

A study monitoring prescription pattern of antibiotics in a tertiary care hospital in North India

Kumar Abhijit, Pushpawati Jain, Prerna Upadhyaya*, Shipra Jain

Department of Pharmacology,
Mahatma Gandhi Medical
College & Hospital, Jaipur,
Rajasthan

Received: 03 September 2014

Accepted: 24 September 2014

***Correspondence to:**

Dr. Prerna Upadhyaya,
Email: drprerna@rediffmail.
com

Copyright: © the author(s),
publisher and licensee Medip
Academy. This is an open-
access article distributed under
the terms of the Creative
Commons Attribution Non-
Commercial License, which
permits unrestricted non-
commercial use, distribution,
and reproduction in any
medium, provided the original
work is properly cited.

ABSTRACT

Background: Irrational prescribing of medicine results in serious morbidity and mortality as well as additional economic burden and also lead to reduction in the quality of treatment; thereby causing wastage of resources, increased treatment cost, increased risk for adverse drug reaction, and emergence of resistance. WHO has generated indicators in three main drug use areas; prescribing, patient care, and facility specific factors.

Methods: This study was carried out with the aim of identifying prescription pattern of antibiotics and evaluates the rationality of prescriptions in accordance with WHO prescribing indicators. 300 prescriptions were examined from the inpatient department (IPD) of a tertiary care teaching hospital from the Department of Medicine, Surgery, and Orthopedics. The IPDs were visited twice a week. Each prescription was followed for the duration of 5 days. The prescribing and dispensing details from each prescription were recorded in a tabular form as mentioned in data acquisition form. The data were analyzed as per the WHO core drug use indicators.

Results: This study clearly highlights the practice of polypharmacy, low uses of generic drugs, injudicious usage of antibiotic, and injection and low usage of the drug prescribed from essential drug list.

Conclusions: Multi-faceted interventions are required at many levels for the benefits of the community in the form of continued medical educational programs, consumer awareness, formation of hospital formulary, and undergraduate clinical pharmacology and therapeutics teaching.

Keywords: Rational prescribing, Antibiotic prescribing, WHO prescribing indicators

INTRODUCTION

Appropriate treatment of commonly occurring disease and injuries and provision of essential drugs are the two vital component of primary health care concept as per the Alma-Ata declaration of 1978.¹ Essential drugs are those drugs that satisfy the healthcare needs of majority of population, they should therefore be available at all times in adequate amounts and in appropriate dosages form at a price the community can afford. These drugs are critically required for the management of 90% of commonly occurring medical conditions specific to that area. They must meet high standard of quality, safety, and efficacy at a low cost.²

Rational prescribing, therefore, involves a right decision of the prescriber. This will eventually encourage the patient to take medication and comply to the prescription served by the prescriber with them. Requirement for rational use of drugs will be fulfilled if the process of prescribing is appropriately followed. The avoidance of combination drug

is also encouraged. Routine and irrational use of injection should also be discouraged.³

Bad prescribing practice leads to ineffective and unsafe treatment prolonging illness, distress and harm to the patient at higher cost. Irrational medicine may result in serious morbidity and mortality as well as additional economic burden and lead to reduction in the quality of drug thereby wastage of resources increased treatment cost, increased risk for adverse drug reaction and emergence of resistance.⁴

The International Network for the Rational Use of Drugs generated indicators in three main drug use areas *viz* prescribing, patient care and drug systems.⁵ Prescribing patient care and facility specific factors were measured using drug use indicators.⁶

These drug use indicators were developed to be used as measures of performance in three general areas related to the rational use of drugs in primary care.

The indicators of prescribing practices measure the performance of health care providers in several key dimensions related to the appropriate use of drugs. The indicators are based on the practices observed in a sample of clinical encounters taking place at outpatient health facilities for the treatment of acute or chronic illness. These encounters can be observed retrospectively, from data recorded in historical medical records, or they can be observed prospectively, from a group of patients attending the clinic on the day the data are collected.⁶

This study was carried out with the aim of identifying prescription pattern of antibiotics and evaluates the rationality of prescriptions in accordance with WHO prescribing indicators. The generated data and recommendation can be utilized in future for promotion of rational antibiotic use in hospital.

