RESEARCH ARTICLE

A STUDY ON PRESCRIBING PATTERN OF ANTIBIOTICS IN RESPIRATORY TRACT INFECTIONS IN A TERTIARY CARE CENTER

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ABSTRACT

Introduction and objectives: Inappropriate use of antibiotics specifically, the broad spectrum antibiotics in respiratory tract infections results in resistance to antibiotics. The common use of antibiotics is the prime reason for the spread of drug resistant bacterial strains which not only results in costly treatment, but also high rate of morbidity and mortality. Hence, the present study was aimed at evaluating the prescribing pattern of antibiotics, disease conditions for which they were prescribed in the departments of Respiratory medicine, General medicine and ENT department.

Methodology: A prospective observational study was carried out involving in-patients of respiratory medicine, general medicine, and ENT departments of a 750 bedded tertiary teaching hospital for six months (November -2013 to May- 2014). The data of sixty seven patients were collected for the study in predefined forms from the medical case records and drug charts. The enrolled patients were observed from admission till discharge. Descriptive statistics were applied to the collected data and analyzed using Microsoft Excel software. Institutional Research and Ethics committee clearance were obtained prior to the study.

Results: The mean age of the study population was 56.2years and the mean duration of the hospitalization among the study population was 6.9 ($\pm$) days. LRTI was found to be the common diagnosis in the study population and the most commonly prescribed antibiotic was cephalosporin.

Conclusions: From this study, it is concluded that cautious and judicious use of antibiotics enables better patient management limiting the resultant morbidity and mortality arising from respiratory tract infections.

INTRODUCTION

Respiratory tract infection (RTI) is considered as one of the commonest public health problem dealt with in primary care. RTI is recognized as the leading cause of morbidity and mortality in many developing countries.RTI is defined as any infectious disease of the upper or lower respiratory tract. Upper respiratory tract infection (URTI) is the most common infectious disease which includes the common cold, laryngitis, pharyngitis/tonsillitis, acute rhinitis, acute rhino-sinusitis and acute otitis media. Lower respiratory tract infections (LRTIs) include tracheitis, acute bronchitis, bronchiolitisand pneumonia(Malladi *et al*., 2012).

The prescribing pattern deals with monitoring, evaluating and suggesting modifications in the prescribing pattern, so as to make patient care safe, effective and cost effective(Remesh *et al*., 2013).Irrational prescribing pattern has been widely reported from both developed as well as developing countries(Kumar *et al*., 2010). It is documented in literature that approximately 5% of hospitalized patients who were given

antibiotics experienced some adverse reactions to the drugs of which 20% required treatment(Akter *et al*., 2012).

Inappropriate use of antibiotics is a great public health concern because of its increased chances of development of antibiotic resistance in a community(Gjelstad *et al*., 2009). The threat caused by injudicious use of antibiotics can be optimized by implementing appropriate use of antibiotics(Kumar *et al*., 2010).

Aims And Objectives

- To evaluate the prescribing pattern of antibiotics in the management of respiratory tract infection and to promote the rational use of antibiotics.

METHODOLOGY

Study design and duration: The study was designed to be a prospective, observational, evaluating the prescribing pattern and medication errors concerned with the use of antibiotics in

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the management of respiratory tract infections, during a period of December-2013 to May-2014.

Inclusion criteria: All inpatients with the diagnosis of respiratory tract infection.

Exclusion criteria

- Patients who refuse to take medication.
- Patients who were not willing to participate in the study.
- Patients with tuberculosis and other infections

Study Site: The study was conducted in the department of Respiratory Medicine, General Medicine and ENT in a tertiary care teaching hospital.

Informed consent: Written informed consent was obtained from the patients.

Source of data: Case sheets of inpatients of Respiratory Medicine, general medicine department and ENT department (including patient prescription and administration details). Medication charts and laboratory reports were also reviewed to collect relevant data.

Study procedure: The prescriptions were chosen based on the inclusion criteria and details of the patient were followed till discharge. During the study, the inpatient case records were reviewed which included patient demographics, specific issue related to antimicrobials use such as names of antimicrobials, their dosage schedule, route of administration, date of discontinuation, generic name and bacteriological investigation. The information collected was documented in the patient profile form. The presumed diagnosis and the antibiotics prescribed along with duration, dosage and dosage schedule were analysed using Micromedex 2.0 and CIMS. The drug interactions were assessed using Micromedex 2.0, Medscape and www.drugs.com.

