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Analysis of Antibacterial Usage Pattern as per ATC/DDD WHO Coding Methodology to Match in Various Clinical Department of Tertiary Care Hospital

Rohit Rathod, Ajas Rahiman P, Chittadi Tanuja Reddy, Sivaranjani S, Merlin Mathew, Liji Joy M*

Department of Pharmacy Practice, The Oxford College of Pharmacy, Hongasandra, Bangalore-560068, Karnataka, India

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ABSTRACT

The WHO advises using the Defined Daily Dose (DDD) as a unit of measurement and the Anatomical Therapeutic Chemical (ATC) classification system for tracking and researching drug use. The main objective of the study is to examine changes in drug utilization. Evaluate interventions on prescribing patterns of antibiotics at The Oxford medical college hospital and research Centre. Patient demographics and drug charts are collected using specified case report form for a period of 6 months using random sampling method. Case report form includes patient demographics, laboratory data, diagnosis, and drug chart with frequency, dose, dosage and route of administration. Out of 183 cases analyzes 45.4% were female and 54.7% were male. Most of the cases were in the group of 20 to 31. Average duration of hospitalization in our study population was around 5 days. A total of 299 antimicrobial were prescribed in 183 cases. Cephalosporins were the most preferred antibiotic followed by other antibiotic class. Ceftriaxone was the most common drug among the cephalosporin. Antibiotic prescribing in the hospital is empirical, we would like to recommend that antibiotic selection should be based on the results of cultural and sensitivity testing whenever possible. The percentage of drug prescribed in generic form was found to be less. We recommend larger scope prospective study to emphasize on ensuring of rational use of antibiotics.

*Corresponding Author

Name: Liji Joy M
Phone: 7034199811
Email: lijijoym@gmail.com

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INTRODUCTION

Antibiotics was derived from the Greek words opposed (against), mikros (little), and bios (life) and refers to all or any agents that act against microorganism organisms. This can be not similar with associate antibiotic, a neologism derived from the Greek word opposed (against) and biotic (concerning life). By strict definition, the term "antibiotic" refers to a substance made by a being that acts to inhibit the multiplication of or to kill another being. Thus, it does not apply to antimicrobial substances that square measure artificial (sulphonamides and quinolones), synthetic (methicillin and amoxicillin), or originating from plants (quercetin and numerous alkaloids) and animals (lysozyme). Antimicrobial refers to all or any agents that act against microorganisms, together with bacterium (antibacterial), viruses (antiviral), fungi (antifungal), and protozoa (antiprotozoal). All antibiotics square measure antimicrobial agents, however not all antimicrobial medicine square measure antibiotics.

Ethics Committee approval was obtained on 31st March 2021 from the Institutional Ethics Committee of The Oxford College Medical College, Attibele, Bengaluru, approved the study prior to the commencement of the study. (Reference no: IEC/TOMCHRC/181/ 2020-21). This is a prospective study (Observational studies) carried out in the various clinical department of The Oxford Medical College and Research Centre located in Attibele, Bangalore for 06 months. Coming to the sample size, 183 Cases were randomly taken during the period of 2021-22.

High utilization and inappropriate usage of antibacterial agents in an internal medicine increase resistant organisms, morbidity, mortality, and treatment cost. Prescription audit and active feedback are proven method to test the irrational prescription. It is the responsibility of the doctors to develop good prescribing habits, which can help in reducing the intensity of the matter. Drug utilization evaluation could be a tool to enhance the rationality in prescribing i.e. it helps in monitoring the drug efficacy, cost constraints and other factors associated with patient safety. It also plays a key role in minimizing adverse drug effects [1].

Measuring drug utilization in DDD/100 bed-days is proposed by the WHO to research and compare the employment of medicine. Data of antibacterial utilization are required for planning an antibiotic policy and for follow-up of intervention strategies. Hence, during this study, WHO proposed to gauge the employment pattern and price analysis of antibacterial employed in the final medicine.

Drug consumption may be expressed in cost, number of units, number of prescriptions or by the physical quantity of medication. But over time, these factors can differ between nations and regions. This limits comparisons of drug consumption at a world level. to deal with this, a technical unit of measurement, the Defined Daily Dose (DDD) was created [2].

ATC DDD

ATC codes on the 'Find a medication' webpage for every medicine. This info is also helpful once finding out individual medicines or categories of medicines.