METHODS

This is a prospective cross-sectional study conducted in inpatient departments (IPDs) of Mahatma Gandhi Medical College and Hospital, Jaipur. Protocol approval was taken from Institutional Ethics Committee.

Totally, 300 prescriptions were examined from the IPD of Mahatma Gandhi Medical College and Hospital, Jaipur especially from the Department of Medicine, Surgery, and Orthopedics. The IPDs were visited twice a week. Each prescription was followed for the duration of 5 days.

The prescribing and dispensing details from each prescription were recorded in a tabular form as mentioned in data acquisition form. The data were analyzed as per the WHO core drug use indicators. The details of each prescription were analyzed by percentage calculation.

RESULTS

Total 300 prescriptions were selected and assessed for the pattern of the prescriptions and the correctness of their components from the Medicine, Surgery, and Orthopedics IPD of Mahatma Gandhi Medical College and Hospital, Jaipur.

Medicine

Monotherapy was prescribed in 51% of prescriptions while 49% of prescriptions had fixed dose combinations. Generic drug was not mentioned in any prescription. 85.3% drug was prescribed as injections. Drugs prescribed from essential drug list (EDL) were 52.9%. Ceftriaxone alone was prescribed in 34% of the prescriptions and ofloxacin alone was prescribed in 17% of the prescriptions amoxicillin-clavulanic acid combination was prescribed in 17% of the prescriptions. Ceftriaxone-sulbactam combination

was prescribed in 14% of the prescriptions. Ceftriaxone + amikacin and tazobactam + piperacillin combination was prescribed in 4% of the prescriptions, while tazobactam + piperacillin + tobramycin and tazobactam + piperacillin + amikacin combination was prescribed in 3% of the prescriptions (Tables 1 and 2).

Orthopedics

Monotherapy was prescribed in only 2% of prescriptions while 98% of prescriptions had fixed dose combinations. Generic name was not mentioned in any prescriptions. 96.9% drugs were prescribed as injections. Drugs prescribed from EDL were 53.9%. Amikacin was given as monotherapy in 2% of prescriptions. Majority (51%) of prescriptions had a combination of ceftriaxone + sulbactam + amikacin. 14% prescriptions had combination of cefpodoxime + clavulanic acid. 8% prescriptions had ceftriaxone + sulbactam. 6% prescriptions had ceftriaxone + sulbactam + gentamicin. 4% prescriptions had amoxicillin + clavulanic acid. 6% prescriptions had various fixed dose combinations of ceftriaxone with ofloxacin/levofloxacin/gentamycin. 4% prescriptions had tazobactam + piperacillin + amikacin.

Table 1: Drugs prescribed in all three departments.

	Medicine	Orthopedics	Surgery
% Monotherapy	51	2	16
% Of fixed dose combinations	49	98	84
% Of generic drugs	0	0	0
% Of injections	85.3	96.9	95.6
% Drugs from EDL	52.9	53.9	58.8

EDL: Essential drug list

Table 2: Antibiotics prescribed in medicine department.

Name of antibiotic	Number	Percent
Ceftriaxone+sulbactam	14	14
Ceftriaxone	34	34
Ceftriaxone+amikacin	4	4
Tazobactam+piperacillin	4	4
Tazobactam+piperacillin+tobramycin	3	3
Tazobactam+piperacillin+amikacin	3	3
Amoxicillin+clavulanic acid	17	17
Amoxicillin+clavulanic acid+doxycycline	4	4
Ofloxacin	17	17
Total	100	100

2% prescriptions had amoxicillin + clavulanic acid + tazobactam + piperacillin. 1% prescriptions had amoxicillin + gentamycin + clavulanic acid (Tables 1 and 3).

