ISSN: 2279 - 0594

Journal of Biomedical and Pharmaceutical Research

Available Online at www.jbpr.in

CODEN: - JBPRAU (Source: - American Chemical Society)

Index Copernicus Value: 63.24

PubMed (National Library of Medicine): ID: (101671502)

Volume 6, Issue 4: July-August: 2017, 09-16

Research Article

Prescribing Pattern and Cost Analysis of β-Lactam Antibiotics in Rural Pediatric Patient: A Prospective Observational Study

Deepak Bhatt[1]*, Ajay Shah[1], Dinesh K. Yadav[1], Ajay K. Shah[1], Dr.NM Mahesh[2], Dr.B.Ravichander[3], Dr.Vidhya Alex[4]

[1]Pharm.D, Department of Pharmacy Practice, Krupanidhi College of Pharmacy, Bangalore-560035

[2]M.Pharm, Ph.D. Professor and Head. Department of Pharmacy Practice, Krupanidhi College of Pharmacy, Bangalore-560035

[3]MD, Professor and Head, Department of Pediatrics, MVJ Medical College and Research Hospital, Bangalore-560029

[4]Pharm.D, Associate Professor, Department of Pharmacy Practice, Krupanidhi College of Pharmacy, Bangalore-560035

Received 15 March 2017; Accepted 02 July 2017

ABSTRACT

Beta-lactam antibiotics are the most widely used antibiotics used in the pediatric population; irrational prescribing of beta-lactam in the treatment process and its resistance in the pediatric population is the main concern of healthcare community. **Objective**: To assess the prescribing pattern of β- lactam antibiotic prescribed for treating a pediatric patient suffering from a commonly occurring infection. **Methodology:** The observational prospective study was conducted in 150 pediatric patients prescribed with beta-lactam antibiotics at MVJ medical hospital and research center for the period of six months (November2015–april2016). All required patient data are collected in specially designed case report form approved by pharmacy practice department; the data were analyzed using descriptive analysis. **Result:** 150 pediatric patients were assessed. The average number of drug per encounter was 4.51. The average number of beta-lactam per prescription was 1.02. Male account for 50.67%and female for 49.33% of the total case. LRTI 36.66%,enteric fever 18%,AGE 10.66% ,UTI 6.66%,meningitis 4%, tonsillitis 4%, diarrhea 2% were the most prevalent disease among pediatric and other constitute 18%. Cephalosporin group of antibiotic were most frequently prescribedi.e 77.14%, penicillin 22.86%, of which ceftriaxone 60.13%, cefotaxime 13.73%, cefpodoxime 3.26%, amoxicillin-clavulanic acid combination was 21.56%.Most beta-lactams were administered parenterally 88.89% and oral 11.11%.and 68% antibiotics were prescribed in generic name. **Conclusion:** Beta-lactam prescribing in pediatric patient is relatively high in rural part of Bangalore. Especially use of broad spectrum cephalosporin antibiotic result in bacterial resistance thus there is need for improving the prescribing pattern of antibiotic; thus development of guidelines for antibiotic prescription and use of an antibiotic for the appropriate disease can result in minimizing the adverse drug reaction with bacterial resistance in the pediatric patient.

Keywords: Beta-lactam, pediatrics Guidelines, Resistance

Introduction

Beta-lactam antibiotics are commonly prescribed antibiotics, similarly based upon a shared structural feature, the beta-lactam ring. Beta-lactam antibiotics include Penicillin's, Cephalosporin, Monobactam, Carbapenems. Antibiotics are among the most commonly prescribed drugs in pediatrics. Infants and children are the most vulnerable population groups to various infection. The use of antibiotics has become a routine practice for the treatment of pediatric illnesses [1].

The objective of our study is:

- To assess the prescribing pattern of β- lactam antibiotic prescribed for treating a pediatric patient suffering from a commonly occurring infection.
- To assess the regimen and drug-related problems of β- lactam antibiotics prescribed for the pediatric population.

*Corresponding author: Deepak Bhatt | E-mail: dipakbhatt2121@gmail.com

- To assess the cost of β- lactam medication prescribed for a pediatric population suffering from a commonly occurring infection.
- To assess the β- lactam antibiotics prescribed for pediatrics population before and after culture sensitivity test.

