

## Study Of Prescribing Patterns Of Antimicrobial Agents In The Medicine Department At Tertiary Teaching Care Hospital In Gujarat

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**Abstracts:** Background: Prescription of drugs which needs to be continuously assessed and refined accordingly. It is not only reflects the physician's knowledge of pharmacology and pathophysiology of diseases but also his/her skill in diagnose and attitude towards selecting the most appropriate cost effective treatment. Antimicrobials are among the most commonly prescribed drugs in hospital. As per literature, they account for nearly 20% of all new and repeat prescription each year. Hospital purchase of these drugs is thought to be about 25 to 30 % of the total annual drug budget. Such studies have been sparse from Gujarat and hence, this study was undertaken. Objective: This study was carried out to find out the prescribing patterns of antimicrobial drugs in the medicine department at tertiary teaching care hospital, Vadodara (Gujarat). Methods: Retrospective study was carried out by collecting 350 prescriptions containing antimicrobial agents of the indoor patients admitted (Oct 2005 to June 2006) in the wards of medicine department at Sir Sayajirao General (SSG) Hospital, Vadodara to assess the prescribing patterns of antimicrobial agents. All the information about drugs details were recorded in pre-tested proforma. Results: In our study, total 350 prescriptions containing 539 antimicrobial drugs were prescribed in-patients during study. Of them  $\beta$ -lactam (except CP) (159; 29.49%) and cephalosporin (156; 28.94%) groups were commonly prescribed. Average number of antimicrobials per prescription was 1.54. Out of 539 antimicrobial agents prescribed, 486 (90.16%) were prescribed by generic name, while only 53(9.53%) were prescribed by trade name. Total numbers of antimicrobial prescribed by parenteral route were 313(58.07%), while 226(41.93%) antimicrobial agents were prescribed by oral route. Conclusion: Results indicate that noticeable controlled over the prescribing habits of the physicians for indoor patients at our hospital. It is suggested that further detail analysis to judge the rationality of the therapy is necessary. [Prajapati V NJIRM 2012; 3(3) : 133-140]

**Key words:** Anti-microbial agents, internal medicine, prescription pattern, retrospective study.

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**Introduction:** Prescription order is an important transaction between the physician and the patient<sup>1</sup>. It is an order for a scientific medication for a person at a particular time<sup>2</sup>. It brings into focus the diagnostic acumen and therapeutic proficiency of the physician with instruction for palliation or restoration of the patients health<sup>1</sup>. It not only reflects the physician's knowledge of pharmacology and pathophysiology of diseases but also his / her skill in diagnosis and attitude towards selecting the most appropriate cost effective treatment<sup>1</sup>.

The study of prescribing patient is a component of medical audit which seeks monitoring, evaluation and necessary modifications in the prescribing practice of the prescribers to achieve the rationale and cost effective medical care. Antimicrobials are among the most commonly prescribed drugs on worldwide basis.

They account for nearly 20% of all new and repeat prescription each year. Hospital purchase of these drugs is thought to be about 25 to 30 % of the total annual drug budget<sup>2</sup> and each tertiary care hospital in the United States typically spends more than \$1 million every year on the purchase of antimicrobial drugs alone. Keeping this in mind, it is not surprising that an increasing number of new antimicrobial agents are being made available regularly.

With widespread use of antibiotics, the prevalence of resistance has increased<sup>3</sup>. The association of resistance with the use of antimicrobials agents has been documented both in patient<sup>4</sup> and outpatient setting<sup>5</sup>. Wide spread irrational usage of antimicrobial agents and their shortage of supply in the Government hospitals, low purchasing capacity of patients and incidence of antimicrobial resistance

complicates the outcome of the therapies<sup>6</sup>. Antimicrobial resistance among streptococcus pneumonia is rapidly increasing in several countries<sup>7</sup> and the single most important factor in the emergence of antimicrobial resistance among respiratory bacterial pathogens is selection pressure from antimicrobial agents<sup>8</sup>. It was found out in some studies, link between rates of antimicrobial agent's prescription and resistance in the communities<sup>9,10</sup>.

In general practice antimicrobial agents usage is highest among children and approximately 70% of all the antimicrobial agents prescribed in children are for URTI<sup>11</sup>. As in other developed countries the most frequent type of misuse is prescribing antimicrobial agents for infections, which are commonly caused by virus<sup>12</sup>. Moreover there seems to be a large variation between physicians in antimicrobial prescribing<sup>13</sup>.