RESULTS

Gender Distribution

In the current study, a total of 67 prescriptions were included as per inclusion and exclusion criteria, out of which 35(52.20%) were males and 32(47.70%) were females **(Fig 1)**.
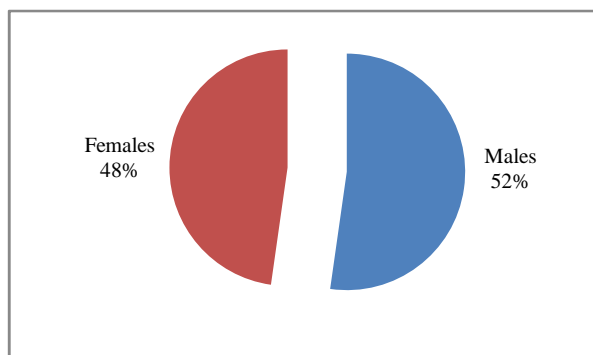

Figure 1 Gender distribution of the study population

Age Categorization

Age categorization of the study population was done. There were 3(4.4%) patients between the age group 11-20, 4(5.9%) patients between the age group 21-30, 5(7.4%) patients between the age group 31-40, 9(13.4%) patients between the age group 41-50, 18(26.8%) patients between the age group 51-60, 13(19.4%) patients between the age group 61-70, 12(17.9%) patients between the age group 71-80 and 3(4.4%) patients between the age group 81-90. Maximum number of patients, 18(26.8%) were found between 51-60 and minimum number of patients, 3(4.4%) between the age groups 11-20 and 81-90. The maximum age of the study population was 90 and minimum age of the patient was 19. The mean age of the study population was found to be 56.2 years.

Classification Of Respiratory Tract Infections

Upper Respiratory Tract Infections: Out of 67 prescriptions, 9 of the cases were of URTI. The diagnosis was as follows: 5(7.4%) patients with URTI (unspecified), 3(4.4%) with tonsillitis, and 1(1.4%) with chronic suppurative otitis media (CSOM).

Lower Respiratory Tract Infections (Lrti): Out of 67 patients, 27(46.55%) were acute bronchitis in which 15 cases were with comorbidities, 16(27.58%) were pneumonia in which 12 cases were with comorbidities, 12(20.68%) were bronchopneumonia in which 10 cases were with comorbidities, 2(3.44%) patients had COPD with secondary infection in which both the cases were with comorbidities and 1(1.72%) was chronic bronchitis **(Table 1).**

Table 1 Distribution of patients with LRTI

Diagnosis	Number of patients (n=58)	Percentage (%)
Acute bronchitis	27	46.55
Pneumonia	16	27.58
Bronchopneumonia	12	20.68
COPD with secondary infection	2	3.44
Chronic bronchitisonia	1	1.72

Prescribing pattern of antibiotics in respiratory tract infections

URTI

Out of 8 antibiotics prescribed in URTI, 3(37.5%) were Ceftriaxone, 2(25%) were Azithromycin, 1(12.5%) Levofloxacin, 1(12.5%) Piperacillin/Tazobactam and 1(12.5%) Amikacin each. The most commonly prescribed antibiotic in URTI was Ceftriaxone **(Table 2).**

Table 2 Prescribing pattern of antibiotics in URTI

Antibiotics prescribed	Number of antibiotics (n=8)	Percentage (%)
Ceftriaxone	3	37.5
Azithromycin	2	25
Levofloxacin	1	12.5
Piperacillin/tazobactam	1	12.5
Amikacin	1	12.5

CSOM

A total of 2 antibiotics were prescribed in CSOM, which includes Ceftriaxone and Ofloxacin.

LRTI

Out of 50 antibiotics prescribed in LRTI, 17(34%) were Ceftriaxone, 10(20%) were Azithromycin and Levofloxacin, 5(10%) were Piperacillin/Tazobactam, 2(4%) were Cefotaxim and Clarithromycin, 1(2%) each of Amoxicillin,Cefaperazone, meropenem and faropenem. The most commonly prescribed antibiotic in LRTI was found to be Ceftriaxone (**Table 3**).

