms such as chlamydiae, mycoplasmas, and rickettsiae, and protozoan parasites. Examples of these include drugs such as tetracycline, doxycycline, minocycline, and oxtetracycline. Resistance to these agents occurs mainly through three mechanisms (Roberts, 1996), namely

- Efflux of the antibiotics,
- Ribosome protection, and
- Modification of the antibiotic.

Efflux of the drug occurs through an export protein from the major facilitator superfamily (MFS). These export proteins are membrane-associated proteins which are coded for by tet efflux genes and export tetracycline from the cell. Export of tetracycline reduces the intracellular drug concentration and thus protects the ribosomes within the cell. Tetracycline efflux proteins have amino acid and protein structure similarities with other efflux proteins involved in multiple-drug resistance, quaternary ammonium resistance, and chloramphenicol and quinolone resistance. The gram-negative efflux genes are widely distributed and normally associated with large plasmids, most of which are conjugative. Ribosome protection occurs through ribosome protection proteins that protect the ribosomes from the action of tetracyclines. Ribosome protection proteins are cytoplasmic proteins that bind to the ribosome and cause an alteration in ribosomal conformation which prevents tetracycline from binding to the ribosome, without altering or stopping protein synthesis. They confer

resistance mainly to doxycycline and minocycline and confer a wider spectrum of resistance to tetracyclines than is seen with bacteria that carry tetracycline efflux proteins. Modification of the antibiotic on the other hand occurs through enzymatic alteration of the drugs. Some of these genes are coded for by tet(X) genes.
(Blair et al., 2014)

1.8.3 Chloramphenicol Resistance:

Chloramphenicol binds to the 50S ribosomal subunit and inhibits the peptidyl transferase step in protein synthesis. Resistance to chloramphenicol is generally due to inactivation of the antibiotic by a chloramphenicol acetyltransferase. Various enzymes have been described and are coded for by the cat genes found in gram negative and gram-positive bacteria and usually show little homology. Sometimes decreased outer membrane permeability or active efflux is responsible for the resistance in gram-negative bacteria. (Blair et al., 2014)

1.8.4 Aminoglycoside Resistance:

Aminoglycosides include a group of drugs which are characterized by the presence of an aminocyclitol ring linked to amino sugars in their structure and have a broad spectrum of activity against bacteria. Examples of these drugs include streptomycin, kanamycin, gentamycin, tobramycin, and amikacin, which are commonly used in the treatment of infections by both gram-negative and gram-positive organisms. Their bactericidal activity is attributed to the irreversible binding to the ribosomes but effects resulting from interaction with other cellular structures and metabolic processes are also known.

Resistance to aminoglycosides such as gentamicin, tobramycin, amikacin, and streptomycin is widespread, with more than 50 aminoglycoside-modifying enzymes described. Most of these genes are associated with gram-negative bacteria. Depending on their type of modification, these enzymes are classified as aminoglycoside acetyltransferases (AAC), aminoglycoside adenyltransferases (also named aminoglycoside nucleotidyltransferases [ANT]), and aminoglycoside phosphotransferases (APH). Aminoglycosides modified at amino groups by AAC enzymes or at hydroxyl groups by ANT or APH enzymes lose their ribosome-binding ability and thus no longer inhibit protein synthesis. Besides aminoglycoside-modifying enzymes, efflux systems and rRNA mutations have been described.
(Blair et al., 2014)

1.8.5 Quinolone Resistance

The first quinolone with antibacterial activity (nalidixic acid) was discovered in 1962 during the process of synthesis and purification of chloroquine (an antimalarial agent). Since then several derivatives have been made available on the market, with the most important ones being fluoroquinolones which contain a substitution of a fluorine atom at position 6 of the quinolone molecule. This greatly enhanced their activity against gram-positive and gram-negative bacteria as well as anaerobes. These agents exert their antibacterial effects by inhibition of certain bacterial topoisomerase enzymes, namely DNA gyrase (bacterial topoisomerase II) and topoisomerase IV. These essential bacterial enzymes alter the topology of double-stranded DNA (dsDNA) within the cell. DNA gyrase and topoisomerase IV are heterotetrameric proteins composed of two subunits, designated A and B.

Mechanisms of bacterial resistance to quinolones as described by Hooper (1999) fall into two principal categories:

- alterations in drug target enzymes and
- alterations that limit the permeability of the drug to the target.

The target enzymes are most commonly altered in domains near the enzymeactive sites, and in some cases reduced drug-binding affinity. In gram-negative organisms, DNA gyrase seems to be the primary target for all quinolones. In gram-positive organisms, topoisomerase IV or DNA gyrase is the primary target depending on the fluoroquinolones considered. In almost all instances, amino acid substitutions within the quinolone resistance-determining region (QRDR) involve the replacement of a hydroxyl group with a bulky hydrophobic residue. Mutations in gyrA induce changes in the binding-site conformation and charge that may be important for quinolone–DNA gyrase interaction . Changes in the cell envelope of gram-negative bacteria, particularly in the outer membrane, have been associated with decreased uptake and increased resistance to fluoroquinolones, and this has not been demonstrated in gram-positive bacteria.

(Blair et al., 2014)

1.8.6 Macrolide, Lincosamide, and Streptogramin (MLS) Resistance:

MLS antibiotics are chemically distinct inhibitors of bacterial protein synthesis. Intrinsic resistance to MLSB (including streptogramin B) antibiotics in gramnegative bacilli is due to low permeability of the outer membrane to these hydrophobic compounds. Three different

mechanisms of acquired MLS resistance have been found in gram-positive bacteria. These include the following:

- Post-transcriptional modifications of the 23S rRNA by the adenine-N6-methyltransferase which alters a site in 23S rRNA common to the binding of MLSB antibiotics which also confers cross-resistance to MLSB antibiotics (MLSB-resistant phenotype) and remains the most frequent mechanism of resistance. In general, genes encoding these methylases have been designated *erm* (erythromycin ribosome methylation).
- Efflux proteins, which pump these antibiotics out of the cell or the cellular membrane, keeping intracellular concentrations low and ribosomes free from antibiotic, and these have become more frequent in gram-positive populations and often coded for by mef, msr, and vga genes.
- Hydrolytic enzymes which hydrolyze streptogramin B or modify the antibiotic by adding an acetyl group (acetyltransferases) to streptogramin A have also been described and these confer resistance to structurally related drugs.

(Tortora et al., 2008)

1.8.7 Sulfonamides and Trimethoprim Resistance:

Resistance in sulfonamides is commonly mediated by alternative, drug-resistant forms of dihydropteroate synthase (DHPS). Sulfonamide resistance in gramnegative bacilli generally arises from the acquisition of either of the two genes sul1 and sul2, encoding forms of dihydropteroate synthase that are not inhibited by the drug. The sul1 gene is normally found linked to other resistance genes in class 1 integrons, while sul2 is usually located on small nonconjugative plasmids or large transmissible multi-resistance plasmids. Trimethoprim is an analog of dihydrofolic acid, an essential component in the synthesis of amino acid and nucleotides that competitively inhibits the enzyme dihydrofolate reductase (DHFR). Trimethoprim resistance is caused by a number of mechanisms including

- overproduction of the host DHFR,
- mutations in the structural gene for DHFR, and
- acquisition of a gene (dfr) encoding a resistant DHFR enzyme which is the most resistant mechanism in clinical isolates.

At least 15 DHFR enzyme types are known based on their properties and sequence homology

(Tortora et al., 2008)

1.8.8 Glycopeptide Resistance:

Glycopeptides comprise peptide antibiotics of clinical interest such as vancomycin and teicoplanin. Their antimicrobial activity is due to binding to D-alanyl-D-alanine side chains of peptidoglycan or its precursors, therebypreventing cross-linking of the peptidoglycan chain and thus are largely effective against gram-positive microorganisms which poses a bigger layer of the peptidoglycan although not all gram-positive organisms are susceptible to these agents. High-level resistance to vancomycin is encoded by the vanA gene that results in the production of VanA, a novel D-Ala-D-Ala ligase resulting in the rebuilding of the peptidoglycan side chain to express D-alanyl-D-lactate type which has less affinity for glycopeptides. There are also other proteins in this gene cluster that are necessary for resistance including VanH and VanX, as well as VanB which confers moderate levels of resistance to vancomycin and susceptibility to teicoplanin. Vancomycin gained clinical importance because it was traditionally reserved as a last resort treatment for resistant infections especially of methicillin-resistant Staphylococcus aureus (MRSA). The emergency of vancomycin-resistant organisms has deprived the usefulness of this drug.
(Tortora et al., 2008)

1.8.9 Multidrug Resistance:

Multidrug resistance among many organisms has become a big challenge to infectious disease management. It is increasingly being reported in bacteria and is often mediated by genetic mobile elements such as plasmids, transposons, and integrons. Integrons are mobile DNA elements with theability to capture genes, notably those encoding antibiotic resistance, by sitespecific recombination, and they have an intergrase gene (int), a nearby recombination site (attI), and a promoter, Pant. Integrons seem to have a major role in the spread of multidrug resistance in gram-negative bacteria but integrons in gram-positive bacteria have also been described. Class 1 integrons are often associated with the sulfonamide resistance gene sulI and are the most common integrons. Class 2 integrons are associated with Tn7. The majority of genes encode antibiotic disinfectant resistance, including resistance to aminoglycosides, penicillins, cephalosporins, trimethoprim, tetracycline, erythromycin, and chloramphenicol.
(Tortora et al., 2008)

1.9 Current Status of Worldwide Antibiotic Resistance:

Antibiotic-resistant bacteria, including methicillin-resistant *Staphylococcus aureus* (MRSA), extended spectrum beta-lactamase producers, and carbapenem-resistant Enterobacteriaceae, are increasing in prevalence worldwide, resulting in infections that are difficult and expensive to treat.

A major driver of antibiotic resistance is antibiotic use, which is fueled by the high background burden of infectious disease in low- and middle-income countries and easy access to antibiotics in much of the world, which increases both appropriate and inappropriate use.

Bacteria resist the effects of antibiotics by using the following genetic strategies, with thousands of variations:

- Producing destructive enzymes to neutralize antibiotics;
- Modifying antimicrobial targets, by mutation, so that drugs cannot recognize them;
- Removing antimicrobial agents by pumping them out (efflux);
- Preventing antibiotics from entering by creating a "biofilm" or otherwise reducing permeability; and
- Creating bypasses that allow bacteria to function without the enzymes targeted by antibiotics.

(McCullough et al., 2016)

1.9.1 Worldwide resistance rates and trends:

Antibiotic resistance patterns of individual pathogens to the drugs used to treat them vary considerably between and within countries. These differences are driven by different patterns of antibiotic use, distinct national disease burdens, disparities in access to first- and second-line treatments, and the burden of coinfections, particularly malaria, the human immunodeficiency virus (HIV), and tuberculosis. Resistance rates have also been correlated with seasonal antibiotic use: in the United States, spikes of resistant E. coli correlated significantly with seasonal highs in aminopenicillin and fluoroquinolone prescriptions, lagging by one month.

Some antibiotic-resistant infections, such as H. influenza in children under five, have higher mortality rates compared with susceptible infections (27 versus 7 percent mortality.

However, this increased risk of death is not universal: in the case of healthcare-associated infections, antibiotic resistance does not greatly increase mortality or length of hospital stay

due to bloodstream infections (risk of death 1.2, CI 0.9 to 1.5) or pneumonia (risk of death 1.2, CI to 1.4). Antibiotic-resistant infections also contribute to the financial burden on health care systems. (Gelband et al., 2015)

1.9.1.1 High-income regions and countries:

In the United States, CDC (2013) has estimated that more than 2 million infections and 23,000 deaths are due to antibiotic resistance each year. In Europe, an estimated 25,000 deaths are attributable to antibiotic-resistant infections.

Resistance of *Streptococcus pneumoniae* invasive isolates to antibiotics has declined in the United States, from 34 to 17 percent from 1999 to 2013 for penicillins, and from 15 to 8 percent from 1999 to 2012 for third-generation cephalosporins. From 1999 to 2012, resistance to macrolides increased from 23 to 34 percent, but fluoroquinolone resistance remained stable, at 2 percent. Among *E. coli* and *K. pneumoniae* isolates, resistance to third-generation cephalosporins and fluoroquinolones increased steadily: for third-generation cephalosporin resistance in *E. coli,* from 2 to 12 percent, and in *K. pneumoniae,* from 8 to 19 percent; for fluoroquinolone resistance in *E. coli,* from 5 to 30 percent, and in *K. pneumoniae,* from 7 to 18 percent. Among *E. faecium* invasive isolates, vancomycin resistance increased from 65 to 76 percent. Compared with other high-income countries, the United States has higher rates of resistance to many Grampositive bacteria, including VRE and MRSA.

In 2013, EARS-Net reported that overall resistance rates for many drug-bug combinations were higher in Southern and Eastern Europe than in the rest of Europe. Resistance rates of Gram-negative bacteria were high, and for nearly all the pathogens under surveillance, resistance to at least one antimicrobial group was observed. Multiple-drug resistance among Gram-negative bacteria to third-generation cephalosporins, fluoroquinolones, and aminoglycosides was

common.

EARS-Net also reported that in 2013, among *S. pneumoniae* invasive isolates, penicillin resistance was highest in Poland (32 percent) and lowest in the Netherlands (1 percent), and for macrolides, resistance was highest in Romania (38 percent) and lowest in Latvia (2 percent). Among *E. faecium* isolates in 2013, vancomycin resistance was highest in Ireland (43 percent) and lowest in Sweden and Estonia (0 percent). Among *E. coli* isolates, third-generation cephalosporin resistance was highest in Bulgaria (41 percent) and lowest in Iceland (5 percent), and for fluoroquinolones, resistance was highest in Cyprus (52 percent) and lowest in Norway (12 percent). Similarly, among *K. pneumoniae* invasive isolates,

thirdgeneration cephalosporin resistance was highest in Bulgaria (71 percent) and lowest in Iceland (0 percent), and for

fluoroquinolones, resistance was highest in Poland (72 percent) and lowest in Finland (5 percent). Carbapenem resistance was more common in *K. pneumoniae* than in *E. coli*. Carbapenem resistance among *K. pneumoniae* invasive isolates was highest in Greece (60 percent). In 2013, carbapenem resistance in *K. pneumoniae* was not detected in Bulgaria, Finland, Latvia, Lithuania, or Sweden.

In Canada, as in several other countries, *S. pneumonia* resistance has decreased following the introduction of pneumococcal vaccines; Callaway 2014). Among *S. pneumoniae* invasive isolates in 2012, penicillin resistance was 8 percent, and macrolide resistance was 23 percent. Among *E. coli* isolates, third-generation cephalosporin resistance was 10 percent, and fluoroquinolone resistance was 27 percent. Similarly, among *K. pneumoniae* invasive isolates, resistance to third-generation cephalosporins was 8 percent, compared with 3 percent resistance to fluoroquinolones. In 2012, carbapenem resistance was not detected in *E. coli*, but 2 percent of *K. pneumoniae* isolates were carbapenem resistant.

In Australia in 2013, 41 percent of *E. faecium* bloodstream isolates were vancomycin resistant. Among *E. coli* isolates, 10 percent were fluoroquinolone resistant and 8 percent were third-generation cephalosporin resistant. Among *K. pneumoniae* isolates, 5 percent were fluoroquinolone resistant and 6 percent were third-generation cephalosporin resistant. Carbapenem resistance was observed in less than 1 percent of *K. pneumoniae* and *E. coli* isolates.

In New Zealand from 2009 to 2012, the prevalence of penicillin-resistant *S. pneumoniae* was fairly consistent. In 2012, 17 percent of *S. pneumonia* isolates were penicillin resistant. Vancomycin resistance among *Enterococcus* spp. increased from 0.3 percent in 2002 to 2 percent in 2013. Among *E. coli* isolates, fluoroquinolone resistance increased from 2 percent to 12 percent in the same period, and third-generation cephalosporin resistance increased from 3 percent to 9 percent. In 2013, carbapenem resistance was observed in 0.3 percent of *E. coli* invasive isolates, but no resistance was observed in *Klebsiella* spp. (Gelband et al., 2015)

1.9.1.2 Low and middle-income regions and countries:

K. pneumoniae is the most commonly reported Gramnegative pathogen in Asia and Africa, making up nearly half of all Gram-negative infections in neonates. In Asia, median resistance of *K. pneumoniae* to ampicillin was 94 percent, and to cephalosporins, 84 percent; in Africa,

it was 100 and 50 percent, respectively. Multidrug resistance appeared in 30 percent of strains in Asia and 75 percent of strains in Africa.

In sub-Saharan Africa, rates of multidrug resistance exceeding 50 percent have been reported in invasive typhoidal and nontyphoidal *Salmonella* infections. Resistance to the drugs used to treat multidrug-resistant *Salmonella*, such as fluoroquinolones, is also increasing. Invasive nontyphoidal *Salmonella* infections are responsible for more than 600,000 deaths per year, 55 percent of them in Africa.

Patterns of antibiotic resistance differ slightly in Latin America and the Caribbean, where prevalence of community-associated Enterobacteriaceae infections is higher than in the rest of the world, especially in urinary tract infections caused by *E. coli* and intra-abdominal infections caused by *E. coli* and *Klebsiella* spp. These infections show increasing resistance to trimethoprimsulfamethoxazole, quinolones, and second-generation cephalosporins. In 2009, rates of resistance in urinary tract *E. coli* isolates reached 71 percent in women and 85 percent in men, with the highest rates occurring in Argentina and Peru.

In Latin America and the Caribbean in 2013, resistance in community *S. pneumoniae* isolates was generally low to penicillins but ranged from 0 percent in Bolivia to 97 percent in Chile. No resistance was detected to vancomycin, and very low resistance was detected in some countries to third-generation cephalosporins. Resistance in *E. faecium* hospital isolates was higher than for *E. faecalis*. Resistance in *E. faecium* was high to ampicillins and vancomycin, reaching 100 percent resistance to ampicillins in Ecuador, El Salvador, and Paraguay. Paraguay also had the highest resistance to vancomycin, at 75 percent. *E. faecalis* resistance to ampicillin ranged from 0 to 15 percent, and resistance to vancomycin ranged from 0 to 22 percent.

In Nepal, resistance rates exceeded 50 percent for *S. pneumoniae* and *K. pneumoniae* isolates to commonly used treatments, having increased from 2000 to 2008. Resistance of *Salmonella Typhi* and *Salmonella Paratyphi* strains have also increased since 1998 to the present, and in *E. coli*, from 2006 to 2010. Resistance rates were above 50 percent to all drugs tested in *E. coli* urinary tract infections, and high resistance rates were detected in gonorrheal infections.

In India, *E. coli* resistance in pregnant women and schoolchildren to at least one antibiotic exceeded 40 and 60 percent, respectively. High levels of resistance were detected in *N. gonorrhoeae* isolates: although all were sensitive to ceftriaxone, nearly a fourth was β-lactamase producers. Resistance in *K. pneumoniae* to second-, third-, and fourth generation cephalosporins was in the 25 to 55 range in 2004–2005.

Resistance to fluoroquinolones among invasive *Salmonella* Typhi isolates in India increased from 8 percent in 2008 to 28 percent in 2014. However, resistance in 2014 to two older antibiotics—ampicillin, 5 percent, and cotrimoxazole, 4 percent—is decreasing and much lower than rates of resistance to fluoroquinolones. From 2008 to 2013, *E. coli* resistance to third-generation cephalosporins increased from 70 to 83 percent, and fluoroquinolone resistance increased from 78 to 85 percent. Among *K. pneumonia* isolates, third-generation cephalosporin resistance decreased from 90 to 80 percent, and fluoroquinolone resistance increased from 57 to 73 percent. In 2014, carbapenem resistance was 57 and 12 percent among *K. pneumoniae* and *E. coli* isolates, respectively. Among *E. faecium* isolates, 11 percent were vancomycin resistant.

In China, more than 90 percent of *E. faecium* isolates were ampicillin resistant. Among nonmeningitis *S. pneumonia* isolates, 15 percent were penicillin resistant. Seventy-one percent of *E. coli* isolates and more than half of *K. pneumonia* isolates were ESBL producer.

