Monitoring the Consumption of Antibiotics in a Multi Super Specialty Hospital

Internship Training
at
Fortis Memorial Research Institute, Gurgaon

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Under the guidance of
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Post Graduate Diploma in Hospital & Health Management
2012–14

Institute of Health Management Research
Jaipur
2014

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that Dr. Sumeet Kaur Bajaj student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from Institute of Health management Research, Jaipur has undergone internship training at Fortis Memorial Research Institute, Gurgaon from 3rd February, 2014 to 30th April, 2014.

The candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

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Certificate of Approval

This is to hereby acknowledge the efforts of Dr. Sumeet Kaur Bajaj, IIHMR, Jaipur during her internship on the following project title **"Monitoring of Utilization of Antibiotics".** This is approved as a certified study in management, carried out and presented in a satisfactory manner. It is understood by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation project report only for the purpose it is submitted.

Signature of mentor

Dr. Anita Arora
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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled "Monitoring the consumption of antibiotics in a multi super specialty hospital" and submitted by Dr. Sumeet Kaur Bajaj Enrollment No. IIHMR/PGDHM/2012-14/17-1388 under the supervision of Mr. Vijay pratap Raghuvanshi for award of Post Graduate Diploma in Hospital and Health Management of the Institute carried out during the period from 3rd Feb 2014 to 30th April 2014 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Signature

ABSTRACT

MONITORING THE CONSUMPTION OF ANTIBIOTICS IN A MULTI SUPER SPECIALTY HOSPITAL

Author: Dr. Sumeet Kaur Bajaj

Background: Antibacterial resistance is a stark reality across globe. Owing to the increased disease burden pertaining to bacterial origin, there is a tremendous rise in the use of antibiotics that can be disastrous in the long run. Antibiotic resistance leads to increased morbidity and mortality, increased cost of treament, increased length of stay and treatable infections becoming untreatable similar to the pre antibiotics era. One of the major challenges is the absence of a good monitoring or surveillance system for prescriptions. Possible reasons for irrational over usage be the lack of microbiological facilities, doctors prescribing antibiotics to any patients with a fever taking it as a sign of bacterial infection, desire to fulfil patient expectations, financial incentives for doctors to make a profit from drug sales and public's lack of knowledge about the (in)appropriate use of antibiotics.

Objectives: The objectives of the study were to monitor the consumption of antibiotics, to perform a comparative study between the usage of restricted and unrestricted antibiotics in ICUs and wards, to compare with international standards and to a standardised tool for point prevalence evaluation of antibiotic use.

Methods: A retrospective analytical study was done to monitor the utilisation of 5 restricted and 9 unrestricted antibioics. The data was collected from HIS and calculations done manually and using the antibiotic amonitoring Calculator.

Results: The antibiotic consumption has increased by 10.32% and the expenditure on procurement of antibiotics had increased by 16%. The resricted antibiotics were being used more in ICUs than in wards. The usage of restricted antibiotics decreased over the time period whereas the utilisation of unrestricted antibiotics increased.

Conclusion: Antibiotic Utilization Monitoring is the key to accountable care and healthcare reform by continually evaluating, identifying, assessing, and stratifying the utilization pattern. Appropriate use of antibiotics can lead to decreased incidence of resistant cases thereby causing decreased morbidity, decreased cost and increased patient satisfaction.

Key words: Restricted and unrestricted antibiotics, Antibiotic Monitor Calculator, Defined Daily Dose

ACKNOWLEDGEMENT

"A Great achievement solution dawns with an idea, grows with our effort and attains fulfillment with our will power". In our effort towards the realization of my project work, I have drawn on the guidance of many people for which I'm glad to acknowledge.

I got the opportunity to pursue my dissertation from Fortis Medical Research Institute, Gurgaon. It was an opportunity to work with one of the best health care service providers.

I would like to thank my mentor & guide **Dr. Anita Arora** , Head Quality and Principal Consultant, Microbiology, Fortis Medical Research Institute, Gurgaon for providing an opportunity to carry out the project work and utilizing the facilities available. Without her valuable guidance and consistent support, this project would not have got underway.

I'm thankful to **Dr. Savitaa Choudhary**, Deputy manager Quality, Fortis Medical Research Institute, Gurgaon for being my mentor and project guide for the entire period of my dissertation, for helping me improve the quality of my work and for helping me identify areas where I lack and work upon them.

I also express my special thanks to **Ms. Shweta Sachdeva,** clinical pharmacologist who helped me develop better understanding of the antibiotics selection and consumption patterns, which has helped me a lot in successful completion of my project.

I'm grateful to my guide **Mr. Vijay Pratap Singh,** Assistant Professor, IHMR, Jaipur and our Dean **Dr. Ashok Kaushik** for their co-operation, help and wholehearted encouragement. Their assistance enabled me to overcome many obstacles during the work of my project study.

I'm also thankful to all those who have directly or indirectly encouraged me to complete this project.

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LIST OF ABBREVIATIONS

DDD**:** Defined Daily Dose

PDD: Prescribed Daily Dose

ATC: Anatomical Therapeutic Chamical classification

DURG: Drug Utilisation Research Group

EuroDURG: European Drug Utilisation Research Group

WHO: World Health Organisation

EACPT : European Association of Clinical Pharmacology and Therapeutics

ICU: Intensive Care Unit

IP: Inpatient

HIS: Hospital Information System

ISPE: International Society of Pharmaco-epidemiology

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CHAPTER- 1

BACKGROUND OF THE STUDY

1.1 INTRODUCTION

Antimicrobial resistance, a global problem, is particularly pressing in developing countries where the infectious disease burden is high and cost constrains the replacement of older antibiotics with newer, more expensive ones. Management of common and lethal bacterial infections has been critically compromised by the appearance and rapid spread of antibiotic-resistant bacteria. The bacterial disease burden in India is among the highest in the world; consequently, antibiotics will play a critical role in limiting morbidity and mortality in the country. As a marker of disease burden, pneumonia causes an estimated 410,000 deaths in India each year, and it is the number-one killer of children. Many of these deaths occur because patients do not have access to life-saving an

tibiotics when and where these are needed. At the other extreme, antibiotics are used in situations where these cannot be expected to improve the patient's condition, particularly as treatment for the common cold and uncomplicated cases of diarrhoea. Every time an antibiotic is used whether appropriately or not, in human beings or in animals, the probability of the development and spread of antibiotic-resistant bacteria is increased (1).

Why this overuse persists is not so easily determined. The possible reasons, as in other parts of the world, include the following: (*i*) lack of microbiology facilities or unwillingness of patients to undergo tests; (*ii*) some doctors' practice of prescribing antibiotics to any patient with a fever, taking it as a sign of bacterial infection, especially when they are concerned that the patient will

not return for follow up; (*iii*) the patient's expectation of being given an antibiotic over-the-counter or a prescription for one at the doctor's office; (*iv*) incentives for pharmacists to make a profit from drug sales; and (*v*) the public's lack of knowledge about the appropriate use of antibiotics.

