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Research Article

PRESCRIPTION PATTERN, COST, AND APPROPRIATENESS OF ANTIMICROBIAL USE BY RURAL PRIVATE PRACTITIONERS - A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Objectives: Antimicrobial consumption in India is continuously increasing, and so are the chances of the emergence of antimicrobial resistance. This present study intends to identify and assess the appropriateness of antimicrobials prescribed by rural private practitioners and the average cost of antimicrobials per prescription.

Methods: This prospective observational study was conducted by the Department of Pharmacology, Government Medical College, Jaulan (Orai). The study included all the prescriptions coming to the chemist shops in the rural town area, having one or more antimicrobials written by private practitioners and assessed for prescription pattern, appropriateness, and cost.

Results: Most antimicrobials were prescribed for gastrointestinal infection (33.50%), followed by fever (27.70%). Only in 12.60% of prescriptions, the utilization of antimicrobials in treatment was established (Category I), and in 56.20% of prescriptions rationale for the utilization of antimicrobials was not established (Category IV and V).

Conclusions: In the study, we found that the maximum antimicrobials prescribed in private settings were by doctors having only MBBS degrees, and more than half of the prescriptions were Inappropriate. More efforts are required to train our medical graduates in antimicrobial stewardship and Antibiotic Stewardship, Prevention of Infection and Control programs and nursing staff to make these programs successful at the ground level.

Keywords: Rural practitioners, Prescription pattern, Cost, Prescription appropriateness.

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INTRODUCTION

Antimicrobial resistance (AMR) is the presence of resistance to antimicrobial medicines in infectious agents, such as bacteria, viruses, fungi, and parasites. It can be inherent or acquired by the inappropriate use of medicines [1]. It is a significant concern worldwide, particularly in developing countries like India, because it's associated with high morbidity and mortality and also puts an enormous economic burden and wastes limited resources [2]. A report from the World Health Organization (WHO) clearly states that not just the just poor or developing countries; this menace of AMR has now spread throughout the world [3]. Antimicrobial-resistant microorganism continues to multiply even in the presence of a therapeutic level of antimicrobial.

The estimated average cost of a 5-day course of common antimicrobials in India is $1.93, and therefore the financial burden of unnecessary antimicrobials dispensed by pharmacies in India may exceed $1 billion [2]. Various factors responsible for AMR include patient, physician, environment, and others. Patient lack of compliance and non-prescription-based use of inappropriate antimicrobials for self-limiting infections are one of the common reasons for AMR [2,4,5]. Sometimes the doctor tries to satisfy the patient's expectations and prescribes antimicrobials for their symptoms. The utilization of antimicrobials for viral infections and the incentives offered by the pharmaceutical industry to prescribe antimicrobials can also be a reason for AMR [6-8]. Environmental factors responsible for AMR include animal discharges that contaminate the environment directly with resistant organisms or indirectly with the discharge of antimicrobials, untreated pharmaceuticals, and hospital wastewater into water bodies and excessive use of antimicrobials in animal husbandry [2,9]. Other factors responsible for AMR include a lack of surveillance mechanisms for monitoring antimicrobial use and resistance and a lack of proper lab investigation facilities such as culture and drug sensitivity [6,10,11]. India has the world's highest rate of AMR, and a recent report showed a direct association between inappropriate and irrational use of antimicrobials and the development of AMR [9]. According to estimations, the prevalence of AMR microorganisms ranges from 50% to 90% [12]. According to the Census of 2011, Of the 121 crore Indians, 83.3 crores live in rural areas. However, most studies on antimicrobial prescription patterns were done in tertiary care hospitals in urban areas [9]. Furthermore, there are only a few studies regarding the appropriateness of antimicrobial prescriptions by those prescribed by private practitioners [7]. With the above background, the study was conducted to identify and assess the appropriateness of antimicrobials prescribed by rural private practitioners and assess the average cost of antimicrobials per prescription.