In Vietnam, among *E. coli* isolates, resistance to thirdgeneration cephalosporins was 64 percent, and to fluoroquinolones, 50 percent. Among *K. pneumonia* isolates, resistance to third-generation cephalosporins was 42 percent, and to fluoroquinolones, 22 percent. Carbapenem resistance was reported in 9 percent of *E. coli* isolates and 22 percent of *K. pneumoniae* isolates. Increasing levels of resistance to ceftriaxone, the primary treatment for bacterial meningitis, have been detected among cases of invasive pneumococcal disease since 2012.

In Thailand, penicillin resistance among *S. pneumonia* isolates decreased from 81 percent in 2009 to 39 percent in 2013. However, macrolide resistance increased from 30 percent in 2009 to 37 percent in 2014. From 2009 to 2013, vancomycin resistance among *E. faecium* isolates decreased from 3 to 1 percent. In the same period, among *E. coli* isolates, third-generation cephalosporin resistance increased from 29 to 37 percent, and fluoroquinolone resistance increased from 38 to 44 percent. Among *K. pneumoniae* isolates, third-generation cephalosporin resistance remained stable, at 32 percent. Fluoroquinolone resistance increased from 28 to 30 percent. In 2013, carbapenem resistance was 2 percent and 0.8 percent among *K. pneumoniae* and *E. coli* isolates, respectively.

Very limited data are available on resistance rates in sub- Saharan Africa. What studies have been done reported that, among isolates of *Enterobacteriaceae* in patients with febrile illness, 31 to 94 percent were resistant to chloramphenicol and 0 to 47 percent to third-generation cephalosporins. Among isolates of *Salmonella Typhi*, 15 to 43 percent were resistant to nalidixic acid. Though even fewer studies are available on Gram-positive pathogens and

urinary tract, meningitis, respiratory tract, and hospital-acquired infections, there, too, high rates of resistance to first-line treatments have been reported.

Kenya experienced a rise in resistance of *S. pneumonia* isolates to penicillin from 25 percent in the 1980s to 43 percent in 2003. Half of children's severe pneumonia infections were resistant to penicillin in 2005. More than two-thirds of *H. influenzae b* were resistant to cotrimoxazolein 2002. Resistance was also high in diarrheal pathogens: three-quarters were resistant to three or more drugs in 2001. Resistance increased in nontyphi *Salmonella* from the 1990s to 2005, and the prevalence of multidrug resistance exceeded 40 percent in 2003. Multi-drug resistant

Salmonella Typhi also increased, to 78 percent in 2004.

A private tertiary hospital in Kenya reported that, among *E. coli* isolates, third-generation cephalosporin resistance was 53 percent and fluoroquinolone resistance was 59 percent. Among *K. pneumoniae* isolates, thirdgeneration cephalosporin resistance was 67 percent and fluoroquinolone resistance was 30 percent. In 2012 in this hospital, carbapenem resistance was not detected in *E. coli* or *K. pneumoniae* isolates, and methicillin and vancomycin resistance was not detected among *S. aureus* and *Enterococcus* isolates, respectively. In 2013, carbapenem resistance emerged among *Klebsiella* spp., but not among *E. coli* isolates.

South Africa detected a high prevalence of intermediate resistance in *S. pneumoniae* isolates to penicillin, and resistance of *H. influenzae* isolates to penicillin was more than 45 percent in some settings. Resistance declined among nontyphoidal *Salmonella* isolates from 2003 to 2010. Resistance in *Shigella* isolates was stable from 2003 to 2010 in older antibiotics, at more than 50 percent, and it was at or below 1 percent for newer antibiotics. Less than

1 percent of diarrheagenic *E. coli* isolates were resistant to the drugs tested. Gonoccoci were fully susceptible to ciprofloxacin, a former first-line therapy, which was replaced with cephalosporins after a rise in quinolone resistance in the early 2000s. (Gelband et al., 2015)

1.10 Knowledge and attitude in self-medication:

Self medication with drugs is an economical choice of treatment for common self limiting illnesses all over the world. In spite of this, the knowledge of the benefits as well as hazardous effects is not as popular as the practice itself. Certain studies amongst different populations reveal that the people had a fairly good knowledge on the advantages of self medication, as they correctly perceived it as time-saving and economical, doing away with the need to go to a doctor for minor illness and providing quick, easy and convenient relief.

These perceptions are similar to those reported by the WHO that self-medication provides a cheaper and convenient alternative for treating common minor illnesses. The same can however not be said concerning the knowledge of consumers with respect the drugs being used, the right indications, dosages, and duration of use as well as the side effects of the drugs. From a study reported that common over the counter (OTC) medications led to adverse health reactions and even fatalities due to inadequate drug knowledge. (Quet et al., 2015) Various studies have shown that because of lack of knowledge and information many people take and use their medication incorrectly or in appropriately. This in turn leads to loss of efficacy and an inefficient use of the considerable resources which are spent annually on drugs. In a descriptive study in Hong Kong in which patients were asked how much they knew about the therapeutic and side-effects of the medications they used, 69% knew at least some of the therapeutic effects while 31% did not know any of the therapeutic effects, so rendering themselves at risk from inappropriate use of drugs. Furthermore, the vast majority 93% of the patients were totally unaware of the possibility of side-effects in that study. A study in Malaysia, about 82% of the respondents stated that their level of knowledge regarding OTC medications was moderate to low. (Teck et al., 2016) (McCullough et al., 2016)

The sources of information or knowledge of drug use according to most surveys include pharmacists, general medicine dealers, general and private medical practitioners, household. Worldwide, particularly in developed countries, surveys reveal that modern consumers wish to take a greater role in the maintenance of their own health and are often competent to manage chronic and recurrent illnesses after proper medical diagnosis and with only occasional professional advice, particularly with the use of analgesics, antibiotics, histamine H_2-receptor blocker, topical corticosteroid, antibiotic and antifungal, and oral contraceptive. They are understandably unwilling to submit to the inconvenience of visiting a doctor for what they rightly feel they can manage for themselves. (Alili-Idrizi, Dauti, and Malaj, 2014)

1.11 Parental knowledge about antibiotic use/discontinuation in Bangladesh:

Many studies suggest that parents had considerable misunderstandings that may contribute to inappropriate antibiotic use. In Bangladesh, high percentage of parents thought that antibiotics could cure infections caused by viruses and also cold, fever and sore throat. A major concern is that nearly half of the parents thought that taking antibiotics in advance could protect children from the common cold. In Bangladesh, children's are self-medicated

by antibiotics for some common cause such as fever, cold, and diarrhea etc. Among the antibiotic drugs, Ceftriaxone, Cefixime, Levofloxacin, Metronidazole etc. were mostly used and the peoples had a little knowledge of antibiotics use. (Biswas et al., 2014)

Other studies also suggest a considerable contrast in perceptions of antibiotics between parents living in central towns and those living in rural villages. Specifically, parents from central towns had a better knowledge of appropriate indications and of side effects of antibiotic use than the rural villages.

Chapter 2

Literature Review

There have been numerous studies on self-medication of antibiotic and the knowledge about antibiotic use and resistance in different countries. A number of them are introduced below:

2.1 Self-medication with Antibiotic in Children in Sana'a City, Yemen.

This study was conducted by Mabrook Mohanna in 2010. It was aimed to clarify the prevalence of self- medication with antibiotic in children presented to the outpatient department at Sam hospital, Sana'a city Yemen. During a five months period from Dec 2007 to Apr 2008 , 1110 male and 890 female total 2000 subject were asked if they used antibiotics in the last 15 days without medical prescription, what type of antibiotic, why and how they obtained it.

The study found that, of the 2000 patients interviewed, 1200(60%) had taken an antibiotic in the last 15 days without a medical prescription. Respiratory (80%) and gastrointestinal (13%) symptoms were most frequently reported. 312(26%) patients used the previous prescription paper to obtain antibiotics, while 888(74%) obtained antibiotics from pharmacies and drug stores without any prescription required. Amoxicillin, Trimethoprim-sulfamethoxazole and amoxicillinclavulanic acid accounted for (85%) of the prescribed antibiotics. From the study result, the prevalence of self-medication with antibiotics in children in Yemen is alarmingly high. A majority of the patients had respiratory and gastrointestinal symptoms and the common used antibiotics were amoxicillin, Trimethoprimsulfamethoxazole and amoxicillin-clavulanic acid. (Mahonna,2010)

2.2 Survey of non-prescribed use of antibiotics for children in an urban community in Mongolia.

This study was conducted by Togooaatar *et al*. in 2010 in Mongolia. It was aim to estimate the prevalence and identify the determinants of non-prescription use of antibiotics for children in Mongolia. A community-based cross-sectional survey was undertaken in 10 sub districts in Ulaanbaatar, Mongolia's capital. And they used a structured questionnaire to collect data from a random sample of 540 households with at least one child aged < 5 years.

The study found that, out of 503 participating caregivers, 71% were mothers; 42.3% (95% confidence interval, CI: 37.8–46.9) of caregivers had used non-prescribed antibiotics to treat symptoms in their child during the previous 6 months. Symptoms commonly treated were cough (84%), fever (66%), nasal discharge (65%) and sore throat (60%). Amoxicillin was the most

commonly used antibiotic (58%). Pharmacies were the main source (86%) of non-prescribed antibiotics. Non-prescribed use by mothers was significantly associated with keeping antibiotics at home (odds ratio, OR: 1.7; 95% CI: 1.04–2.79), caregiver self-medication (OR: 6.3; 95% CI: 3.8–10.5) and older child's age (OR: 1.02; 95% CI: 1.01–1.04). Caregivers with a better knowledge of antibiotics were less likely to give children non-prescribed antibiotics (OR: 0.7; 95% CI: 0.6–0.8).

The prevalence of non-prescribed antibiotic use for young children was high in Ulaanbaatar. Because such use leads to the spread of bacterial resistance to antibiotics and related health problems. (Togoobaatar, et al. 2010)

2.3 Development and assessment of a questionnaire for a descriptive cross – sectional study concerning parents' knowledge, attitudes and practises in antibiotic use in Greece.

Panagakou *et al*. conducted this research in 2010. It involved a cross-sectional study on 8000 parents. The aim of this study is to describe the process of developing a questionnaire to assess parents' Knowledge, Attitude and Practices (KAP) concerning the role of antibiotics when children suffer from URIs, as well as to evaluate the response rates, the completeness and the reliability of the questionnaires. Cronbach index test and factor analysis were used to assess the reliability of the questionnaire.

The major findings of the study are: The response rate of the parents was 69%. Sixty – eight point nine percent of the sample returned questionnaires fully completed, while 91.5% completed 95% of the questions. Three questions out of 70 were answered in a very low rate which was associated mostly with immigrant respondents. The section describing parents' attitude toward antibiotic use was not completed as much as the sections of knowledge or practices. Limitations of the study, such as the vocabulary and form of the questionnaire and the idiocycrancy of the respondents, emerged during the analysis. (Panagakou *et al*. 2010)

2.4 Self-medication in children and adolescents.

Pereira. F. S. *et al.* conducted this research in 2007 in Limeira and Piracicaba, state of São Paulo with the aim to determine the prevalence of self-medication in children and adolescents. 772 subjects were participated in a face to face interview. Subjects were divided into two study

groups according to their pattern of drug use: self-medication (lay advice) and medical prescription.

The study found that, the prevalence of self-medication was 56.6%. Mothers (51%) and drugstore employees (20.1%) were most frequently responsible for self-medication. The prevalence of self-medication in children and adolescents was high, which reinforces the need for public health interventions aiming at preventing this practice. (Pereira. *et al.* 2007)

2.5 Parental self medication of antibiotics for children in Baghdad city.

This study was conducted by Jasim, L. A., in 2014 in Baghdad in order to detect the factors associated with self medication practice of parents for the behalf of their children**.** It involved a cross-sectional descriptive study in which the data was collected via direct interviews with the parents using previously prepared questionnaires. A total of 124 parents were participated in this study.

The study found that, the majority of children were 1-6 years old and male children were slightly more than females. The main reason of self medication was dealing with same current ailments previously followed by considering the current illness as mild one. The major sources of information about self medicated antibiotics were previous prescription and community pharmacists. The most frequent source of antibiotics was the community pharmacies.

Many parents considered that self medicated antibiotics are powerful agents in treating a wide range of children conditions without confirming the microbial cause of these conditions.

(Jasim. L. A, 2014)

2.6 Knowledge, attitudes, and practices of parents in rural China on the use of antibiotics in children: a cross-sectional study.

Yu. M. *et al.* conducted this study in 2014 with the aim to investigate parents' perceptions of antibiotic use for their children, interactions between parents and physicians regarding treatment with antibiotics, and factors associated with parents self-medicating children with antibiotics. It involved a cross-sectional study which was conducted in vaccination clinics in two rural Chinese counties were a 55-item structured questionnaire was given to 854 child's parents to collect information on the parents' knowledge and attitudes regarding when, why, and how to use antibiotics and on their practices of purchasing antibiotics and medicating children.

From the study they found that, 79% of parents thought antibiotics could cure viral infections, and half believed that antibiotics could shorten the duration of upper respiratory tract infection. Sixty-two percent of the parents had self-medicated their children with antibiotics. Living in rural villages (Adj OR = 1.643, 95% CI: 1.108–2.436), raising more than one child (Adj OR = 2.174, 95% CI: 1.485–3.183), increasing age of child (Adj OR = 1.146, 95% CI: 1.037–1.266), purchasing antibiotics without a prescription (Adj OR = 6.264, 95% CI: 4.144–9.469), storing antibiotics at home (Adj OR = 2.792, 95% CI: 1.961–3.975) and good adherence to physicians' advice (Adj OR = 0.639, 95% CI: 0.451–0.906) were independently associated with self-medicating behavior. Low levels of knowledge on the use of antibiotics and a high prevalence of self-medicating children with antibiotics were observed among parents in rural China.
(Yu. *et al.* 2014)

2.7 The Parental Use of Antibiotics in Children in Saudi Arabia.

This study was conducted by Alumran. A. *et. al.* in 2015 in Saudi Arabia. The aim of this study is to assess the factors underlying the parental use of antibiotics for children in Saudi Arabia. It involved a cross-sectional study design which was carried out on 1104 Parents (52% were mothers) children younger than 12 years. Ordinal logistic regression was used to identify the factors influencing the parental use of antibiotics in children.

The major findings of the study are that, there is a high association between the frequency of cold episodes and the number of antibiotics used for the youngest child in the family during the previous year. Three parent-related psychosocial aspects appeared to be significantly associated with the parents' tendency to use an antibiotic in their children: Knowledge and beliefs, behaviors, and seeking health-related information. Also, parent's geographical background is associated with their use of antibiotics. (Alumran. *et. al.* 2015)

2.8 Parental knowledge, attitude and practice on antibiotic use for upper respiratory tract infections in children.

Khaled Al-Dossari conducted this study in 2013 in Riyadh, with the aim to assess the level of knowledge and practice of parents about antibiotics use for upper respiratory tract infection (URTI) in their children as well as to determine the contributing factors for inappropriate use. A cross-sectional study was carried out in two PHC centers in National Guard Health Affairs,

Riyadh, total of 352 parents of Saudi children (age from birth to 12 years) were participated in this study.

The study found that, Most of the parents (71%) reported doctors as their source of antibiotic information. Only 1.4% of the participants identified correctly all antibiotics while 35.8% of them did not identify any antibiotic correctly. Factor analysis showed that the three common underlying factors responsible for antibiotics overuse were: parental self-prescribing tendency, parental tendency of asking for antibiotics from doctor and parental carefree attitude regarding over use and the three common underlying factors responsible for cautious approach to antibiotics use were: parental cautious nature, parental preference of advice over antibiotics and parental belief that URTI are mostly self-limiting. (Al-Dossari, 2013)

2.9 Self-medication with antibiotics in Lithuania.

Berzanskyte. A. *et al.* conducted this study in 2006 with the aim of study was performed to estimate the prevalence of antibiotic use in the general population of Lithuania with special interest in self-medication with antibiotics and sources of their acquisition. Study involved structured questionnaires which were carried out in 746 adult during 12 months of time.

From the study it was found that 39.9% of respondents reported antibiotic use during the last 12 months preceding the study and 53.2% of those used them in self-medication. In general, 22.0% (95%CI: 19.1–25.1) of respondents used antibiotics without prescription, whereas 45.0% (95%CI: 41.3–48.7) of them used antibiotics for intended self-administration. Representatives of managerial, executive and professional occupations used non-prescribed antibiotics 8.38 times more often (95% CI: 1.76–39.91, p = 0.01) than retired people. Healthy people showed the tendency to self-medication 2.04 times more frequently than those with chronic diseases (95%CI: 1.11–3.75, p = 0.02). Rural people used non-prescribed antibiotics 1.79 times more often than inhabitants of urban areas (95%CI: 1.00–3.18, p = 0.049). Community pharmacies proved to be the most frequent (86.0%) source of over the counter antibiotics. The high prevalence of self-medication with antibiotics was found in Lithuania. (Berzanskyte. *et al.* 2006)

2.10 Parental knowledge, attitudes and antibiotic use for acute upper respiratory tract infection in children attending a primary healthcare clinic in Malaysia.

Chan G C & Tang S F conducted this study in 2006 in a primary healthcare clinic in the Hulu Langat district of Malaysia. The aim of this study was to assess the parental knowledge, attitudes and antibiotic use for common childhood acute upper respiratory tract infection (URT I). It involved a cross-sectional study performed in 421 parents, who were surveyed by using an interviewer-administered questionnaire, from April to June 2001. 59 percent of parents

From this study result, that weather was the main cause of acute URT I of their children, 13 percent thought it was due to food, and only about 27 percent said it was caused by germs. Nearly 68 percent, 69 percent and 76 percent of them believed that antibiotics\ was helpful in treating the common cold, cough and fever, respectively. 29 percent of parents who thought that their child with acute URT I needed antibiotics were not prescribed with any. On the other hand, 17 percent believed that antibiotics were unnecessary when prescribed. 28 percent of parents had requested for antibiotics, and 93 percent received what they requested for their child with acute URT I. About 31 percent of parents who did not request any antibiotics claimed that private general practitioners habitually prescribed antibiotics. The antibiotic compliance was poor with only 74 percent completing the entire course, with 85 percent of them stopping once they improved symptomatically. 15 percent of parents gave “leftover” antibiotics, 24 percent gave “shared” antibiotics, and 5.5 percent bought antibiotics for their child with acute URT I without consulting a doctor. (Chan and Tang, 2006)

Chapter 3

Methodology

3.1 Type of Study

This is a survey based study.

3.2 Study Population

In this study, parents were the study population, who self-medicated to their children for any diseases during last 6 months. The age group of children was 0-12 years.

3.3 Study design

This study involved a simple questionnaire based cross-sectional survey. Total 36 questions were divided into three segments.

3.4 Study period

The study was conducted from December 2015 to May 2016.

3.5 Study Area

The study was conducted in three different areas in Bangladesh. And we collected data from various place of:

1. Faridpur
2. Madaripur &
3. Shariatpur

3.6 Sample size

There were 276 parents of children who participate in the survey. The question was filled up by father or mother or guardian of child.

3.7 Sampling Technique

In this study random sampling was followed.

3.8 Inclusion Criteria

The only inclusion criteria for the subjects were to be parent's of child.

- Children suffer for any diseases during last 6 months.
- The age group of children was 0-12 years.

3.9 Exclusion Criteria

The exclusion criteria for the subjects were not being a parent's of child.

3.10 Data Collection Tools

The tools used for the survey were a questionnaire.

3.10.1 Questionnaire

The questionnaire comprised of questions regarding demographic information, child's disease and medication usage information, parental perception and their understanding of antibiotic use, and status of parental understanding of antibiotic resistance.

3.11 Data Collection method

The data was collected through questionnaire that is formed in English language. It is a questionnaire consists of multiple choice type questions. The data was collected by both face to face interview and by questionnaire supply.

3.12 Data Analysis

After collecting, the data were checked and analyzed with the help of Microsoft Excel 2013. The result was shown in bar, pie and column chart and different variables were calculated in percentages.