In the view of the emerging worldwide threat of bacterial resistance, there are increasing need to identify determinants and patterns of antimicrobial prescribing to identify where the clinical practice can be improved<sup>14</sup>.

The present study was planned with the objectives (1) to study the antimicrobial agent's utilization patterns in the different diseases and (2) to study the existing prescribing practices of the antimicrobial agents by the physicians of the medicine department.

The data generated from this study would be helpful to communicate with the prescribers and suggest the various lacunae observed to improve the prescribing practice. The data will also be helpful in planning longitudinal studies on prescribing pattern and drug utilization patterns. Thus it will ultimately benefit the patients with fewer incidences of adverse effects with minimal rise in resistance strain of bacteria and reduction in the cost of therapy.

**Material and Methods:** This retrospective study was carried out by collecting prescriptions of the indoor patients of medicine wards at Sir Sayajirao General (SSG) Hospital, Vadodara to assess the prescribing patterns of antimicrobial agents. Total 350 prescriptions containing antimicrobial agents were collected from the hospital record section for the study. Prescriptions were collected irrespective of their indications. The data were noted in proforma finalized in our study.

**Inclusion criteria:** All the Patients of either sex with age >12 years and taken the groups of antimicrobial drugs like  $\beta$ -lactams(except CP), cephalosporins, aminoglycosides, macrolides, fluoroquinolones, tetracycline, sulfonamides and metronidazole were included in our study.

**Duration of study:** A retrospective study was carried out over 9 months of period from October 2005 to June 2006 in the medicine wards. Total numbers of the antimicrobial agents prescribed in each prescription were counted irrespective of number of the prescriptions.

Basic drug indicators were selected to analyze the prescribing patterns<sup>15</sup>. The prescriptions data were analyzed on the basis of the following parameters.

1. Total numbers of the antimicrobial agents prescribed.
2. Mean numbers of the antimicrobial agents per prescriptions.
3. Prescribing frequency of antimicrobial agents.
4. Numbers of antimicrobial agents prescribed by generic vs. trade name.
5. Numbers of antimicrobial agents administered orally or parenterally.
6. Numbers of prescription with one or more than one antimicrobial agents.

Data were also analyzed by using Microsoft excel sheet. Proportions of different antimicrobial agents were calculated from the total number of antimicrobial agents

prescribed. Further, proportions of the different antimicrobial agents prescribed for different systems were calculated.

**Results:** Total 350 prescriptions of the patients admitted in the wards of medicine department were studied during the period of October 2005 to June 2006. Total numbers of antimicrobial agents prescribed in the medicine wards were 539. Therefore, average number of antimicrobials per prescription in the medicine wards was 1.54. The results are summarized to study frequency of prescribing patterns of antimicrobial agents in different systems in accordance with diagnosis as well as prescribing frequency of antimicrobial agents by using table for the wards.

(A) Preference of antimicrobial agents:

From the group of metronidazole (69; 12.80%) prescribed, highest numbers were prescribed for respiratory tract infections (28.98%), while lowest were prescribed for genitourinary tract

During study period, the highest numbers of antimicrobial agents prescribed were from  $\beta$ -lactam groups (except CP) 159(29.49%) and cephalosporins 156(28.94%) while sulfonamides were the least (09; 1.67%) prescribed agents. Total included numbers of groups of antimicrobial agents, highest number of prescribed was from cephalosporins group of drugs 81(51.92%) for respiratory tract infections. Also among the total numbers from  $\beta$ -lactam group prescribed, ampicillin (67.29%) was prescribed for extensively, while piperacillin (0.63%) has very low preference in prescriptions (Table 2). Among the cephalosporins, cefotaxime (22.53%) was prescribed almost constitutively, while cefadroxyl (1.28%) was not prescribed frequently (Table 2).

infection (1.45%), for prophylactic purpose (1.45 %) and none for either cardiovascular or soft tissue infections (Table 1).

