



Assessment of Antimicrobial Utilization and Prescribing Pattern among the Health Care Professionals at a Tertiary Care Rural Teaching Hospital in Southern India

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Authors' contributions

This work was carried out in collaboration between all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: To monitor the antimicrobial utilization; identify the preferred group of antibiotics in outpatient services, determine the prescribing pattern of antibiotics by consultants in a rural teaching hospital, evaluate the inappropriate usage of antibiotics among population and evaluate the patients knowledge about use of antimicrobials taken for their illness.

Methodology: A period of 24 months of investigation is carried out towards prescribing antibiotics and the inappropriate usage of antibiotics among rural population who attended outpatient departments were elicited by Questionnaires survey method and analysed in relation to rational use of antibiotics. The patients were also interviewed for their knowledge regarding drugs, sources, dose, duration and frequency of the drugs.

Results: The percentage of distribution of various group of antibiotics in the years of 2009-2010 and 2010-2011 were Sulphonamide (SULP) (4.42%, 1.1%), Penicillin (Pn) (52.4%, 9%), Fluroquinolones (FQs) (24.9%, 44%), Cephalosporins (CPs) (1.2%, 5.2%), Broad spectrum antibiotics (BSA) (3.4%, 3.6%), Macrolide (Mac) (1.3%, 5.2%), Antiprotozoal drug (APD)-metronidazole (12.3%, 12.7%) and fixed dose combination (FDC) (0.2%, 3.6%) respectively. Many practitioners were not aware of Multidrug Resistance (MDR) (50.5%) nor the type of infections (52.6%) or the group of antibiotics (57.9%) exhibiting resistance.

Conclusion: Antibiotics are considered as the second most prescribed drugs in the world. In our study, 76.2% were prescribed with antibiotics in their prescription. Analysis of utilization of antibiotics in pharmacy during the year of 2010-2011 revealed a reduction in antibiotic use compared to 2009–2010. Further awareness required to the prescribers and beneficiaries regarding antimicrobial resistance.

Keywords: Antibiotics; prescribing patterns; health care professionals; emergence of AMR.

1. INTRODUCTION

Drug utilization research (DUR) is defined by World Health Organization (WHO) as the promotion, delivery, prescription and utilize of drugs in the public, with particular prominence on the resulting medical, social and economic consequences.

- ❖ To increase the therapeutic effectiveness and lessen the progress of resistance, drug consumption model needs to be evaluated periodically.
- ❖ Unfortunately the usage of drugs and dosage forms result in latent health risk to the patients and cause economic lumber.
- ❖ To avoid such problems, each and every members of the healthcare system should practise realistically.

The five important criteria for rational drug use are accurate diagnosis, proper prescribing, correct dispensing, suitable packing and patient adherence [1]. The increasing magnitude of DUS as a valuable investigation resource in pharmacoepidemiology has been bridging it with other health allied areas, such as public health, rational use of drug, evidence based drug use, pharmacovigilance, pharmacoconomics, eco-pharmacovigilance and pharmacogenetics [2]. Despite several years of clinical use of antibiotics, little is known about the optimal use of these drugs in the clinic to minimize resistant development without compromising safety and efficacy. The international network for the Rational Use of Drugs (INRUD) was established in 1989 to promote the rational use of drugs in developing countries.

Various indicators were developed by INRUD in collaboration with WHO that provided objective indices to allow for assessment of drug use practices [3]. Still there is a need for data on both antibiotic use and its determinants from all the regions of the world [4]. Recently there has been an alarming concern over the injudicious use of antimicrobials worldwide. This practice of indiscriminate prescribing of antimicrobial agents has led to ineffective and unsafe treatment, exacerbation or prolongation of illness, distress and harm to the patient as well as an additional burden of an expensive medical cost for the patient. The National Health Services circular (UK), formulated a drive against over utilization of Antimicrobial

agents which was based on four elements of strategy, surveillance, prudent antimicrobial use and infectious control [5].