3.13 Sample of Questionnaire

PREVALENCE OF SELF-MEDICATION OF ANTIBIOTICS IN CHILDREN AND PARENTAL PERCEPTION AND KNOWLEDGE REGARDING ANTIBIOTIC USE AND RESISTANCE

(Department of Pharmacy, East West University)

(All the questions asked are used for research purpose only and all the information is kept confidential)

Place of Interview:_____ Date of Survey:_____

Place a tick (√) on your choice of answer

1. Parent filling up the questionnaire: ⊡ Father ⊡ Mother ⊡ Others _____

2. Education level: ⊡ Primary school⊡ School certificate (class 10 equivalent) ⊡ High school (class 12 equivalent) ⊡ Non-university diploma ⊡ Bachelors (university) ⊡ Post graduate (university)

3. Occupation: ⊡ Studying ⊡ Homemaker ⊡ Healthcare professional ⊡ Unemployed ⊡ Others _____

4. Net household income (BDT) : ⊡< Tk 5000 ⊡ Tk 5000-10,000 ⊡ Tk 10,000-30,000 ⊡ Tk 30,000 <

5. Age of child (who is medicated): ⊡ < 3 months ⊡ 3 months- 1 yr ⊡ 1-5 yr ⊡ 5-12 yr

6. Gender of child: ⊡ Male ⊡ Female

7. Did the child suffer from any disease, disorder or injury in the past 6 months that required antibiotic use? ⊡ Yes ⊡ No

8. What was the nature of the child's disease, disorder or injury? ⊡ runny nose ⊡ nasal congestion ⊡ cough and cold ⊡ sore throat ⊡ fever ⊡ diarrhea ⊡ Others _____

9. How did you respond when your child suffered from the disease, disorder or injury? ⊡ consulted a doctor and medicated according to prescription ⊡ self-medicated

10. Name the antibiotic you self medicated to your child? _____

11. Name the antibiotic prescribed for your child. _____

Chapter 4

Result

4.1 Demographic Information

4.1.1 Parent filling up the questionnaire

Table 4.1.1: Parent filling up the questionnaire

Parent filling up the questionnaire	Number	Percentage
Father	38	14%
Mother	234	85%
Others	4	1%
Total= 276		

Figure 4.1.1: Parent filling up the questionnaire.

From this column chart we found that, the majority of the respondents are mother (85%)

4.1.2 Education level of parent filling up the questionnaire

Table 4.1.2: Education level of parent filling up the questionnaire

Education level	Number	Percentage
Primary school	90	32.60%
School certificate (Class 10 eqivalent)	87	31.50%
High school (Class 12 eqivalent)	73	26.45%
Non-university Diploma	2	0.72%
Bachelors	19	6.88%
Post-graduate	5	1.81%
Total= 276		

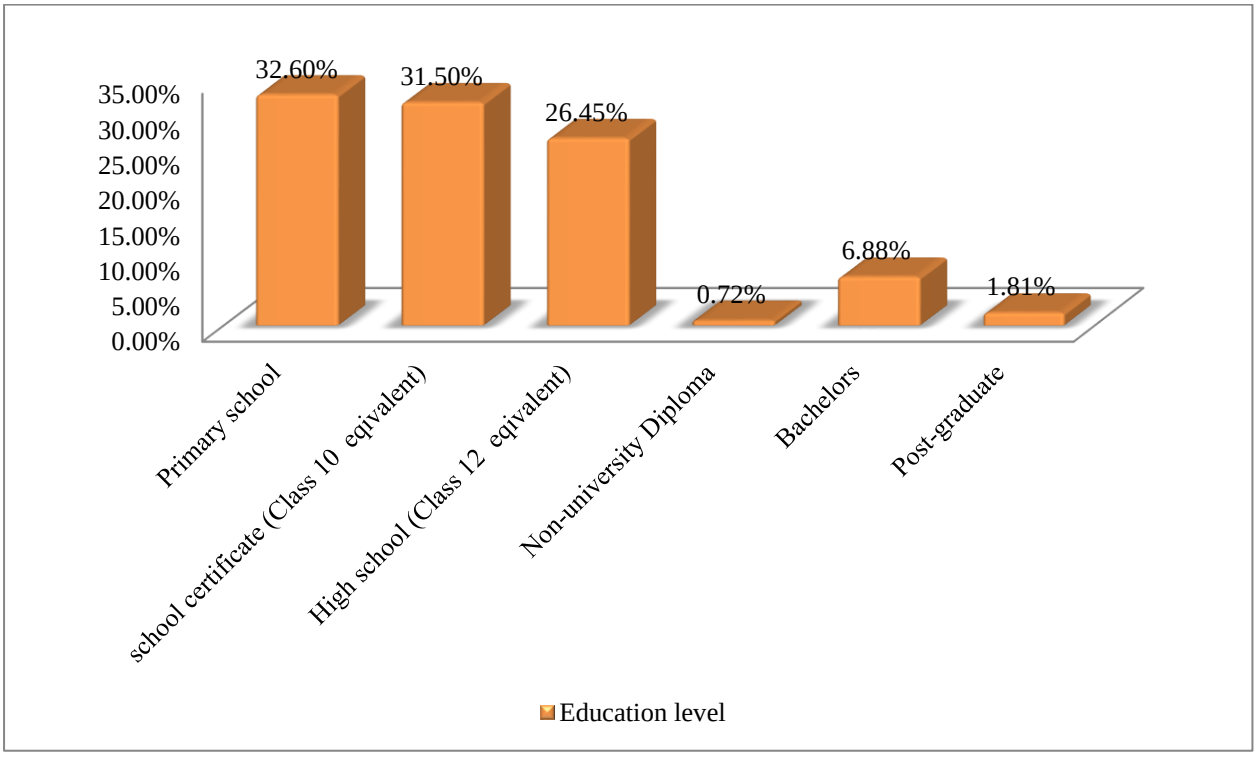

Figure 4.1.2: Education Level of parent filling up the questionnaire

From this column chart we see that, maximum medication provider have education level between primary school (32.60%), class 10 equivalent (31.50%) and class 12 equivalent (26.45%).

4.1.3 Occupation of parent filling up the questionnaire

Table 4.1.3 Occupation of parent filling up the questionnaire

Occupation	Number	Percentage
Studying	9	3.30%
Homemaker	179	64.85%
Healthcare professional	1	0%
Unemployed	9	3.26%
Others	78	28.26%
Total= 276		

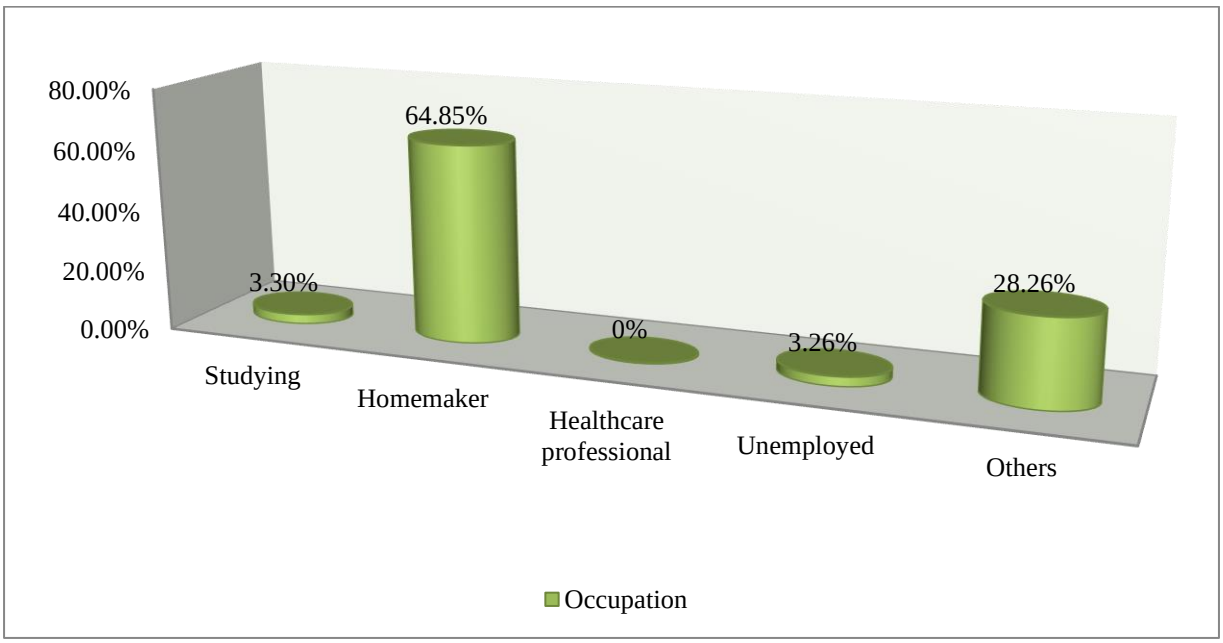

Figure 4.1.3: Occupation of Parent filling up the questionnaire

From this figure we found that majority of the respondents are homemaker (64.85%).

4.1.4 Net household income (in BDT) of parent filling up the questionnaire

Table 4.1.4: Net household income (in BDT) of parent filling up the questionnaire

Net Household income	Number of response	Percentage
<Tk 5000	9	3%
Tk 5000-10000	114	52%
Tk 10000-30000	143	41%
Tk 30000<	11	4%
Total= 276		

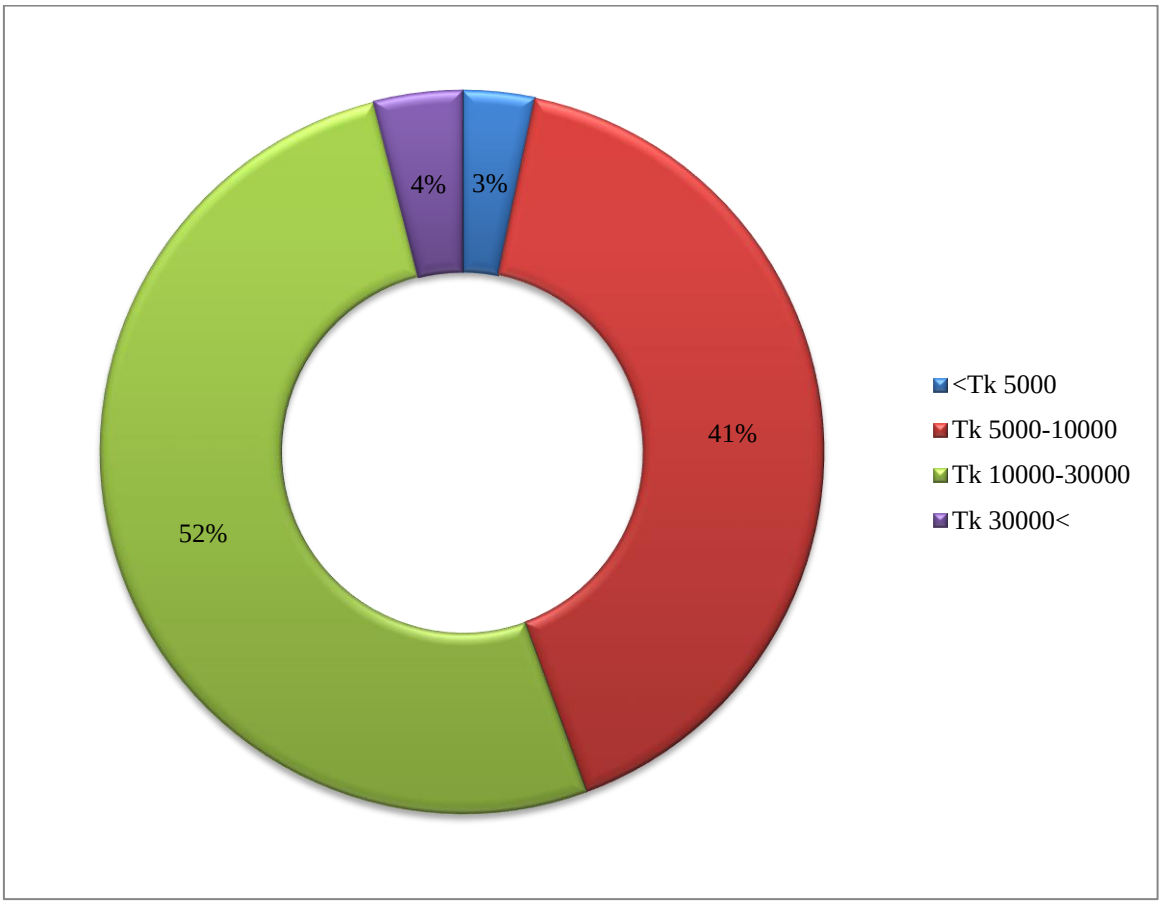

Figure 4.1.4: Net household income (in BDT) of Parent filling up the questionnaire

Among the total respondents, majority respondent's family net household income is in the range of Tk 10,000-30,000.

4.1.5 Number of child in the family

Table4.1.5: Number of child in the family

Number of Children	Frequency	Percentage
1	72	26.10%
2	103	37.31%
3	94	34.10%
Others	7	2.50%
Total= 276		

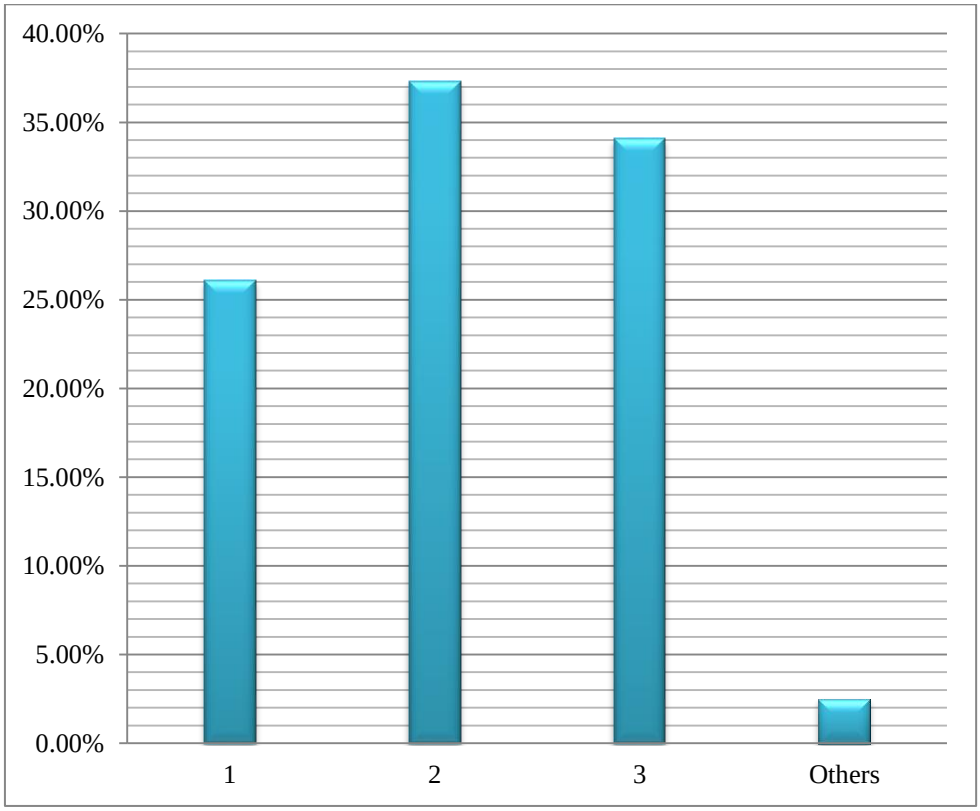

Figure 4.1.5: Number of child in the family of responders

Among of those respondents, most of the family has two child (37.31%). 26.10% family has one child and 34.10% family has three child. 2.50% family has more than three child.

4.1.6 Healthcare degree of the parent filling up the questionnaire

Table 4.1.6: Healthcare degree of the parent filling up the questionnaire

Healthcare degree	Yes	No
Percentage	0.36%	99.64%
Number	1	275

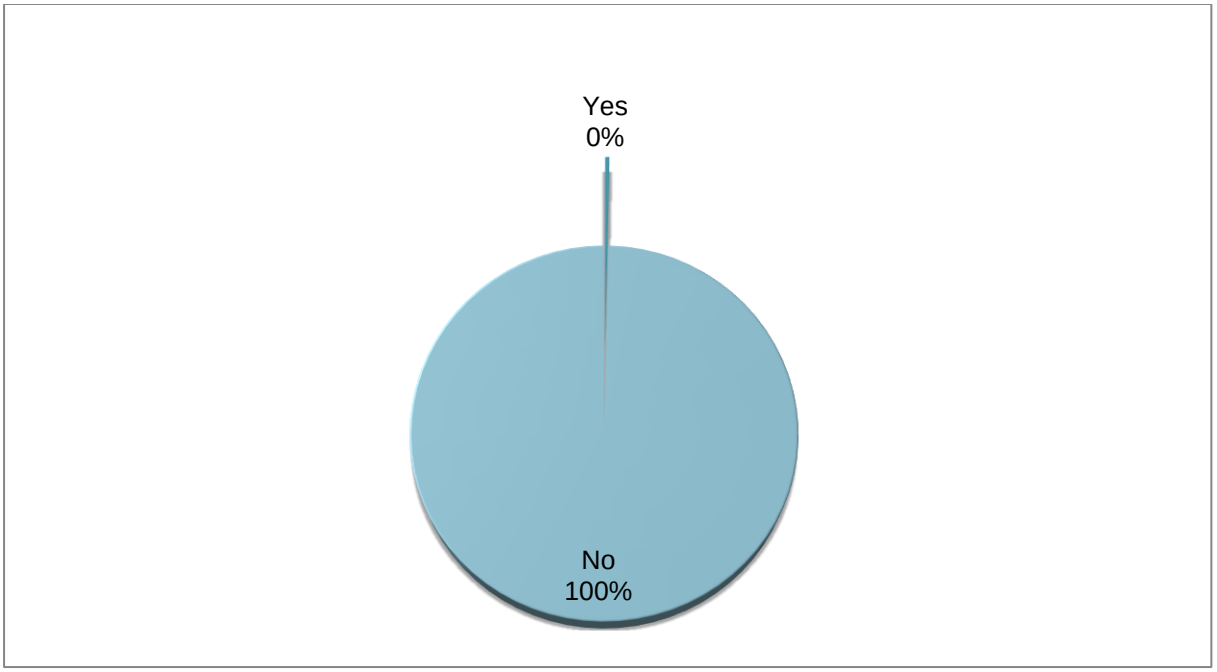

Figure 4.1.6: Health care degree

Among all of those respondents, majority of the respondents (99.64%) do not have any health care degree. Only 0.36%% respondents have health care degree.

4.1.7 Age of child (who is medicated)

Table 4.1.7: Age of child (who is medicated)

Age of children	Number	Percentage
< 3 months	57	20.65%
3 months-1 year	96	34.78%
1year- 5 years	71	25.73%
5 years- 12 years	52	18.84%
Total= 276		

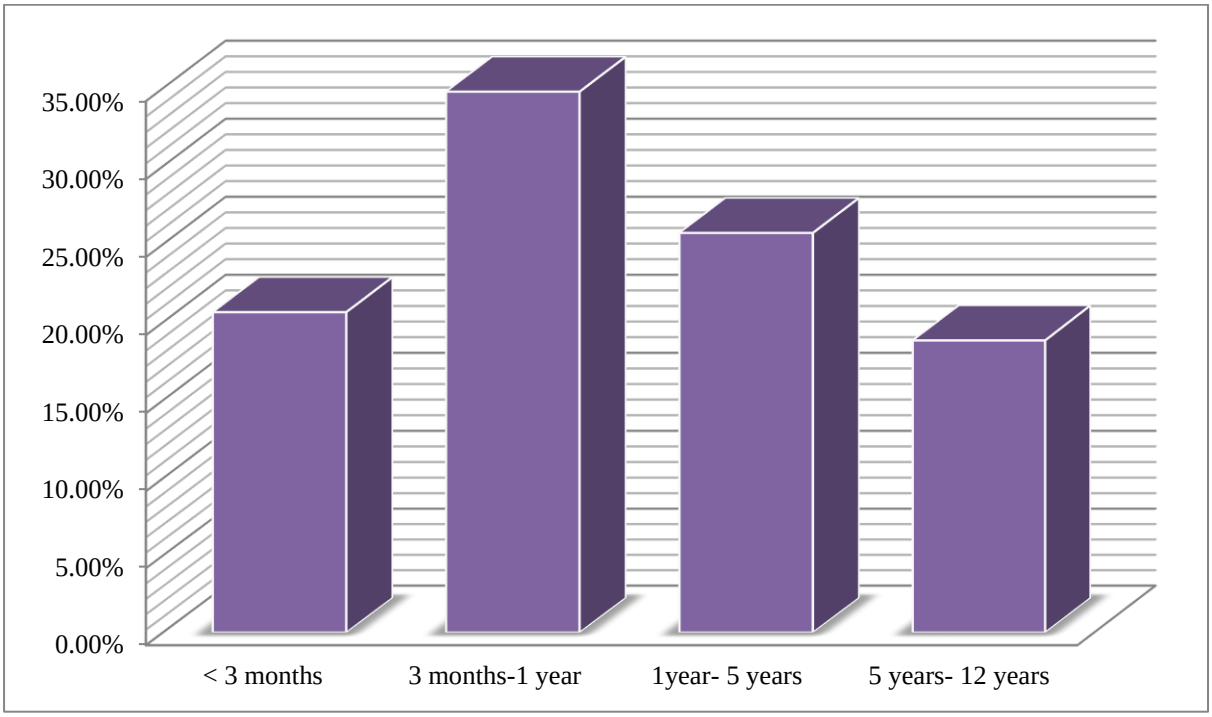

Figure 4.1.7: Age of child (who is medicated)

The above graph shows that children of 3months to 5 years old required greater (55.43%) percent of medication.