**Table 1: Frequency of prescribing patterns of antimicrobial agents in different systems in accordance with diagnosis in medicine wards**

Antimicrobial Agents prescribed	Total Prescribed No (%)	RS No(%)	CNS No(%)	CVS No(%)	GIT No(%)	GUT No(%)	HBT No(%)	MISC No(%)	PROPH No(%)	Soft tissue No (%)
$\beta$ -lactum (except CP)	159 (29.49)	60 (37.74)	15 (9.43)	07 (4.40)	4 (2.52)	07 (4.40)	34 (21.18)	23 (14.47)	04 (2.52)	5 (3.15)
Cephalosporins	156 (28.94)	81 (51.92)	14 (8.97)	07 (4.48)	12 (7.69)	07 (4.48)	34 (21.79)	23 (14.74)	04 (2.56)	05 (3.20)
Metronidazole	69 (12.80)	20 (28.98)	09 (13.04)	00 (0.0)	11 (15.94)	01 (1.45)	14 (20.29)	13 (18.84)	01 (1.45)	00 (0.0)
Fluoroquinolones	65 (12.05)	21 (32.30)	02 (3.07)	01 (1.54)	21 (32.30)	05 (7.69)	07 (10.76)	05 (7.69)	05 (4.61)	00 (0.0)
Tetracyclines	33 (6.12)	09 (27.27)	09 (6.06)	01 (3.03)	01 (3.03)	01 (3.03)	00 (0.0)	18 (54.55)	01 (3.03)	00 (0.0)
Aminoglycosides	25 (4.64)	14 (56)	5 (20)	1 (4)	00 (0.0)	00 (0.0)	02 (08)	02 (08)	01 (04)	00 (0.0)
Macrolides	23 (3.33)	21 (91.3)	00 (0.0)	01 (4.35)	00 (0.0)	00 (0.0)	01 (4.35)	00 (0.0)	00 (0.0)	00 (0.0)
Sulfonamides	09 (1.67)	05 (55.56)	00 (0.0)	00 (0.0)	01 (11.11)	01 (11.11)	00 (0.0)	01 (11.11)	00 (0.0)	01 (11.11)
Total	539 (100)	231 (42.85)	49 (9.09)	18 (3.33)	50 (9.27)	22 (4.08)	92 (17.06)	89 (16.51)	16 (1.8)	11 (2.04)

RS-Respiratory system; CNS-Central nervous system; CVS-Cardio vascular system; GIT-Gastro intestinal tract; HBT-Hepato biliary tract; GUT- Genitourinary tract; PROPH-Prophylaxis; MISC:-Miscellaneous including- Pyrexia of unknown origin, Malaria, Myasthenia gravis, Tetanus, Poisoning; CP- Cephalosporins.

From the total numbers of fluoroquinolones (65; 12.05%) prescribed, highest numbers were prescribed for respiratory tract (32.30%) and gastrointestinal tract infections (32.30%), while lowest were for cardiovascular diseases (1.54%) and none for soft tissue infections (Table1). However ciprofloxacin (63.07%) was prescribed extensively while gatifloxacin (4.62%), ofloxacin (4.62%) and norfloxacin (4.62%) have very low preference in the prescriptions (Table 2).

Among the total numbers of tetracycline groups 33(6.12%), highest numbers were prescribed for miscellaneous infections(54.55%), while the lowest(3.03%) were for cardiovascular diseases, gastrointestinal tract infections, genitourinary tract infections and prophylactic purposes .While none of them were for either

hepatobiliary tract diseases or soft tissue infections(Table1).From the tetracycline group only doxycycline(Table2) was prescribed.

However, aminoglycosides 25(4.64%), macrolides 23(3.33%) and sulfonamides 09(1.67%) have very low frequency of prescription. All the three antimicrobials were mainly prescribed for respiratory tract infection (Table1). However, among the total numbers of aminoglycosides, amikacin (60%) and gentamicin (40%) were prescribed(Table2).While from the macrolides group, azithromycin(78.26%) and erythromycin (21.74%) were prescribed and from sulfonamides group, only cotrimoxazole(1.67%) was prescribed (Table2).

**Table2: Prescribing frequency of antimicrobial agents in medicine wards**

Sr. No	Antimicrobial agents	No (%)	Sr. No	Antimicrobial agents	No (%)
1	β-lactum(Except CP)			Sparfloxacin	09(13.84)
	Ampicillin	107(67.29)		Levofloxacin	06(9.23)
	Amoxicillin	20(12.3)		Ofloxacin	03(4.62)
	Crystalline penicillin	16(10.06)		Gatifloxacin	03(4.62)
	Cloxacillin	08(5.03)		Norfloxacin	03(4.62)
	Coamoxy-clav	07(4.40)	5	Tetracycline	
	Piperacillin	01(0.63)		Doxycycline	33(6.12)
2	Cephalosporins		6	Aminoglycosides	
	Cefotaxime	130(22.53)		Amikacin	15(60)
	Ceftriaxone	21(13.46)		Gentamicin	10(40)
	Cefixime	03(1.92)	7	Macrolides	
	Cefadroxyl	02(1.28)		Azithromycin	18(78.26)
3	Metronidazole			Erythromycin	05(21.74)
	Metronidazole	69(12.80)	8	Sulfonamides	
4	Fluroquinolones			Cotrimoxazole	09(1.67)
	Ciprofloxacin	41(63.07)		Total	539