Surgery

Monotherapy was prescribed in 16% of prescriptions, while 84% of prescriptions had fixed dose combinations. Generic name was not mentioned in any prescriptions. 95.6% drugs were prescribed in injection form. Drugs prescribed from EDL were 58.8%. Ceftriaxone was prescribed in 8% of prescriptions, ofloxacin in 6%, and levofloxacin in 2%. 18% of prescriptions had a combination of ceftriaxone + sulbactam + tobramycin. 16% prescriptions had combination of ceftriaxone + sulbactam. 8% prescriptions had ceftriaxone + amikacin. 4% prescriptions had ceftriaxone + sulbactam + amikacin. 4% prescriptions had ceftriaxone + sulbactam + ofloxacin, 4% had ceftriaxone + amikacin + metronidazole, 4% had tobramycin+ amikacin, 4% had levofloxacin + amikacin. 2% prescriptions had fixed dose combinations of ceftriaxone + metronidazole, 2% had ceftriaxone + sulbactam + amoxicillin + clavulanic acid. 2% had ceftriaxone + amoxicillin + clavulanic acid, 2% had ceftriaxone + gentamicin, 2% had tazobactam + piperacillin + tobramycin, 2% had tazobactam + piperacillin + linezolid, 2% had tazobactam + piperacillin + amikacin + metronidazole, 2% had cefpodoxime + clavulanic acid and 2% had amoxicillin + clavulanic acid + amikacin (Tables 1 and 4).

Table 3: Antibiotics prescribed in orthopedics department.

Type of antibiotics	Frequency	Percent
Ceftriaxone+sulbactum	8	8
Ceftriaxone+sulbactum+amikacin	51	51
Ceftriaxone+sulbactum+ofloxacin	2	2
Ceftriaxone+sulbactum+levofloxacin	2	2
Ceftriaxone+sulbactum+gentamycin	6	6
Ceftriaxone+gentamycin	2	2
Linezolid+doxycycline	2	2
Amikacin	2	2
Tazobactum+piperacillin	2	2
Tazobactum+piperacillin+amikacin	2	2
Amoxicillin+clavulanic acid	4	4
Amoxicillin+clavulanic acid+tazobactum+piperacillin	2	2
Amoxicillin+clavulanic acid+gentamycin	1	1
Cefpodoxime+clavulanic acid	14	14
Total	100	100

DISCUSSION

A prescription by a doctor may be taken as a reflection of physician’s attitude to the disease and the role of drug in its treatment. It also provides an insight into the nature of the health care delivery system.⁷ Quality-of-life can be improved by enhancing standards of medical treatment at all levels of the health care delivery system. Setting standards and assessing the quality of care through performance review should become part of everyday clinical practice.⁸

Assessment of the average number of drugs per encounter

Based on the WHO prescribing indicators, it was seen that the average number of drugs per prescription (in a

Table 4: Antibiotics prescribed in the surgery department.

Antibiotic	Frequency	Percent
Ceftriaxone+sulbactum	16	16
Ceftriaxone+sulbactum+metronidazole+tobramycin	4	4
Ceftriaxone+sulbactum+tobramycin	18	18
Ceftriaxone+sulbactum+amikacin	4	4
Ceftriaxone+sulbactum+amoxicillin+clavulanic acid	2	2
Ceftriaxone+sulbactum+ofloxacin	4	4
Ceftriaxone	8	8
Ceftriaxone+metronidazole	2	2
Ceftriaxone+amikacin	8	8
Ceftriaxone+amikacin+metronidazole	4	4
Ceftriaxone+amoxicillin+clavulanic acid	2	2
Ceftriaxone+gentamycin	2	2
Tobramycin+amikacin	4	4
Tazobactum+piperacillin+linezolid	2	2
Tazobactum+piperacillin+tobramycin	2	2
Tazobactum+piperacillin+amikacin+metronidazole	2	2
Amoxicillin+clavulanic acid+amikacin+metronidazole	2	2
Ofloxacin	6	6
Levofloxacin	2	2
Levofloxacin+amikacin	4	4
Cefpodoxime+clavulanic acid	2	2
Total	100	100