The Anatomical Therapeutic Chemical (ATC) Classification is an associate degree internationally accepted organization for medicines that is maintained by the globe Health Organization (WHO). The United Nations agency assigns ATC codes to any or all active substances contained in medicines that supported the therapeutic indication for the drugs. Victimization the ATC code, active substances square measure classified in teams at 5 completely different levels in step with the organ or system on that they act and their therapeutic, pharmacologic and chemical properties. Wherever the relevant info is offered, a full ATC code can have seven components created of letters and numbers. In some cases, associate degree ATC code is part allotted with a reduced range of components, associate degrees in alternative cases an ATC code is not allotted.

Medicinal merchandise square measure classified in steps with the most therapeutic use of the most active ingredient. The ATC system is, however, not strictly a therapeutic organization. In several ATC main teams, medical specialty teams are appointed on the ordinal, third and fourth levels permitting medicine with many therapeutic uses to be enclosed while not specifying the most indication. for instance, metallic element channel blockers square measure classified within the medical specialty cluster C08 metallic element channel blockers, that avoids specifying whether or not the most indication is coronary cardiopathy or high blood pressure. Subdivision on the mechanism of action can, however, usually be rather broad (e.g. antidepressants), since a too careful classification in step with mode of action usually can lead to having one substance per subgroup that as way as attainable is avoided. Some ATC teams square measure divided in each chemical and medical specialty teams (e.g. ATC cluster J05A - Direct acting antivirals). Preference are going to be given to establishing a brand new medical specialty fourth level instead of a chemical subgroup.

Only one ATC code for every route of administration Medicinal substances square measure categorised in step with the most therapeutic use or medical specialty class on the fundamental principle of only 1 ATC code for every route of administration (e.g. oral formulations with similar ingredients and strength can have an equivalent ATC code). this is often a vital principle for ATC classification because it permits aggregation of information in drug utilization observation and analysis while not enumeration a pharmaceutical product over once.

Therapeutic doses for individual patients and patient groups will often differ from the DDD as they're going to be supported individual characteristics like age, weight, ethnic differences, type and severity of disease, and pharmacokinetic considerations.

Drug utilization data presented in DDDs provides a rough estimate of consumption and not a precise picture of actual use. DDDs provide a hard and fast unit of measurement independent of price, currencies, package size and strength enabling

the researcher to assess trends in drug utilization and to perform comparisons between population groups [3].

By applying DDD it's possible to:

Examine changes in drug utilization over time, Make international comparisons, Evaluate the effect of an intervention on drug use management, Document the relative therapy intensity with various groups of medication.

The prescribed daily dose (PDD) is defined as the average dose prescribed in step with a sample of prescriptions. The PDD can be determined from studies of prescriptions, medical or pharmacy records, and it's important to relate the PDD to the diagnosis on which the drug is employed. The PDD will give the typical daily amount of a drug that's actually prescribed. When there's a considerable discrepancy between the PDD and also the DDD, it's important to require this into consideration when evaluating and interpreting drug utilization figures [3].

MATERIAL AND METHODS

Ethics Committee approval was obtained on 31st March 2021 from the Institutional Ethics Committee of The Oxford College Medical College, Attibele, Bengaluru, approved the study prior to the commencement of the study. (Reference no: IEC/TOMCHRC/181/ 2020-21). This is a prospective study (Observational studies) carried out in the various clinical department of The Oxford Medical College and Research Centre located in Attibele, Bangalore for 06 months. Coming to the sample size, 183 Cases were randomly taken during the period of 2021-22.

Collection of Data

The medical records of patients who are admitted in the hospital during the period of 2021-2022 were collected from the various clinical ward of hospital. Patient related information such as age, sex, diagnosis and date of admission and discharge was noted. Drug related information contained details such as number of antimicrobials prescribed, name and category of antimicrobial agent, dosage form, route of administration, antimicrobials prescribed by generic or brand name and use of fixed dose combinations (FDC). Case record form was designed to enter the patient details.

Study Procedure

Step 1: Ethical approval was obtained from the Institutional Ethical Committee of The Oxford Medical College Attibele Bangalore.

Step 2: Data collection will be done including patient characteristics like age, gender, diagnosis, duration of hospitalization and prescription characteristics like name of the drug, strength and dosage form, number of units filled, whether or not a generic name was prescribed. We also evaluated the WHO core drug prescribing indicators including average number of medicine per encounter, percentage of medication prescribed by generic names, percentage of encounters with an antibiotic, percentage of encounters with an injection, and percentage of medication prescribed from the essential drugs list or formulary

Step 3: Median Cost per Prescription In Various Wards. The total number of DDDs consumed was maximum for antibacterial while the quantity of DDDs per 100 beds the comparison of number of PDDs and DDDs of assorted antibacterial.