(B)Frequency of prescribing patterns of antimicrobial agents in accordance with diagnosis (see table 1): Among the total number of 539 antimicrobial agents, 231(42.85%) were prescribed in respiratory infections which was highest in number and 11(2.04%) in soft tissue infections which was lowest in number. In most common respiratory tract infection, highest numbers were

prescribed from cephalosporins followed by β-lactam group, fluoroquinolones and macrolides. In hepatobiliary diseases, highest number drugs were prescribed from β-lactam group and cephalosporins followed by metronidazole. In miscellaneous infections, highest numbers were prescribed from β-lactam and cephalosporins groups followed by tetracyclines. However for soft tissue infections,

antimicrobial agents from  $\beta$ -lactam group and cephalosporins were prescribed.

(C) Route of administration: Total 539 numbers of prescribed, it was observed that 313(58.07%) and 226(41.93%) antimicrobial agents were prescribed for parenteral administration as well as oral route respectively (Table3b).

**Table 3a: Prescription analysis in medicine wads**

No. of antimicrobial agents	Total Number (%)
More than one	162(46.28)
Only one	188(53.51)
Total	350

**Table 3b: Route of administration**

Total no. of prescriptions	350
Total numbers of antimicrobial agents prescribed	539
Mean numbers of the antimicrobial agents per prescriptions	1.54

**Table3c: Antimicrobial agents prescribed by name**

Antimicrobial administered by route	Total Number (%)
Parenteral	313(58.07)
Oral	226(41.93)
Total	539 (100)

**Table 3d:No. of prescriptions with one or more than one antimicrobial agents**

Antimicrobial agents prescribed by name	TotalNumber (%)
Generic name	486(90.16)
Trade name	53(9.83)
Total	539 (100)

(D)Generic versus trade name: Out of the 539 antimicrobial agents prescribed, 486(90.16%) were prescribed by generic name while rests 53(9.83%) were prescribed by trade name (Table3c). (E)Number of antimicrobial agents per prescription: Among the 350 prescriptions studied, it was found that 188(53.71%)

prescriptions constitute single antimicrobial agents, while 162(46.28%) prescriptions contain either two or more than two antimicrobial agents (Table3d).

**Discussion:** A prescription by a doctor may be taken as a reflection of physician's attitude to the diseases and the role of drug treatment. It also provides an insight into the nature of health care delivery system<sup>16</sup>. Several classes of antimicrobial agents have been discovered and hundreds of them are available today. Antimicrobial agents are life saving in many conditions. It has been observed that 30% or more of all hospitalized patients are treated with one or more courses of antibacterial therapy<sup>17</sup>.

In our study we have observed that, highest numbers of antimicrobial agents were prescribed for respiratory tract infections. Among the total numbers of antimicrobial agents prescribed, highest numbers were prescribed from cephalosporins and  $\beta$ -lactam group. Among them cefotaxime and ampicillin were commonly prescribed. The reason may be due to their broad spectrum of activity and less incidences of adverse effects. Also physician's choice and easier availability in hospital pharmacy may also dictate a rather heavy use of a particular drug.

A study carried out in eastern Nepal reported that, gentamicin, ampicillin, crystalline penicillin, cefotaxime were the most commonly prescribed<sup>18</sup>. A study carried out in medical wards of university hospital, Bangkok reported that penicillin were the most frequently prescribed antimicrobial agents followed by cephalosporins and gentamicin<sup>19</sup>. Same research study carried out in tertiary hospital Chandigarh (1997) reported that, penicillin and cephalosporins were prescribed more frequently followed by quinolones, aminoglycosides and metronidazole<sup>20</sup>. Ampicillin and cephalosporins were the most commonly prescribed drugs at a general hospital in Pennsylvania<sup>21</sup>. We observed the antimicrobial prescribing pattern which is in

consonance with the studies carried out at these places.