METHODS

A prospective observational study was conducted at the Department of Pharmacology and Therapeutics, Government Medical College, Jalaun (Orai), after obtaining approval from the Institutional Ethics Committee.

The study participants included the chemist shops in the nearby rural and town area of Jalaun (Orai). The purposive sampling method was used to decide the sample size, and 1000 prescriptions were analyzed. All prescriptions having at least one or more antimicrobials written by private practitioners coming to the chemist shop in rural and town areas of Jaulan (Orai) were included in the study.

Inclusion criteria

Prescriptions with at least one or more antimicrobials belonging to patients of Medicine, Surgery, Orthopedics, Obstetrics and Gynecology, and Pediatrics from chemist shops in rural and town areas were included in the study.

Exclusion criteria

Prescriptions from any other department apart from those mentioned above and prescriptions without antimicrobials were excluded from the study.

A total of 1000 prescriptions were analyzed for age, sex, signs, and symptoms of infection and provisional or definitive diagnosis mentioned or not, site of infection, source of infection identified or not, the number of antimicrobials prescribed, name of antimicrobials, whether generic or branded prescribed, correct doses of antimicrobials and correct duration of antimicrobial therapy mentioned or not, whether culture sensitivity test was done/ordered or not, or there was any change in antimicrobial therapy (addition or substitution), compatibility of co-prescribed antimicrobials, bacterial morphology, and gram stain performed or not performed.

Average antimicrobial drug costs per prescription were calculated based on whether a generic or brand-name antimicrobial agent was prescribed. The cost of each antimicrobial agent was calculated from the drug price as reported in drug today.

Wherever possible educational qualification of the prescriber was noted to know the stream of medical science the prescriber belongs to and whether or not he/she is qualified to prescribe antimicrobials. The prescriber's and patient's identities were kept confidential, and only details of the qualification of the prescriber were used in the study.

Assessment for the appropriateness of antimicrobials was done whenever possible. Principles of antimicrobial prescription and prescription assessment tools for evaluating the appropriateness of antimicrobial prescribed were based on a tool developed by Adorka *et al*. [13] Consent for using the tool was obtained from the developer before the commencement of the study.

First, data were tabulated in Microsoft Excel and were later analyzed using Statistical Package for the Social Sciences (SPSS version 15.0) software using appropriate statistical methods.

RESULTS

Out of 1000 prescriptions that were analyzed from Rural Private Practitioners, Jalaun (Orai), a maximum number of antimicrobials were by doctors having only MBBS degrees (68.60%) followed by MD/PG diplomas having doctors (18.40%) and BAMS doctors (13%) (Fig. 1).

On analysis of the prescription pattern, antimicrobials were prescribed most frequently for Gastrointestinal Infection (33.50%), followed by fever (27.70%) and least for lower RTIs (6.40%) (Fig. 2).

Of all the 1000 prescriptions analyzed, 13.40% of prescriptions contained more than one antimicrobial, and these were mainly prescribed by MBBS doctors (43.28%), followed by BAMS doctors (37.32%) and MD/PG Diploma doctors (19.40%) (Table 1).

On analysis, it was found that a total of 1188 antimicrobials were prescribed, out of which quinolones (34.0%) were prescribed most frequently, followed by anti-protozoal (25.67%), B lactams (21.04%), and aminoglycosides (11.20%). Macrolides (0.51%) and Tetracycline (1.34%) were prescribed less frequently (Table 2).

According to the assessment tool developed by Adorka *et al*. used for evaluating the appropriateness of antimicrobials, out of 1000 prescriptions analyzed, only 12.60% of prescriptions needed for the use of antimicrobials in treatment was established (Category I), 29.2% of prescriptions belonged to Category II (Infection present but not confirmed), in 2% use of antimicrobial prophylactically was established (Category III) and 56.20% prescriptions belonged to (Category IV and V), that is, the rationale for the use of antimicrobial was not established (Fig. 3).