Antibiotics have been found to be the most commonly prescribed and used class of drugs in several national and international studies [6-8]. The emergence of antibiotic resistant bacterial pathogens on a large scale over last two decades is taken as an inevitable consequence of these over uses of antibiotics worldwide [9,10]. Between 2005 and 2009, the units of antibiotics sold increased by about 40 per cent. Increased sales of cephalosporins were particularly striking, with sales (in units sold) increasing by 60per cent over that five-year period [11].

The bacterial disease burden in India is among the highest in the world [11]. Data on the use of antimicrobial agent at the population level are lacking in India as we do not have any database for the consumption of antimicrobials in the community. This is mainly because, in India, unlike many developed countries, prescriptions are kept by the patient and not with the pharmacist and antibiotics may be obtained with or without a prescription. Therefore, determining antimicrobial use or antibiotic medicines use is problematic, more so in the private sector, since there are no prescription records. Hence, there is an utmost need to develop a methodology that can measure consumption of antimicrobial use in the community [12].

The emergence of Antimicrobial Resistance (AMR) bacterial pathogens on a large scale over last two decades is taken as an inevitable consequence of over uses of antibiotics worldwide [9,10]. This AMR depends on many factors, such as prescribing pattern of clinicians, marketing of antibiotics over the counter (OTC), self-medication among end users and use of antibiotics in veterinary etc. In our previous study [13], on AMR pattern of gram negative bacteria (GNB) on broad spectrum antibiotics, 3rd Generation Cephalosporins in rural tertiary hospital revealed that 52.3% to 100% were resistant to cephalosporins. Hence, this study was conducted to analyse the prescribing pattern of prescribers and antibiotic utilization in pharmacy and to correlate it with emergence of AMR.

The major objectives of this present investigation are to monitor the antimicrobial utilization and to identify the preferred group of antibiotics in outpatient services in a rural teaching hospital; to determine the prescribing pattern of antibiotics by consultants working in a rural teaching hospital; to evaluate the inappropriate usage of antibiotics among rural population by self-medication and to evaluate the patients knowledge about use of antimicrobials/ drugs to be taken for their illness.

2. MATERIALS AND METHODS

A retrospective study was carried out in the pharmacy of tertiary care teaching hospital at Tiruchirapalli of South India. The description of the hospital-950 bedded tertiary care teaching hospital. Institutional prescriptions entered in the computer over a period of 24 consecutive months (September 2009-August 2011) were retrieved and analysed.

A total of Doctors' attitude towards prescribing antibiotics and the inappropriate usage of antibiotics among rural population who attended outpatient departments were elicited by Questionnaires survey method and analysed in relation to rational use of antibiotics. The patients were also interviewed for their knowledge regarding drugs, source, dose, duration and frequency of the drugs to be taken for their illness. Statistical analysis was performed using SPSS software.

The study was approved by the Institutional Ethical Committee. An oral and written consent was obtained from the patients before their participation in the study. The inclusion criteria are prescriptions [oral forms of antimicrobial agents (AMA)] of adult patients attending the Out Patient department (OPD) were included in this study. Prescribers those were willing to participate in the study were included. The exclusion criteria are paediatric preparations and injection forms of AMAs were excluded. Patient visiting the emergency department or who got admitted during the OPD visits were not included in this study their prescribing patterns may be substantially different from those of ambulatory patients.

3. RESULTS

During this study period, out of the total 4,62,090 [2009-2010 (2,29,991) and 2010-2011 (2,32,099)] of outpatients, 3,52,112 (76.2%) were prescribed with antibiotics in their prescription. The percentage of distribution of various group of antibiotics in the years of 2009-2010 and 2010-2011 in our pharmacy were Sulphonamide (SULP) (4.42%, 1.1%), penicillin (Pn) (52.4%, 9%), Fluroquinolones (FQs) (24.9%, 44%), cephalosporins (CPs) (1.2%, 5.2%), Broad spectrum antibiotics (BSA) (3.4%, 3.6%), Macrolide (Mac) (1.3%, 5.2%), Antiprotozoal drug (APD)-metronidazole (12.3%, 12.7%) and fixed dose combination (FDC) (0.2%, 3.6%) respectively see Fig. 1.