1.2 RATIONALE

- On one hand, antibiotics are necessary in many life-threatening cases. On the other hand, overuse of antibiotics can be disastrous in the long run. Hence, judicious use of antibiotics is required, but acceptable strategies to achieve this goal and to address the challenges must be devised and communicated.
- Another major challenge is the absence of a good monitoring or surveillance system for prescriptions.
- To acquire an antibiotic tool for comparative study of antibiotics.

1.3 OBJECTIVES

- To monitor the consumption of antibiotics in a multi-super specialty, quaternary care hospital.
- To perform a comparative study between the usage of restricted and unrestricted antibiotics.
- To perform a comparative study between the utilization of antibiotics in ICUs and wards.
- To compare with international standards.
- To device a standardised tool for point prevalence evaluation of antibiotic use.

1.4 OPERATIONAL DEFINITIONS

- Restricted antibiotics: Prescribed and supplied only after approval from a Consultant Microbiologist. Pharmacists are required to confirm Microbiology approval or formulary indication before dispensing restricted antimicrobials. These are often broad-spectrum antibiotics those are effective against a wide variety of organisms
- Unrestricted antibiotics: Physicians do not need prior approval to prescribe these.
- Drug Utilization Monitor**:** Defined by WHO in 1977 as the marketing, distribution, prescription, and use of drugs in a society, with special emphasis on the resulting medical, social and economic consequences. Since then, a number of other terms have come into use and it is important to understand the interrelationships of the different domains (2).

1.5 LIMITATIONS

- The study does not consider geographic transactions like Age, Sex, etc while collecting and analysis of the data.
- Due to time constraints, complete implementation of the Antibiotic Monitoring Tool could not be done.
- 2 periods taken in the study could not be the same time of the year as its an upcoming hospital and hence the difference of 1 year could not be taken for more appropriate comparisons.

CHAPTER- 2

REVIEW OF LITERATURE

2.1 THE HISTORY OF DRUG UTILISATION STUDIES AND THE DRUG UTILISATION RESEARCH GROUP

The field of drug utilization research has roots back to the 1960s, when early drug utilization studies were performed in Northern Europe and the United Kingdom. During this early work, international comparisons were impossible, due to the application of different units and methods to measure drug use. Soon after this pioneering work, at a seminal symposium in Oslo (entitled the "Consumption of Drugs", 1969), organized by the WHO Regional Office for Europe, researchers expressed the need for a common classification system for drugs as well as a technical unit of comparison in drug utilization studies . To overcome this difficulty, scientists mainly from Northern European countries came together in an informal group and developed a new unit of measurement, initially called the agreed daily dose, and later the defined daily dose (DDD). Another important methodological development was the introduction of the uniform Anatomical Therapeutic Chemical (ATC) classification system in the mid-1970s. The small group of scientists active in these areas established the informal Drug Utilization Research Group (DURG) in 1976 (3). As the WHO Regional Office for Europe served as its secretariat, this group was often referred as WHO-DURG for about 20 years. The first publication applying the ATC/DDD principles appeared in 1975, while from 1981, the ATC/DDD system was proposed for drug utilisation studies (4). To maintain and develop the ATC/DDD system, the WHO Collaborating Centre for Drug Statistics Methodology was established in 1982 in Oslo (5).

In 1996, the WHO realized that the ATC/DDD system should be implemented and used outside of Europe as well, and the expert panel of WHO International Working Group for Drug Statistics Methodology was founded to facilitate the globalization of the ATC/DDD system. By 1993, the relationship between DURG and WHO has loosened as the later was unable to further support the DURG with secretarial functions. Therefore in 1994 an independent EuroDURG (European Drug Utilisation Research Group) interim committee was elected, while in 1996, at a meeting at Lake Balaton, the EuroDURG was formally established. Since the 1996 meeting at Balatonaliga, there has been EuroDURG meeting practically every year, most of them organized jointly with the European Association of Clinical Pharmacology and Therapeutics (EACPT) or the International Society of Pharmacoepidemiology (ISPE) (4).

The contribution of WHO-DURG/EuroDURG and its members to these conferences and drug utilisation research itself has been substantial. The number of English-language papers on the subject listed in the *Cumulativeindex medicus* rose from 20 in 1973 (when the term “drug utilization” first appeared) to 87 in1980, 167 in 1990, and 486 in 2000.

History has taught us that successful monitoring for antibiotics utilization requires multidisciplinary collaboration between clinicians, clinical pharmacologists, pharmacists and medical quality coordinators. Without the support of the prescribers, this monitoring effort will fail to reach its goal of facilitating the rational use of drugs.

The pioneers of this research understood that a correct interpretation of data on drug utilization and antibiotic monitoring requires investigations at the patient level. It became clear that we need to know the answers to the following questions:

- ✓ Why Drugs Are Prescribed

- ✓ Who Are The Prescribers
- ✓ For Whom The Prescribers Prescribe The Drugs
- ✓ Whether Patients Are Taking Their Medicines Correctly
- ✓ What Are The Benefits And Risks Of The Drugs

2.2 THE ANATOMICAL THERAPEUTIC CHEMICAL (ATC) SYSTEM

In the ATC classification system, drugs are divided into different groups according to the organ or system on which they act and their chemical, pharmacological, and therapeutic properties. Drugs are classified in groups at five different levels where a seven digit code identifies a unique active agent. The structure of the code is illustrated by the complete classification of levofloxacin:

J	Antiinfectives for systemic use (1st level, anatomical main group)
J01	Antibacterials for systemic use (2nd level, therapeutic subgroup)
J01M	Quinolone antibacterials (3rd level, pharmacological subgroup)
J01MA	Fluoroquinolones (4th level, pharmacological/chemical subgroup)
J01MA12	Levofloxacin (5th level, chemical substance) (5)

Medicinal products are classified in the ATC system according to their main therapeutic indication of their main active ingredient. An active ingredient can be classified under more than one ATC codes, if it is marketed in different strength and/or formulation with clearly different

therapeutic uses (e.g. oral and rectal metronidazole: P01AB01; intravenous metronidazole: J01XD01) (2).

2.3 DRUG UTILISATION METRICS, CONCEPT OF THE DEFINED DAILY DOSE (DDD)

The defined daily dose (DDD) is an internationally accepted technical unit in drug utilization studies. It means the assumed average maintenance dose per day for a drug used for its main indication in adults. It should be emphasized that the DDD does not necessarily correspond to the recommended-, or actually prescribed daily dose (RDD and PDD) (2).

Drug utilisation figures should ideally be standardized. The DDDs per 1,000 inhabitants and per day is the most widely used measurement unit, mainly applied for ambulatory care drug consumption data. When drug use in hospitalised patients is considered, the number of DDDs per 100 patient-days is the WHO recommended technical unit, while the number of DDDs per 100 admissions is an optional, complementary unit.