prescription audit) is an important index of the scope for review and educational interventions in prescribing practices. The mean number of drugs per prescription should be as low as possible since higher figures increase the risk of drug interaction, risk of bacterial resistance, non-compliance, and cost of the treatment.⁹ The study suggests that it is preferable to keep mean number of drugs as low as possible since higher figures always lead to increased risk of drug interactions and increased treatment cost.^{10,11} In the present study, monotherapy was prescribed in 51% prescriptions in medicine, 16% in surgery, 2% in orthopedics and polytherapy was prescribed 98% in orthopedic, 84% in surgery 49% in medicine.

Polypharmacy, as well as inappropriate prescribing, is a major problem and a challenge that contributes to costs, adverse drug events, confusion, compliance issues, and errors in management. A systematic approach to drug monitoring is an important aspect of appropriate prescribing.

Assessment of drugs prescribed by generic name

For the propagation of rational use of medicines (RUM) in India, the All India Drug Action Network was founded in 1982. Since then, it is active in the campaign for RUM prescribing under generic name is considered rational and economical, but none of the prescriptions were written under a generic name in this study. Generic prescribing helps the hospital pharmacy to have a better inventory control. Confusion among the pharmacists while dispensing can also be reduced, when prescribed by generic names. Moreover, generic drugs are more cost-effective than the branded ones.¹² However, in the present study, no drugs were written in generic form in Medicine, Orthopedics, and Surgery Department. All the drugs were written as brand names. In a study conducted in Nigeria, almost 100% of the prescriptions in the name of essential and generic drug in the national drug list were reported; although only 50% of the prescriptions were correct according to the standard treatment guidelines.¹³

Assessment of prescriptions with antibiotics prescribed

The present study focused on the usage of antibiotics in the IPD of Medicine, Surgery, and Orthopedics. It is seen that the majority of prescriptions in all three specialties had fixed dose combinations, with maximum prescriptions in orthopedics. Most commonly prescribed combination was of ceftriaxone + sulbactam + amikacin. This combination was prescribed maximum in orthopedics. The antibiotics were prescribed without sensitivity tests.

Antibiotic resistance among pathogenic microorganisms is a matter of worldwide concern. Selective pressure by antimicrobial drugs is by far the most important driving force for the development of such resistance. Antibiotics are

among the most commonly prescribed drugs in hospitals and developed countries around 30% of the hospitalized patients are treated with these drugs.¹⁴ Meanwhile, the widespread use of antibiotic even for a minor infection has resulted in resistance to some of these drugs.¹⁵

Therefore, efforts are needed to counteract the growing problem of antimicrobial resistance. Drug utilization research can provide useful information to health care providers and policy makers. Therefore, any study to evaluate the pattern of antibiotic utilization can be fruitful in formulating interventions as well as promoting product use of antibiotics.¹⁶

Antibiotics smart use (ASU) was introduced in 2007 as an innovative model to promote the RUM and counteract antimicrobial resistance. It was established for two major reasons. First, few resources were available for the fight against the irrational use of antibiotics, which was rampant. Using these few resources to empower health professionals and the public was seen as an expedient and efficient way to galvanize improvements by inducing individual behavior change while creating a critical mass of people who could conduct advocacy and promote the rational use of antibiotics. Second, the RUM as a concept was not always getting translated into practice, and the ASU model was felt to be useful in bridging this gap.¹⁷

Assessment of prescriptions with injections prescribed

In the present study, in medicine, 85.3% prescriptions had injections, in orthopedics, 96.9% prescriptions had injections and in surgery, 95.6% prescriptions had injections. Unsafe use and overuse of injection play an important role in the transmission of very serious blood-borne infections. A study revealed that injection prescribing proportion in rural Western China was higher than that in India and lower than that in Cambodia. The proportion of prescriptions with injection was 22.93%.¹⁸ Prescribing more injections per prescription are of concern, considering the likelihood of adverse effect of possible use of unsafe syringes to transmit HIV, hepatitis B and C and added economic impact on the patient and health care system.¹⁹ Further, excessive use of injection will lead to more generation of biomedical waste in that area.