Table 3 Prescribing pattern of antibiotics in LRTI

Antibiotics	Number of antibiotic(n=50)	Percentage (%)
Ceftriaxone	17	34
Azithromycin	10	20
Levofloxacin	10	20
Piperacillin/tazobactam	5	10
Cefotaxim	2	4
Clarithromycin	2	4
Amoxicillin	1	2
Cefaperazone	1	2
Meropenem	1	2
Faropenem	1	2

Bronchopneumonia

Out of 21 antibiotics prescribed in bronchopneumonia, 4(19.04%) were Ceftriaxone, Piperacillin/Tazobactam, and Meropenem, 3(14.28%) were Azithromycin, 2(9.52%) were Clarithromycin, Levofloxacin and, 1(4.76%) was Cefaperazone and Amoxicillin. The most commonly prescribed antibiotic for bronchopneumonia was found to be ceftriaxone and Piperacillin/Tazobactam(**Table 4**).

Table 4 Prescribing pattern of antibiotics in bronchopneumonia

Antibiotics prescribed	Number of antibiotics (n=21)	Percentage (%)
Ceftriaxone	4	19.04
Piperacillin/tazobactam	4	19.04
Meropenem	4	19.04
Azithromycin	3	14.28
Clarithromycin	2	9.52
Levofloxacin	2	9.52
Cefoperazone	1	4.76
Amoxicillin	1	4.76

Table 5 Prescribing pattern of antibiotics in acute bronchitis

Antibiotics prescribed	Number of antibiotics (n=31)	Percentage (%)
Ceftriaxone	9	29.03
Azithromycin	8	25.80
Levofloxacin	4	12.9
Piperacillin/tazobactam	4	12.9
Cefotaxim	2	6.45
Amoxicillin/clavunoic acid	2	6.45
Cefoperazone	1	3.22
Amikacin	1	3.22

Acute Bronchitis

Out of 31 antibiotics prescribed in acute bronchitis, 9(29.03%) were Ceftriaxone, 8(25.80%) were Azithromycin, 4(12.9%) were Levofloxacin and Piperacillin/Tazobactam, 2(6.45%) wereCefotaxim and Amoxicillin, 1(3.22%)each of Cefoperazone and Amikacin. The most commonly prescribed antibiotic for acute bronchitis was Ceftriaxone (**Table 5**).

Chronic Bronchitis

Chronic bronchitis case was treated with Piperacillin/Tazobactam and Clarithromycin.

Pneumonia

Out of 39 antibiotics prescribed in pneumonia, 9(23.07%) were Ceftriaxone, 7(17.94%) were Piperacillin/tazobactam, 6(15.38%) were Azithromycin, 4(10.25%) were Levofloxacin, 3(7.69%) were Clarithromycin, 2(5.12%) were Cefixime, Meropenem and Faropenem, 1(2.56%) each ofCefaperazone, Doxycycline, Cefpodoxime and Amoxicillin. The most commonly prescribed antibiotic was Ceftriaxone (**Table 6**).

Table 6 Prescribing pattern of antibiotics in Pneumonia

Antibiotics prescribed	Number of antibiotics (n=39)	Percentage (%)
Ceftriaxone	9	23.07
Piperacillin/tazobactam	7	17.94
Azithromycin	6	15.38
Levofloxacin	4	10.25
Clarithromycin	3	7.69
Cefixime	2	5.12
Meropenem	2	5.12
Faropenem	2	5.12
Cefaperazone	1	2.56
Amoxicillin	1	2.56
Doxycycline	1	2.56
Cefpodoxime	1	2.56

Copd With Secondary Infection

Out of 4 antibiotics prescribed in COPD with secondary infection, 2were Ceftriaxone and 1 each of Azithromycin and Piperacillin/Tazobactam.

Prescribing Pattern Analysis

Almost all the patients were prescribed with antibiotics. It was found that Cephalosporins 56(35.66%), Macrolides 38(24.20%), -lactams 28(17.83%), Fluoroquinolones 22(14.01%), Monobactams 10(6.36%), Aminoglycosides 2(1.27%), Tetracyclines 1(0.63%) were the various antibiotics prescribed for respiratory tract infections.
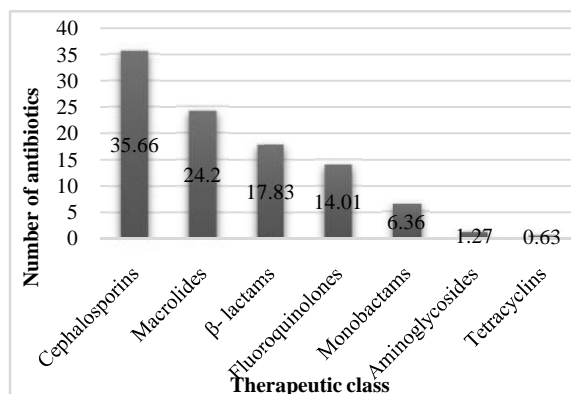

