

A prospective assessment of antimicrobial agents utilization pattern in a tertiary care hospital

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ABSTRACT

Background: The antimicrobial resistance is increasing globally and, concurrently, downward trend in development of newer antibiotics is leading to a serious public health problem and economic consequences.

Methods: Prescriptions with at least one antimicrobial were included in the study. A total of 242 prescriptions were included in the study. The antimicrobials were classified into different classes based on WHO-ATC classification.

Results: A total of 281 antimicrobials prescribed in 242 prescriptions with an average of 1.16 per prescription. In most of the prescriptions, 1 antimicrobial were prescribed (88.43%). The routes of the antimicrobial administration were mostly oral 268 (95.37%) followed by injectable 13 (4.63%). The most commonly prescribed classes of antimicrobial in this study were antibacterials for systemic use (J01) (74.02%) followed by antimycobacterials (J04) (13.88%), antiparasitic drugs (P) (8.19%), antimycotics for systemic use (J02) (2.49%) and antivirals for systemic use (J05) (1.42%). Among antibacterials, the most commonly prescribed classes of antibacterial was various antibacterial FDCs (19.22%), followed by quinolones (18.86%), macrolides (18.15%), β -lactams (11.03%) cephalosporins (6.76%), penicillins (4.27%), aminoglycosides (2.84%), metronidazole (1.78%), clindamycin (1.78%) and tetracycline (0.36%). The total percentage of antimicrobials prescribed as Fixed Dose Combinations (FDCs) were 32.38%.

Conclusions: The present study has reported that most commonly prescribed antimicrobials were quinolones followed by macrolides and β -lactams. Recommendations to change the ongoing prescribing practices should be based on the Standard Treatment Guidelines, EDL and Antibiotic policy or by following the information, education, and communication (IEC) interventions.

Keywords: Antimicrobial utilization pattern, Anatomical Therapeutic and Chemical - ATC, Essential Drug List- EDL, World Health Organization - WHO

INTRODUCTION

Drug utilization is defined by the World Health Organization (WHO) as “the marketing, distribution, prescription, and use of drugs in society, with special emphasis on the resulting medical, social, and economic consequences”.¹ Overall, 80-90% of the antibiotics are consumed in outpatients and the rest in inpatients.² About 20-50% of all antibiotic use is irrational and this irrational use leads to increased risk of adverse drug events, increase in antimicrobial resistance and higher health care cost.^{3,4} In the outpatients, the antibiotics are most commonly prescribed for fever, sore throat and

diarrhea. These infections are usually viral in origin and antimicrobials have no role in their treatment.⁵

The ‘microbial threat’ was first recognized as a widespread problem in the 1990s and is now highlighted as a major global risk by several agencies, including the World Health Organization (WHO) and World Economic Forum (WEF).⁶⁻⁸ The antimicrobial resistance is increasing globally and, concurrently, downward trend in development of newer antibiotics are leading to serious public health problem and economic consequences. There are many factors responsible for antimicrobial resistance, but the utmost important is the overall quantity of antimicrobial consumption.^{2,3,9} Between 2000 and 2010,

the worldwide antibiotic consumption increased by 36% and 76% of which was in Brazil, Russia, India, China, and South Africa. In 2010, India was the single largest consumers of antibiotics in the world, followed by China and US.¹⁰

Antibiotic resistance is a major determinant of the outcome of infectious disease management. The clinician is not only important to development of this issue but also key to control it.¹¹ The prescribing practice of clinician is affected by various elements and to modify this it is essential to understand reason behind it.¹² It is utterly important to assess and audit the antimicrobials utilization pattern periodically for enabling suitable modifications in utilization patterns; to increase the therapeutic benefits and also to decrease the health care cost, antimicrobial resistance, adverse drug events for improving the medical services.¹³

The aim of this study was to assess the utilization pattern of different classes of antimicrobials in the Medicine OPD of a tertiary care teaching hospital along with the study of the dosage form of antimicrobials. We also assessed the utilization of antimicrobials from the essential drug list and as fixed dose combinations.

METHODS

Institutional Ethical Committee permission was taken before the start of the study.

Study site

This study was conducted in the Out Patient Department of General Medicine, King George's Medical University, Lucknow, India.

Study period

This study was carried out prospectively over a period of 1 month, from 1st January 2016 to 31st January 2016.

It was a prospectively designed cross-sectional observational study.

Sample size

Total 1000 patients of either sex, visiting for the first time to the OPD were selected randomly for the study. Prescriptions with at least one antimicrobial were included in the study. Those constituted 242 out of 1000 prescriptions screened.

Patient selection

Inclusion criteria

Patient attends medicine OPD and were ready to give consent were included in the study. Prescription containing at least one antimicrobial agent.

Exclusion criteria

Patient who was followed up, referral patients, seriously ill patients and mentally disabled patients.

Study material

Proforma was designed for recording patient's specific information such as patient's demographic profile, diagnosis, drug, name, dose, route, frequency and duration of prescription. The antimicrobials were classified into different classes based on WHO-ATC classification. The brand name of drugs was decoded by CIMS drug manual for the purpose of analysis.