Assessment of drugs prescribed from an EDL/essential medicine list

In the present study, 52.9% drugs from medicine, 58.8% drugs from the surgery, and 53.1% drugs from orthopedics prescriptions were from the National List of Essential Medicines of India, 2011. A study on evaluation of drug use in Jordan using WHO prescribing indicators concluded that the percentage of prescriptions involving drugs from the essential drugs list averaged 93%.²⁰ The essential drug

concept is an old concept, and over 30 years have passed since it was first mooted. The concept of essential medicines has also been adopted by many international organizations, including the United Nations Children's Fund and the Office of the United Nations High Commissioner for Refugees, as well as by nongovernmental organizations and international non-profit supply agencies. Many of these organizations base their medicine supply system on the model list. Lists of essential medicines also guide the procurement and supply of medicines in the public sector, schemes that reimburse medicine costs, medicine donations, and local medicine production, and, furthermore, are widely used as information and education tools by health professionals. Health insurance schemes too are increasingly using national lists of essential medicines for reference purposes. The model list serves as a baseline for further modification (addition and deletion of new medicines), correct dosage strength, and form depending upon the national priority and available evidence.²¹ Ironically, no clinician was able to correctly quantify the drug/drug combinations in the Indian EDL. This clearly indicates the lack of continued medical education. The other factor may be a market-driven forces leading to prescription of new and branded drugs.

The following strategies have been advocated by WHO for promoting RUM. There is 3 M concept in RUM: medicines mean money. Thus, RUM means less profit and income for those dealing with medicines; prescribers, and sellers. This conflict of interest is particularly relevant in our country where just only 3-5% of populations are covered under any form of health insurance.² The medical practitioners have wide scope and responsibility too in promoting RUM for better health care. Educational strategies to healthcare practitioners and consumers have been proved a successful model for promoting RUM. One of the educational strategies is to train the medical students of different levels on RUM. The concept and usefulness of RUM need to be the part of the curriculum. A WHO manual "Guide to Good Prescribing: a Practical Manual" is a useful publication for undergraduate and post graduate students is a welcome step in this endeavor.²²

The medical practitioners need to keep themselves updated through attending seminars, conferences, and other continuing professional development programs. These programs should not be supported by pharmaceutical industries, as often there is a conflict of interest. They should look for independent publications or drug information centers for drug-related information, but not from the medical representatives. The hospital formulary is a good source of information. The essential medicines should be the first choice during medical practice. Finally, they should take care of their clients, the patients, by spending some time with them explaining the appropriate use of prescribed medicines. The patients should be accepted as a partner in drug therapy prescribing.