Although the DDD per 100 patient-days is the WHO recommended measure of hospital drug use that allows international comparison (2), its limitations should be emphasised. First, different studies may use different definitions for the length of stay or fail to report the definition (e.g. which could greatly affect the value of the denominator (i.e. patient-days) and hence the resulting drug consumption value. Due to this, the applied calculation method (e.g. whether days of admission and discharge count together as one or two patient-days) should be clearly stated. Secondly, drug utilisation studies rarely assess the precise amount of drug ingested by or administered to the patients (6). They provide an upper or lower estimation of real drug use, depending on the data source they are derived from (prescribed quantity, distributed quantity,

dispensed quantity, reimbursed quantity). Although the WHO intends to keep the number of alterations to minimum, it is important to be aware that the ATC/DDD index is a dynamic system to which changes are made continually.

For enhancing the meaningful comparisons of drug consumption data, the applied version of the ATC/DDD index should be also indicated in the published data. As concerns the antibiotics more than 30 DDD changes have been made since 1982.

CHAPTER- 3

METHODOLOGY

3.1 STUDY DESIGN

A Retrospective and Analytical design was planned to check the utilization of restricted and unrestricted antibiotics in a Multi-Super Specialty Hospital.

3.2 STUDY SETTING

Antibiotics used in all the in-patient departments of Fortis Memorial Research Institute.

Exclusion Criteria

- Antibiotics used in OPD and Day care patients have not been included in the study.

3.3 STUDY RESPONDENTS

- The data for comparative study can be obtained by total prescribed drugs and total dispensed drugs using HIS.

3.4 TIME PERIOD

- Period 1: July-August'2013
- Period 2: February-March'2014

3.5 SAMPLING TECHNIQUE

- Purposive sampling technique was used to select the sample.

3.6 SAMPLE SIZE

9 restricted antibiotics & 5 un-restricted antibiotics were monitored.

- 5 Restricted Antibiotics studied were:

Imipenem, Colistin, Linezolid, Meropenem, Teicoplanin

- 9 Un-restricted Antibiotics studied were :

Amoxicillin, Ceftriaxone, Cefotaxime, Cefazolin, Cefuroxime, Azithromycin, Clarithromycin, Gentamicin, Clindamycin

3.7 SOURCE OF DATA

TrakCare and Oracle Software

3.8 DATA COLLECTION:

- **Tool:** Antibiotic Monitor Calculator
- **Technique:** All the data regarding the antibiotics under study was collected from the IP pharmacy. Calculations were done manually to convert the total usage of individual drugs into grams and then the data was fed into the calculator.

3.9 DATA ANALYSIS APPROACH

All the necessary data was collected from the TrakCare and Oracle Softwares. Only the consumption in hospitalised patients was determined from the following areas:

- ✓ ICUs
- ✓ Cath Lab
- ✓ OTs
- ✓ Wards

Antibiotics included as a part of the study were:

- ✓ Amoxicillin
- ✓ Ceftriaxone
- ✓ Cefotaxime
- ✓ Cefazolin
- ✓ Cefuroxime
- ✓ Azithromycin
- ✓ Clarithromycin
- ✓ Gentamicin
- ✓ Clindamycin
- ✓ Imipenem
- ✓ Colistin
- ✓ Linezolid
- ✓ Meropenem
- ✓ Teicoplanin

The exact composition of the various drugs used was confirmed from the CIMS website.

Considering the need of hour and various benefits of monitored utilization pattern of antibiotics, an initiative was taken to channelize the whole process into a proper set of procedures and drafting it in an organisational friendly manner. Certain steps and processes need to be followed for the required applicative calculations with the help of antibiotic calculator for the DDD calculations.

Firstly, the data was segregated and calculations were done manually. DDDs are different for different administration routes. Hence, calculations were done separately.

Table 3.1: Calculation of total consumption of antibiotic

	Main Antibiotic	Extra Salt	Total Quantity (oral)	Total Antibiotic (mg)
Amoxycillin	Amox(mg)	Clavulinic Acid (mg)		
ADVENT DRY SYRUP 30ML CIPLA	200	28.5	10x6	12000
ADVENT 1G TABLET 125MG/875MG 1X4 CIPLA	875	125	16x4	56000
ADVENT 625MG TABLET 125MG/500MG 1X6 CIPLA	500	125	59x6	177000
AUGMENTIN 375 TABLET 250/125MG 1X6 GLAXO	250	125	7x6	10500
AUGMENTIN DDS DRY SYRUP 30ML GLAXO	200	28.5	49x6	58800
NOVAMOX CAPSULE 500MG 1X6 CIPLA	500		1x6	3000
				317300
			Total Quantity (P/E)	
ADVENT 300MG INJECTION 250MG/50MG CIPLA	250	50	423	105750
ADVENT 600MG INJECTION 500MG/100MG CIPLA	500	100	196	98000
AUGMENTIN 1.2G INJECTION 1G/200MG GLAXO	1000	200	2	2000
AUGMENTIN 300MG INJECTION 250/50MG GLAXO	250	50	8	2000
AUGMENTIN 600MG INJECTION 500/100MG GLAXO	500	100	5	2500
MOXYNIC 1.2G INJECTION 1G/200MG ABBOTT HEAL	1000	200	523	523000
NOVAMOX CV INJECTION 1.2GM CIPLA	1000	200	77	77000
				810250

The data for total usage was fed into the calculator.