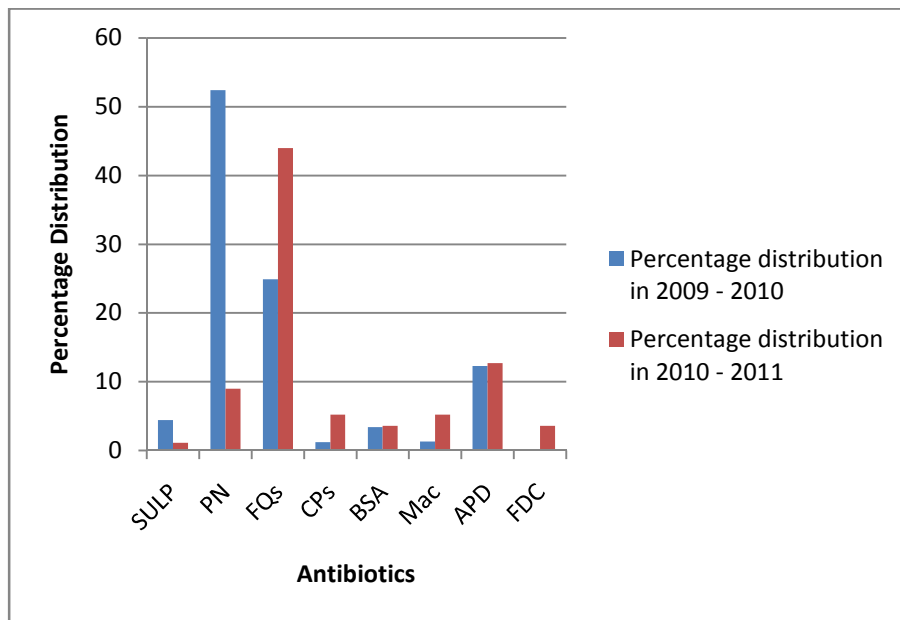


Fig. 1. Percentage distribution of group of drugs (2009-2010 vs 2010-2011)

On analysing the prescribers' prescribing pattern towards antibiotics, the following results were revealed. 83% of the consultants preferred to prescribe penicillin groups of antibiotics such as Ampicillin and Amoxicillin in primary cases/ for the first time. The percentage of 62.1% was observed as AMR in their practice. Many practitioners were not aware of Multidrug Resistance (MDR) (50.5%) nor the type of neither infections (52.6%) nor the group of antibiotics (57.9%) exhibiting resistance. Out of total rural population 82.5% take self-

medication, 51.5% have drugs through OTC, 48.5% take left out drugs and 28.5% get from relatives see Fig. 2.