Figure 2 Prescribing pattern of antibiotics based on therapeutic class

Cephalosporins were the highest prescribed class of antibiotics and Tetracycline was the least prescribed class of antibiotics in the study population (**Fig 2**).

Number Of Antibiotic Per Prescription

The number of antibiotic prescribed for the study population was calculated and categorized. The categorization was based on monotherapy, dual therapy and triple therapy. One antibiotic was prescribed to 21 (31.3%) patients, two antibiotics for 34 (50.7%) patients, three antibiotics for 9 (13.4%) patients, four antibioticsfor 1 (1.49%) patient and no antibiotic was prescribed for 1 (1.49%) patient (**Fig 3**).
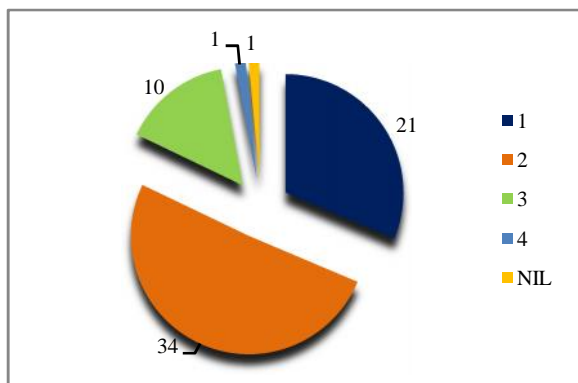

Figure 3 Number of antibiotics per prescription

Table 7 Monotherapy of antibiotics

Monotherapy	Number of prescriptions (n=21)	Percentage (%)
Cephalosporins	9	42.8
-lactams	6	28.5
Fluroquinolones	3	14.2
Macrolides	2	9.5
Aminoglycosides	1	4.7

Table 8 Two drug combination therapy of antibiotics

Dual therapy	Number of prescriptions (n= 34)	Percentage (%)
Cephalosporin+Macrolide	13	38.23
Cephalosporin+Fluroquinolone	9	26.47
-Lactam + Macrolide	5	14.7
Fluroquinolones+ -Lactam	2	5.88
-Lactam + Monobactam	2	5.88
-Lactam +Cephalosporin	1	2.94
-Lactam + -Lactam	1	2.94
Monobactam+Macrolide	1	2.94

Table 9 Three drug combination therapy of antibiotics

Triple combination therapy	Number of prescriptions (n= 10)	Percentage (%)
Cephalosporin+Macrolide+ -Lactam	2	20
Cephalosporin+fluroquinolone+ -Lactam	2	20
Cephalosporin+Aminoglycoside+Macrolide	1	10
Cephalosporin+Macrolide+Fluroquunilones	1	10
-Lactam +Macrolide+monobactam	1	10
Cephalosporin+Tetracycline+Macrolide	1	10
Cephalosporin+fluroquinolone+fusicidic acid	1	10
Cephalosporin+Macrolide+Monobactam(2)	1	10

Prescribing Pattern Of Cephalosporins

Among 157 antibiotics prescribed, 56(34.66 %) patients received cephalosporins. The various cephalosporins used in the study population was found out and analyzed. Ceftriaxone was prescribed for 45 patients (80.35%), cefotaxim and cefaperazone for 4 patients (7.14%),cefixime for 2 patients (3.57%) and cefpodoxime for 1 patient (1.78%)(**Fig 4**)
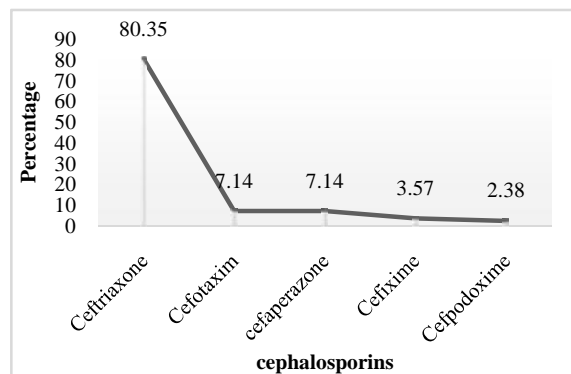

Figure 4 Prescribing pattern of Cephalosporins

Prescribing Pattern Of Macrolides

Macrolides were prescribed to 38(24.20 %) patients. There were only 2 macrolides used in the study population Azithromycin was found to be prescribed for 30 patients (78.94%) and clarithromycin for 8 patients (21.05%).