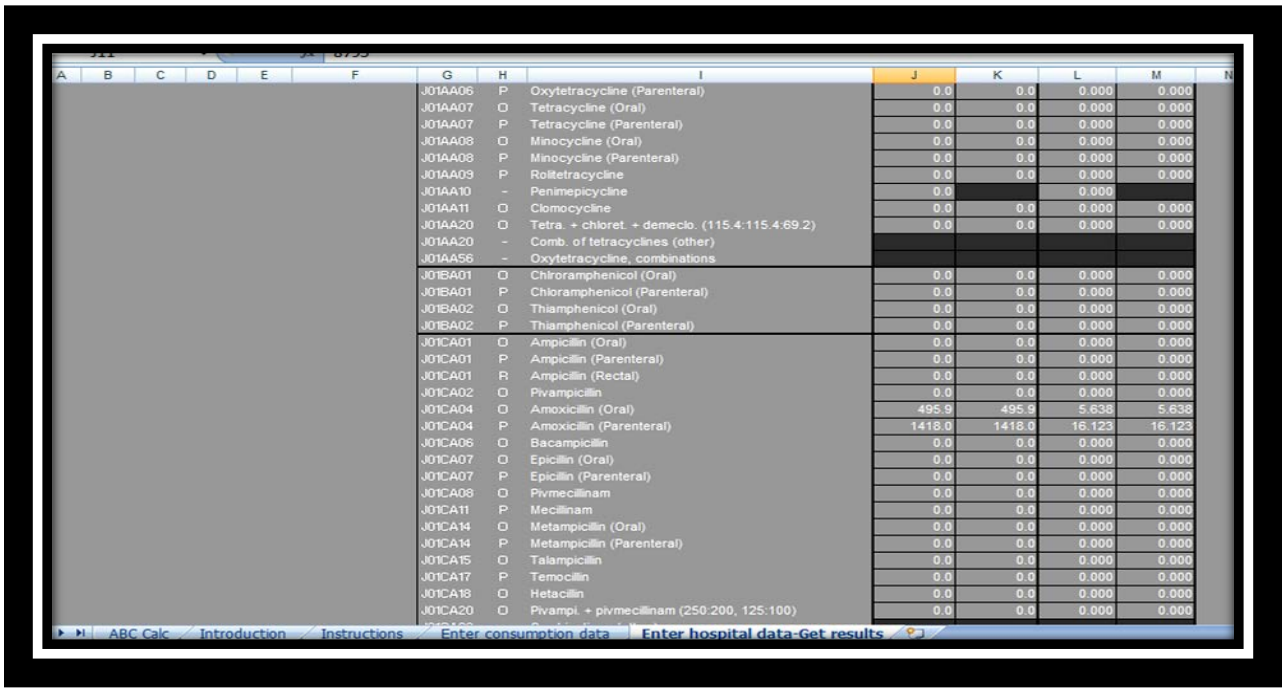

Figure 3.1: Antibiotic monitor calculator

Similarly, DDDs were calculated for all the antibiotics in both the periods. And also DDDs were calculated separately for ICUs and wards as well.

3.10 FEASIBILITY OF THE STUDY

To assess the feasibility of the study, a survey was carried out with the following objectives

- To assess the availability of study respondents.
- To study feasibility and practicability of tool.
- To refine methodology.
- To find out means of analysis and interpretation of data.

It was found that:

- Study was feasible to conduct, as there was adequate availability of required study respondents.
- Methodology was found appropriate for study.
- Analysis and interpretation of data were planned as per expected data.

3.11 ETHICAL CONSIDERATIONS

The confidentiality of the patients and their records was maintained and not shared elsewhere. It was taken only for study purpose and no information of hospital will be revealed elsewhere other than the academic purposes.

CHAPTER 4

ANALYSIS AND RESULTS

Various findings are presented in the form of tables and figures.

4.1 COMPARATIVE ANALYSIS OF THE USAGE OF RESTRICTED AND UNRESTRICTED ANTIBIOTCS

Table 4.1: Total usage of restricted antibiotics

Name of A/B	DDD's (Period 1)	DDD per 100 bed days (Period 1)	DDD's (Period 2)	DDD per 100 bed days (Period2)	DDD (WHO)
Imipenem	131.5	**1.746**	138.1	**1.57**	2
Colistin	977.3	**12.98**	414.7	**4.715**	3
Linezolid	110.5	**1.467**	136	**1.546**	1.2
Meropenem	619.3	**8.225**	761.5	**8.658**	2
Teicoplanin	236	**3.134**	363.5	**4.133**	0.4

- As evident from the Table 4.1, DDDs per hundred bed days has increased for the month of February-March'14 in comparison to July- August'13 for Linezolid, Meropenem and Teicoplanin whereas for the same period DDDs have decreased for Imipenem and Colistin.

- In comparison to WHO norms, DDDs per hundred bed days are more for Colistin, Linezolid, Meropenem and Teicoplanin.
- The maximum difference is seen in the consumption of Teicoplanin

Table 4.2: Total usage of unrestricted antibiotics

Name of A/B	DDD's (Period 1)	DDD per 100 bed days (Period 1)	DDD's (Period 2)	DDD per 100 bed days (Period2)	DDD (WHO)
Amoxicillin (oral)	317.3	**4.214**	495.9	**5.638**	1
Amoxicillin (P/E)	810.3	**10.760**	1418	**16.123**	1
Cefuroxime (oral)	678	**9.004**	638	**11.757**	0.5
Cefuroxime (P/E)	714.5	**9.489**	998.3	**13.286**	3
Ceftriaxone	1254.9	**16.665**	1851	**21.561**	2
Cefotaxime	194.7	**2.586**	275.7	**3.134**	4
Cefazolin	76.2	**1.012**	67.5	**0.767**	3
Clarithromycin (oral)	678	**1.567**	290	**3.297**	0.5
Clarithromycin (P/E)	111.5	**1.481**	189	**2.149**	1
Azithromycin	145.3	**1.930**	270.3	**3.073**	0.5
Clindamycin	102	**1.355**	181.4	**2.063**	1.2
Gentamycin	127	**1.687**	176.3	**2.005**	0.24

- As evident from the table 4.2, DDDs per hundred bed days has increased for the month of February-March'14 in comparison to July- August'13 for all the antibiotics except

Cefazolin, where the consumption has decreased marginally. Amoxicillin, Cefuroxime, Ceftriaxone, Cefotaxime, Clarithromycin, Azithromycin, Clindamycin and Gentamycin whereas for the same period DDDs have decreased only for Cefazolin.

- In comparison to WHO norms DDDs per hundred bed days are more for all the unrestricted antibiotics except Cefazolin and Cefotaxime.
- The maximum difference is seen in the consumption of Amoxicillin, Cefuroxime and Ceftriaxone

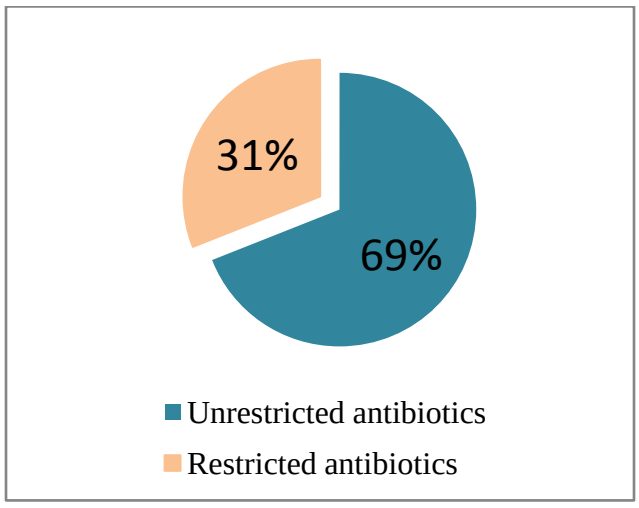

Figure 4.1: DDDs/100 bed days in July-Aug

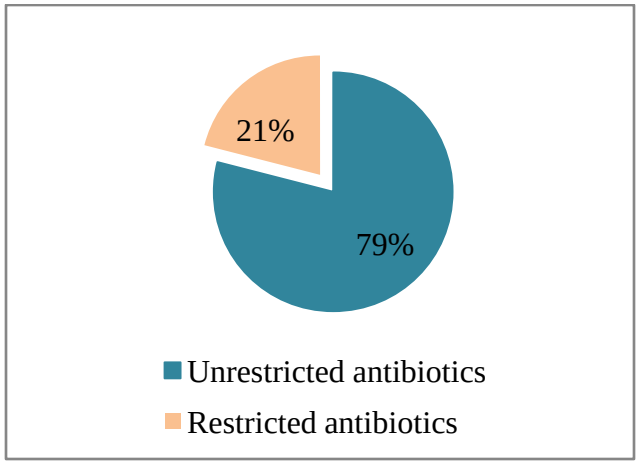

Figure 4.2: DDDs/100 bed days in Feb-March

From the Figures 4.1 and 4.2, it is evident that in period 1 (July-Aug), of the total antibiotics used, about one-third were the restricted antibiotics while in period 2 (Feb-March), the usage of the restricted antibiotics decreased to one-fifth. The proportionate usage of restricted antibiotics has shown a downward trend**.**

The total expenditure incurred by the hospital to procure the antibiotics under study was also calculated by collecting the exact purchase rate of each of the drug from the IP pharmacy. The expenditure in Period 1 was Rs. 39, 93,558 and in Period 2 was Rs. 46, 31,461. Hence, an increase in the expenditure by 16% was seen.