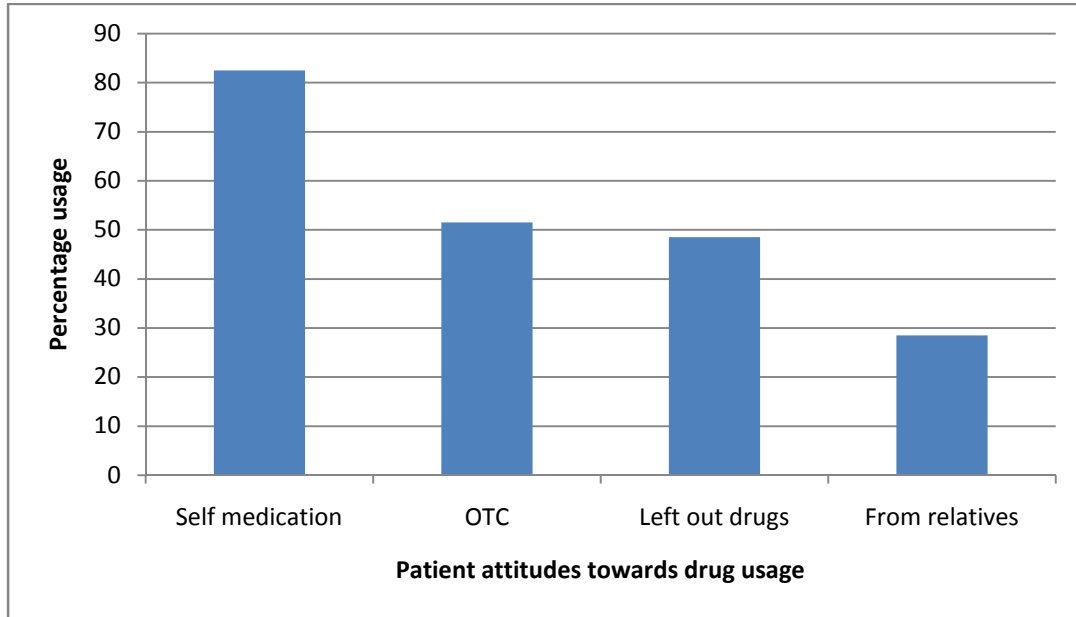


Fig. 2. Percentage distribution towards the patient's attitude in antibiotic usage

4. DISCUSSION

Antimicrobial resistance is a global threat affecting industrialized and developing countries. Prescribing pattern of drugs reflects the clinical judgement of the clinicians [14]. Antibiotics are considered as the second most prescribed drugs in the world, only next to the drugs indicated for cardiovascular diseases [15]. In our study, 76.2% were prescribed with antibiotics in their prescription. The common antibiotics used in relation to beneficiaries were semisynthetic penicillins, fluoroquinolones, metronidazole, cephalosporins and fixed dose combinations in 2009-2010. Analysis of utilization of antibiotics in our pharmacy during the year of 2010-2011 revealed a reduction in antibiotic use. At the same time there was a shift in the preferred drug from semisynthetic penicillin to fluoroquinolones, metronidazole, cephalosporins and others. This contradicts the study conducted by Ain et al. (2010) who documented amoxicillin as the most common antibiotic prescribed [4].

Our infection control committee reported that the penicillin group of antibiotics like ampicillin and amoxicillin showed (95%) of resistance in various isolates. Reasons for AMR in the OPD may be due to irrational use of antibiotics by general practitioners, and other health care workers in and around tertiary care hospital, vigorous incentive based marketing for prescription writing has lead to sub therapeutic or inadequate dose.

Self-administration of antibiotics is considered as a key reason for irrational use, followed by inappropriate prescription by physicians. Generally the role of pharmacists in proper dispensing of antibiotics also plays a major role in this. A global survey reported the trend of using leftover drugs and recommended to dispense only the exact number of pills to the

patients. Better physician-pharmacist relationship can promote rational antibiotics usage to a larger extent [16]. In this study, out of 400 rural populations, 82.5% take self-medication, 51.5% have drugs through OTC, 48.5% take left out drugs and 28.5% get from relatives. It showed unawareness of AMR among rural population. Most of the patient used to attend the big institutions with severe illness after attempting the local practitioners with irrational prescription or self-medication or OTC drugs or more than these two, which are the factors responsible for AMR. The shift in prescribing pattern in this study may due to these reasons. Even though Doctors are aware of their professional responsibilities and even though they have knowledge on guidelines for prescription, but in reality for the safer side they are forced to prescribe the broader group of AMA.