Among 258 prescriptions belonging to Category IV, 68.21% were prescribed by MBBS doctors, 16.27% by BAMS doctors, and 15.5% by MD/MS/Diploma doctors. Out of 304 prescriptions belonging to Category V, 63.15% of antimicrobials were prescribed by MBBS doctors and 26.13% by BAMS, and 10.52% by MD/MS/Diploma doctors (Table 3).

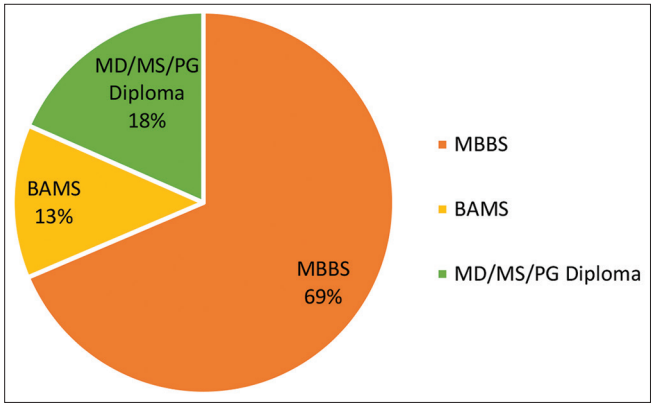

Fig. 1: Distribution of prescriptions according to the qualification of prescribers

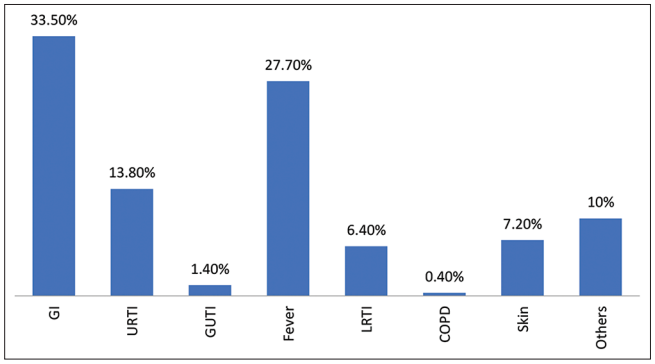

Fig. 2: Clinical conditions/Complaints for which antimicrobials were prescribed. GI: Gastrointestinal infection, URTI: Upper respiratory tract infection, GUTI: Genitourinary tract infection, LRTI: Lower respiratory tract infection, COPD: Chronic obstructive pulmonary tract infection

Table 1: Prescriptions containing more than 1 antimicrobials

Qualification of prescriber	n (%) n=134
MD/MS/Diploma	26 (19.4)
MBBS	58 (43.28)
BAMS	50 (37.32)

Table 2: Frequency and percentage of class of antimicrobials prescribed by rural private practitioners

Class of antimicrobial	Frequency of antimicrobials n (%) n=1188
B Lactams	250 (21.04)
Quinolones	404 (34)
Macrolides	6 (0.51)
Anti-protozoal	305 (25.67)
Anti-fungal	22 (1.85)
Anti-helminthic	34 (2.86)
Tetracycline	16 (1.34)
Aminoglycosides	133 (11.20)
ATT	12 (1.01)
MDT (Leprosy)	4 (0.34)
Sulfonamides	2 (0.18)

ATT: Anti-tubercular treatment

On the calculation of the total cost of antimicrobials prescribed by private practitioners for 5 days of treatment, it came out to INR 2,12,910.2 ($ 3000.74), that is, INR 212.91 ($ 3.01) per prescription and 40.42% of the total cost burden, that is, INR 86,058.34 was due to inappropriate use of antimicrobials (Category IV and V) (Table 4).

DISCUSSION

This study was intended to assess prescription patterns, cost, and appropriateness of antimicrobial use among rural private practitioners. One thousand prescriptions from private practitioners from the town of Orai and nearby areas were analyzed. Private practitioners prescribed a total of 1188 antimicrobials.