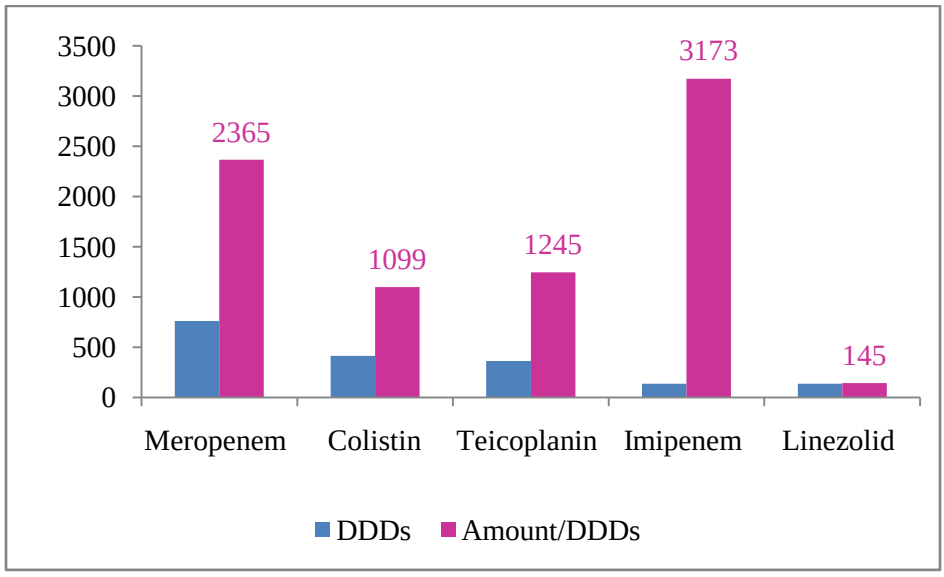

Figure 4.3: Amount spent on restricted antibiotics

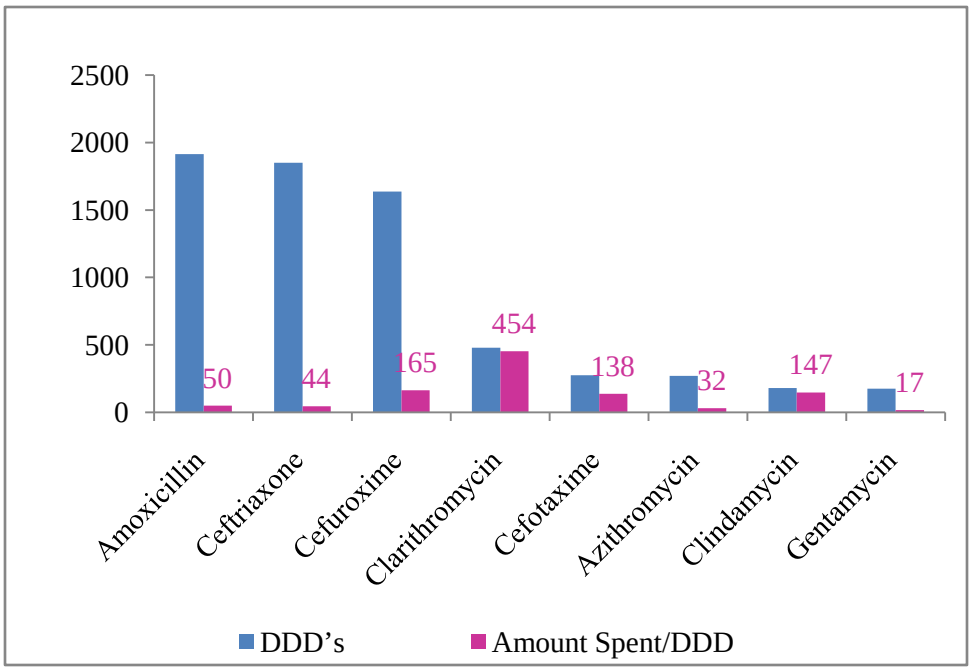

Figure 4.4: Amount spend on un- restricted Antibiotics

From the Figures 4.3 and 4.4, it is evident that although the number of DDDs utilised in the hospital for unrestricted antibiotics are far more than restricted ones. But, the amount spend/DDD on the restricted antibiotics is markedly higher than the amount spend on unrestricted antibiotics.

4.2 COMPARATIVE ANALYSIS OF THE USAGE IN ICUs AND WARDS

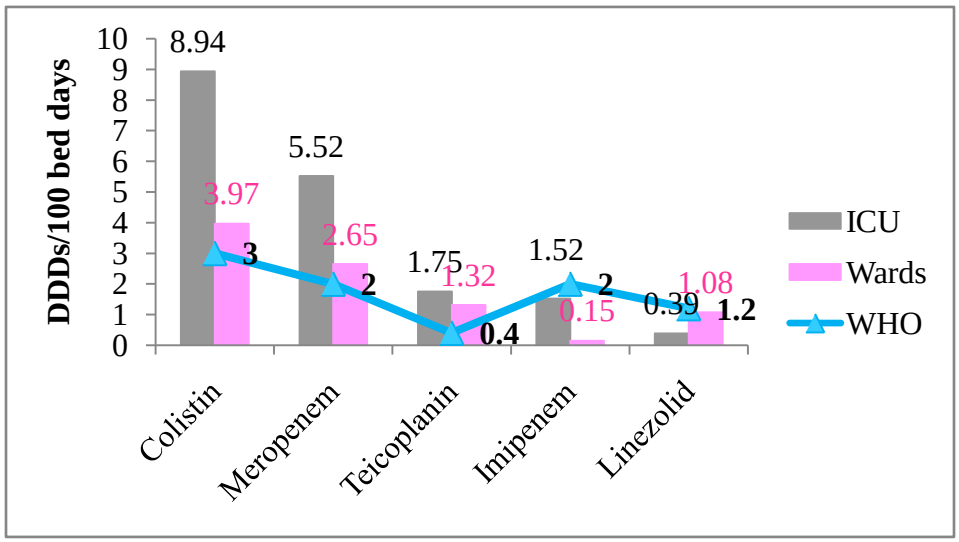

Figure 4.5: Restricted antibiotic usage (July-Aug)

The figure 4.5 depicts that in July-August, consumption of all restricted antibiotics was more in ICUs than in wards except for Linezolid where it was consumed more in wards.

Also, it shows that the utilization was more than the WHO recommendations for Colistin, Meropenem and Teicoplanin both in ICUs and wards.