The introduction of β-lactam antibiotics into the healthcare system in the latter stages of 1940's represents one of the most significant contributions to medical science in recent history. Today, β-lactams remain the most widely utilized antibiotics owing to their comparatively high effectiveness, low cost, ease of delivery and minimal side effects.[2]Beta lactam antibiotics are the amongst the most common antibiotics prescribed for children [3]. Recent years, however have seen an uncontrolled rise in antimicrobial-resistant infections, result in increased morbidity, mortality, and healthcare costs.[4]Rational prescribing practices serve to combat this global public health challenge by preventing antibiotic overuse and misuse.[5] There is a high potential for overuse of β- lactam antibiotics and can be purchased without a prescription and there is a lack of public awareness in antimicrobial resistance. Without a national surveillance network to monitor antimicrobial resistance, little is known about the state of antimicrobial resistance [6].The WHO has developed prescribing indicators to detect barriers to good antimicrobial stewardship. These indicators measure the performance of health care providers in prescribing drugs suitably in primary health-care facilities and are usually used the standard in drug utilization studies.[7]Antibiotics are the most widely prescribed therapeutic agents in children. This is particularly true for children under five year-old population reported to receive the greatest exposure with a prevalence of up to 50%. It is well established that the majority of antibacterial drugs prescribed to children are for the treatment of commonly occurring conditions (cold, upper respiratory tract infections, bronchitis) that do not typically benefit from antibiotic therapy. It has been projected that approximately 50% of antibiotic prescriptions for children given by general practitioners (GPs) are unnecessary. Antibiotic resistance has become key global public health problem by outspreading the suffering of patients, increasing healthcare costs and being associated with financial implications for society [8].Respiratory infections are very common diseases, particularly in childhood which need the treatment with the antibiotics in India [9]. Rational use of antibiotics means that correct antibiotic should be prescribed for the right patient in an adequate dose for the adequate duration as suitable to the clinical needs of the patient at the lowest cost. There is a need in some cases to carry out a sensitivity test before prescribing antibiotics, particularly in children as their organs are not completely developed and they can easily suffer from toxic and adverse effects of drugs[10]. Proper utilization of β-lactam antibiotics is essential in the pediatric patients because of its adverse effects which are very usually observed nowadays like, bone marrow depression, JarischHerxheimer reaction, granulocytopenia, hepatitis, suprainfection, hypersensitivity reactions, nephrotoxicity, diarrhea, low WBC Count, bleeding, Disulfiram- like reaction [11]. The prescription pattern is an important operation between the physician and the patient. It brings into focus the diagnostic and therapeutic expertise of the physician with training for symptomatic treatment of the patient's health. Prescription of drugs is an important ability which needs to be continuously assessed and developed accordingly [12].Cost is a vital issue, since, in developing countries like India, compliance is mainly reliant on the cost of treatment. Therefore determination of prescribing pattern and cost analysis is required to understand the usage pattern of β- lactam antibiotics including educating the same patients about the impact of regular use of medications and lifestyle modifications.

METHODOLOGY:

Study Design and Human Ethical Clearance:

A prospective, observational study was conducted for duration of 6 months from October 2015 to March 2016 in accordance with the ethical principles of the declaration of Helsinki and principles of current Good Clinical Practice (GCP). The study protocol was approved by the Institutional Ethical Committee (IEC) with ethical clearance number: Central Research/MVJ MC & RH/04/2016

Inclusion Criteria:

- In-Patients who were treated with β-lactam antibiotics in pediatric department.
- Patients admitted to NICU (neonatal intensive care unit) and PICU (pediatric intensive care unit) and treated with β-lactam antibiotics
- In-patients of either sex aged below 12 years.

Exclusion Criteria:

- Immunosuppressed Paediatric in-patients
- Patients treated with β-lactam antibiotics on out- patient basis.
- Paediatric In-patients who are unwilling to participate in the study.

Method:

All the patients who met the inclusion criteria were enrolled in the study after taking parental Informed Consent (IC) before commencing the study. The basic demographics, medication-related details and laboratory investigation values were collected by the researchers personally using the Case Report Form (CRF). This information was collected from the patient's case sheets. The medications prescribed for pediatric in-patient is compared with indicator. The regimen such as dose, frequency, strength, route of administration, as well as drug related problem such as drug –drug interaction, ADR,duplication of medication associated with β- lactam antibiotics are assessed and managed in paediatric patient.The management of drug-related problem is done with the help of standard drug references and physician. The change in drug regimen is documented during 7 days.