Step 4: Comparison of the amount of Defined Daily Doses per 100 Bed Days of Major Groups of medication Prescribed

Step 5: Comparison Of Estimated Prescribed Daily Doses and Defined Daily Doses of varied Anti-Bacterial

Step 6: Analysis of DDD and PDD patterns by using ATC coding.

Step 7: The obtained data will be subjected for suitable statistical method. (Chi-Square Test)

Step 8: To provide the feedback results to clinicians and other relevant groups

Inclusion Criteria

Inpatients of various Clinical Department and Patients who are above 18 years of age were included.

Exclusion Criteria

Pediatrics and pregnant females were not included as they have separate ATC/DDD coding Sources For Data Collection: Patient case records, Case Record Form (CRF)Special data form was designed.

RESULTS

Out of 183 cases analyzes 45.4% were female and 54.7 %were males. Most of the cases were in the group of 20 to 31 years followed by 31 to 40 years as shown in Graph 1 and Table 1.

About 110 drugs were prescribed by Generic names, (36.7%) and 189 were prescribed in Brand name, (63.2%) cases as shown in Table 2 & Graph 2. The distribution of the number of antimicrobial drugs per prescription which ranges from 1 to 5 as shown in Table 3. Cephalosporins 28.76% were the most

Table 1: Age-Wise Distribution

Age	Male	Female
18-20	18	2
21-30	16	31
31-40	26	19
41-50	12	15
61-70	1	2
71-80	3	4

Table 2: Antibiotic Prescribing Pattern

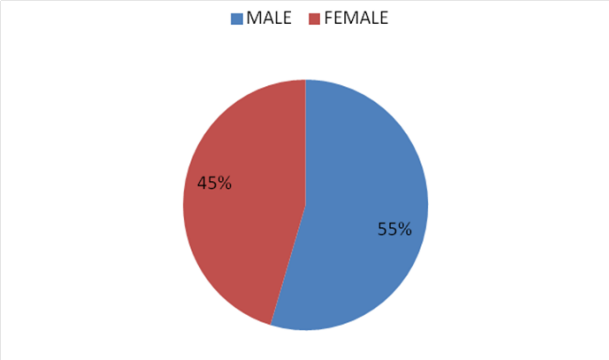
Antibiotic Prescribing Pattern	Total 299 Antibiotic in 183 Prescription
Antibiotic with Generic Name	110
Antibiotic with Brand Name	189

Table 3: Antibiotic Per Prescription

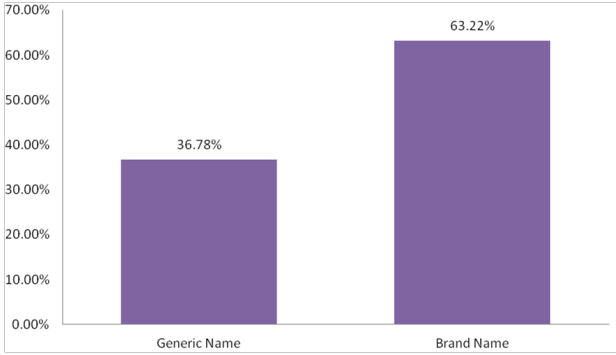
No of Antibiotic	Antibiotic Per Prescription
01	23
02	107
03	27
04	22
05	4

Table 4: Prescribing Frequency of Antibiotic % of Different Class

Antibiotic Class	Prescribing Frequency of Antibiotic %
Cephalosporins	28%
Aminoglycosides	7.023%
Penicillin	15.71%
Macrolids	18.39%
Antiamoebic	10.70%
Quinolones	13.71%
Tetracyclin	5.68%



Graph 1: Gender Wise Distribution



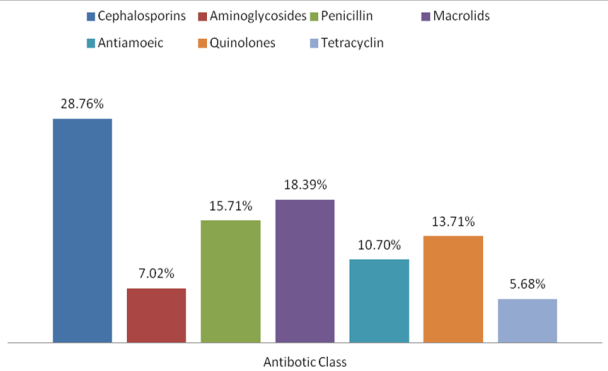
Graph 2: Antibiotic Prescribing Pattern %

preferred antibiotic followed by Macrolids, Penicillins, Quinolons, Antiomoebic and aminoglycoside as shown in Table 4 and Graph 3.

