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Original Research Article

Prescription pattern of antibiotics in hospital discharge summaries of a tertiary care hospital in India: a cross-sectional study

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ABSTRACT

Background: Particularly in poor and developing nations, antibiotics have a remarkable role in extending life. Inappropriate antibiotic prescribing methods are implicated by a number of factors, including a lack of communication between the doctor, pharmacist, and patients, peer pressure and patient demands, diagnostic uncertainty, and inadequate expertise among clinicians. Aim of this study was to observe pattern of antibiotic prescribing in discharge summaries of admitted patients.
Methods: A cross sectional IPD based study was carried out in a tertiary care hospital of north India for a period of 3 months.500 discharges were collected and data regarding antibiotic prescribing was analysed in the form of Name, and route of the antibiotic prescribed, usage of multiple antibiotics, usage of prophylactic antibiotic, prescribing of antibiotics according to access watch and reserve. The recorded data was then compiled in spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 29.0 and R software.
Results: Total 500 discharge summaries were analysed. A total of 468 (93.6%) antibiotics were prescribed. Females were prescribed a high number of antibiotics compared with males. Antibiotics were prescribed most commonly to patients of >60 years of age. Out of 468 antibiotics (101) antibiotics were from ACCESS group 314 from WATCH group and 53 from RESERVE. Percentage of drugs prescribed by generic name was 1.6%.58.4% of prescriptions had a single antibiotic, and 16.6% of the population have received multiple antibiotics.
Conclusions: Out of 500 prescriptions analysed 468 prescriptions had antibiotics prescribed which constituted a percentage of about 93.6% exceeding the WHO limit of 30% suggestive of irrational antibiotic prescribing. WATCH group of antibiotics constituted the highest number according to AWaRe which is a concern since these antibiotics have higher resistance potential and includes highest priority agents among antibiotics. Awareness among the physicians must be boosted up in this regard. Strict implementation of the use of standard treatment guidelines and Adherence to AWaRe prevents inappropriate prescribing. To combat antibiotic resistance such studies should be continued and proper auditing after every 3 months should be implemented.

Keywords: Antibiotics, Irrational prescribing, AWaRe, Antimicrobial resistance

INTRODUCTION

Antibiotic resistance was specifically mentioned as a major threat to public health economic growth and global economic stability. It poses a severe hazard to public health worldwide.[1] Antibiotic resistance rates increase duration of treatment and result in prolonged hospitalization.[2] The key contributing cause to this resistance is inappropriate or irrational use of antibiotics. Irrespective of the worrying growth in resistance, there is

an increased irrational prescribing practice of antibiotics across different locations.[3] In order to update the Essential Medicines List, the World Health Organization (WHO) commissioned thorough reviews on the usage of antibiotics for particular illnesses in 2017.[4] The mushrooming of multiple new antibiotic classes with excellent safety reports has led to significant improper antibiotic usage and a lack of strict prescription guidelines at a multitude of global locations. Studies revealed that between 30 and 50 percent of antibiotic prescriptions are written incorrectly and without following prescription criteria.[5] Every year, antibiotic resistance results in 700,000 deaths globally, 25,000 in the United States, and 23,000 in America.[6] Research has shown that 70–100% of Enterobacteriaceae in India include Extended Spectrum Beta-Lactamase (ESBLs), and that the carbapenem group of antibiotics is widely and uncontrollably used to treat ESBLs which has led to the development of carbapenem resistance in India's New Delhi Metallo-Beta-Lactamase (MBL).[7] It is estimated that by 2050, drug-resistant diseases will claim 10 million lives yearly and result in US$100 trillion in economic losses worldwide if antibiotic resistance keeps growing as it has been for the past few decades.[6] Antibiotic resistance must therefore be addressed immediately. Antibiotic Stewardship Programs and Hospital Infection Control Committees (HICC) are essential in avoiding resistance to antibiotics.[8]