4.1.8 Gender of child

Table 4.1.8: Gender of child

Gender of Child	Number	Percentage
Male	98	35.50%
Female	178	64.50%
Total= 276		

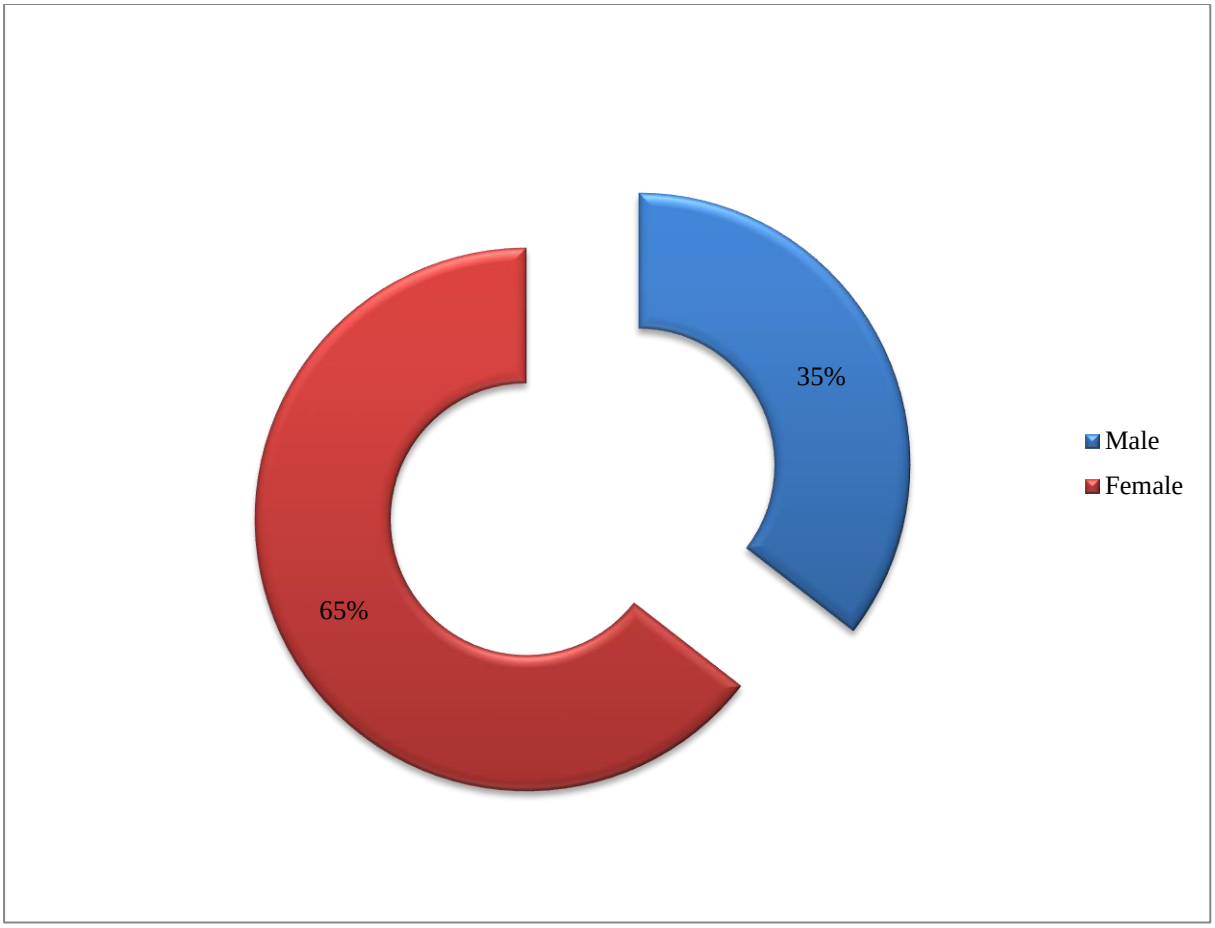

Figure 4.1.8: Gender of child

There is high percentages of female children are medicated by their parents then the male children.

4.1.9 Child who is medicated

Table 4.1.9: Child who is medicated

Who is medicated	Number	Percentage
1st born	124	44.93%
2nd born	87	31.52%
3rd born	65	23.55%
Others	0	0%

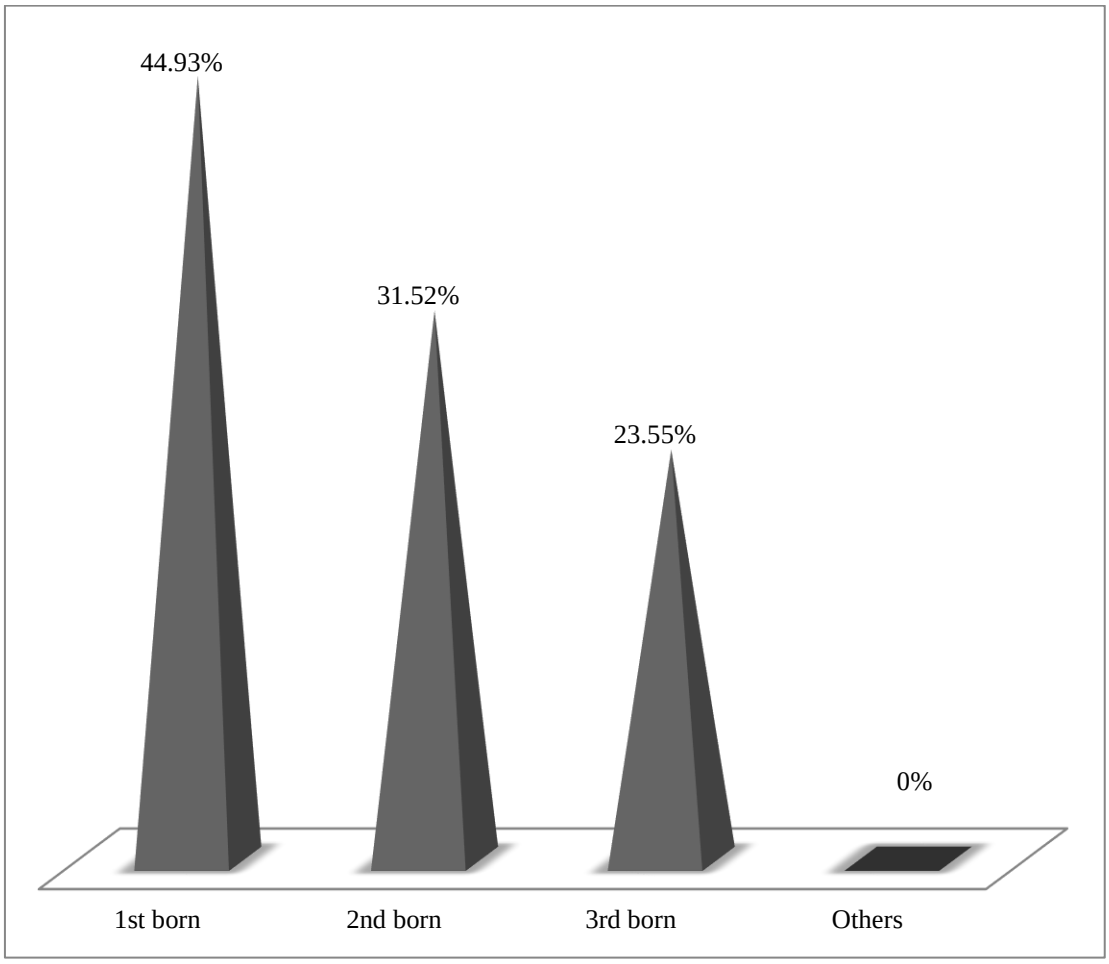

Figure 4.1.9: Child who is medicated

Among all respondents, most of the children were either 1st or 2nd born who is medicated.

4.2 Child's disease during and medication usage information

4.2.1 Nature of diseases

Table 4.2.1: Nature of diseases

Name of disease	Number
Runny nose	4
Nasal congestion	22
Cough and cold	161
Sore throat	23
Fever	11
Diarrhea	14
Skin wound or infection	15
Pain and burning during urination	4
Dental or gingival complication	1
Abnormal discharge and vaginal infection	0
Pain and redness of tonsils	13
Others	19
	Total= 276

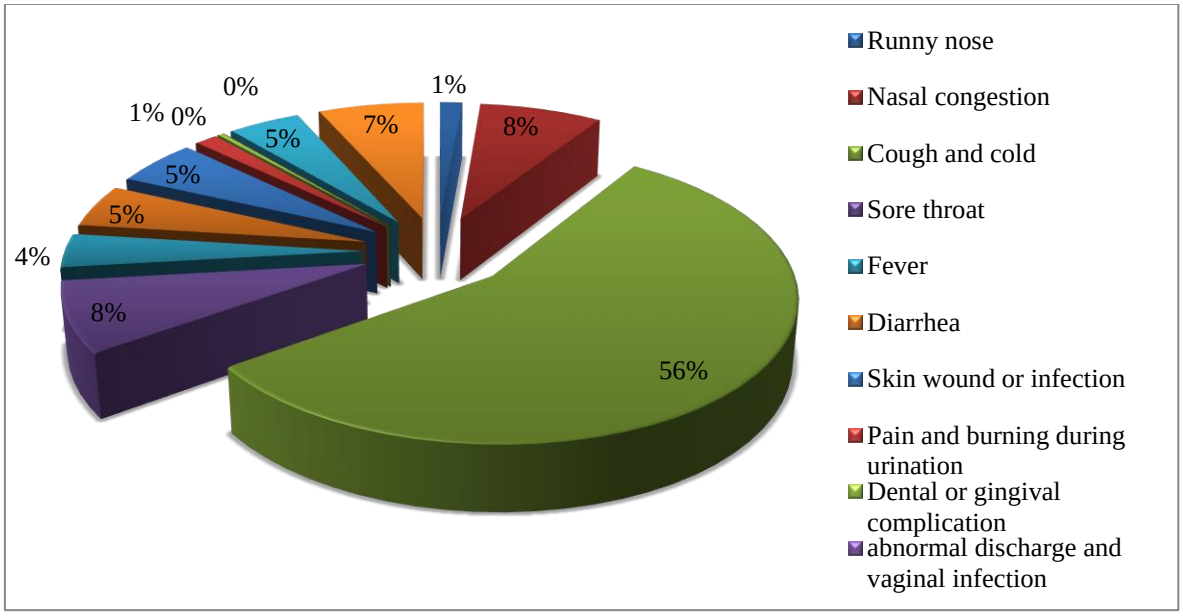

Figure 4.2.1: Nature of diseases

Form this survey it has seen that majority of the children (55%) have suffered from cough and cold during last 6 months and required antibiotics.

4.2.2 Perception of parents about health status of child

Table 4.2.2: Perception of parents about health status of child

Health status	Number of population	Percentage
Good	1	0.36%
Fairly good	0	0%
Moderate	33	11.96%
Fairly poor	139	50.36%
Poor	103	37.32%
Total= 276		

Figure 4.2.2: Perception of parents about health status of child

Form this study it is seen that all the children suffered from various diseases during last 6 months but almost 50.36% parents thought their child's health status is fairly poor enough and requires medication.

4.3 Parental perception and understanding of antibiotic use

4.3.1 Response of parents when child suffered from disease

Table 4.3.1: Response of parents when child suffered from disease

How did you respond	Population number	Percentage
Consulted a doctor	165	59.70%
Consulted a non-prescribing health care professional	3	1.10%
Waited until the disease relieved	0	0%
Self-medicated	108	39.13%
Total= 276		

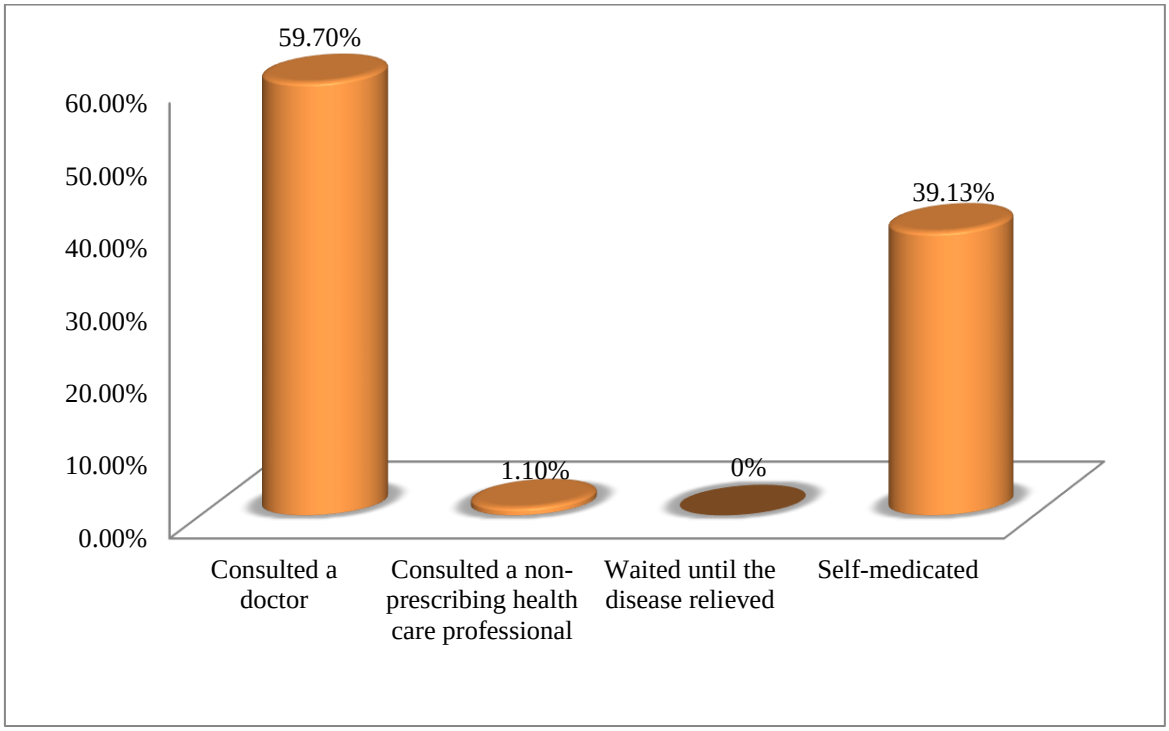

Figure 4.3.1: Response of parents when child suffered from disease

From this survey it is found that 39.13% respondents have self-medicated their child when their child suffered from disease, 59.70% have consulted a doctor and maintain prescription.

4.3.2 Perception of safety of self-medication

Teble4.3.2: Perception of safety of self-medication

Is self medication of child is safer?	Number	Percentage
Yes	6	5%
No	105	95%
Total self-medicated number= 111		

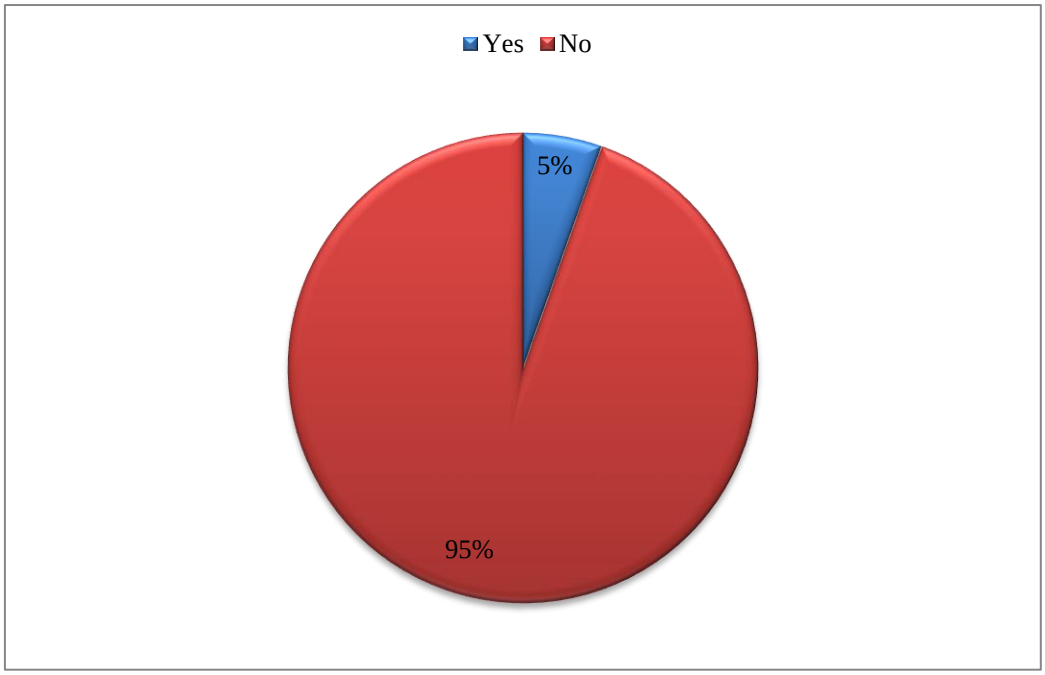

Figure 4.3.2: Perception of safety of self-medication

Maximum of the respondents said that, self-medication is not safer than the doctor consultation.

4.3.3 Reasons behind self-medication

Table 4.3.3: Reasons behind self-medication

Reasons behind self medication	Number	Percentage
Considered ailment as minor	16	14.41%
Self decision by parents	20	18.01%
Previous treatment by physician was unsuccessful	3	2.70%
Long waiting time to avil doctor	15	13.51%
Asked doctor for a medication	0	0%
Shortage of drug supply in stores	0	0%
Previous prescription as reference for same illness	18	16.22%
High cost of treatment	18	16.22%
Taking child in inconvenient	0	0%
Lack of nearby health care provider	21	18.92%
Problems with behavior of medical staff	0	0%
Others	0	0%
Total self-medicated number= 111		

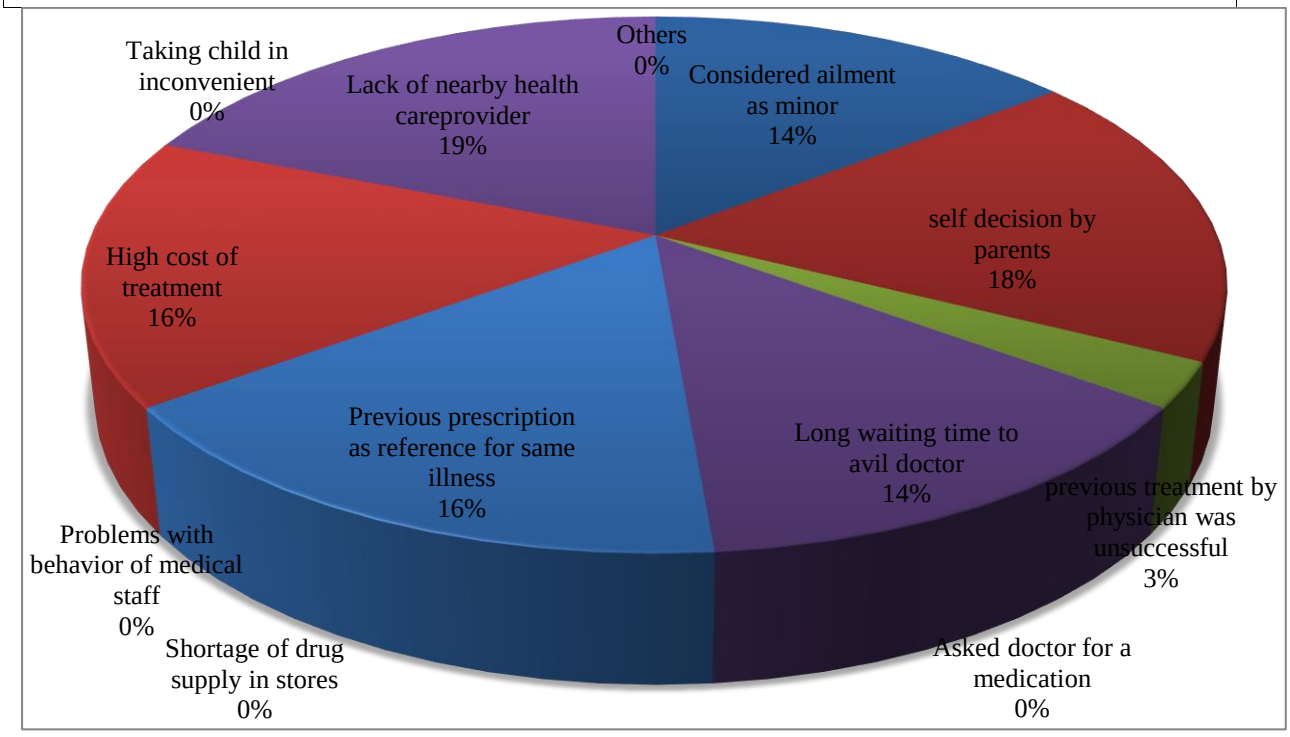

Figure 4.3.3: Reasons behind self-medication

18.9% respondent's lack of nearby healthcare provider, 18% respondents said that self-medication decision by parents.