RESULT:

Demographic data:

Among 150pediatric patient, the ratio of male to female was found to be almost similar. The detailed demographic data is illustrated in Table no.1

Table 1: (N=150)

Gender	Patient	Percentage
Male	76	50.67
Female	74	49.33

Based on patient age group:

Most of the patient in this study are in the age group of 5-12 years, 0-1 years with44.67% and 36.67% respectively and least number of patient from age group 1-3 year as shown in table no .2

Table 2: (N=150)

Age	Patient	percent
0-1 year	55	36.67
1- 3year	21	14
3-5 year	7	4.66
5-12 year	67	44.67

Based on disease diagnosed:

Out of 150 cases collected, the highest number of the patient was having LRTI followed by enteric fever and acute gastroenteritis and least patient were having a tonsillitis and diarrhea. The detailed data is illustrated in Table 3.

Table 3: (N=150)

Disease	Patient	percent
LRTI	55	36.66
Enteric fever	27	18
AGE	16	10.66
UTI	10	6.66
Meningitis	6	4
Tonsillitis	6	4
Diarrhea	3	2
Others(fracture, nephritic syndrome, organomegaly, diarrhea, DM, attend axial dislocation)	27	18

Based on the route of administration:

Most of the beta-lactam antibiotic given in pediatric patients were through parental route and least by the oral route. Maximum drugs are given by intravenous route to attain rapid onset of action with maximum bioavailability.Also for infant group, maximum drugs are available in intravenous form.

Table 4: (N=153)

ROA	percent
Parental (IV route)	88.89%
Oral route	11.11%

A number of the patient based on beta-lactam class prescribed:

Highest number of beta-lactam prescribed in 150 cases is ceftriaxone followed by Amoxicillin+ clavulanic acid, cefotaxime, cefpodoxime and least prescribed beta-lactam was amoxicillinand.Total number of beta-lactam prescribed were 153 in 150 patients as there was prescription of amoxicillin+ clavulanic acid substituted by ceftriaxone in 3 cases

Table 5: (N=150)

Beta lactam	Ceftriaxone	Cefotaxime	Cefpodoxime	Amoxicillin	Amoxicillin+ clavulanic acid
Percent	60.13%	13.73	3.26	1.30	21.56

Total number drug prescribed:

Among 150 patients the total number of β-lactam prescribed is 153 drugs along with a total number of 677 drugs in 150 prescriptions and the average number of beta-lactam per prescription in our study was 1.02. An average number of drugs per prescription was found to be 4.51 drugs.

A number of drugs prescribed by generic name:

Among 153 beta-lactam prescribed total drug prescribed by generic name was almost double the drug prescribed by brand name as shown in table no 6.

Table No: 6(N=150)

Prescribed name	Generic name	Brand name
Beta lactam	102	51

Cost analysis of drugs:

The total cost of 150 prescriptions was found INR.126348.15 for 677 drugs and total beta-lactam cost of 150 prescriptions was INR 63480.35 for 153 drugs. Average per prescription cost was INR.842.32 and average per prescription beta-lactam beta cost was INR. 423.20 .The beta-lactam cost was 50.24% of total prescription cost and ceftriaxone was highly paid beta-lactam antibiotic as compared to other as shown in table no.7 and figure no. 1

Table 7: (N=126348.15)

Drug	cost (INR)	Percent
Ceftriaxone inj	36801.30	58%
Cefotaxime inj	2646.40	4.15%
Cefexime oral	104	0.16%
Cefpodoxime oral	625	0.98%
Amoxicillin+clavulanic acid oral	1957.05	3.08%
Amoxicillin+clavulanic acid injection	21284.4	33.52%
Amoxicillin oral	62.20	0.01%

Utilization review and cost comparison:

Below graph shows the beta-lactam utilized in pediatric patient against the cost used:

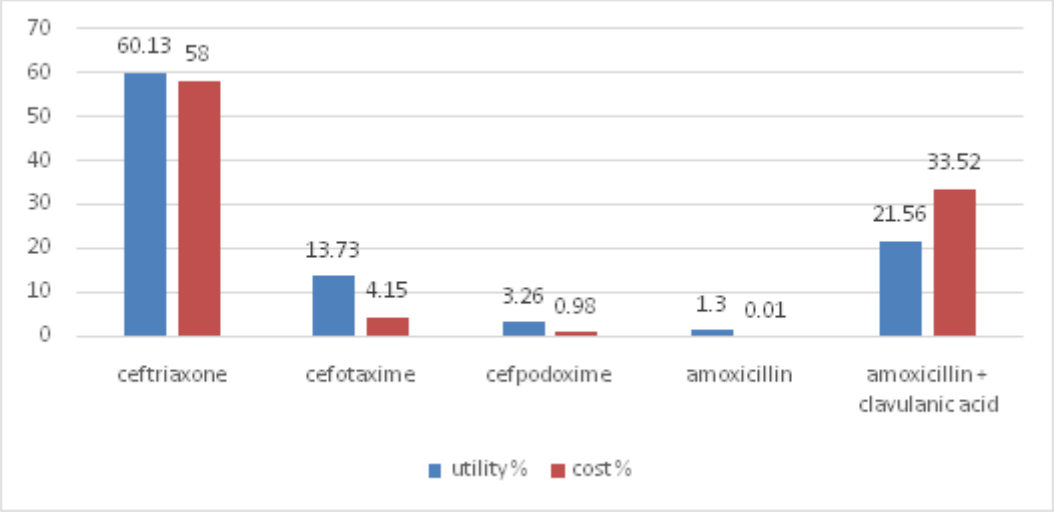

Figure 1:

Discussion:

A prospective observational study was conducted for a period of six months in the pediatric department of tertiary care hospital.

In our study, out of 150 patients were reviewed, the numbers of male patients were prescribed with β-lactam antibiotics was higher 50.67% (76) than female subjects 49.33% (74). This was due to the fact that more males were admitted than females for the treatment of various disease conditions. This result was similar to the study conducted by Omole 2012 in southwest Nigeria and palikhe N 2004.

Out of 150 patient admitted in pediatric ward most patients were in the age group of 0-1 years (36.67%) and 5-12 years(44.67%). The age group with the lowest number of patient is 3-5 years(4.67%). This result was similar to the study conducted by K. Sattanathan, V. Sekar in July-sept 2015 in namakali India.

Most patients admitted to the pediatric ward was for LRTI(36.66%) followed by enteric fever(18%). other diseases which were found in remaining cases were acute gastric enteritis(AGE), meningitis, tonsillitis, with some cases of organomegaly, diarrhea, nephritic syndrome, diabetic Mellitus and others. Most cases of LRTI was found in the age group 0-1 years. This study was similar to the study conducted by LayaVahdati Rad in Bangalore Karnataka India 2015. Only fever is seen in most cases compared to this study as our study site was in the dengue-prone area and cases of dengue fever were wide.

Most of the drug given by intravenous route (88.89%) than oral route (11.11%).Which is similar to the study carried out by Vipul Prajapati and J.D. Bhatt showed that 86.81% antimicrobial agents were given by IV route. Route of administration was selected based on the severity of the disease. The parenteral route was preferred for quick onset of action.

It was seen that in most cases of patient ceftriaxone was given widely (60.13%) followed by amoxicillin + clavulanic acid combination (21.56%) and others drugs prescribed were cefotaxime, cefpodoxime, and amoxicillin. All the drugs from cephalosporins group prescribed belong to the 3rd generation of antibiotic. No drug was given from 1st generation and 2nd generation. This study was similar to study conducted by K. Sattanathan, V. Sekar in July-sept 2015 in Namakali India.

In the study, most of the beta-lactam were prescribed by generic name (66.66%) and by brand name (33.33%). Although according to our study, there were a fairly good percentage of prescriptions by generic names, this habit which

will again help in reducing the cost, as was also concluded by another study.

In 33 cases out of 150 combination drug was given which was amoxicillin + clavulanic acid. No other drug was given in combination therapy.

The interaction between beta-lactam antibiotics and other drugs were found between ceftriaxone and furosemide, cefotaxime + amikacin. This interaction was suggested to be managed with dosage adjustment and monitoring for an adverse reaction to the concomitant drug.

In our study, most patients received a single antibiotic in some cases with two antibiotics which on average is 1.02 and according to whom indicator antibiotic prescribed per prescription should be less than two which match in our study and it shows the rational use of an antibiotic.

Medication administration related factors were observed at the study site where it was observed that nurses were unable to administer the exact dosage of mainly intravenous dosage as ordered by a doctor on the medical sheet. it was also observed that in most of the cases culture sensitivity test was not done which is required to be done if the drug doesn't show improvement of condition or before substituting the drug.