Table 10 Four drug combination therapy of antibiotics

Four drug combination therapy	Number of prescriptions (n= 1)
Macrolide+Cephalosporin(2)+Aminoglycoside+ -Lactam	1

Prescribing Pattern Of Fluoroquinolones

Fluoroquinolones were prescribed to 22(14.01%) patients. There were only 2 fluoroquinolones used in the study population. Levofloxacin was found to be prescribed for 21 patients (95.45%) and ofloxacin for 1 patient (4.54%).

Prescribing Pattern of - lactams

- Lactams were prescribed to 28 patients (17.83%). There were only 2 - lactams used in the study population which were found and analyzed. Piperacillin was found to be prescribed for 23 patients (82.14%) and amoxicillin for 5 patients (17.85%).

Prescribing Pattern of Monobactams

Monobactams were prescribed to 10 patients (6.36%) in the study population. Meropenemwas found to be prescribed for 7 patients (70%)and faropenem for 3 patients (30%).

Prescribing Pattern of Aminoglycosides

Aminoglycoside group Inj. Amikacin was prescribed to 2 patients in the study population.

Prescribing Pattern of Tetracyclines

Doxycycline was prescribed to 1 patient in the study population.

DISCUSSION

Prescribing patterns for antibiotics for RTIs vary widely among general practices. There is currently no national clinical guideline relating to antibiotic prescribing for RTIs. Hence, management of RTIs has been a challenge to the physician, mostly due to emergence of multi drug resistance(Ramana *et al.*, 2013). The emerging problem of antibiotic resistance has become a major threat to the medical field. Excessive and inappropriate use of antibiotics has been a major contributor to this ever-growing problem (Nandimath *et al.*, 2012). The present study indicates the general trends of use of antibiotics in RTIs in respiratory medicine, general medicine and ENT departments.

A study of prescribing pattern of antibiotics is an effective way of reflecting appropriateness of antibiotic use. In addition, it can also help in reduction in the cost of therapy, minimizing practice of polypharmacy and improving rational use of antibiotics (Malladi *et al.*, 2012).Prescribing indicators has been developed by World Health Organization (WHO) in a collaborative work with International Network for rational use of drugs. Prescribing indicators is defined as the indicators used to measure the performance of health care providers in several key dimensions related to appropriate use of drugs. It is being used to detect various problems in prescribing practices such as polypharmacy, inclination for branded products, overuse of antibiotics or injections and prescribing out of formulary or essential drug list(Kumar *et al.*, 2010).

The issues related to antibiotic resistance can be solved by making the practitioners aware of the treatment for respiratory tract infection. There are many studies related to antibiotic use in hospitals The information regarding antibiotics use provide a constructive approach in solving problems arising from multiple antibiotic use(Remesh *et al.*, 2013).

The age distribution of patients showed that the age group of 51-60 constituted 26.8% of the study population. No much variation between males (52.20%) and females (47.70%) was noted in the study population. The mean age of the study population was 56.2 ± 17.7 years which was found to be similar to the study conducted by (Rosman *et al.*, 2007) in France and Netherlands where the mean age of study population was 50.5 ± 7.7 years, The mean average stay of hospitalization was found to be 6.9 ± 5.33 days.

A total of 13.43% of the study population was found to be diagnosed with URTI which were further categorized as: URTI (unspecified) (7.4%), tonsillitis (4.4%), CSOM (1.4%), respectively. In a study conducted by (Zoutman*et al.*, 2006) the most frequent diagnoses were common cold (36%), acute bronchitis (20%), pharyngitis (19%), acute otitis media (14%), acute sinusitis (13%), influenza (3%), laryngitis (2%) and croup (1%).