4.3.4 Antibiotics which are self-medicated

Table 4.3.4: Antibiotics which are self-medicated

Name of Antibiotics	Number of self-mediation	Percentage
Amoxicillin	23	20.72%
Ampicillin	14	12.61%
Azythromycin	9	8.11%
Cefadroxil	2	1.80%
Cefixime	11	9.91%
Cefradine	6	5.41%
Ceftriaxone	4	3.61%
Cefuroxime	3	2.71%
Ciprofloxacin	3	2.71%
Erythromycin	11	9.91%
Erythromycin	3	2.71%
Gentamicin	3	2.71%
Levofloxacin	3	2.71%
Metronidazole	7	6.31%
Cannot remember	9	8.11%
Total self-medicated number= 111		

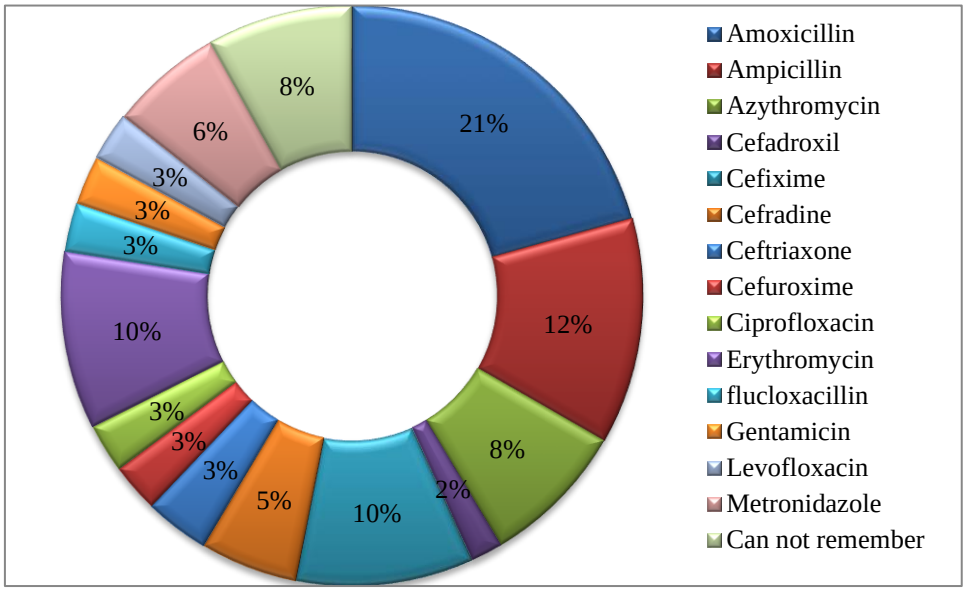

Figure 4.3.4: Medication history

Majority of the respondents self-medicated amoxicillin (21%), ampicillin (12%), erythromycin (10%) and cannot remembered the antibiotics name is (8%).

4.3.5 Remember the treatment schedule of antibiotic

Table 4.3.5: Remember the treatment schedule of antibiotic

Remembered the treatment schedule	Number	Percentage
Yes	97	87.39%
No	14	12.61%
Total self-medicated number= 111		

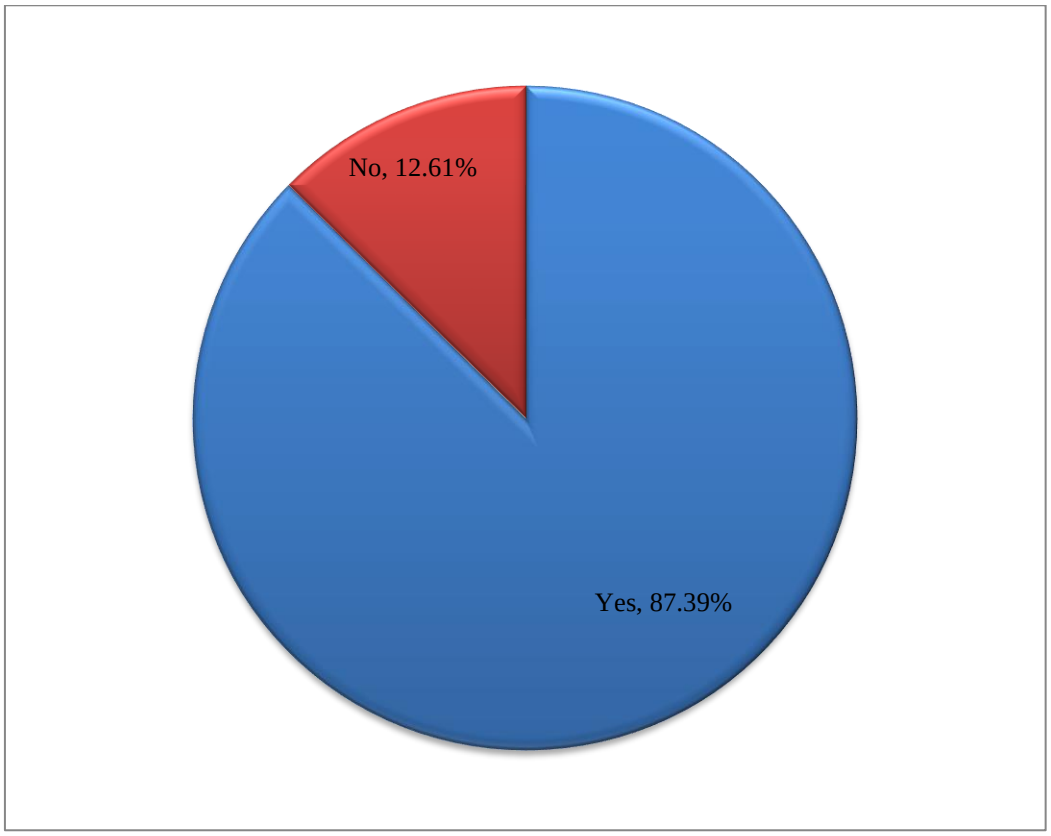

Fig 4.3.5: Remember the treatment schedule of antibiotic

87.39% participation's can remember their treatment schedule of antibiotic administration to children.

4.3.6 Source of medication

Table 4.3.6: Source of medication

Source of medication	Number	Percentage
OTC from dispensaries	97	87.38%
Healthcare professionals	6	5.41%
Friends and family	8	7.21%
Family medicine cabinet	0	0%
Others	0	0%
Total number of self-medicated= 111		

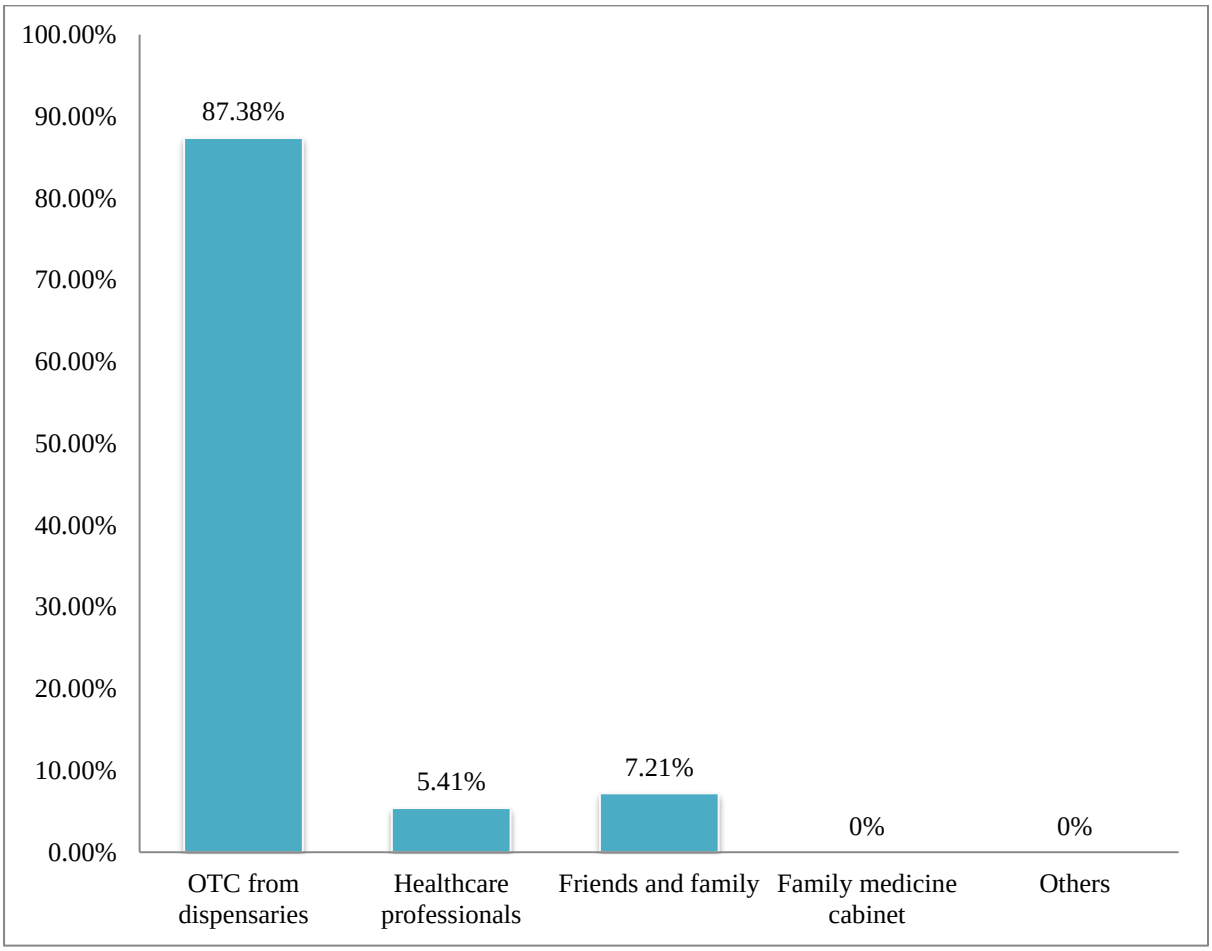

Figure 4.3.6: Source of medication

Main sources of medicine were personnel at pharmacy dispensaries (87.38%).

4.3.7 Conscious about side effect of the antibiotic prior to administration in child

Table 4.3.7: Conscious about side effect of the antibiotic prior to administration in child

Conscious about side effect	Response number	Percentage
Yes	69	75%
No	207	25%
Total number of self-medicated= 111		

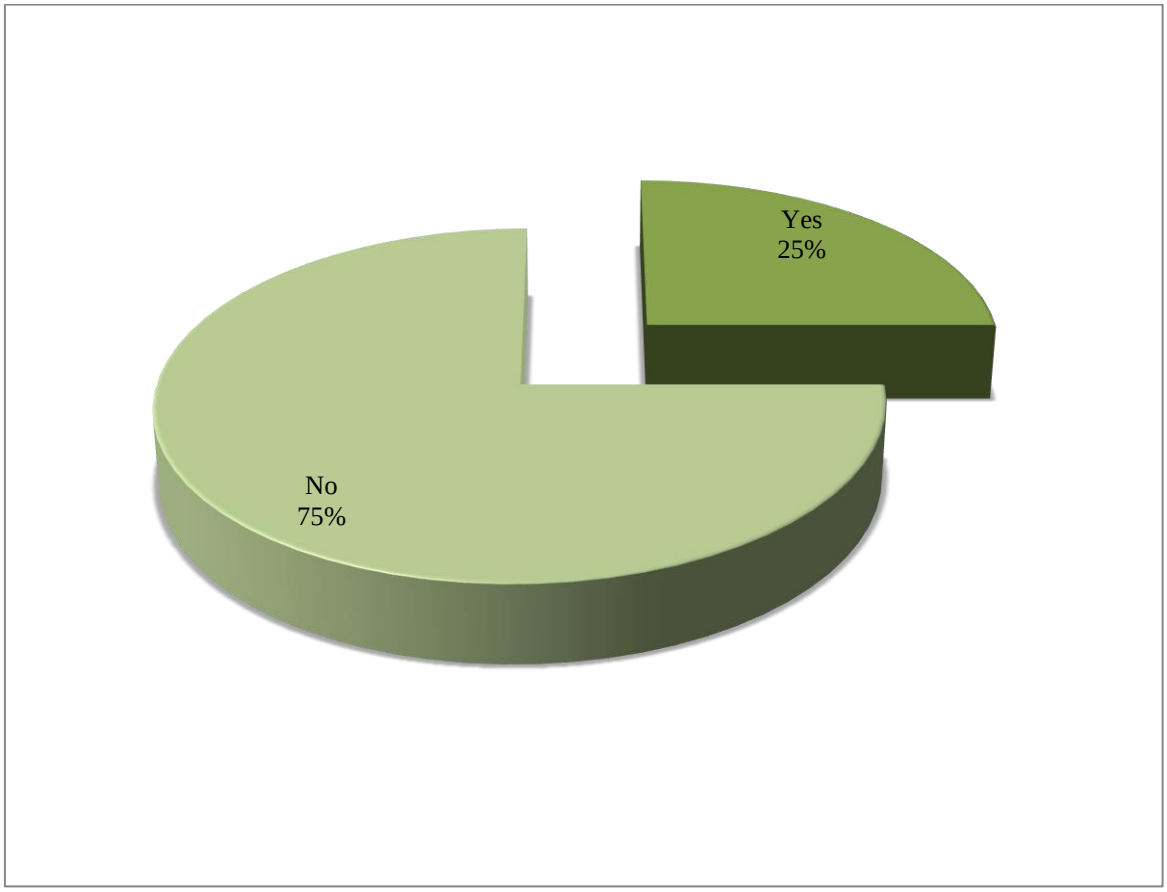

Figure 4.3.7: Conscious about side effect of the antibiotics

Among all the respondents, 75% respondents are not conscious about the side effect of the drug and 25% respondents said that they are conscious about the side effect of the drug.

4.3.8 Knowledge about antibiotic before administering that to child

4.3.8 Knowledge about antibiotic before administering that to child

Knowledge about drug before administering	Number of response	Percentage
Yes	68	35%
No	208	75%
Total number of self-medicated= 111		

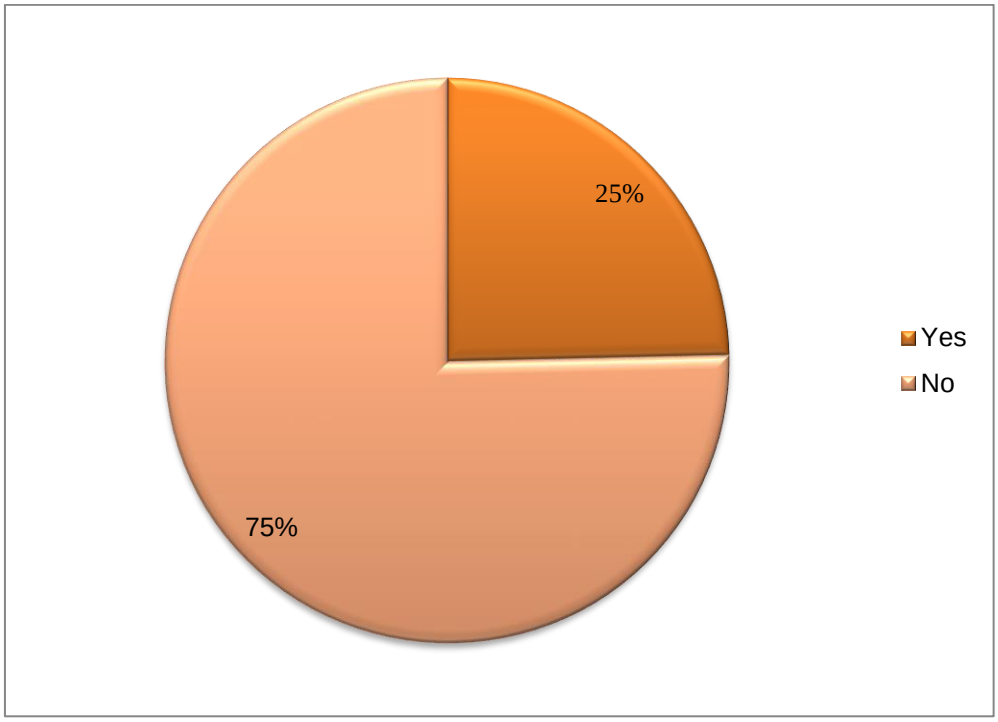

Figure 4.3.8: Knowledge about antibiotics administration

Majority of the respondents (75%) have no knowledge about drug administration and only 25% respondents have the knowledge about the drug before administering that drug to their child.