Total cost for the 150 prescriptions was 126348.85 with average prescription cost 842.32 and total cost on beta-lactam antibiotic was 63480.35 with average beta-lactam per prescription 423.20. In the study, it was seen that most of the cost was spent on ceftriaxone, which was 58 % of total beta-lactam cost utilized and in combination drug amoxicillin + clavulanic acid which spent cost is 33.52%.

Limitations:

The major limitation of this study was the short period of study which was done only for six months and the difficulty in data collection, getting informs consent from parents. There was consistency on prescribing pattern as most prescription was from single physician.

Conclusion:

Beta-lactam resistance among the pediatric population is a matter of worldwide concern. Beta-lactam is among the most commonly prescribed antibiotics in hospitals. Beta-lactam prescription was studied over 6 months, the number of samples which were sent for culture and sensitivity testing was small which may also affect the validity of the conclusions drawn about beta-lactam resistance. Antibiotic prescribing in the pediatric patient is relatively high in rural part of Bangalore. Amoxicillin + clavulanic acid is given to almost 1/3 patient i.e. in 33 patient compared to ceftriaxone i.e. in 92 patient which spent cost more than half compared to cost used on ceftriaxone. The high rate of prescription of parental beta-lactam is a matter of concern. Decreasing the prescribing of parental antibiotics and an early switch to oral antibiotics will significantly reduce the expenditure incurred. An intravenous to oral antibiotic conversion program can be instituted. Guidelines for antibiotic use in the community and restricting the level of health care practitioners who can prescribe antibiotics are required.

ACKNOWLEDGEMENT

The authors are thankful to the principal of Krupanidhi College of Pharmacy and MVJ Medical College and Research Hospital for providing the necessary facilities for conduction of the study. The authors are also thankful to the staffs of pediatricDepartments MVJ hospital and research hospital for their valuable services.

CONFLICT OF INTEREST:

The authors declare no Conflict of Interest.

ABBREVIATION

LRTI: Lower respiratory tract infection
AGE: Acute Gastro Enteritis
UTI: Urinary Tract Infection
GP_s: General practitioners
WHO: World health organization
IEC: Institutional ethical committee
GCP: Good clinical practice
NICU: Neonatal intensive care unit
PICU: Pediatric intensive care unit
ICF: Inform consent form
CRF: Case report form
DM: Diabetic mellitus
IV: Intra venous

Reference:

1. Palikhe N. Prescribing pattern of antibiotics in paediatric hospital of Kathmandu valley.

Kathmandu University medical journal (KUMJ). 2003 Dec;2(1):6-12.