Significant regional differences exist in the prescription pattern for antibiotics, which may be attributed to differences in medication price of the medication, physician preferences, and susceptibility. In order to create global and local strategies and guidelines for battling antibiotic resistance, analysis of regional differences in the pattern of antibiotic prescriptions is crucial.[9,10] The development of antibiotic resistance must be slowed down by periodically monitoring antibiotic use, determining the causes of their improper use, and proposing remedies. The Infectious Diseases Society of America and the Society for Healthcare Epidemiology developed a guide to help develop a program to rationalize the use of antibiotics in hospitals. Society of America, suggests that an important tactic to support equitable and appropriate use of antibiotics is the audit of medicines together with engagement, intervention, and feedback to the doctor who prescribes the drug.[11] Subsequently, the expert committee developed the ACCESS, WATCH, RESERVE (AWaRe) antibiotic classification scheme, which aims to improve clinical outcomes and accessibility while reducing the likelihood of antibiotic resistance and preserving the potency of last-resort antibiotics.[12] ACCESS group of antibiotics are first and second choices for empirical treatment of 21 common or severe clinical syndromes. The Access group of antibiotics are a core set of antibiotics and should always be made available in every place at an appropriate quality, dose, duration, formulation, and price. The WATCH group includes antibiotics with higher toxicity concerns or resistance potential compared with the Access group. The Watch group antibiotics assist the development of tools for stewardship at the local, national, and global levels. The RESERVE group antibiotics are last-resort options and are used for specific patients and clinical settings in case of failure of other alternatives. Prioritizing this group as key targets of high-intensity national and international stewardship programs preserves their effectiveness.[13]

The present study was conducted to evaluate the patterns of antibiotic prescribing in the hospital's inpatient department. In order to investigate the various classes of antibiotics provided to patients upon their discharge from the hospital.

METHODS

A cross sectional IPD based study was carried out in In Patient department of Shri Maharaja Hari Singh Hospital for a period of 3 months from December 2023 to February 2024. The study was carried out after approval of institutional review board (IRB) and institutional ethics committee (IEC) on 22/11/23. All discharge summaries of in-patient department irrespective of patient characteristics and patients willing to share their discharge summaries after proper counselling and consent were included in the study. Patients discharged on holidays were excluded from the study. 500 discharges satisfying the inclusion criteria were selected and data regarding antibiotic prescribing was analysed. Data was collected using a data collection checklist which included patient identity age, legibility, Name of the antibiotic prescribed, usage of multiple antibiotics, usage of prophylactic antibiotic and prescribing of antibiotics according to access watch and reserve.

Statistical analysis

The data regarding the drugs prescribed were analysed and assessed with respect to the aim of study. The recorded data was compiled and entered in a spreadsheet (Microsoft Excel) and then exported to data editor of SPSS Version 29.0 (SPSS Inc., Chicago, Illinois, USA) and R software. Continuous variables were expressed as Mean±SD and categorical variables were summarized as frequencies and percentages. Graphically the data was presented by bar line diagrams and pie charts.

RESULTS

This section represents analysis and interpretation of data collected from the study patients related to the set objectives. The results of the study conducted on 500 patients are presented here.

The medical records with discharges were 500. Among them, 241 (48%) were males and 259 (52%) were females (Figure 1). The medical records audited included four departments in which majority of the prescriptions were from Department of General medicine 350,100 were from Department of General Surgery, 40 were from Department

of ENT and only 10 were from Dermatology department (Figure 2).

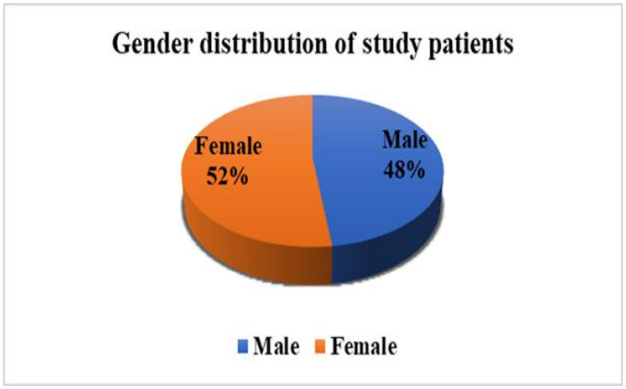

Figure 1: Male and female distribution.

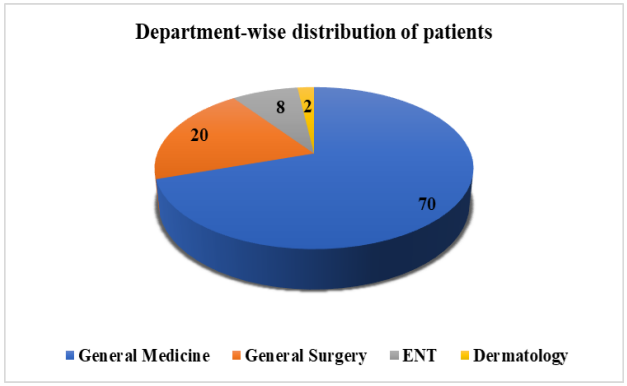

Figure 2: Department wise distribution of patients.