4.3.9 Source of Information regarding the antibiotic

Table4.3.9: Source of Information regarding the antibiotic

Source of Information	Response number	Percentage
Health care professionals	48	17.39%
Drug sellers	137	49.64%
Family and friends	38	13.76%
Media	1	0.36%
Patient information leaflet	30	10.87%
Others	22	7.98%
Total number of self-medicated= 111		

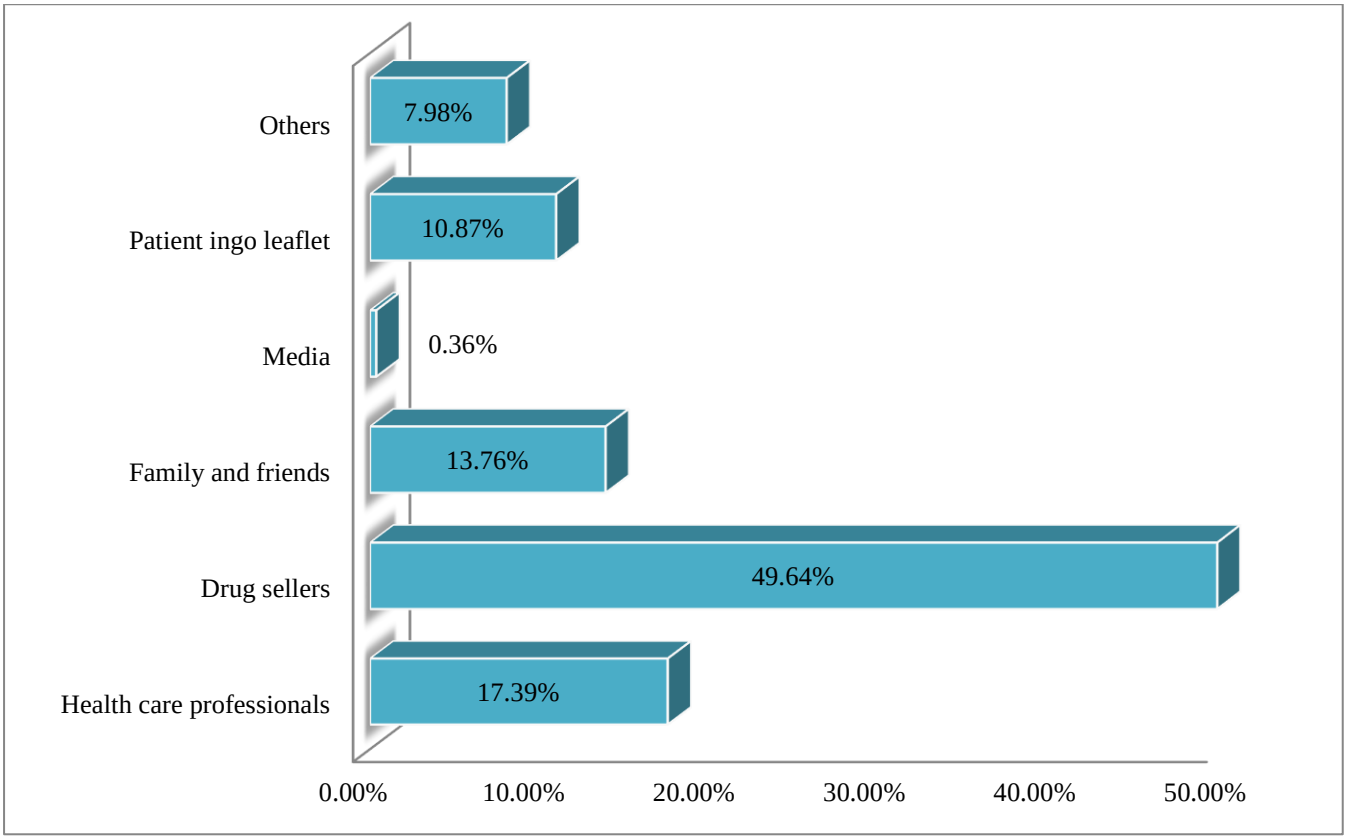

Figure 4.3.9: Source of Information regarding the antibiotics

Majority 49.64% respondents gathered knowledge about drug from drug sellers.

4.3.10 Name of the prescribed antibiotic

Table 4.3.10: Name of the prescribed antibiotic

Name of the prescribed antibiotic	Number
Amoxicillin	3
Ampicillin	3
Azythromycin	9
Cefaclor	9
Cefixime	24
Cefadroxil	10
Ceftriaxone	11
Cefuroxime	16
Ciprofloxacin	22
Erythromycin	18
Flucloxacillin	8
Neomycin	1
Neomycin	2
Cefradine	21
Clindamycine	3
Metronidazole	2
Total number of prescribed antibiotic= 162	

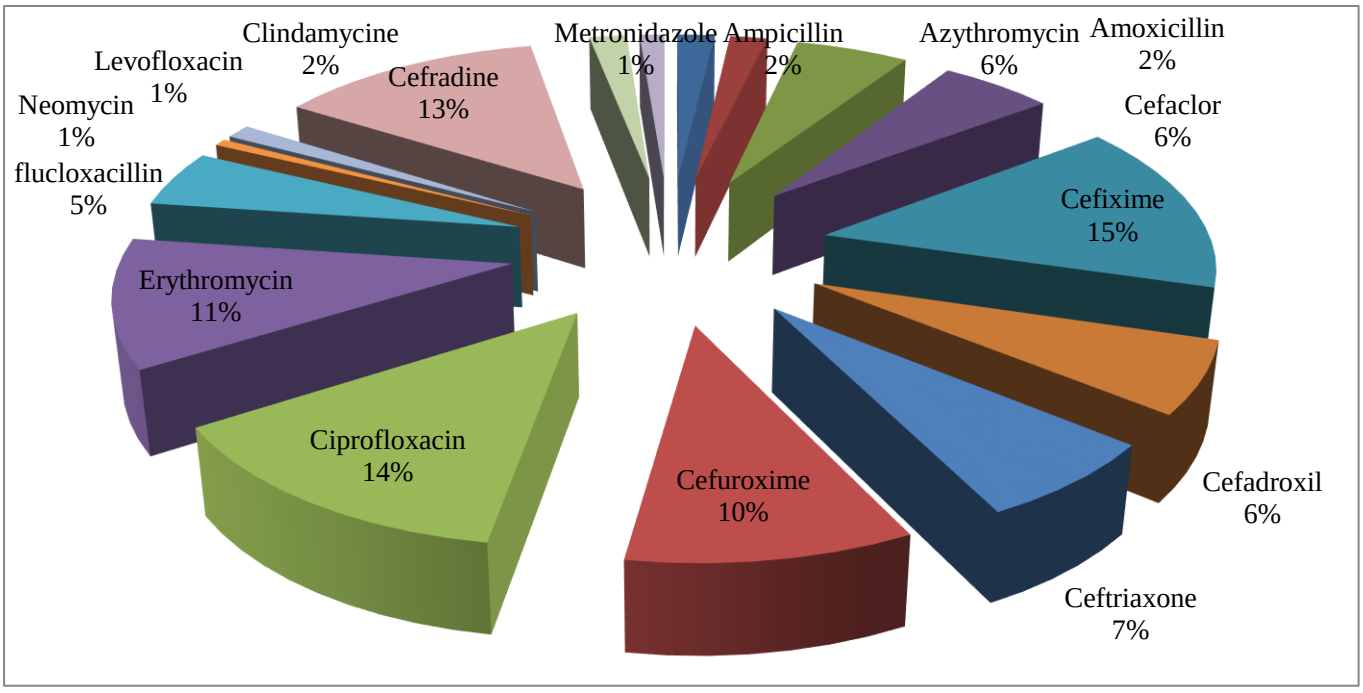

Figure 4.3.10: Name of the prescribed antibiotic.

The most prescribed antibiotics are cefixime (15%), ciprofloxacin (14%) & cefradine (13%).

4.3.11 Agreement to treatment schedule provided by physician

Table 4.3.11: Agreement to treatment schedule provided by physician

Agreement to treatment schedule	Response number	Percentage
Yes	140	86%
No	22	14%
Total number of prescribed antibiotic= 162		

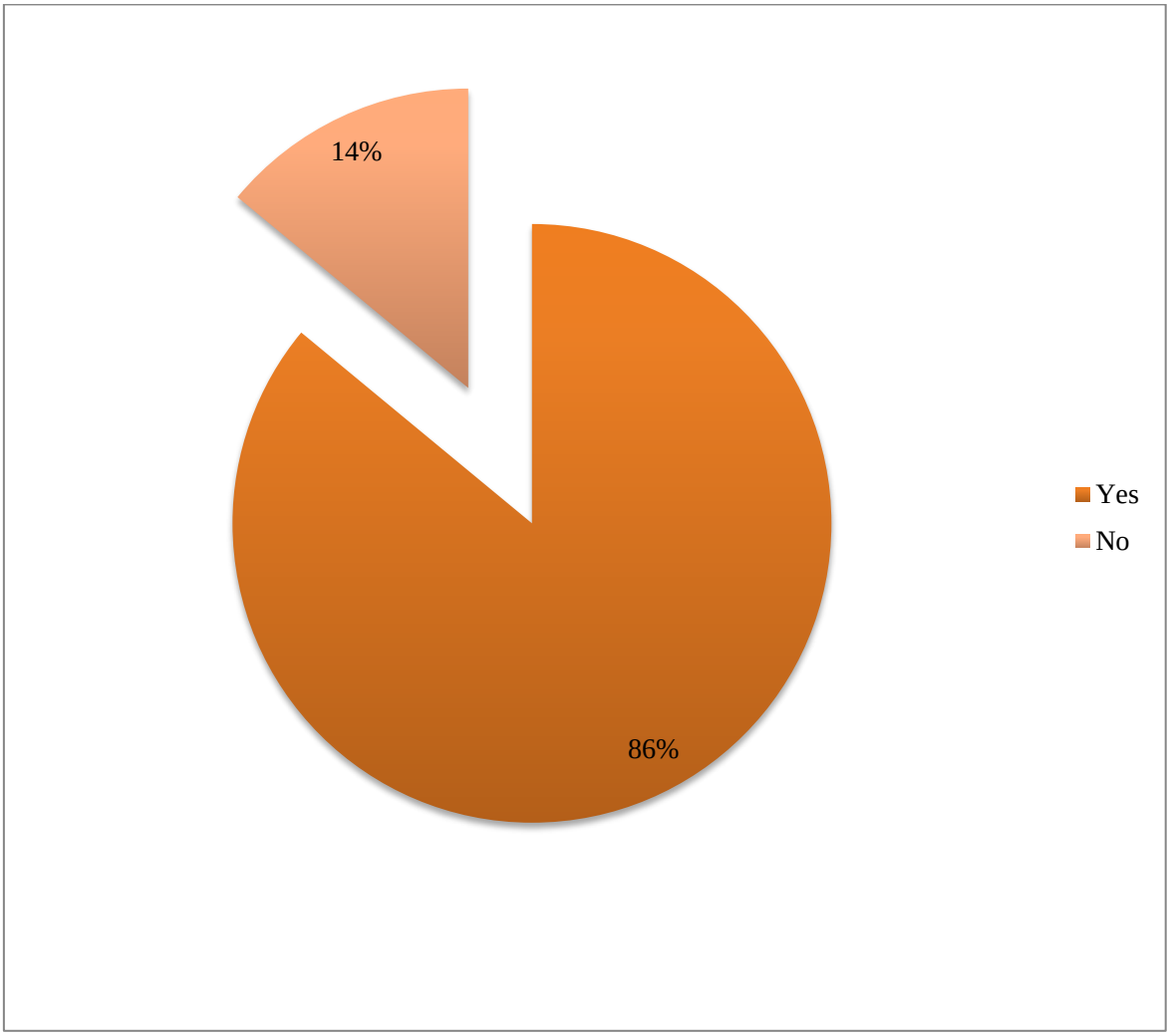

Figure 4.3.11: Agreement to treatment schedule provided by physician

Most of all respondent's do agree to the treatment schedule provided by the doctors and only 14% is disagreed to the treatment schedule.

4.3.12 Request for antibiotic from physician

4.3.12 Request for antibiotic from physician

Request for antibiotic	Number	Percentage
Yes	11	7%
No	151	93%
Total number of prescribed antibiotic= 162		

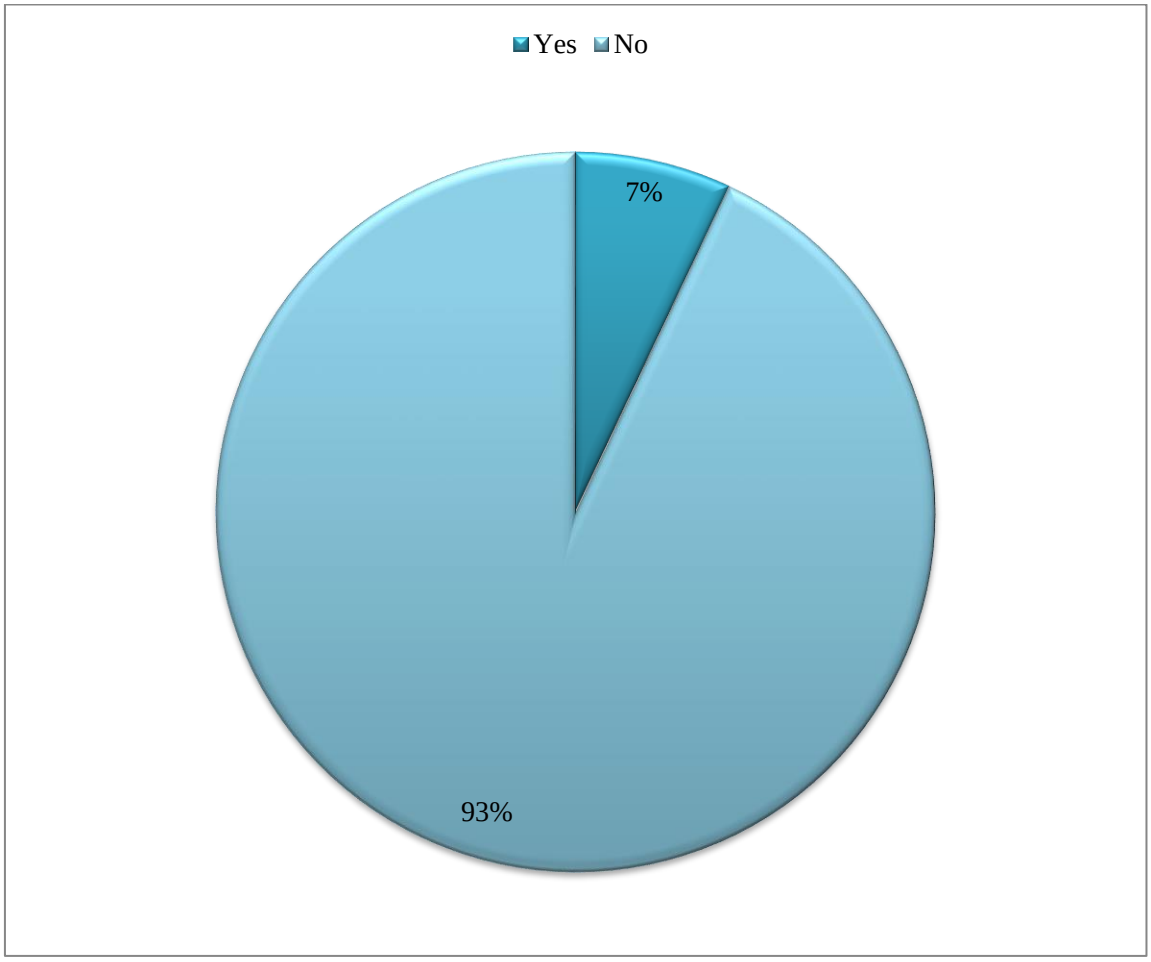

Figure 4.3.12: Request for antibiotic from physician

Major portion of respondents do not give suggestion to doctor about antibiotic for their child but only a few percent respondents are ask doctors to prescribed antibiotic.

4.3.13 Request for specific antibiotic from physician

Table 4.3.13 Request for specific antibiotic from physician

Request for specific antibiotic	Number	Percentage
Yes	9	95%
No	155	5%
Total number of prescribed antibiotic= 162		

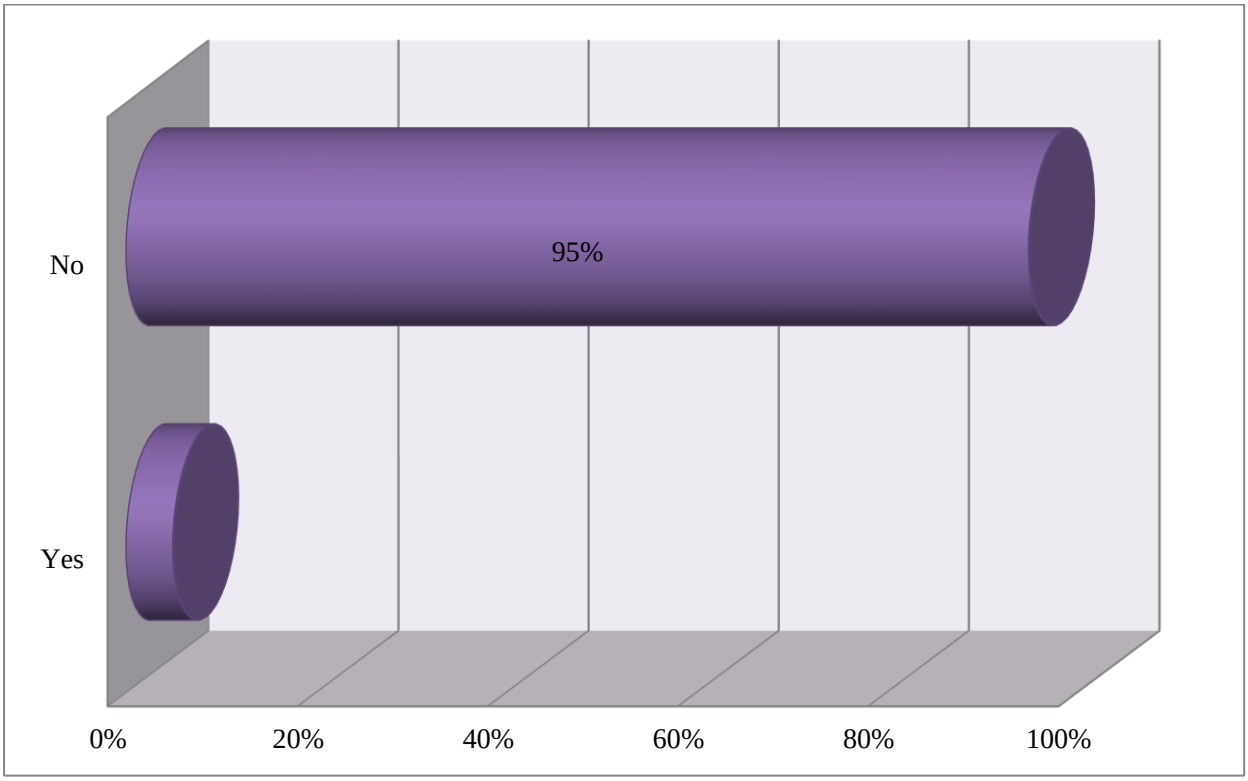

Figure 4.3.13: Request for specific antibiotic from physician

Major portion of respondents do not give suggestion to doctor about specific antibiotic for their child but only a few percent respondents are ask doctors to prescribed specific antibiotic.

4.3.14 Opinion of parents regarding tendency of prescribing antibiotic by physician

Table 4.3.14 Opinion of parents regarding tendency of prescribing antibiotic by physician

Opinion of patients	Number	Percentage
Yes	240	87%
No	36	13%
Total number = 276		

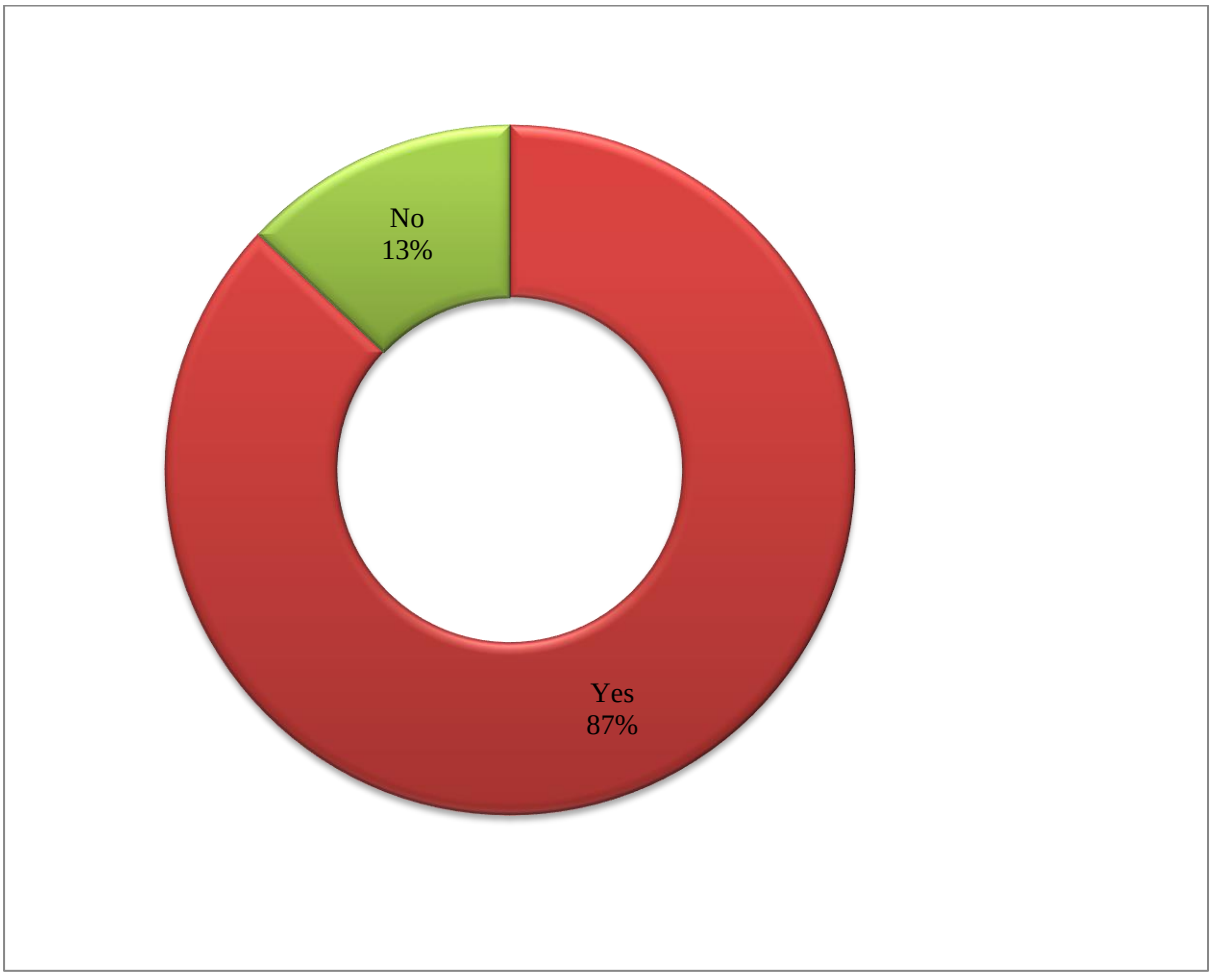

Figure 4.3.14: Tendency of prescribing antibiotic by physician

Maximum respondent thought and believed that doctors have high tendency of prescribing antibiotic but 13 % people do not think so.