Our study reports, 62.1% antibiotic resistance in the OPD. Among the subjects included, 50.2% of prescribers were not aware of MDR nor the type of infections (52.6%) nor the group of antibiotics (57.9%) exhibiting resistance. Tertiary care hospitals are a potential source for development and spread of bacterial resistance being in the loop to receive outpatients and referrals from community nursing homes / primary health centres or nearby hospitals [13]. Various remedial measures (10 steps) to curbs minimize, eliminate the increasing AMR have been suggested under "Antimicrobial stewardship" [13].

Prescription of antibiotics in generic names is also poor in this study, as only 29.5% of the antibiotics were prescribed in generic names [14]. In the study area, 68.4% of prescribers prescribed the antibiotics in branded name. This is unfavourable dispensing situation for our pharmacists. Branded name drugs are costlier than generic drugs and prescribing drugs in their branded name may lead to confusion among the pharmacists while dispensing and also leads to incomplete-course consumption of AMAs and economical stress to our rural patients. This scenario is an evidence of vigorous promotional strategies by pharmaceutical companies [14].

The periodic auditing of antibiotic prescriptions ensures the rational use of drugs by adhering the WHO guidelines [18]. In the institutional level we recommend regular CMEs and integrated teaching programmes for the doctors at different levels to encourage prescribing by generic names and on correct writing of prescriptions. The problem of rational antibiotic use requires the coordination of the activities of health care authorities, institutions and individual practitioners. Establishment of a rational antibiotic policy (RAP) is a key issue for combating antimicrobial resistance. Each health-care institution should have a therapeutics team, which should develop a confined antibiotic policy based on countrywide recommendations. Therapeutics committee should be multidisciplinary so that the strategy is acceptable to all sections of the organization and should observe the execution of the strategy, receive feedback information, assess the ending and converse it with the prescribers [19]. The policy should be revised each year, based on the experience of prescribers and the susceptibility reports of the microbiology laboratory. Although defined at a very preliminary stage, the minimum standards should be: -Establishment of an antimicrobial resistance surveillance system on a computer-based programme, e.g. WHONET to provide data about antibiotic usage, resistance and linked clinical information.

Antibiotics are considered as the second most prescribed drugs in the world, only next to the drugs indicated for cardiovascular diseases [15]. In our study, it showed 76% of prescription contains antibiotics. The prescribing pattern and antibiotic utilization in pharmacy were found to have changed in this study period [17]. AMR pattern of our previous study, Hospital infection control reports, patient attitudes towards medication and percentage of attitude and awareness of MDR and AMR among our medical practitioners drive us to make-an urgent

need for making Surveillance Network system for AMR, antibiotic policy including antibiotic cycling and conducting AMR awareness programmes for both the prescribers and end users, to rationalize the use of antibiotics. Quality of treatment can be improved by setting certain standards at all levels of health care delivery systems. It is important to assess the quality of patient care through proper surveillance.

5. CONCLUSION

Most infections, including the infections of nosocomial origin, are serious in nature and require longer and complex treatment procedures. The treatment modalities for such infections always include antibiotics. As the drug resistance is on the raise, there is a huge need for taking steps to promote rational antibiotics use. Antibiotics are the most commonly used and misused drugs by patients and prescribers. Early disease recognition and early start of corrective treatments for such infections were proved to have significant outcomes in terms of treatment effectiveness. Further awareness required to the prescribers and beneficiaries regarding antimicrobial resistance. This study also suggests that a hospital formulary encompassing national essential drug list, prescription auditing and generic prescribing are urgently needed.

CONSENT

All authors declare that 'written informed consent was obtained from the patient (or other approved parties) for publication of this case report and accompanying images.