Most (68.6%) of antimicrobials were prescribed by MBBS doctors in a private setting. Lack of simple diagnostic tools such as culture and sensitivity and simple biochemical test results in prescribing antimicrobials on a symptomatic basis.

Our study also found that 134 (13.4%) prescriptions from private prescriptions had more than one antimicrobial. Combining two or more antimicrobials can increase the spectrum of coverage and decrease the chances of the emergence of resistance. It can show synergistic effects, but combination antimicrobial has disadvantages, and irrational use can worsen the already alarming scenario of antibiotic resistance.

Antimicrobials were mainly prescribed based on symptoms and were most commonly prescribed for symptoms of gastrointestinal infection by private practitioners (33.50%), followed by the symptom of fever (27.70%). Private practitioners also prescribed antimicrobials in 13.80% of patients presenting with symptoms of upper respiratory tract infection (RTI) such as cough and cold. Our results were comparable to other studies conducted in India and other countries [11,14,15].

The use of antimicrobials in treating Upper RTI is not only ineffective but also adds to the cost and increases the likelihood of the development of AMR [16]. Avoid prescribing antimicrobials for URTI, and promoting a scoring system like CENTOR SCORE would increase the rational use of antimicrobials [17,18]. Symptoms of acute gastroenteritis (AGE) are normally self-limiting in most patients, and therefore the use of antimicrobials is not indicated in empirical treatment [19]. Empirical treatment of AGE is indicated in certain situations, like in patients with febrile diarrheal illness, a patient having fever and bloody diarrhea, or symptoms persisting for >1 week or with immunocompromised status [6]. Treatment of fever is only symptomatic, and antimicrobials are indicated only when it is associated with other symptoms and diagnosis of infection is confirmed by appropriate laboratory investigations.

The appropriateness of each antimicrobial prescribed was assessed using an assessment tool, and more than half, 56.20%, of the antimicrobials prescribed by private practitioners were found to be inappropriate. In our study, the inappropriate use of antimicrobials was found to be much higher than those seen in developed countries [20,21]. Since doctors with MBBS degrees prescribed the most inappropriate antimicrobials, it raises serious concerns over the extent the National action plan (NAP) for containing AMR has been implemented. This NAP outlines priorities and strategies for curbing AMR in India [22]. In 2012, the antibiotic stewardship, prevention of infection and control program was started by the ICMR, designed to compile the faculty from clinical pharmacology, microbiology, and other disciplines to work together to initiate and improve antibiotic stewardship [23,24]. But still, more than 50% of health institutes lack an Antimicrobial Stewardship (AMS) program. The most common reasons for the non-implementation of AMS were lack

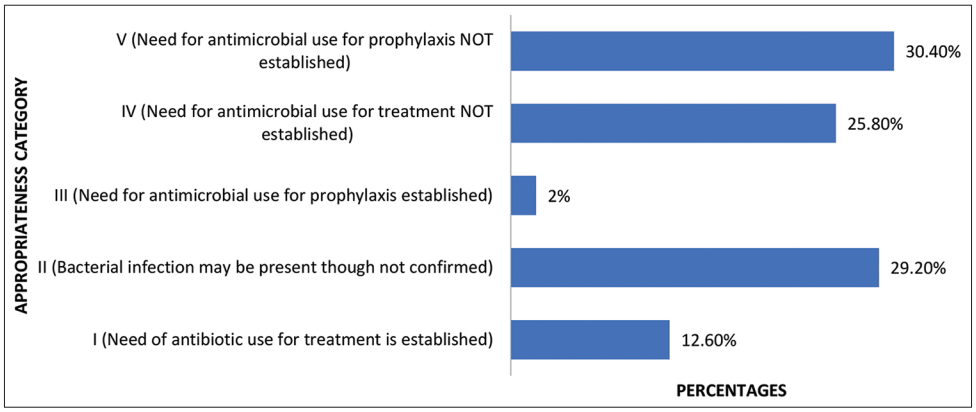

Fig. 3: Distribution of prescriptions according to appropriateness category

Table 3: Prescription pattern for Category IV and V among BAMS, MBBS and MD/MS/diploma doctors