Table 1: Distribution of antibiotics according to AWaRe.

Group	Frequency
Access	53
Watch	314
Reserve	101
Total	468

This table indicates the distribution of patients across different groups: RESERVE, WATCH, and ACCESS. The Reserve group comprises approximately 11.32% of the total patients indicating a small portion under this group which is in accordance with WHO guidelines.

The majority of patients, around 67.09%, fall into the WATCH group, indicating a significant portion under observation or monitoring.

The ACCESS group accounts for approximately 21.58% of the patients, indicating a substantial but smaller portion compared to the Watch group, possibly indicating a group with varying levels of access to care or resources.

Table 2 and Figure 3 show the frequencies of various antibiotics being prescribed to the patients. The frequently prescribed antibiotic is Cefpodoxime followed by Amoxycillin and clavulanic acid which is in turn followed by Levofloxacin. The least prescribed antibiotic was Ceftriaxone and Sulfamethoxazole and trimethoprim.

Table 2: Different classes of antibiotics used with different frequencies.

S. no.	Antibiotic	Frequency
1	Amoxycillin and clauvinic Acid	96
2	Cefpodoxime	102
3	Levofloxacin	78
4	Moxifloxacin	58
5	Farropenem	23
6	Sulfamethaxozole and Trimethoprim	5
7	Piperacillin and Tazobactum	19
8	Azithromycin	57
9	Ceftriaxone	0
10	Meropenem	30

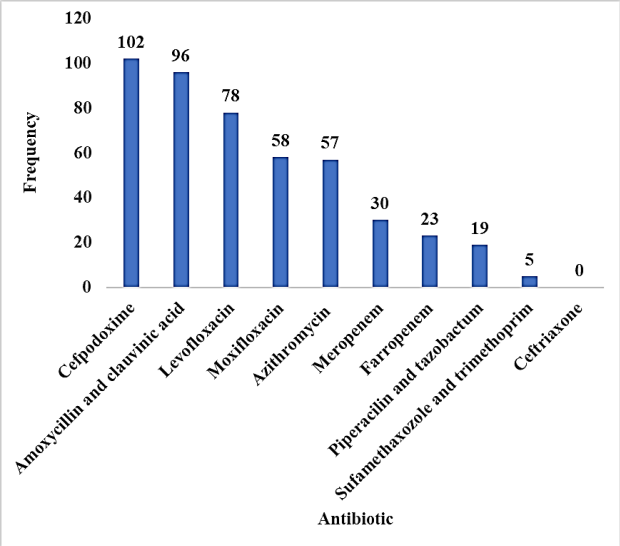

Figure 3: Antibiotic distribution.

Table 3: Age distribution of patients in relation to AWaRe.

Age group (years)	Reserve	Watch	Access	Total
<20	5	22	12	39
21-40	8	70	22	100
41-60	22	86	31	139
>60	18	136	36	190
Total	53	314	101	468

The Table 3 and 4 illustrates the distribution of patients across various age groups within three categories: RESERVE, WATCH, and ACCESS. Among patients aged less than 20 years, the majority fall into the WATCH category with 22 patients. In the 21-40 age bracket, the WATCH category remains predominant with 70 patients. Patients aged 41-60 exhibit a similar pattern, with 86

patients under WATCH, among patients aged over 60 years, the highest count is again in the WATCH category with 136 patients. Overall, the data underscores the varying healthcare needs across different age groups, with a significant portion requiring ongoing observation or monitoring across all age demographics.

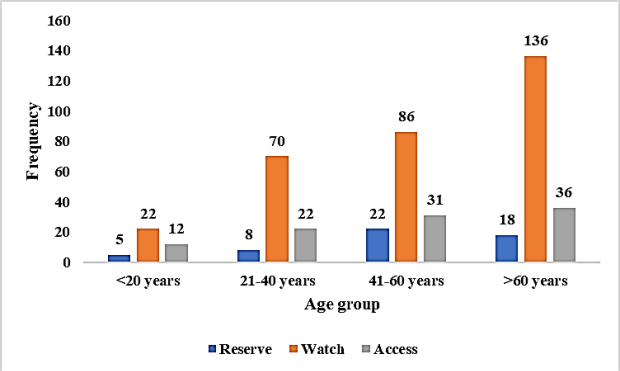

Figure 4: Age groups in relation with AWaRe.