Prescribing indicators

- Percentage of encounters with an antimicrobial
- Percentage of antimicrobial prescribed in fixed dose combination (FDCs)
- Percentage of antimicrobial drug prescribed from the Essential Drug List.

Statistical analysis

Statistical Packages for Social Sciences (SPSS) version 20 was used for entry and analysis of the quantitative data. In the statistical analysis, frequencies, averages/means, and percentages were obtained.

RESULTS

Demographic data

Out of 1000 prescriptions, only 242 prescriptions had at least one antimicrobial and were selected for analysis. The percentage of males was 54.96% and that of females was 45.04%. Age distribution shows, most of the patients were adults (20-60 years) constituting 81.82 %, followed by adolescents (15-19 years) 9.50 % and geriatric (≥ 60 years) 8.68 % (Table 1).

Table 1: Baseline demographics of the patients.

Age	No. (%)
Adolescents (15-19 year)	23 (9.50%)
Adults (20-60 year)	198 (81.82%)
Geriatric (>60 year)	21 (8.68%)
Gender	No. (%)
Male	133 (54.96%)
Female	109 (45.04%)

Prescription data

A total of 281 antimicrobials prescribed in 242 prescriptions with an average of 1.16 per prescription. In most of the prescriptions, 1 antimicrobial were prescribed (88.43%), followed by 2 antimicrobial (8.26%), 3

antimicrobial (2.07%), and 4 antimicrobial in 1.24% of prescriptions (Table 2).

Table 2: Number of antimicrobials prescribed per prescription.

No. of antimicrobials	No. of prescriptions (%)
1	214 (88.43%)
2	20 (8.26%)
3	5 (2.07%)
4	3 (1.24%)
Total	242 (100%)

Routes of antimicrobial administration were mostly oral 268 (95.37%) followed by injectable 13 (4.63%). The most common antimicrobial prescribed in injectable was streptomycin (8), followed by benzathine benzylpenicillin (4) and Cefoperazone+Sulbactam (1).

The most commonly prescribed classes of antimicrobial in this study were antibacterials for systemic use (J01) (74.02%) followed by antimycobacterials (J04) (13.88%), antiparasitic drugs (P) (8.19%), antimycotics for systemic use (J02) (2.49%) and antivirals for systemic use (J05) (1.42%) (Table 3).

The total percentage of antimicrobials prescribed as Fixed Dose Combinations (FDCs) were 32.38%. The antimicrobial FDCs mostly were antibacterials (19.22%) followed by antimycobacterials (9.25%), anthelmintics (4.63%) and antiprotozoals (3.56%) (Table 3).

Table 3: Percentage of different class of antimicrobials as per ATC classification.

Class of antimicrobials	ATC code	Number (%)	No. of FDCs (%)
Antibacterials for systemic use	J01	208 (74.02%)	54 (19.22%)
Antimycotics for systemic use	J02	7 (2.49%)	0 (0%)
Antimycobacterials	J04	39 (13.88%)	26 (9.25%)
Antivirals for systemic use	J05	4 (1.42%)	0 (0%)
Antiprotozoals	P01	10 (3.56%)	6 (2.13%)
Anthelmintics	P02	13 (4.63%)	5 (1.78%)
Total		281 (100%)	91 (32.38%)

Table 4: Percentage of different class of antimicrobials.

Class of Antimicrobial	Name of the Antimicrobial	ATC Code	Number (%)
Tetracyclines (J01A)	Tetracycline	J01AA07	1 (0.36%)
Penicillins (J01C)	Amoxicillin	J01CA04	7 (2.49%)
	Ampicillin	J01CA01	1 (0.36%)
	Benzathine benzylpenicillin	J01CE08	4 (1.42%)
Cephalosporins (J01D)	Cefuroxime	J01DC02	10 (3.56%)
	Cefixime	J01DD08	6 (2.13%)
	Cefpodoxime	J01DD13	3 (1.07%)
Macrolides (J01FA)	Erythromycin	J01FA01	7 (2.49%)
	Azithromycin	J01FA10	44 (15.66%)
Lincosamides (J01FF)	Clindamycin	J01FF01	5 (1.78%)
Quinolones (J01M)	Ofloxacin	J01MA01	28 (9.96%)
	Ciprofloxacin	J01MA02	7 (2.49%)
	Norfloxacin	J01MA06	15 (5.34%)
	Levofloxacin	J01MA12	3 (1.07%)
Aminoglycosides (J01G)	Streptomycin	J01GA01	8 (2.84%)
Other antimicrobials (J01X)	Metronidazole	J01XD01	5 (1.78%)
Antimycotics for systemic use (J02)	Fluconazole	J02AC01	7 (2.49%)
Antimycobacterials (J04)	Rifampicin	J04AB02	3 (1.07%)
	Isoniazid	J04AC01	3 (1.07%)
	Pyrazinamide	J04AK01	7 (2.49%)
Antivirals for systemic use (J05)	Aciclovir	J05AB01	4 (1.42%)
Antiprotozoals (P01)	Chloroquine	P01BA01	4 (1.42%)
Anthelmintics (P02)	Albendazole	P02CA03	6 (2.14%)
	Ivermectin	P02CF01	2 (0.71%)
Various antimicrobial FDCs			91 (32.38%)
Total			281 (100%)

Among antibacterials, the most commonly prescribed classes of antibacterial was various antibacterial FDCs (19.22%), followed by quinolones (18.86%), macrolides (18.15%), β -lactams (11.03%) cephalosporins (6.76%), penicillins (4.27%), aminoglycosides (2.84%), metronidazole (1.78%), clindamycin (1.78%) and tetracycline (0.36%) (Table 4).