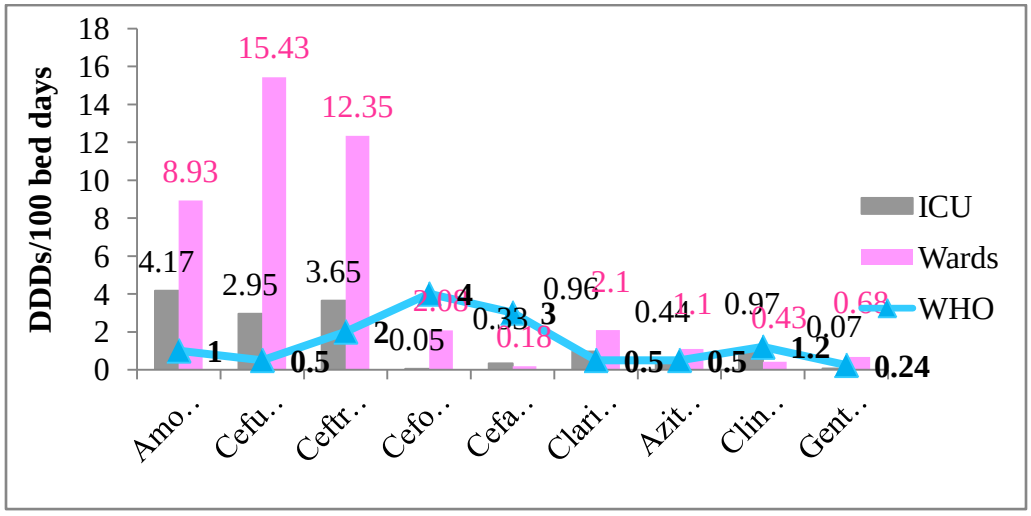

Figure 4.6: Unrestricted antibiotic usage (July-Aug)

Figure 4.6 reveals that in July-August, the use of most of the unrestricted antibiotics was more in wards than in ICUs. Cefazolin and Clindamycin were used more in ICUs.

The usage was more than WHO recommendations for Amoxicillin, Cefuroxime, Ceftriaxone, Clarithromycin, Azithromycin and Gentamycin.

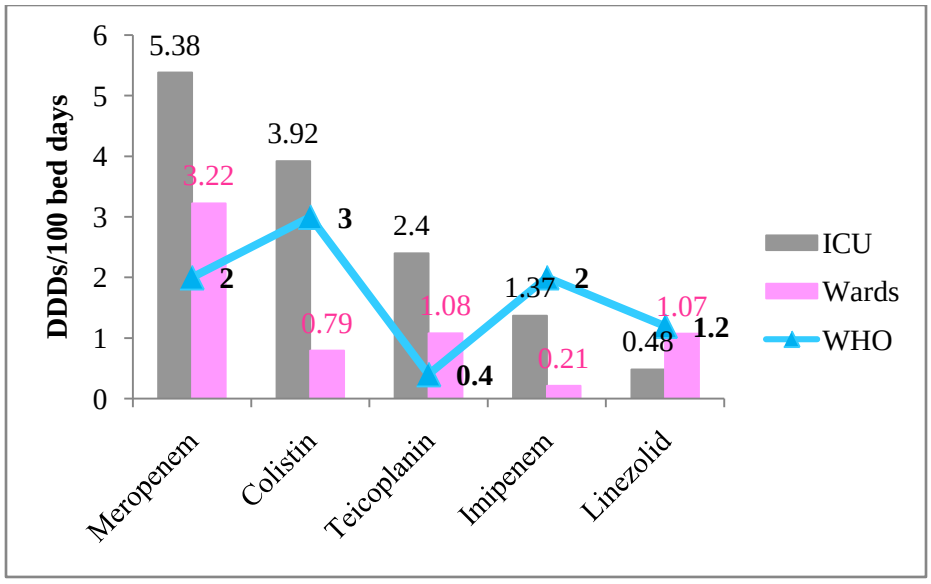

Figure 4.7: Restricted antibiotic usage (Feb-March)

The figure 4.7 shows that in Feb-March, consumption of all restricted antibiotics was more in ICUs than in wards except for Linezolid where it was consumed more in wards.

Also, it shows that the utilization was more than the WHO recommendations for Colistin, Meropenem and Teicoplanin.

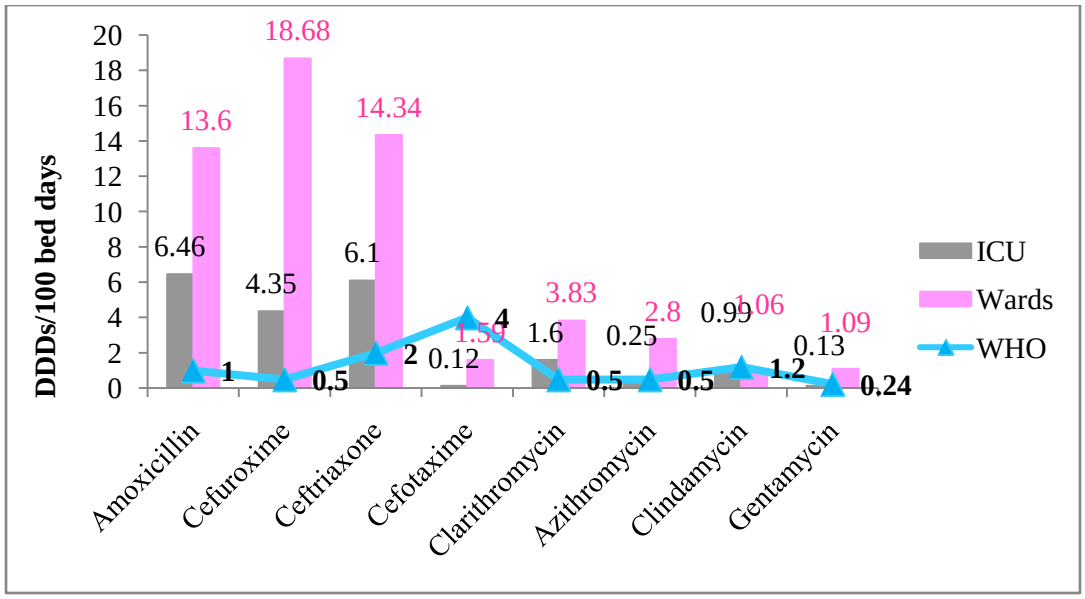

Figure 4.8: Unrestricted antibiotic usage (Feb-March)

The Figure 4.8 signifies the more utilization of all the unrestricted antibiotics in wards in comparison to ICUs in the months of Feb-March. Also the consumption was more than the WHO norms for all except Cefotaxime.