ETHICAL APPROVAL

Authors hereby declare that all experiments have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Isabella T, Chennama B, Yugandhar B, Balakrishnan S. Antibiotic prescribing pattern in ophthalmology outpatient department in a tertiary care hospital. *J Pharmacol Pharmacother.* 2012;3(2):190-1.
2. Shalini S, Ravichandran V, Mohanty BK, Dhanaraj SK, Saraswathi R. Drug utilization studies—an overview. *Inter J Pharmaceut Sci Nanotechnol.* 2010;3(1):803-10.
3. Laporte JR, Porta M, Capella D. Drug utilization studies. A tool for determining the effectiveness of drug use. *Br J Clin Pharmacol.* 1983;16(3):301-4.
4. Farhan AK, Sheikh N, Mohammed TS. Patterns of prescription of antimicrobial agents in the Department of Otorhinolaryngology in a tertiary care teaching hospital. *Afr J Pharm Pharmacol.* 2011;5(14):1732-8.
5. Das BP, Sethi A, Rauniar GP, Sharma SK. Antimicrobial utilization pattern in outpatient services of ENT department of tertiary care hospital of Eastern Nepal. *Kathman Univ Med J.* 2005;3(4):370-5.

6. Shankar PR, Dubey AK, Rana MS, Mishra P, Subish P, Vijaya Bhaskar P. Drug utilization with special reference to antimicrobials in a Subhealth post in Western Nepal. *J Nep Hlth Res Council*. 2005;3(2):65-9.
7. Kanakambal S, Murigesh N, Shanthi M. Drug prescribing pattern in a tertiary care teaching hospital in Madurai (Tamilnadu). *Ind J Pharmacol*. 2001;33:223.
8. Sepehri G, Meimandi MS. The quality of prescribing in general practice in Kerman, Iran. *Int J Hlth Care Qual Assur*. 2005;18(5):353-60.
9. Smith RD, Coast J. Antimicrobial resistance: A global response. *Bull World Hlth Organ*. 2002;80:126-33.
10. Levy SB, Marshall B. Antibacterial resistance worldwide: Causes, challenges and responses. *Nat Med*. 2004;10(Suppl.12):122-9.
11. Global Antibiotic Resistance partnership (GARP)–India working group. Rationalizing antibiotic use to limit antibiotic resistance in India. *Ind J Med Res*. 2011;134:281-94.
12. Anita K, Kathleen H, Chaudhury RR. Methodology for surveillance of antimicrobials use among out-patients in Delhi. *Ind J Med Res*. 2009;129:555-60.
13. Jeyaseelan TS, Revathi P, Rath PK, Suresh M, Vigneshwari RS, Uma A, et al. Antimicrobial resistant pattern of gram negative bacteria to third generation cephalosporins in rural and urban centres of Tamil nadu, India. *The Internet J Biol Technol*. 2012;3(1):32-8.
14. Marjani A, Gharavi AM, Jahanshahi M, Vahidirad A, Alizadeh F. Stress among medical students of Gorgan (South East of Caspian Sea). *Kathman Univ Med J*. 2008;6(3):421-5.
15. Tünger O, Dinc G, Ozbakkaloglu B, Atman UC, Alqun U. Evaluation of rational antibiotic use. *Int J Antimicrob Agents*. 2000;15(2):131-5.
16. Kardas P, Pechere JC, Hughes DA, Cornaglia G. A global survey of antibiotic leftovers in the outpatient setting. *Int J Antimicrob Agents*. 2007;30(6):530-6.
17. Remesh A, Salim S, Gayathri AM, Uma N, Retnavally KG. Antibiotics prescribing pattern in the in-patient departments of a tertiary care hospital. *Arch Pharm Pract*. 2013;4(2):71-6.
18. Bimo, Chowdhury A, Das A, Diwan V, Kafle KK, Mabadeje B, et al. How to investigate drug use in health facilities: Selected drug use indicators-EDM. Geneva: World Health Organization; 2012.
19. Keuleyan E, Gould M. Key issues in developing antibiotic policies: From an institution level to Europe-wide. European study group on antibiotic policy (ESGAP), Subgroup III. *Clin Microbiol Infect*. 2001;7(6):16-21.

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