4.3.15 Discontinuation of the antibiotic therapy

Table 4.3.15: Discontinuation of the antibiotic therapy

Discontinuation of the drug therapy	Number	Percentage
Yes	96	35%
No	180	65%
Total number= 276		

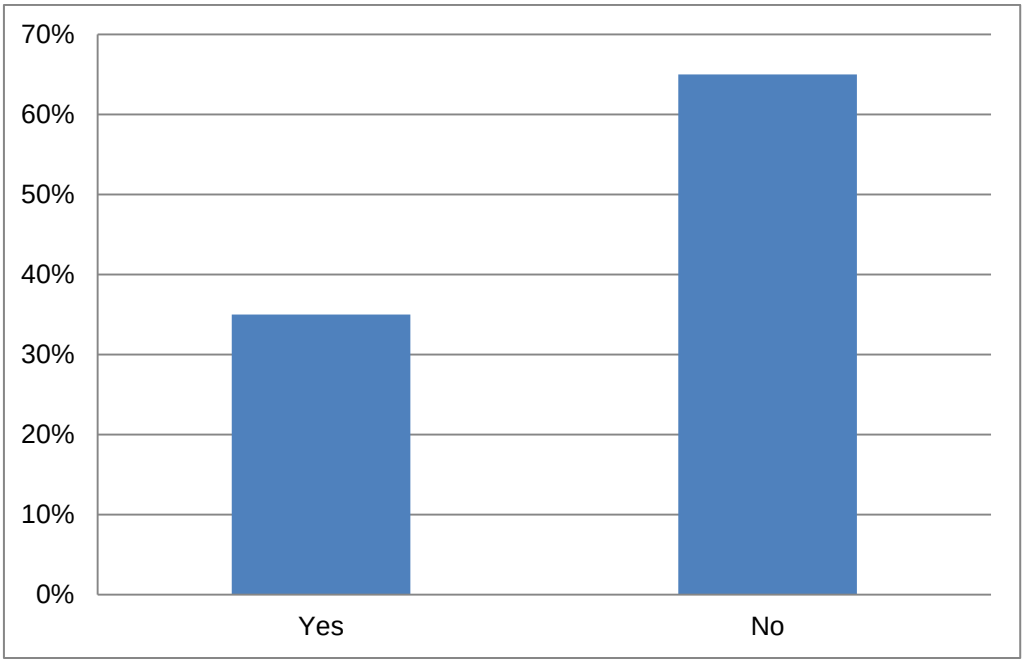

Figure 4.3.15: Discontinuation of the antibiotic therapy

All most half of the respondents did not discontinue the drug therapy whereas another half of the respondents discontinued the therapy.

4.3.16 Reasons behind discontinuation of the therapy

Table 4.3.16: Reasons behind discontinuation of the therapy

Reasons behind discontinuation	Number	Percentage
Symptoms have disappeared	86	90%
Drugs ran out	1	1%
Side effects appeard	0	0%
Child was unwilling to take medication	8	8%
Others	1	0%
Total number of discontinuation = 96		

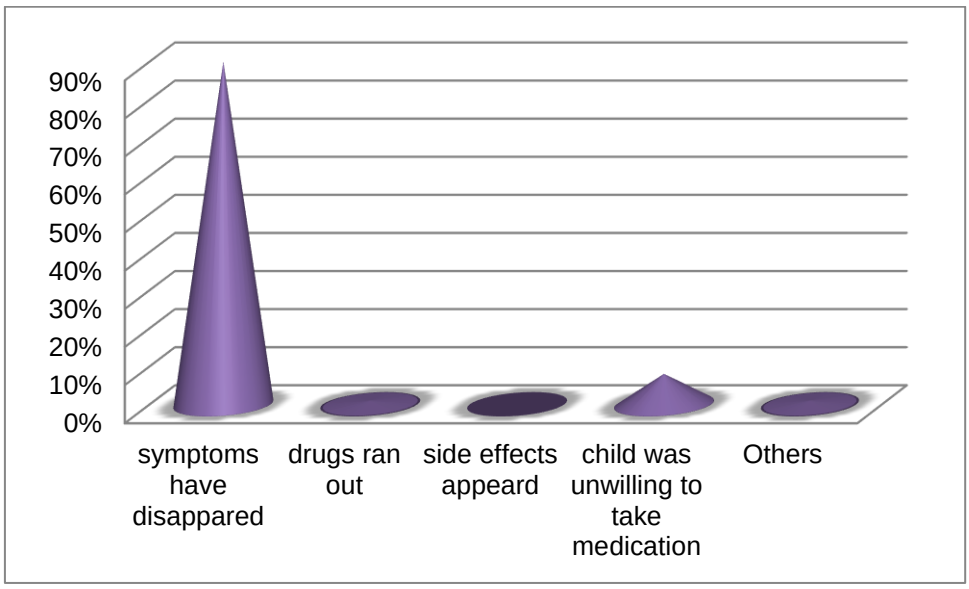

Figure 4.3.16: Reasons behind discontinuation of the therapy

Of the 96 number of respondents who discontinued antibiotic therapy, 90% of respondents stated their reasons for discontinuation is disappearance of symptoms.

4.3.17 Suffering from side effect due to antibiotic use

Table 4.3.17: Suffering from side effect due to antibiotic use

Side effect appeared	Number	Percentage
Yes	43	15%
No	234	85%
Total number= 276		

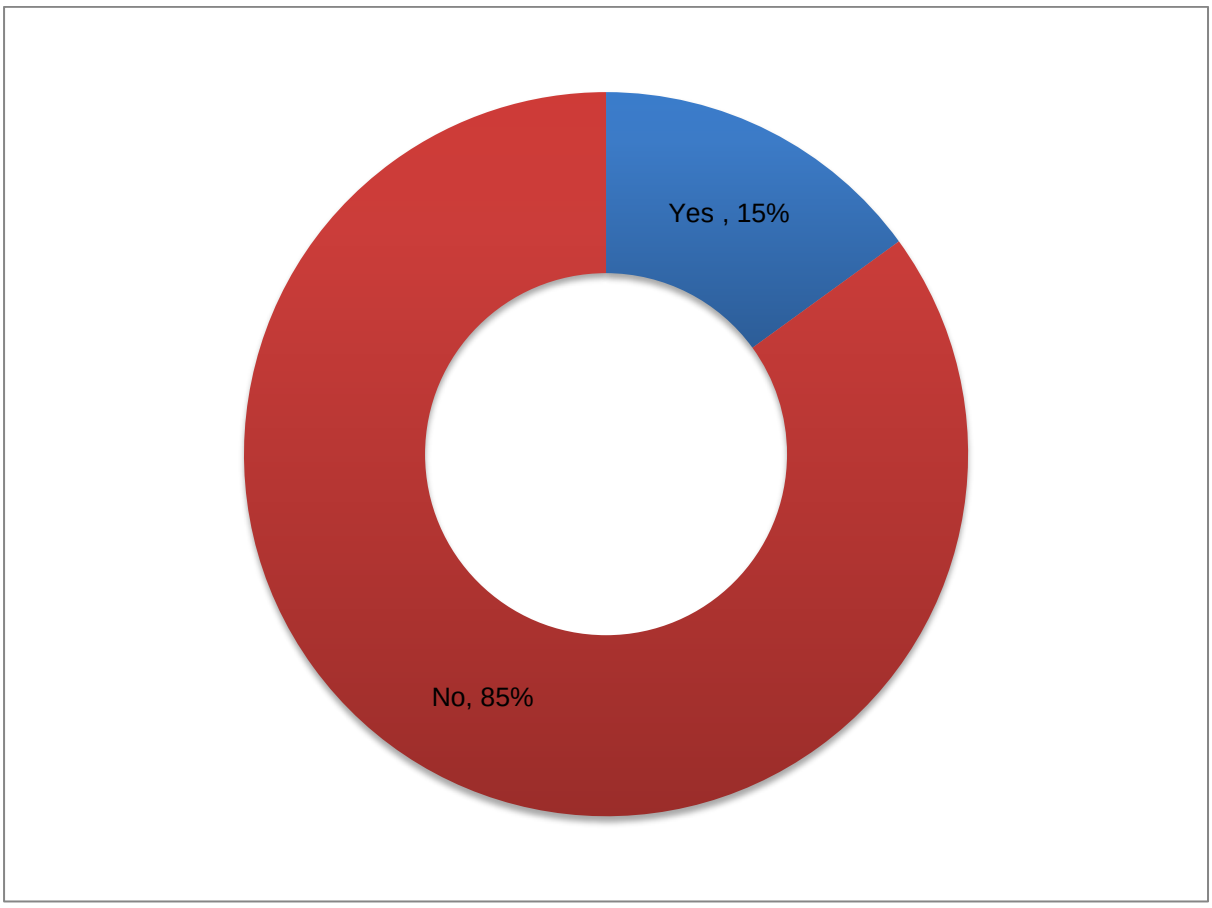

Figure 4.3.17: Suffering from side effect due to antibiotic use

Only 15% are suffered from side effect due to use of antibiotic both prescribed and self-medicated medicines.

4.3.18 Remember the nature of the side-effect due to antibiotic use

Table 4.3.18: Remember the nature of the side-effect due to antibiotic use

Remember side-effect	Number of response	Percentage
Yes	36	84%
No	7	16%
Total number of respondents= 43		

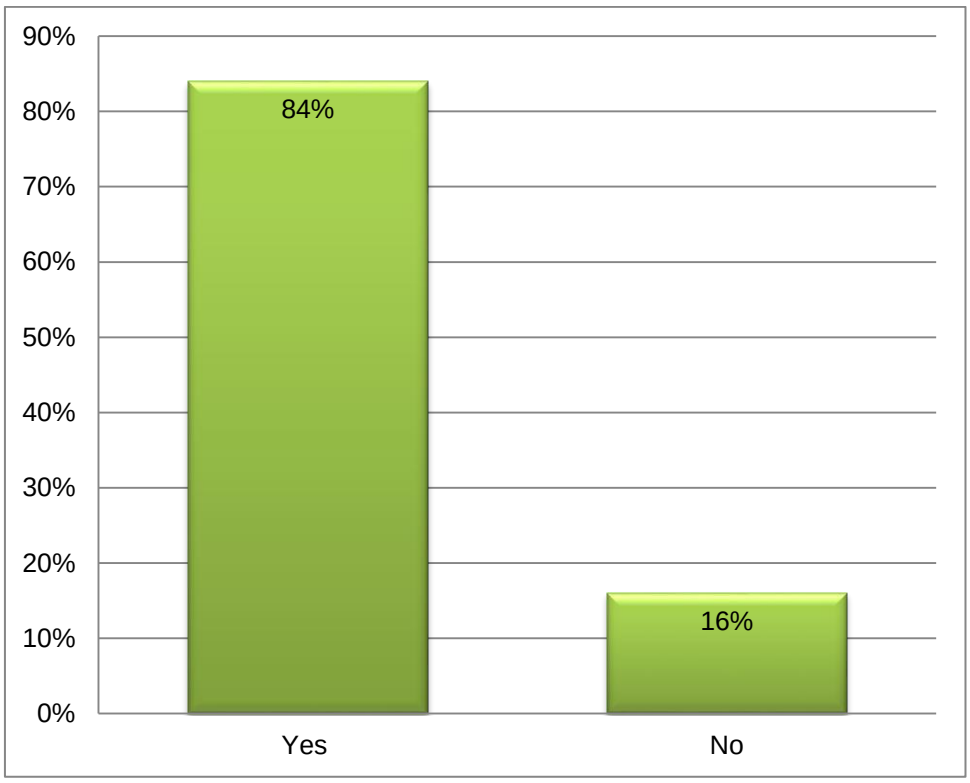

Figure 4.3.18: Remember the nature of the side-effect due to antibiotic use

Maximum participants could remember the side-effect that appears due to use of antibiotics.

4.4 Status of parental understanding of antibiotic use and resistance

4.4.1 Knowledge about antibiotic resistance

Table 4.4.1 Knowledge about antibiotic resistance

Knowledge about antibiotic resistance	Number	Percentage
Agree	8	3%
Disagree	0	0%
Neither agree or disagree	28	10%
Do not know	248	87%
Total number= 276		

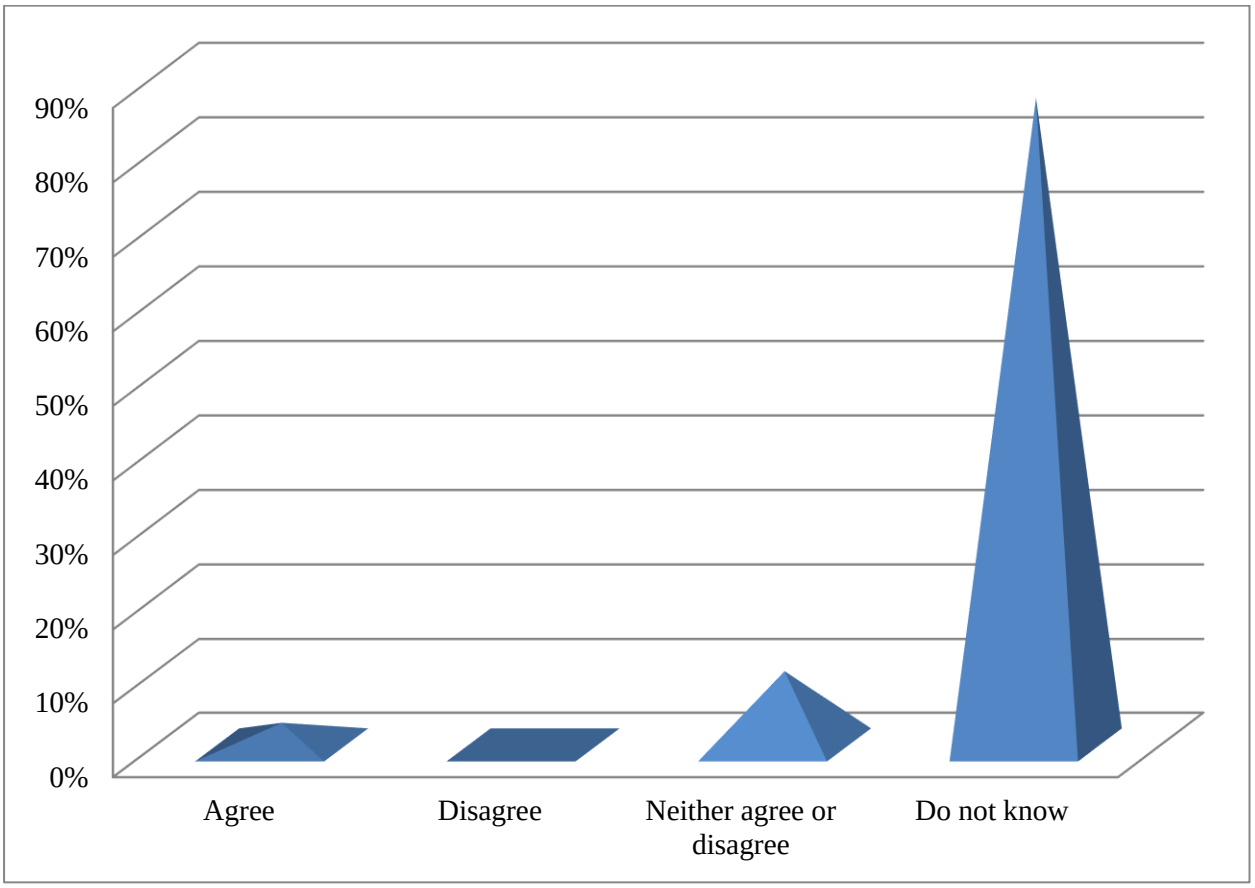

Figure 4.4.1: Knowledge about antibiotic resistance

Maximum portion of the respondents (87%) said that they do not have any idea on antibiotic resistance.

4.4.2 Antibiotic resistance is promoted by not completing full course of antibiotics

Table 4.4.2 Antibiotic resistance is promoted by not completing full course of antibiotics

Antibiotic resistance is promoted by not completing full course	Number	Percentage
Agree	12	4%
Disagree	0	0%
Neither agree or disagree	58	21%
Do not know	206	78%
Total number= 276		

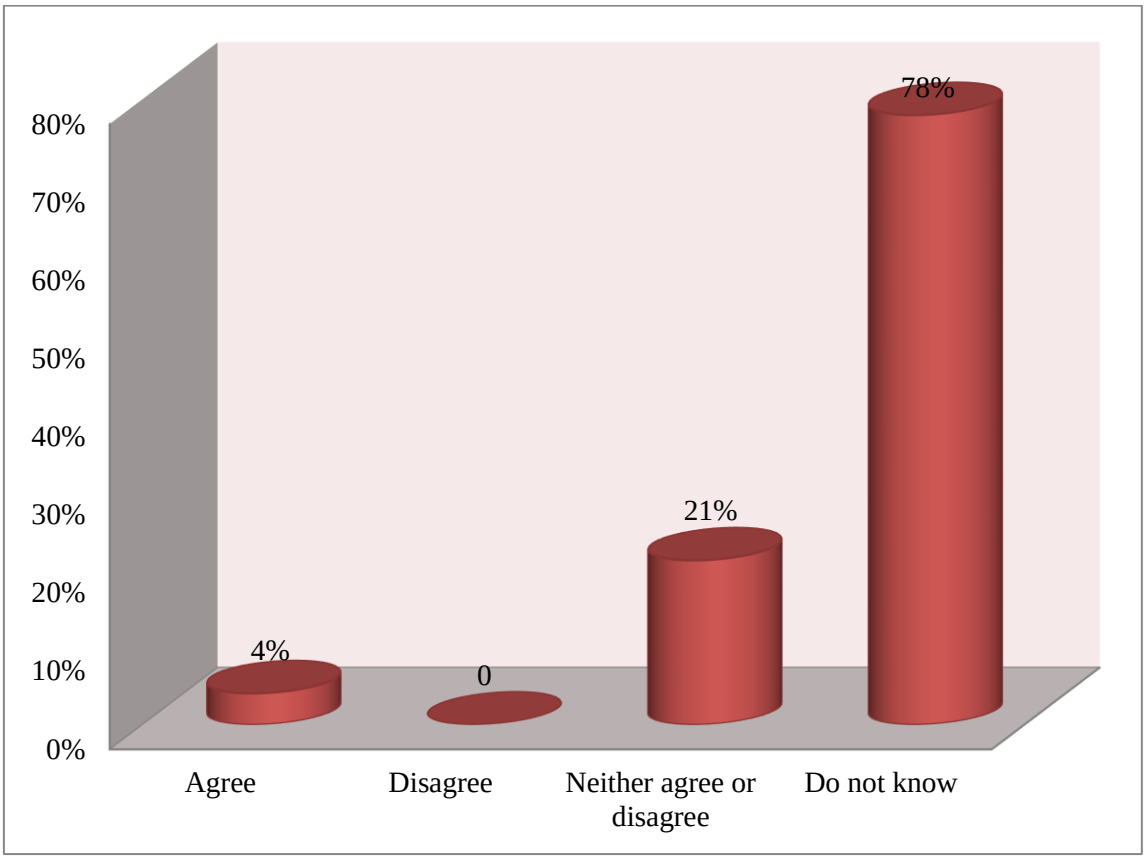

Figure 4.4.2: Antibiotic resistance is promoted by not completing full course of antibiotics

Maximum portion (78%) of the respondents said that they do not know whether antibiotic resistance builds up or not in case where the full course of antibiotic is not completed.