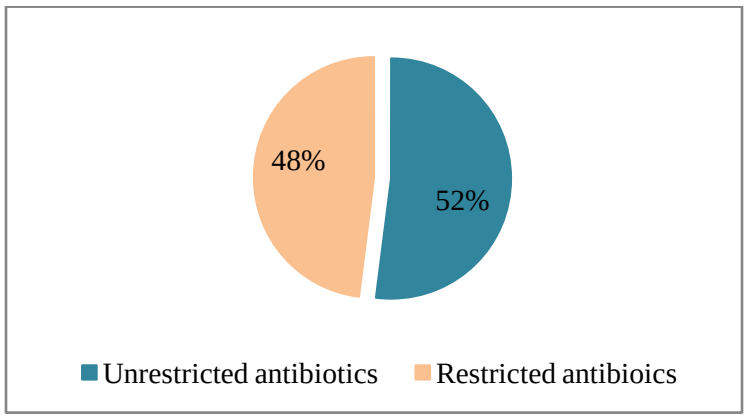

Figure 4.9: DDDs/100 bed days in ICUs (Combined 4 months)

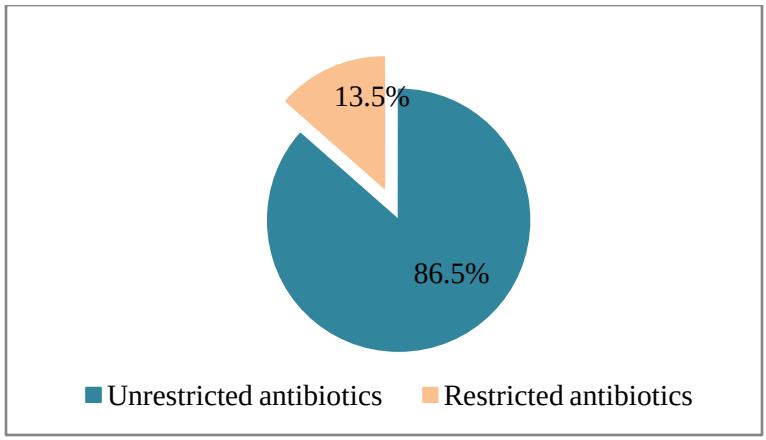

Figure 4.10: DDDs/100 bed days in Wards (Combined 4 months)

From the above Figures 4.9 and 4.10, it is clear that of the total antibiotics used in ICUs, a little less than half proportion (48%) was of the restricted antibiotics.

The proportionate utilization of restricted antibiotics in wards was 13.5%.

4.3 COMPARISON OF THE ICU USAGE BETWEEN BOTH PERIODS

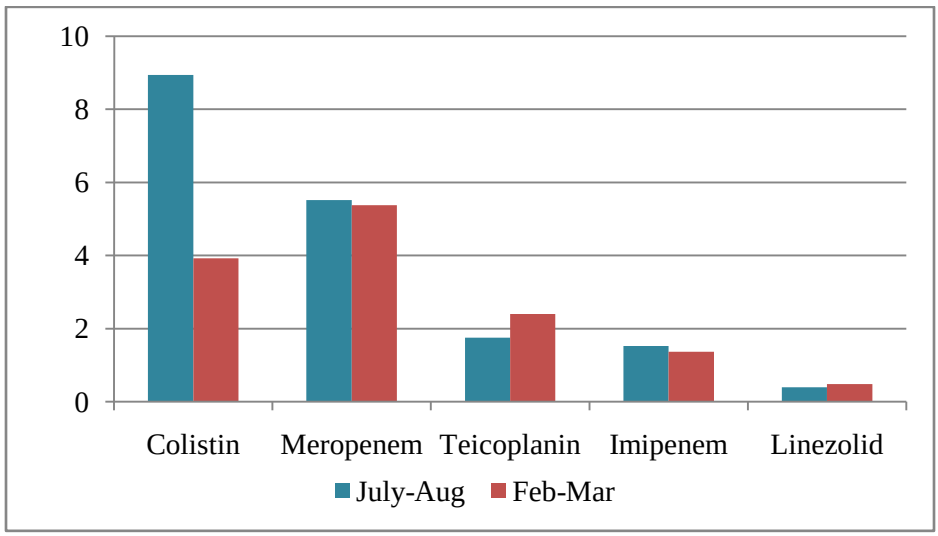

Figure 4.11: ICU usage of restricted antibiotics

Figure 4.11 reveals that the ICU usage of restricted antibiotics for Feb-March has decreased than in July-August except for Teicoplanin where its utilization was more in Feb-March.

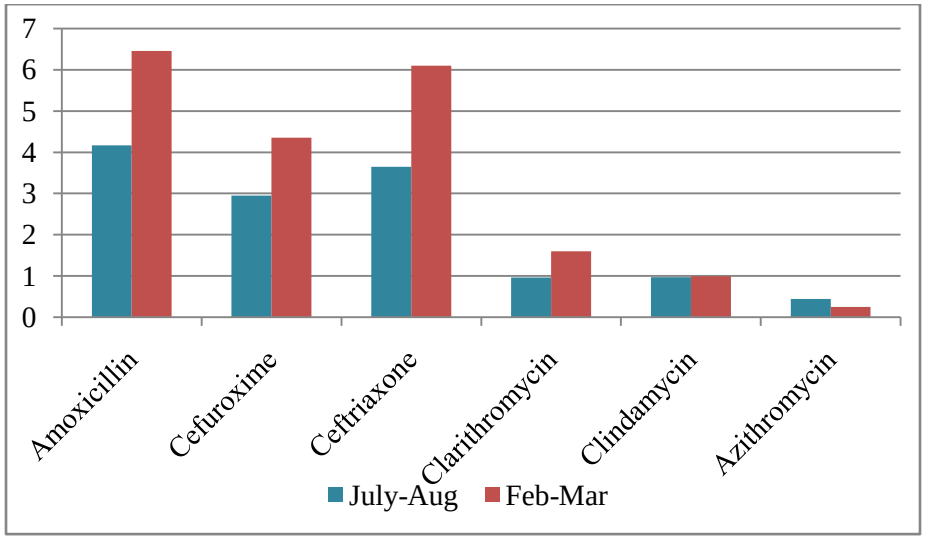

Figure 4.12: ICU usage of unrestricted antibiotics

The ICU usage of unrestricted antibiotics has increased for Feb-March in comparison to July-August.

4.4 COMPARISON OF THE USAGE IN WARDS BETWEEN BOTH PERIODS

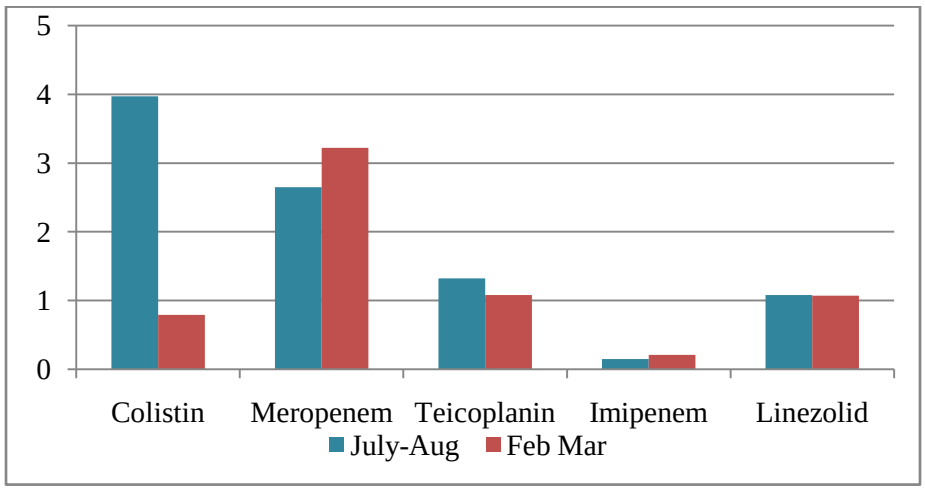

Figure 4.13: Usage of restricted antibiotics in wards

Similar trend is seen in wards as in ICUs. The usage of restricted antibiotics in general over the period has decreased even for wards apart from Meropenem and Imipenem where the utilization is more in February-March than in July-Aug (Figure 4.13).