The table 4 presents an analysis of antibiotic usage across different age groups, providing insights into the distribution of antibiotic prescriptions among patients of varying ages. Amoxicillin and clavulanic acid, as well as cefpodoxime, are frequently prescribed across all age groups, with a relatively higher proportion of patients aged 41-60 years and >60 years receiving these antibiotics. Levofloxacin also demonstrates significant usage, particularly among patients younger than 20 years and those aged >60 years. Moxifloxacin shows a varied distribution, with a notable proportion of younger patients receiving this antibiotic. Farropenem, sulfamethoxazole, and trimethoprim have comparatively lower usage across all age groups, while piperacillin and tazobactam exhibit a consistent distribution. Azithromycin is commonly prescribed, especially among patients younger than 20 years and those aged >60 years. Ceftriaxone, on the other hand, shows no usage in the dataset. Overall, the analysis highlights variations in antibiotic prescription patterns across different age brackets.

Table 4: Age distribution of patients and antibiotics.

Age group/antibiotic	<20 years	21-40 years	41-60 years	60 years	Total
Amoxicillin and Clauvanic acid	12	19	31	34	96
Cefpodoxime	8	16	31	47	102
Levofloxacin	9	18	22	29	78
Moxifloxacin	1	16	14	27	58
Farropenem	1	4	11	7	23
Sulfamethaxozole and trimethoprim	0	3	0	2	5
Piperacillin and tazobactum	1	4	6	8	19
Azithromycin	3	16	13	25	57
Ceftriaxone	0	0	0	0	0
Meropenem	4	4	11	11	30
Total	39	100	139	190	468

Table 5: Frequency of antibiotics per prescription with percentages.

No. of antibiotic	Frequency	Percentage
No antibiotic	125	25
Single antibiotic	292	58.4
Multiple antibiotic	83	16.6
Total	500	100

Table 6: Antibiotic prescribing according to WHO Indicators.

S. no.	WHO prescribing indicators	Percentage
1	Percentage of encounters with antibiotic prescribed	93.6%

This table 5 presents the distribution of antibiotic usage among a sample population of 500 individuals. It categorizes the antibiotic usage into three groups: "No antibiotic," "Single antibiotic," and "Multiple antibiotics." From the data, it's evident that the majority of individuals, comprising 58.4% of the sample, have been prescribed a single antibiotic, while 25% have not been prescribed any antibiotics. Additionally, 16.6% of the population have received multiple antibiotics.

This table 6 denotes the number of antibiotics prescribed in 500 prescriptions analysed according to WHO prescribing indicators. A total of 468 antibiotics were prescribed in 500 prescriptions accounting for about 93.6% which is almost 3 times more than WHO percentage of <30%.

DISCUSSION

We observed a high antibiotic prescribing rate in the patient age group >60. Interestingly, the rate of antibiotic prescription in the elderly was as high as 197 (39%). In general, the elderly are more vulnerable to infections, and

thus a higher number of antibiotics are expected to be prescribed for them. Females were prescribed a higher number of antibiotics than males. Relatively speaking, females are less exposed to external environments than males; however, in our study, females were prone to more infections which was similar to the study conducted by Valentina Orlando.[14]

The general medicine department covers a wide variety of diseases. Hence, the general medicine department consumed a higher percentage of antibiotics about 350 (70%). In our study single antibiotics prescribed were 292 (58.4%) compared to 83 (16.6%) prescriptions with multiple antibiotics. Oral antibiotics accounted for about 396 prescriptions (85%) and parenteral antibiotics for 70 prescriptions (15%).

In our study Cefpodoxime (20.4%) was the most frequently prescribed antibiotic, followed by Amoxycillin and Clavulanate acid (19.2%), followed by Levofloxacin (15.6%) and Azithromycin (11.4%). The least prescribed antibiotic was Meropenem Farropenem and sulfamethoxazole and trimethoprim Atif et al reported ceftriaxone was the most commonly prescribed antibiotic (71.8%).[15] The most frequently prescribed antibiotic class was cephalosporins (81.5%), which is similar to our study with cefpodoxime a cephalosporin prescribed in 102 prescriptions (20.4%). A repeated point prevalence survey on the appropriateness of antimicrobial prescribing reported that penicillin with beta-lactamase inhibitors were the most frequently prescribed antibiotics (30%), which was in close agreement (19.2%) with the results of our study.[16]