In the present study majority of the study population, i.e. 86.56% of the patients were diagnosed with LRTI which were further categorized as LRTI (unspecified) (41.79%), acute bronchitis (41.79%), pneumonia (23.88%), bronchopneumonia (17.9%), COPD with secondary infection (2.66%) and Chronic Bronchitis (1.33%).

A similar study carried out by (Naik *et al.*, 2013) found that LRTI (non-specific LRTI and acute bronchitis) accounted for 46.87% and pneumonia was found in 53.13% of total cases analysed.

Bacteriological analysis in RTIs helps in providing accurate antibiotic therapy to the patient in turn leading to better patient outcome and decreased emergence of drug resistance.

In the current study, out of total 67 patients that were enrolled only 7 (10.4%) patient's sputum samples showed positive bacteriological findings. The results of anti-microbial sensitivity pattern were available for 3 (4.47%) patients. The most common causative organism isolated from the sample was E.coli (4.47%). Other organisms found in the isolates were Staphylococcus aureus (1.49%) and Klebsiella pneumonia (1.49). Gram positive cocci were noted in 2 (2.98%) patients.

Antibiotics prescribed for uncomplicated respiratory tract infection in India is 69.4%.In Canada, overprescribing of antibiotics is also evident in children with URTI 74%,and in the United States is 46%, (Nandimath *et al.,* 2012).

In the present study patients suffering from URTI, 88.88% were prescribed with antibiotics. This 88.88%   value is more than that of the study values (67%) conducted by (Linder *et al.*, 2003).

 The most commonly prescribed antibiotics for URTI were cephalosporin (44.4%) and macrolides (22.2%). The studies conducted by (Maniar *et al.*, 2013).found that macrolides (32%) were the most prescribed class of antibiotics for URTI. Similar study conducted by (Cantrell *et al.*, 2002) found that the most prescribed antibiotics were macrolides (33%) and penicillin (30%). Another study conducted by (Mazzaglia *et al.*, 1998) showed the antibiotic prescribing as follows: macrolides (38.6%), cephalosporins (27.1%) and a combination of penicillins with -lactamase inhibitor (15.7%) and extended spectrum penicillins (13.5%).

In the current study all the study patients diagnosed with LRTI were prescribed with antibiotics. However, in a study conducted by (Malladi *et al.*, 2012) the antibiotic prescribing for LRTI was found to be 57%. The percentage of antibiotics prescribed for LRTI in a study conducted by (Naik *et al.*, 2013) was found to be 46.87%. In the present study the most commonly prescribed antibiotics for LRTI were cephalosporin (89.6%), macrolides (62.6%), penicillins (46.5%) and quinolones (34.4%). The study conducted by (Tobia *et al.*, 2008) found the following antibiotic class being commonly prescribed, macrolides (27%), penicillin (22%), quinolones (12%) and cephalosporin (1%).The study conducted by (Malladi *et al.*, 2012)found that cephalosporin's were the most commonly prescribed antibiotics for LRTI.The study conducted by (Naik *et al.*, 2013) found the antibiotic use for LRTI as follows: cephalosporin's (55.55%), macrolides (37.77%), penicillins (11.11%), quinolones (8.88%).

CONCLUSION

The most commonly diagnosed disease among respiratory tract infection in the in-patient department of Respiratory medicine, general medicine and ENT was found to be LRTI. The most commonly prescribed antibiotics for respiratory tract infections were cephalosporin, macrolides, penicillins and quinolones. Two drug combinations of antibiotics were more prescribed than monotherapy and triple therapy.

From this study, it is concluded that cautious and judicious use of antibiotics will reduce the burden of multi-drug resistance and thereby enabling better patient management and limiting the resultant morbidity and mortality arising from respiratory tract infections.

The incidence of medication error was found to be low and there were no life threatening events. Clinical pharmacists play a major role in early detection and prevention of medication errors and thus can improve the quality of care to the patients. Involvement of clinical pharmacist in prescription analysis and prescribing pattern studies can help provide feedback to the physicians on the current prescribing practices. This can further contribute in reducing the incidence of emergence of drug resistance and promote rational prescribing of antibiotics.

Abbreviations

RTI – Respiratory tract infections, URTI – Upper respiratory tract infections, LRTI – Lower respiratory tract infections, COPD – Chronic obstructive pulmonary disease, CSOM - Chronic suppurative otitis media.

Acknowledgment

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