Appropriateness category	Prescribed by BAMS doctors (%)	Prescribed by MBBS doctors (%)	Prescribed by MD/MS/ Diploma doctors (%)
IV (Need for antimicrobial usage for treatment not established)	42 (16.28)	176 (68.21)	40 (15.51)
V (Need for antimicrobial usage for prophylaxis not established)	80 (26.32)	192 (63.16)	32 (10.52)

Table 4: Cost burden due to Inappropriate use of antimicrobials for treatment (Category IV) and Prophylaxis (Category V)

Appropriateness category	Prescribed by BAMS (%)	Prescribed by MBBS (%)	Prescribed by MD/ PG Diploma (%)	Cost burden due to antimicrobials prescribed in each category (in INR) (%)
IV (Need for antimicrobial use for treatment NOT established)	42 (16.28)	176 (68.21)	40 (15.51)	45,605.4 (21.42 of the total cost burden)
V (Need for antimicrobial usage for prophylaxis NOT established)	80 (26.32)	192 (63.16)	32 (10.52)	40,452.94 (19.0 of the total cost burden)
Total Cost: INR				86.058.34 (40.42% of the total cost)

of funding, information technology, awareness of administration, and prescriber opposition [23,24]. Lack of culture and sensitivity (C & S) and paucity of microbiological and biochemical testing is one of the reasons for prescribing antimicrobials on a symptomatic basis. In 2015, the WHO launched Global AMR and Surveillance system to standardize AMR surveillance, yet surveillance of AMR has not reached the required standards and, in most parts of India, it is absent [25].

Undoubtedly, increased availability and affordability of antimicrobials have improved the healthcare scenario, but on the other hand, it has increased the chances of emergency AMR many folds. The cost per prescription of antimicrobials prescribed by private practitioners is INR 212.91 ($ 3.0). It was much cheaper than the cost per prescription in other parts of the world [21,26].

There have been only a few studies done to evaluate the appropriateness of antimicrobials, and that too in urban tertiary hospitals. No study identified and assessed the appropriateness of antimicrobials prescribed by rural private practitioners from the Bundelkhand region, which is among the foremost backward region of the State of Uttar Pradesh, India. Reluctant Limitations of the study were that chemists were reluctant to share details of prescriptions, although details of prescribers were to be kept confidential, and there was a paucity of knowledge for comparison.

CONCLUSION

Antimicrobials are getting a staple in modern medicine, which may produce catastrophic results in the near future due to the emergence of AMR, making treatment of previously sensitive microorganisms difficult, resulting in an increase in morbidity and mortality. Our study found that 56.2% of the prescriptions analyzed were inappropriate according to the assessment tool used and contributed to 40% of the total antimicrobial cost burden.

It is evident from the study that despite AMS and NAP guidelines, the inappropriate use of antimicrobials is increasing rapidly as healthcare professionals and hospital administrators are not actively participating in these programs. There is a strict need to supervise the antimicrobials prescribing patterns and consumption and dispensing from the pharmacy shops. This study also gives insight to medical practitioners practicing in backward rural areas of Uttar Pradesh, like Jalaun (Bundelkhand region), about antimicrobial consumption, inappropriate prescription patterns, and extra cost burden due to inappropriate use. It will thus help in reducing AMR in rural areas of India.

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AUTHORS CONTRIBUTION

Dr. Piyush Misra contributed to the concept, intellectual content, study design, literature search, manuscript preparation, and manuscript editing. Dr. Neha tyagi contributed to the study design, data analysis, manuscript preparation, editing, and manuscript review. Dr. Prashant Upadhyay contributed to the study design, data acquisition, data analysis, statistical analysis, and manuscript preparation.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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