Among the antibacterial FDCs, the most commonly prescribed FDCs were combination of macrolide and cephalosporin (6.05%) followed by fluoroquinolone and nitroimidazole (4.63%), penicillin with β -lactamase inhibitor (3.91%), cephalosporin with β -lactamase inhibitor (3.20%), fluoroquinolone and macrolide (0.71%), fluoroquinolone and cephalosporin and sulfamethoxazole-trimethoprim (0.36%) (Table 5).

Table 5: FDCs of different class of antimicrobials.

Name of FDCs	Number (%)
Amoxicillin+Clavulanate	8 (2.85%)
Amoxicillin+Dicloxacillin	3 (1.07%)
Cefixime+Clavulanate	5 (1.78%)
Cefpodoxime+Clavulanate	3 (1.07%)
Cefoperazone+Sulbactam	1 (0.36%)
Macrolide+Cephalosporins	17 (6.05%)
Fluroquinolones+Macrolide	2 (0.71%)
Fluroquinolones+ Cephalosporins	1 (0.36%)
Fluroquinolones+ Ornidazole/ Tinidazole	13 (4.63%)
Sulfamethoxazole+ Trimethoprim	1 (0.36%)
Isoniazid+Rifampicin	8 (2.85%)
Isoniazid+Rifampicin+Ethambutol	11 (3.91%)
Isoniazid+Pyridoxine	7 (2.49%)
Artesunate+Sulfadoxine- Pyrimethamine	3 (1.07%)
Artesunate+Lumefantrine	3 (1.07%)
Ivermectin+Albendazole	5 (1.78%)
Total	91 (32.38%)

The antimicrobials prescribed from the National Essential Drugs List were 47.68%.

DISCUSSION

Assessment of the antimicrobial prescription is an important issue because of rapidly increasing antimicrobial resistance across the globe, lack of adherence to standard treatment guidelines and increase in health care expenditure.

The average number of drugs per prescription is an important index of prescription audit. Polypharmacy is usually associated with negative consequences such as increased chances of drug interactions, adverse drug events, medication non-adherence and ultimately increased health care cost. In this study, a total of 281 antimicrobials prescribed in 242 prescriptions with an

average of 1.16. In a study conducted by Khan et al it was 1.61.¹⁴

The average number of antimicrobials per prescription was mostly one (88.43%) followed by two antimicrobials in 8.26% prescriptions. The FDCs constituted 32.38% of total antimicrobials. Two studies from India reported antimicrobial FDCs as 18.88% and 29.18%, respectively.^{15,16}

In the present study, most commonly prescribed antimicrobial class was quinolones followed by macrolides, β -lactams, and aminoglycosides. In the study conducted by Admane et al, most commonly prescribed antimicrobials were β -lactam antibiotics (61.54%) followed by sulphonamides (26.05%) and fluoroquinolones (6.97%).¹⁶ Another study by Selvaraj et al, reported β -lactams (35.09%), followed by fluoroquinolones (18.88%) and combinations of antimicrobials from different classes (13.85%) as the most commonly prescribed classes of antimicrobials.¹⁵ Lalan et al, reported that the most commonly prescribed antimicrobials were Ciprofloxacin (3.80%), followed by Amoxicillin (3.73%) and Metronidazole (2.30%).¹⁷ According to Khan et al, most commonly prescribed antimicrobials were the β -lactams (penicillins and cephalosporins) followed by the quinolones, Nitroimidazoles, aminoglycosides and the macrolides.¹⁴

Among different classes of antimicrobial FDCs, the combination of macrolide and cephalosporin was the most frequently prescribed combination followed by combination of fluoroquinolone and nitroimidazole and combination of penicillin with β -lactamase inhibitor.

The percentage of antimicrobials prescribed from the National Essential Drugs List was 47.68%, which is lower than the WHO standard value (100%).¹⁸ Only 16.48% of FDCs were from the National Essential Drugs List.

CONCLUSION

The present study has reported that most commonly prescribed antimicrobials were quinolones followed by macrolides and β -lactams. The FDCs of antimicrobials was 32.38%. The rational use of antimicrobial agents is one of the important factors to control the antimicrobial resistance, adverse drug events and health care cost. Recommendations to change the on going prescribing practices should be based on the Standard Treatment Guidelines, EDL and Antibiotic policy or by following the information, education, and communication (IEC) interventions.

Limitations of study

This study was conducted only in a single department with a limited period of time and sample size. The

rationality of antimicrobial prescriptions was not checked in this study.

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