4.4.3 Antibiotic resistance due to self-medication of antibiotics

Table 4.4.3 Antibiotic resistance due to self-medication of antibiotics

Antibiotic resistance due to self-medication	Number	Percentage
Agree	0	1%
Disagree	3	0%
Neither agree or disagree	24	8%
Do not know	205	90%
Total number= 276		

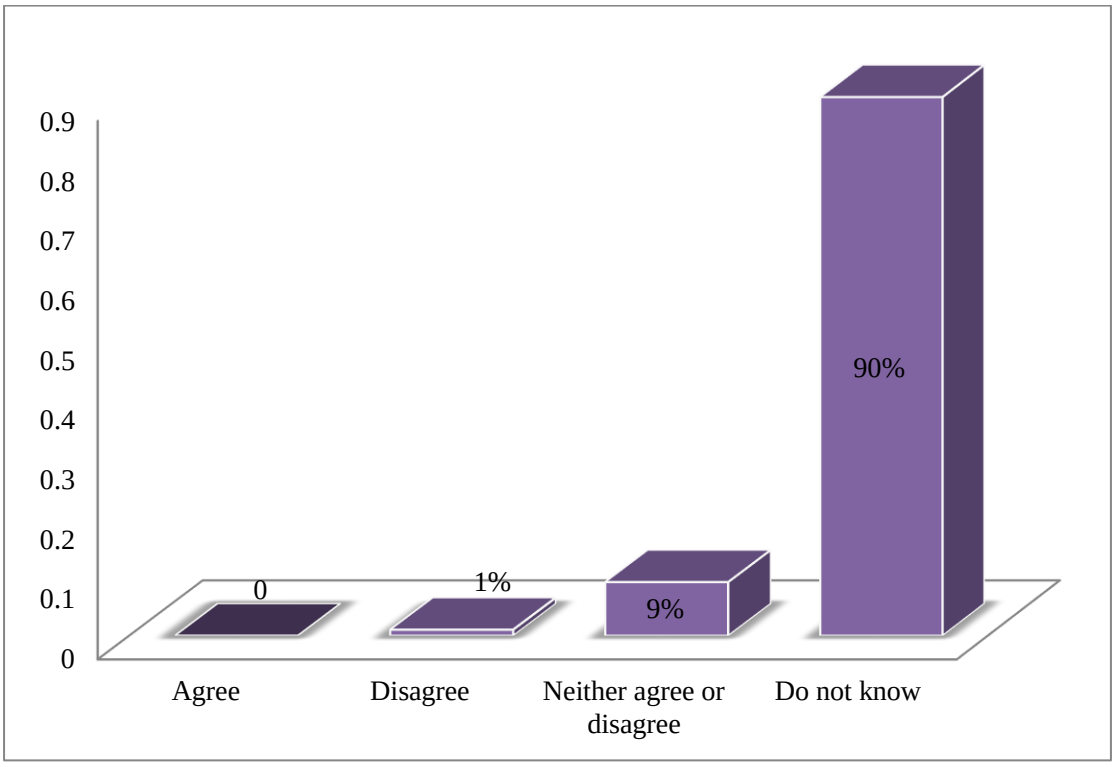

Figure 4.4.3: Antibiotic resistance due to self-medication of antibiotics

Majority of the respondents said that they do not know whether antibiotic resistance builds up or not in case of the self-medication of antibiotics. Only a few respondents neither agree nor disagree on that statement of antibiotics resistance.

4.4.4 Antibiotic resistance is promoted by using antibiotics by using antibiotics with other drugs

Table 4.4.4: Antibiotic resistance is promoted by using antibiotics by using antibiotics with other drugs

Resistance occur due to using antibiotic with other drugs	Number	Percentage
Agree	5	1%
Disagree	4	2%
Neither agree or disagree	44	16%
Do not know	223	81%
Total number= 276		

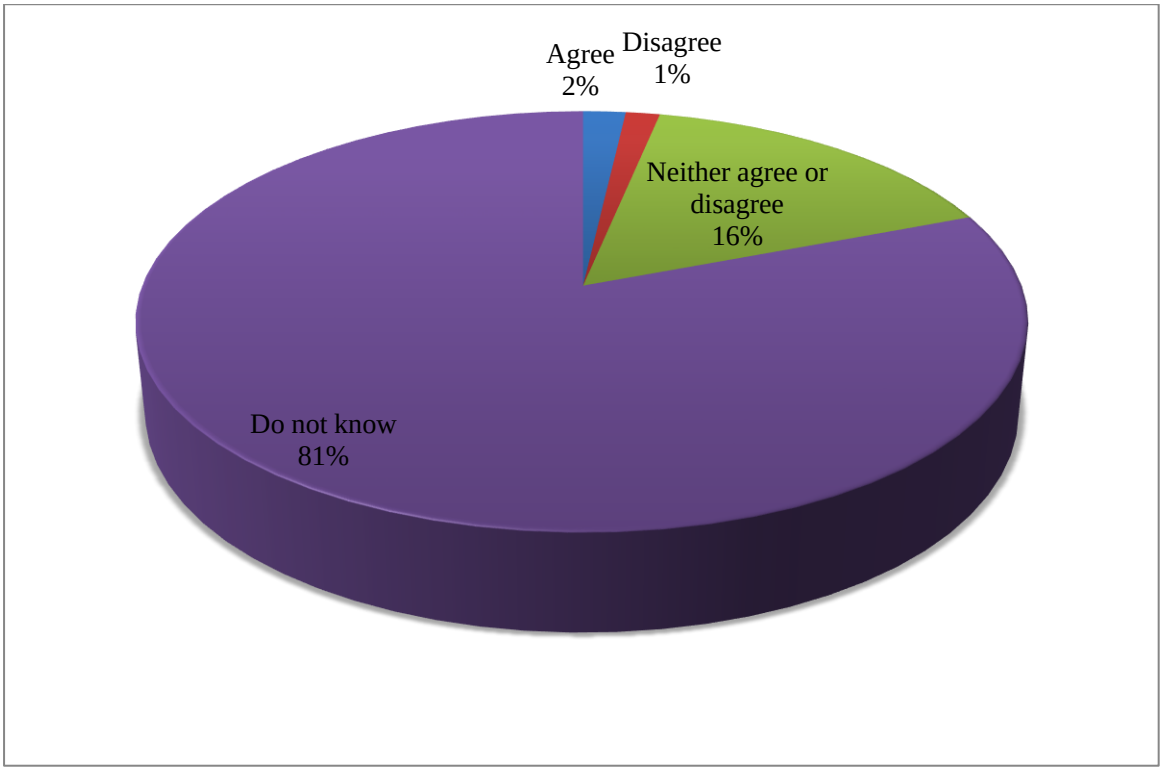

Figure 4.4.4: Antibiotic resistance is promoted by using antibiotics by using antibiotics with other drugs

Majority of the respondent's (81%) do not know whether antibiotic resistance is promoted by using antibiotics with other drugs or not. Only (2%) of respondent's knows.

4.4.5 Viral infection with fever should be treated with antibiotics

Table 4.4.5: Viral infection with fever should be treated with antibiotics

Viral infection with fever should be treated with antibiotics	Number	Percentage
Agree	139	50%
Disagree	1	0%
Neither agree or disagree	19	7%
Do not know	117	43%
Total number= 276		

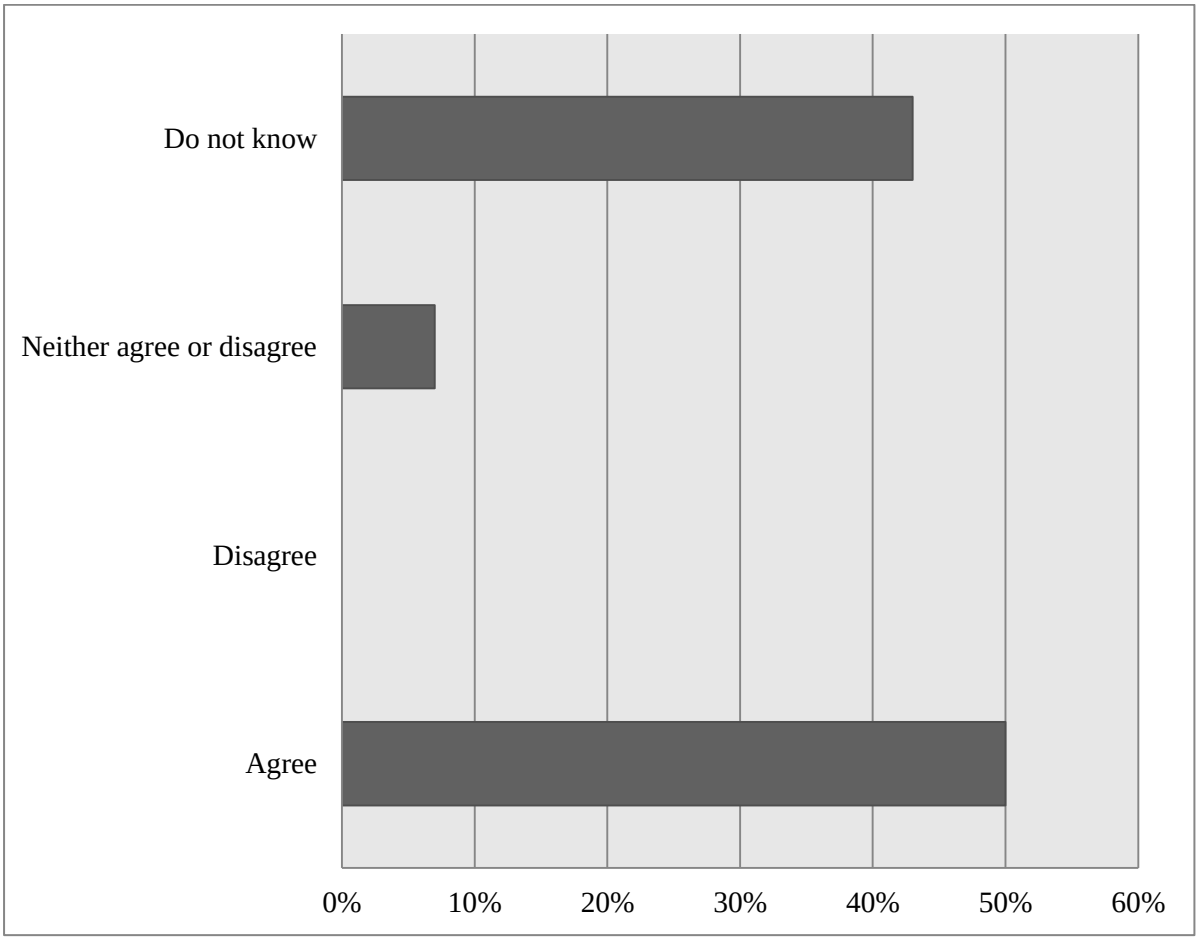

Figure 4.4.5: Viral infection with fever should be treated with antibiotics

Half of the respondents have said that viral fever should be treated with antibiotics. Another 43% respondent said they have no idea about this statement.

4.4.6 Effectiveness of antibiotics in the treatment of same infection in future

Table 4.4.6: Effectiveness of antibiotics in the treatment of same infection in future

Effectiveness of antibiotics in the treatment of same infection in future	Number	Percentage
Agree	180	66%
Disagree	0	0%
Neither agree or disagree	31	11%
Do not know	64	23%
Total number= 276		

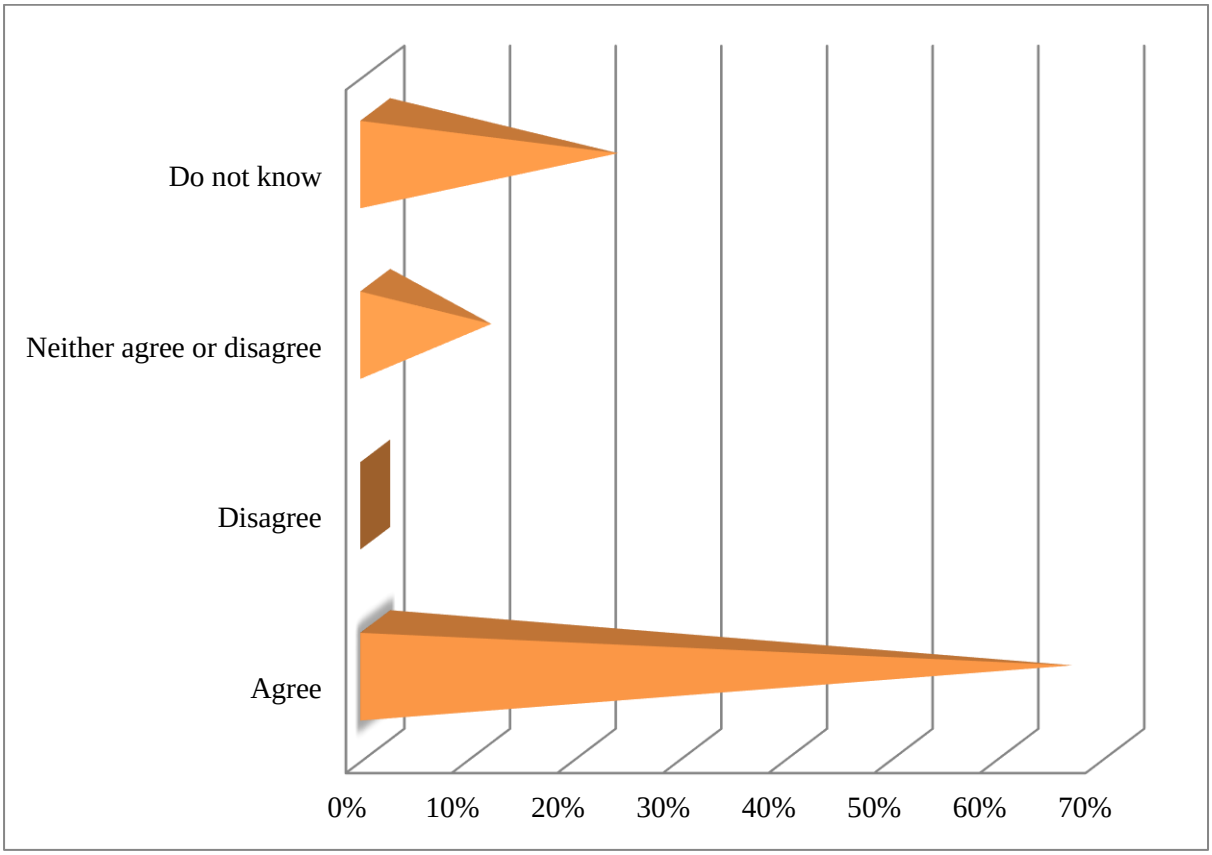

Figure 4.4.6: Effectiveness of antibiotics in the treatment of same infection in future

Majority of the respondents (66%) said that they agree with the effectiveness of antibiotics in the treatment of same infection in future. But 23% respondents said that they have no idea about it effectiveness in future.

Chapter 5

Discussion and Conclusion

5.1 Discussion

A study was conducted on Bangladeshi parents' practice, knowledge and attitudes of self-medication to their children in Faridpur, Madaripur and Shariatpur district. From that study we can able to get an overview on parental knowledge and attitudes of self-medication, self-medication practice among children. After this study it is found that self-medication practice tendency of parents to their children is greatly depends on age of children, previous experience, sort of disease, monthly net house hold income, location of the healthcare, parent's education level etc.

From the demographical data, we found that most of the cases of child are medicated by their mother (85%), the mother played active role in medication administration in child where fathers are second in this category (14%) and last the others e.g. grandmother, brother, sister only (1%). Also from the education data most of the parents who medicated their child have education level only school certificate (31.50%) and primary school (32.60%). The occupation of the parents is homemaker (64.85%), studying (3.3%), un-employed (3.26%) and employed or others are (28.26%). The net household income is also a major contributor in self-medication practice where maximum parents income is between Tk5000-10000 (52%) and Tk10000-30000 (41%) which produces a great impact between self-medication and consulting a doctor for medicating their children during disease condition. From this study we have seen major of children who are medicated by antibiotics are 3 months-1 year (34.78%) and 1year- 5 years (25.73%). Maximum children were female and whether they are 2nd (37.31%) or 3rd (34.10%) born. Male children number is ½ of female children (35.50%). Since majority of the responders had no health care degree, responders have shown difficulty in identifying the drugs and dosage regimen they followed for their children.

This study showed the majority of the children are suffered from cough and cold (56%) few are suffered from pain and redness of tonsils (5%), pain and burring during urination (8%), some gastrointestinal disease like diarrhea (5%), skin wound or infection (5%) and others. and the perception of the parents about health status of their children's is fairly poor (50.36%), from the opinion of most of the parents they responded by self medicating (39.13%) or consulting a doctor (59.70%). 95% people think that self-medication is not safer than the consulting a doctor. Parents are complain various reasons e.g. considered ailment as minor (14.4%), self decision by parents (18%), high cost of treatment (16.2%), lack of nearby health care provider (18.9%) are responsible for the self-medicating of their children.

Many of them have been able to indicate the exact schedule of medication (87.39%) but mojority (75%) have no adequate idea about the side effects of the medication prior to administering the drugs. Those of the respondents, who have gathered some information about the medication, have done it from unreliable sources such as the drug sellers (49.64%) or incomplete sources such as packaging inserts in medication carton (10.87%). Also 75% parents haven't proper knowledge about drug before administering that to child. Most used their children are medication of-antibiotic drugs in which used by the parents for self amoxicillin (21%), ampicillin (12%), and erythromycin (10%) and fewer cannot remember the name of the antibiotic (8%). The main source of collecting those antibiotics is from the OTC from dispensaries (87.38%) without any prescription. The not-so-strict enforcement of medical laws and regulations in Bangladesh enable clinic dispensers and pharmacists to sell the drugs to the people over-the-counter without a doctor's prescription. These attitudes were also due to lack of knowledge and awareness of the parents of the unnecessary undesirable effects and outcomes to the children as well as increasing bacterial resistance.

Most prescribed antibiotics by the doctor's are cefixime (15%), ciprofloxacin (14%) & cefradine (13%) and 86% respondents are agreed with the treatment schedule provided by the doctor, only14% is disagreed to the treatment due to some problem with the dosage regiment.

Many who have visited the doctors thought that physicians prescribe drugs too easily to the children. Some respondents (7%) had request physician to give antibiotics and some of them (5%) had requested for a specific drug to physician.

Many (47%) have discontinued drug therapy as symptoms disappeared due to the lack of knowledge (90%) about the consequences. Fewer children suffered from the side-effect due to the use of antibiotic and (15%) and maximum parents have been able to remember the side-effect (92%).

When the parents were asked about antibiotic resistance then most of the respondents (87%) said that they do not have any idea about antibiotic resistance. This is because only few percent parents have health care degree and they are not supposed to know about antibiotic resistance. Most of the parents (66%) even think that the antibiotics will be effective in the treatment of same infection in future if the full courses of the therapy do not maintained properly. They also think that (50%) antibiotics are effective in viral fever. Though 8.69% of the respondents have university level educational qualification but they do not have the proper knowledge about antibiotic resistance.

5.2 Conclusion

The results of this study confirm that, the prevalence of self-medication with antibiotics in children is a frequent problem in Faridpur, Madaripur and Shariatpur district of Bangladesh. From this study it also reveals that, the inadequate knowledge of parents about the resistance and practice of the self-medication is also play a vital role in misuse of antibiotics and promotes its resistance. Thus interventions at different levels are required in order to reduce the frequency of antibiotics misuse. Adequate health education to stop this unsavory practice needs to be mounted while efforts should be made to make qualitative health care readily available. Health care providers should educate patients on the dangers of self-medication. Such messages should be extended to the community at large periodically by government health ministries.

Chapter 6

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