The types of antibacterial used at each centre depend on many factors like the patient profile, type of infection, availability of antibacterial, susceptibility patterns, the prescriber's awareness on rational antimicrobial use etc. Variations in the antimicrobial susceptibility between different regions have been described and may result in different prescribing practices<sup>22</sup>. Such statistics form an important index of ongoing antimicrobial audit as they indicate the changes in the pattern of usage accordance with the susceptibility patterns of bacteria. They also indicate the extent of use of newer antimicrobial agents. Factors contributing to the preferential uses of the above antimicrobial agents in the wards may be due to their low cost with better safety profile and ease of their availability from the hospital pharmacy.

Data analysis in our study showed that the numbers of prescriptions with two or more than two antimicrobial agents per prescriptions were low as compared to those with a single antimicrobial agent. Mean number of drugs per prescription was 1.54. This indicates a large numbers of prescriptions in our study were for single drugs. This may not indicate empirical nature of therapy. Use of single antimicrobial agent per prescription was common. A study carried out in teaching hospital of eastern Nepal (1998) reported that, mean number of the drugs per prescriptions was 5.26, while prescriptions with two or more than two antimicrobial agents per prescriptions were very high as compared to prescriptions with single antimicrobial agent<sup>18</sup>. These figures are quite high as compared to our study. A study carried out in a teaching hospital Pondicherry (1998) reported that, mean numbers of antimicrobial agents prescribed per prescription were 2.1<sup>23</sup>. This is somewhat higher than that reported in our study.

Average number of the drugs per prescription is an important index of the scope for review and educational intervention in prescribing practices. It is preferable to keep the mean number of drug per prescription as low as possible, since highest figures always leads to increased risk of drug – drug interaction<sup>24</sup>.

In our study, it was found that, 58.07% antimicrobial agents were prescribed for parenteral administration, while only 41.93% were for oral route. In a study, carried out in Yemen reported that, 25 to 60 % of patients received drugs by injection<sup>25</sup>. These figures are quite similar to our study. Another study carried out in eastern Nepal reported that, 48.9% of patients received parenteral drugs. These figures are lower as compared to our study.

The excessive use of injectable is common in many developing countries<sup>26</sup>. In countries where disposable needles and syringes are scarce and the sterilization facilities are unsatisfactory, the administration of drugs by injection should be kept to the minimum required. Parenteral use of drugs in general and antibacterial in particular is important parameters to judge rationale drug use. Unnecessary use of parenteral antimicrobial adds to cost of therapy and also increases the risk of blood borne infections. Preference to parenteral route over oral route observed in our study could be due to study conducted in the indoor patients.

In our study, it was found that, 90.16% antimicrobial agents were prescribed by generic name, while 9.83% by using trade name. A study carried out in a teaching hospital Pondicherry (1998) reported that 43.9% antimicrobial agents were prescribed by generic name, while 56.1% by using trade name<sup>23</sup>. These figures suggest quite different trends in prescribing drugs by generic vs. trade name in respect to our observations. These show that apparent control over the prescribing habits of the physicians for indoor patients at our hospital. The most probable reason for such

prescribing may be due to easier availability of antimicrobial agents in our hospital pharmacy as well as proper communication between the prescribing physicians and the hospital authority.

Our study had a number of limitations. The study was retrospective and seasonal variations were not considered. The patient care indicators were not studied. The study was limited to medicine department. Also further studies for a longer period of time in all the clinical departments are required. The data presented here will be useful in future, long-term and more extensive drug utilization studies in the hospital and in promotion of rational prescribing and drug use in hospitals.

**Conclusion:** Result from this study indicates that overall apparent controlled over the prescribing habits of the physicians for indoor patients at our hospital. It is observed that further detail analysis in respect to selection of dose, frequency and duration of therapy of antimicrobial agents used in the wards is needed as per criteria's of Kunin et al.<sup>27</sup> to judge the rationality of the therapy.

Prescribing under generic name is considered economical and rational. One of the positive finding in our study like majority of antimicrobial drugs prescribed by using generic name. So, it is encouraging for the undergraduate medical students and post graduate students as well as during internship training for easily communicates with basic Pharmacology in clinical practice. More emphasis needs to be laid on teaching the art of writing a prescription to undergraduate and postgraduate medical students. A one week posting in clinical pharmacology and therapeutics if possible, should be taught over during internship and this period should be utilized in teaching prescription writing and rational drug therapy.

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