Ceftriaxone (39.53%) was the most common drug

Table 5: Prescribing Frequency of Antibiotic in Each Class

Drug Class	Drug Subgroup	Prescribing Frequency
Cephalosporin	Cefixime	29.06
	Ceftriaxone	39.53
	Cefotaxim	24.41
	Cefoperazone	6.97
Penicillin	Amoxicillin	25.53
	Amoxcilin+Clavalunic Acid	57.44
	Ampicillin	17.02
Aminoglycosides	Amikacin	57.14
	Gentamicin	38.09
	Neomycin	4.76
Macrolids	Erithromycin	7.27
	Azithromycin	49.09
	Clarithromycin	10.9
	Chloromphinicol	7.27
	Strephtomycin	3.63
	Clindamycin	21.81
Quninoles	Norfloxacin	39.02
	Moxifloxacin	4.87
	Levofloxacin	4.87
	Ofloxacin	14.63
	Ciprofloxacin	60
Antiomebic	Nitroimidazole	25
	Metronidazole	75
Tetracyclin	Doxycycline	100



Graph 3: Prescribing Frequency of Antibiotic Class %

among the cephalosporin class. Amoxicillin + Clavulanic acid (57.44%) was the most common drug among the Penicillin class. Amikacin (57.14%) was the most common drug among the aminoglycoside class. Azithromycin (49.09%) was the most common drug among the macrolids. Norfloxacine (39.02%)was the most common drug among the Quninoles. Metronidazole (75%) was the most common drug among the Antiamoebic. Doxycycline (100%) was the most common drug among Tertracycline [Table 5].

Pattern of antibiotic drug use as per the ATC/DDD classification is shown in the Table 6 denotes the comparison of PDD and DDD values. The comparison is made based on the PDD/DDD ratio. When the PDD to DDD ratio is either less than or greater than one, it may indicate that there is either less than or greater than one, it may indicate either under or over utilization of drug. Nevertheless, it is important to note that PDD can vary according to patient and disease factor. For instance among anti-infective

Table 6: Pattern of Antibiotic Drugs Use as per the ATC/DDD

SL	Drug	ATC Code	DDD(gm)WHO	DDD(gm)	PDD(gm)	PDD/DDD
1	Cefixime	J01DD08	0.4	70	0.35	0.92
2	Ceftriaxone	J01DD04	2	2000	2	1
3	Cefotaxime	J01DD01	4	2000	4	1
4	Cefaperioxone	J01DD13	0.4	500	0.5	1.25
5	Amoxicillin	J01CA04	1	500	1	1
6	Ampicillin	J01CA01	2	1500	3	1.5
7	Amikacin	J01GB06	1	500	1	1
8	Gentamycin	J01GB03	0.24	30	0.32	1.3
9	Azithromycin	J01FA10	0.3	250	0.5	1.6
10	Clarithromycin	J01FA09	0.5	150	0.3	0.6
11	Clindamycin	J01FF01	1.2	20	1	0.83
12	Norfloxacin	J01MA06	0.8	320	0.8	1
13	Moxifloxacin	J01MA14	0.4	110	0.2	0.5
14	Levofloxacin	J01MA12	0.5	250	0.5	1
15	Ofloxacin	J01MA01	0.4	150	0.7	1.75
16	Ciprofloxacin	J01MA02	1	1500	3	3
17	Metronidazole	J01XD01	1.5	750	1.8	1.2
18	Doxycyclin	J01AA02	0.1	30	0.3	3

Table 7: Comparison of DDD and PDD

PDD>DDD	PDD<DDD	PDD=DDD
Cefixime	Clarithromycin	Ceftriaxone
Cefaperiaxone	Clindamycin	Cefotaxime
Ampicillin	Moxifloxacin	Amoxicillin
Gentamicin		Amikacin
Azithromycin		Norfloxacin
Ofloxacin		Levofloxacin
Metronidazole		
Doxycyclin		

PDD varies according to the severity of the infection.

In our study, PDD/DDD ratio greater than 1 for the antibiotic such as Cefixime Ampicillin Gentamicin Azithromycin Ofloxacine Metronidazole and doxycycline were observed. Whereas PDD/DDD ratio lesser than1 for the antibiotic such as Clarithromycin Clindamycin Moxifloxacin and PDD/DDD ratio was equal for Ceftriaxone Cefotaxime Amoxicillin Amikacin Norfloxacin and Levofloxacin were observed, as shown in Table 7.

DISCUSSION

Antibiotics being the most commonly prescribed group of drugs, the problem of its overuse is a global phenomenon Drug use studies are effective investigative techniques for determining the function of drugs in society. By monitoring the antimicrobial pattern in a particular geographical area, we can improve the quality of health care system by proper intervention [4].