In their study, Mule et al found that azithromycin intake was higher (107.83 DDD/1000/day).[17] On the other hand, penicillin's (mean consumption 4.52 DDD/1000/day) were identified as a commonly used antibiotic subgroup in a population-based study on trends in antibiotic use in Korea. These were followed by second-generation cephalosporins (4.47 DDD/1000/day), macrolides (3.32 DDD/1000/day), and fluoroquinolones (2.75 DDD/1000/day).[18] Bansal et al reported higher consumption of ceftriaxone (143.22 DDD/1000 patient-days), followed by doxycycline (85.02 DDD/1000 patient-days) and azithromycin (66.37 DDD/1000 patient days, oral; 59.37 DDD/1000 patient days per oral.[19]

Mugada et al cited in the study, prescriptions were written for four antibiotics from the ACCESS category and five.[20] Antibiotics under the WATCH category was taken in large quantities. The hospital did not have standard treatment guidelines, which was almost identical to our study in which we saw six drugs from watch group and two drugs from ACCESS group with the exception of two antibiotics from RESERVE.

Amoxicillin and clavulanic acid are listed in the ACCESS category of the WHO model list of essential medicines. For COPD, hospital-acquired pneumonia, skin infections, and community-acquired pneumonia, it is the recommended first-choice antibiotic. For surgical prophylaxis, otitis media, soft-tissue infections, lower urinary tract infections, and bone and joint infections, it is the second-choice antibiotic. Cefpodoxime was prescribed in majority of prescriptions irrespective of the category of infections. However, according to the WHO model list, cefpodoxime belongs to Watch group antibiotics and is preferred as the second choice for acute diarrhoea/dysentery and gonorrhoea.[21]

Antibiotic resistance was specifically mentioned as a major threat to public health economic growth and global economic stability. It poses a severe hazard to public health worldwide.[1] This antibiotic resistance which is a major global threat in years to come WHO commissioned number of antibiotics per prescription should be <30%. We discovered in our research that the average number of antibiotics prescribed was 93.6%, exceeding the recommended WHO Criteria of <30% by three times.[22] This overprescription of antibiotics by health workers and overuse of antibiotics by patients is further worsening the already existing anti-microbial resistance. Not adhering to WHO prescribed values for antibiotic usage will not only threaten our ability to treat common infectious diseases but also lead to scarcity of drugs to treat life threatening sepsis. Similar results were found in Study conducted by Decosta A reported that antibiotic encounter percentage was 63.5.[23] Sharma et al, also reported a higher percentage of antibiotic prescribing accounting for about 51% with only one antibiotic in 40% of prescriptions. There should be national guidelines in place and implementation of these guidelines for antibiotic prescribing.[24]

Limitations

It was Single-centre study, short-duration design limits the generalizability of the findings and may not reflect seasonal variations in antibiotic prescribing. Absence of clinical and microbiological correlation, as patient outcomes and culture–sensitivity results were not evaluated. Appropriateness of antibiotic use was not assessed, including dose, duration, and route of administration patient-specific factors such as comorbidities, severity of illness, and prior antibiotic exposure were not considered. Observational nature of the study prevented assessment of the impact of antimicrobial stewardship interventions or guideline implementation.

CONCLUSION

The current study presents patterns in the prescription of antibiotics to this institution's inpatients. Generic prescribing of Antibiotics was as low as 5.34%. Antibiotic prescribing was high with 468 antibiotics in 500 prescriptions accounting for about 93.6% which is way more than 30% as prescribed by WHO in core drug indicators. Commonly prescribed antibiotic was Cefpodoxime. Out of 468 antibiotics 101 antibiotics were from ACCESS group suggesting easily accessible

antibiotics for most of diseases. 314 from WATCH group indicating significant prescribing of antibiotics from group that needs close and 53 from RESERVE. Since watch group of antibiotics constituted the highest number according to AWaRe which is a concern as these antibiotics have higher resistance potential and includes highest priority agents among antibiotics. Awareness among the physicians must be boosted up in this regard. There is a need to maintain standard treatment guidelines in the hospital because it prevents irrational use of antibiotics. Strict implementation of the use of standard treatment guidelines and AWaRe guidelines prevents inappropriate prescribing. To combat this antibiotic resistance Antibiotic audit must be performed every 3 monthly.

Recommendations

Since watch group of antibiotics constituted the highest number according to AWaRe which is a concern as these antibiotics have higher resistance potential and includes highest priority agents among antibiotics.

To combat antimicrobial resistance following is recommended awareness among the physicians must be boosted up in this regard. There is a need to maintain standard treatment guidelines in the hospital because it prevents irrational use of antibiotics. Strict implementation of the use of standard treatment guidelines and AWaRe guidelines prevents inappropriate prescribing. To combat this antibiotic resistance Antibiotic audit must be performed every 3 monthly.

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