CONCLUSION

This study clearly highlights the practice of polypharmacy, low uses of generic drugs, injudicious usage of antibiotic and injection, and low usage of the drug prescribed from EDL. Rational use of the drug is the foremost goal in writing a prescription. Irrational prescriptions of antibiotics with poly-pharmacy, more number of injections, less drugs from EDL/essential medicine list result in a global increase in antimicrobial resistance and a simultaneous downward trend in the development of new antibiotics leading to serious public health and economic implications.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Declaration of Alma Ata. 1978. Available at http://www.who.int/hpr/NPH/docs/declaration_almaata.pdf. Accessed 18 Mar 2014.
2. Promoting Rational Use of Medicines: core Components. Available at <http://www.apps.who.int/medicinedocs/en/d/Jh3011e/2.html>. Accessed 18 Mar 2014.
3. De Vries TP, Henning RH, Hogerzeil HV, Fresle DA. Treating your patients. Guide to Good Prescribing: a Practical Manual. (WHO/DAP/94.11). Geneva: World Health Organization; 1994: 33-6.
4. Bhartiyy SS, Shinde M, Nandeshwar S, Tiwari SC. Pattern of prescribing practices in the Madhya Pradesh, India. *Kathmandu Univ Med J (KUMJ)*. 2008;6(1):55-9.
5. Laing RO. Rational drug use: an unsolved problem. *Trop Doct*. 1990;20(3):101-3.
6. Desta Z, Abula T, Beyene L, Fantahun M, Yohannes AG, Ayalew S. Assessment of rational drug use and prescribing in primary health care facilities in North West Ethiopia. *East Afr Med J*. 1997;74(12):758-63.
7. Ravi Shankar P, Partha P, Nagesh S. Prescribing patterns in medical outpatients. *Int J Clin Pract*. 2002;56(7):549-51.
8. Patterson HR. The problems of audit and research. *J R Coll Gen Pract*. 1986;36(286):196.
9. Kutty KVG, Narmadha S, Nagarajan M. A study on drug prescribing pattern in Madurai city. *Indian J Pharmacol*. 2002;34:361-2.
10. Nies SA. Principles of therapeutics. In: Gilman GA, Rall WT, Nies SA, Taylor P, editors. *The Pharmacological Basis of Therapeutics*. 8th Edition. New York: Pergamon Press; 1990: 62-83.
11. Atanasova I, Terziivanov D. Investigation on antibiotics in a hospital for a one-year period. *Int J Clin Pharmacol Ther*. 1995;33:32-3.
12. Jana SK, Mondal P, Bhattacharya SK. A historical perspective on the rational use of drugs (RUD) in India. *Indian J Pharmacol*. 2006;38:374-5.
13. Mallet HP, Njikam A, Scouffaire SM. Evaluation of prescription practices and of the rational use of medicines in Niger. *Sante*. 2001;11(3):185-93.
14. Ebrahimzadeh MA, Shokrzadeh M, Ramezani A. Utilization

- pattern of antibiotics in different wards of specialized Sari Emam University Hospital in Iran. *Pak J Biol Sci.* 2008;11(2):275-9.
15. Sivagnanam G, Thirumalaikolundusubramanian P, Mohanasundaram J, Raaj AA, Namasivayam K, Rajaram S. A survey on current attitude of practicing physicians upon usage of antimicrobial agents in southern part of India. *Med Gen Med.* 2004;6(2):1.
 16. Wise R, Hart T, Cars O, Streulens M, Helmuth R, Huovinen P, et al. Antimicrobial resistance. Is a major threat to public health. *BMJ.* 1998;317:609-10.
 17. Sumpradit N, Chongtrakul P, Anuwong K, Puntong S, Kongsomboon K, Butdeemee P, et al. Antibiotics smart use: a workable model for promoting the rational use of medicines in Thailand. *Bull World Health Organ.* 2012;90(12):905-13.
 18. Dong L, Wang D, Gao J, Yan H. Doctor's injection prescribing and its correlates in village health clinics across 10 Provinces of Western China. *J Public Health (Oxf).* 2011;33(4):565-70.
 19. Maselle AY, Mashalla YJ, Kayombo EJ, Mwaiselage JD, Mwambane NE, Kaniki T. Reducing therapeutic injection over use through patients-prescribers interaction group discussion in Kinondoni district, Dar Es Salam, Tanzania. *Tanzan J Health Res.* 2011;13:87-92.
 20. Ootom S, Batieha A, Hadidi H, Hasan M, Al-Saudi K. Evaluation of drug use in Jordan using WHO prescribing indicators. *East Mediterr Health J.* 2002;8(4-5):537-43.
 21. WHO. The Selection and Use of Essential Medicines. Technical Report Series No 946. Geneva: WHO Press; 2007.
 22. World Health Organization. Teacher's Guide to Good Prescribing. Geneva: WHO Press; 2001.

doi: 10.5455/2319-2003.ijbcp20141209

Cite this article as: Abhijit K, Jain P, Upadhyaya P, Jain S. A study monitoring prescription pattern of antibiotics in a tertiary care hospital in North India. *Int J Basic Clin Pharmacol* 2014;3:1006-11.