Present study was carried out to evaluate the antimicrobial drug utilize pattern in our institute. The average number of antimicrobials per prescription came out to be 2.01% which is in the lie range of 1.3 - 2.2 found in similar studies in other countries. These findings suggest limited incidence of polypharmacy. It is preferable to keep the number of drugs per prescription as low as possible since polypharmacy leads to increased risk of drug interactions, increased hospitalization cost and errors of prescribing. Out of the 189 prescription, use of antibiotic monotherapy (12.16%) and 2 drug therapies (56.6%) were common and had more than two antibiotics. This could be expected since many patient were having type of infection so two or more antibiotic had been used to cover the pathogen.

Drugs covering gram +ve glam -ve and in certain situation anaerobic as well were given together [5].

The most common one of antibiotic administration was parenteral that accounted. This is because ceftriaxone, amikacin, & metronidazole which are mainly used parentally contributed to the large section of the prescription sample. Parenteral to oral shift was practiced. Clinicians prescribed a significant number of antibiotic (36.7%) by generic names but majority were used by brand name (63.3%). This is an issue of concern and can be readdressed to some extent by prescribed education [6].

Among the antibiotic cephalosporin were found to be prescribed to the largest number of patient followed by macrolids, penicillin. Similar findings were observed in many studies. Among cephalosporin, third generation is the most commonly prescribed one. Cephalosporins are group of antibiotic with broad spectrum of activity, low rate of toxicity and ease of administration. Due to their availability, third-generation cephalosporin are most commonly used. This may put cephalosporin having wider action including activity pseudomonas into danger of becoming ineffective.

Ceftriaxone was the most frequently prescribed antibiotic drug. Ceftriaxone has a strong antibacterial effect, a broad range of biological action, and little risk for toxicity. it is used to treat different types of bacterial infection including respiratory, bone, abdominal, urinary tract and skin infection. Ceftriaxone was the most common antibiotic used for the treatment of urinary tract infections.

PDD varies according to the severity of the infection. The DDDs for most anti-infective are based on treatment of moderately severe infections. In hospital care, much higher doses are frequently used and this must be considered when using the DDD as a unit of measurement, The PDDs can also vary substantially between different countries. Thus WHO encourages countries to have their own DDD list based on indigenous data by collaborative efforts involving physicians, surgeons, pharmacologist and microbiologist.

CONCLUSION

The present study provides baseline data of prescribing pattern of antibiotic agents in indoor patient of medicine department. Ceftriaxone and amikacin were found to be the first and second most commonly prescribed antibiotics. Our findings are in line with what were reported by previous similar work. Antibiotic prescribing in our hospital is empirical, we would like to recommend that antibiotic selection should be based on the result of culture and sensitivity testing whenever possible. The percentage of drug prescribed in generic form was found to be less in comparison to what WHO recommends and this issue must be addressed. This study is limited by the fact that we relied on relatively small sample size that may compromise the generalizability of the findings. , we recommend larger scope prospective study to emphasize on ensuring of rational use of antibiotics and hence fighting against the alarmingly increasing antibiotic resistance.

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Conflict of Interest

The authors declare that there is no conflict of interest.

REFERENCES

[1] Rode S, Salankar H. Analysis of antimicrobial usage pattern: a retrospective observational study. International Journal of Pharmaceutical Sciences and Research. 2018;9(3):12316.

[2] Först G, With KD, Weber N, Borde J, Querbach C, Kleideiter J. Validation of adapted daily dose definitions for hospital antibacterial drug use evaluation: a multicentre study. Journal of Antimicrobial Chemotherapy. 2017;72(10):2931–2938.

[3] WHO. Collaborating centre for drug statistics methodology, guidelines for ATC classification and DDD assignment. WHO Collaborating Centre for Drug Statistics Methodology; 2000. WHO Collaborating Centre for Drug Statistics Methodology, World Health Organization.

[4] With KD, Meyer E, Steib-Bauert M, Schwab F, Daschner FD, Kern WV. Antibiotic use in two cohorts of German intensive care units. Journal

of Hospital Infection. 2006;64(3):231–238.

[5] Bergmans DC, Bonten MJ, Gaillard CA, Van Tiel FH, Van Der Geest S, De Leeuw PW. Indications for antibiotic use in ICU patients: one-year prospective surveillance. The Journal of antimicrobial chemotherapy. 1997;39(4):527–562.

[6] Teng L, Xin HW, Blix HS, Tsutani K. Review of the use of defined daily dose concept in drug utilisation research in China. Pharmacoepidemiol Drug Saf. 2012;21(10):22438276.

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