2. Omole MK, Michael A. A Study of Rational Prescriptions of Penicillin and Cephalosporin Antibiotics in a Secodary Health Care Facility in South West Nigeria. Global Journal of Medical Research. 2012;12(4).
3. Hersh AL, Shapiro DJ, Pavia AT, Shah SS. Antibiotic prescribing in ambulatory pediatrics in the United States. Pediatrics. 2011 Dec 1;128(6):1053-61.
4. Laxminarayan R, Duse A, Wattal C, Zaidi AK, Wertheim HF, Sumpradit N, Vlieghe E, Hara GL, Gould IM, Goossens H, Greko C. Antibiotic resistance—the need for global solutions. The Lancet infectious diseases. 2013 Dec 31;13(12):1057-98.
5. World Health Organization. The World medicines situation 2011: rational use of medicines. Geneva:WHO;2011,http://www.who.int/medicines/areas/:policy/world_medicines_situation/WMS_ch14_wRational.pdf
6. Strategy C. WHO Country Cooperation Strategy for the South Pacific.
7. World Health Organization. Worldwide country situation analysis: response to antimicrobial resistance.
8. Rossignoli A, Clavenna A, Bonati M. Antibiotic prescription and prevalence rate in the outpatient paediatric population: analysis of surveys published during 2000–2005. European journal of clinical pharmacology. 2007 Dec 1;63(12):1099-106.7; 63: 1099-1106.
9. Kaur S, Gupta K, Bains HS, Kaushal S. Prescribing Pattern & Cost-Identification Analysis of Antimicrobial Use in Respiratory Tract Infections.
10. Tripathi KD. Beta-lactam antibiotics. In: Essentials of medical pharmacology,6th ed. Jaypee Brothers: New Delhi, 2008: 694-709
11. Wilke MS, Lovering AL, Strynodka NCJ. Betalactam antibiotic résistance. Current Opinion in Microbiology 2005; 8: 525-533.
12. Prajapati V, Bhatt JD. Study of prescribing patterns of antimicrobial agents in the paediatric wards at tertiary teaching care hospital, Gujarat. International journal of pharmaceutical sciences and research. 2012 Jul 1;3(7):2348.
13. Wald ER, Applegate KE, Bordley C, Darrow DH, Glode MP, Marcy SM, Nelson CE, Rosenfeld RM, Shaikh N, Smith MJ, Williams PV. Clinical practice guideline for the diagnosis and management of acute bacterial sinusitis in children aged 1 to 18 years. Pediatrics. 2013 Jul 1;132(1):e262-80..
14. Chow AW, Benninger MS, Brook I, Brozek JL, Goldstein EJ, Hicks LA, Pankey GA, Seleznick M, Volturo G, Wald ER, File TM. IDSA clinical practice guideline for acute bacterial rhinosinusitis in children and adults. Clinical Infectious Diseases. 2012 Mar 20:cir1043.
15. Lieberthal AS, Carroll AE, CLieberthal AS, Carroll AE, Chonmaitree T, et al. The diagnosis and management of acute otitis media. Pediatrics. 2013;131(3):e964-99.honmaitree T, et al. The diagnosis and management of acute otitis media. Pediatrics. 2013;131(3):e964-99.
16. Hersh AL, Jackson MA, Hicks LA, Committee on Infectious Diseases. Principles of judicious antibiotic prescribing for upper respiratory tract infections in pediatrics. Pediatrics. 2013 Dec 1;132(6):1146-54..
17. Coker TR, Chan LS, Newberry SJ, Limbos MA, Suttorp MJ, Shekelle PG, Takata GS. Diagnosis, microbial epidemiology, and antibiotic treatment of acute otitis media in children: a systematic review. Jama. 2010 Nov 17;304(19):2161-9.
18. Howard NJ, Laing RO. Changes in the World Health Organisation essential drug list. The Lancet. 1991 Sep 21;338(8769):743-5.
19. Taylor D, Paton C, Kerwin R, editors. The Maudsley 2005-2006 prescribing guidelines. CRC Press; 2005 May 12.
20. Food and Drug Administration. Guidance for Industry: General considerations for pediatric pharmacokinetic studies for drugs and biological products. November 30, 1998.
21. Nataraj GR. PRESCRIBING PATTERN OF β-LACTAM ANTIBIOTICS IN PAEDIATRIC PATIENTS IN A TERITARY CARE HOSPITAL.
22. Moinuddin K, MA Altaf, Githa k. Study of prescribing pattern of antibiotics in pediatric patient with pneumonia,journal of applied pharmacy,2014; volume 4 ,issue 3
23. Alakhali KM, Mohammad AA. Prescribing Pattern of Antibiotics in Pediatric Patients in the Jazan Region, Kingdom of Saudi Arabia. Age (mean±SD). 2014;3:3-62.

24. Shivaleela, Jagadeesh K. Prescription Pattern of Antibiotics in Pediatric In-Patients,IOSR Journal of Dental and Medical Sciences,2014;Volume 13, Issue 12 Ver. IV , PP 67-71

25. Choudhury DK, Bezbaruah BK. Antibiotic prescriptions pattern in paediatric in-patient department Gauhati medical college and hospital, Guwahati. Journal of Applied pharmaceutical science. 2013 Aug 1;3(8):144.26.Reddy NS, Kejiya G , P.Lakshmi, Manohar,B, Ranganayakulu ,D. Evaluation of cephalosporin use among pediatric in patent, International Journal of Institutional Pharmacy and Life Sciences 2015; (ISSN): 2249-6807:01-03-2015

26. Naik HG, Khanwelkar CC, Kolur A, Desai R, Gidamudi S. Drug utilization study on antibiotics use in lower respiratory tract infection. National J Med Res. 2013;3(4):324-7.

27. PottegardA,Broe A, Aabenhus,Bierrum L. Use of antibiotic in children,2015 Feb;34(2):e16-doi:10.1097/INF.0000000000000519

28. SenokAc,ismaeel AY,AL- QasharFA, AgabWA. Pattern of upper respiratory tract infection : physician and antibiotics prescribing practices,2009;18(3):170-4

29. Yaffe SJ, Aranda JV. Pediatric pharmacology: therapeutic principles in practice. WB Saunders Company; 1992