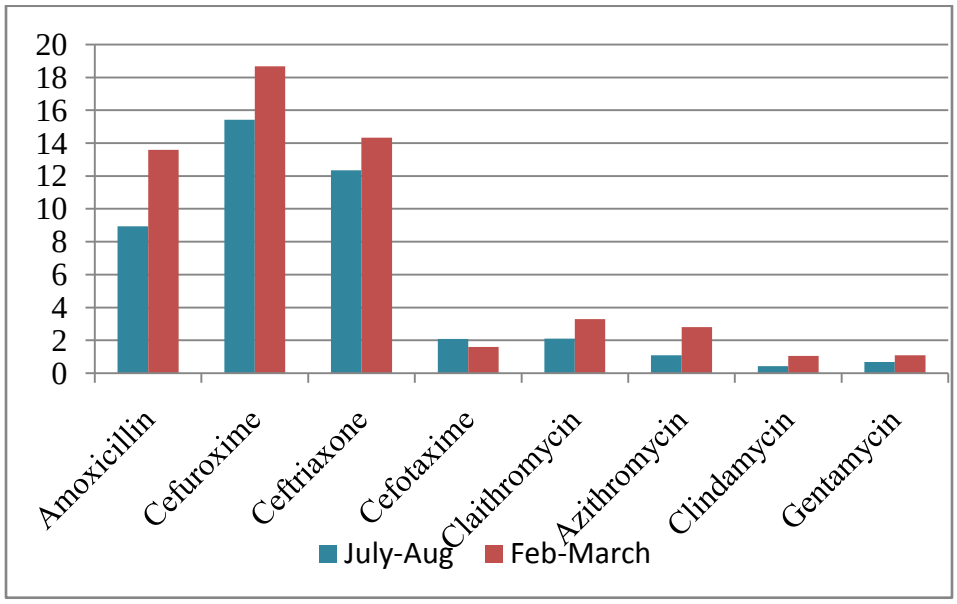

Figure 4.14: Usage of unrestricted antibiotics in wards

The drug utilization for unrestricted antibiotics shows the increased trend in wards for Feb-march in comparison to July-Aug (Figure 4.14).

In general, it can be said that the utilization of restricted antibiotics has decreased and that for restricted has increased over the period which is beneficial in a way but the overall usage of antibiotics in the hospital has increased by 10.32%.

CHAPTER 5

SUGGESTIONS

An initiative has been taken to develop Antibiotic Monitoring Tool with the help of IT department with Antibiotic Monitoring Calculator incorporated in it.

5.1 VISION OF ANTIBIOTIC MONITOR TOOL

Antibiotic Monitor Tool aims at providing insight into the following aspects of drug utilization and drug prescribing:

A. Pattern of Usage

This will cover the extent and profile of drug use and the trends in drug use over time.

It can be used to estimate the numbers of patients exposed to specified antibiotic within a given time period.

B. Quality of Usage

This is determined using audits to compare actual use to national prescription guidelines or local drug formularies. It can determine the pattern or profile of drug use and the extent to which alternative drugs are being used to treat particular conditions. It can also help in formulating and reframing the antibiotic policies.

C. Determinants of Usage

Drug utilization data can be fed back to prescribers. This is particularly useful when the drug prescribing by a particular individual can be compared with some form of best practice and with the average prescriptions in the relevant hospital.

D. Outcomes of use: These are the health outcomes (i.e. the benefits and adverse effects) and the study of antibiotic resistance. The number of case reports about antibiotic resistance or adverse effects can be related to the number of patients exposed to the drug to assess the potential magnitude of its utilization.

Antibiotic Utilization Monitor is the key to accountable care and healthcare reform. By applying technology and standard norms we can continually evaluate, identify, assess, and stratify utilization pattern. Physician groups can use technology and automation to augment the role of care teams, manage the patients more effectively and efficiently, drive better outcomes, and decrease over utilization of antibiotics. Various interventions and strategies are suggested below.

1. Surveillance for *antibiotic resistance* and surveillance for *antibiotic use*.

   Knowing resistance levels and tracking them over time. Resistance patterns can produce evidence for whether interventions are working, and can also help to identify problem areas.

2. Increasing use of diagnostic tests.

   Form alliances between hospitals with and without diagnostic facilities to initially outsource testing, and eventually build capacity. Implement quality assurance programmes and work to develop new tests.

3. Strengthening infection control committees

   Coordinate measures such as isolation. Conduct demonstration projects, audits of prescribing and behaviour. Support and participation of top administrators needed.

Various hospitals, Head (ICC) should be called upon to share their analysis with counterparts in other hospitals.

4. In-service training for Physicians

   Conduct interactive workshops that fulfil CME requirements addressing reasons for doctors overprescribing antibiotics and teaching about rational prescribing.

CHAPTER 6

CONCLUSION

Antibiotic Utilization Monitoring is the key to accountable care and healthcare reform. By applying technology and standard norms we can continually evaluate, identify, assess, and stratify utilization pattern. Physician groups can use technology and automation to augment the role of care teams, manage the patients more effectively and efficiently, drive better outcomes, and decrease over utilization of antibiotics.

Appropriate use of antibiotics in the hospital leads to:

- Decreased antibiotic resistance: Hospitals were the birthplace of antimicrobial resistance and continue to be a source of evolution and propagation. So controlling the consumption will lead to check on the resistance levels.
- Decreased hospital stays: Decreased morbidity and mortality leads to decreased length of stay of patients in the hospitals.
- Decreased cost of treatment: First line of drugs is more effective against an infection than the second choice of drugs and are less expensive as well thereby leading to decreased treatment cost for the patients.
- Patient satisfaction: Decreased treatment cost leads to easy and early settlement of insurance claims. Also decreased length of stay increases the patient satisfaction.

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3.

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ANNEXURES

A. LIST OF UN-RESTRICTED ANTIBIOTICS

1. Cefoperazone Sodium

2. Cefuroxime

3. Amoxycillin + Clavulanic Acid

4. Cefepime

5. Sulbactam

6. Rifaximin

7. Cefuroxime

8. Gentamicin

9. Clindamycin

10. Doxycycline + Lactobaccillus Acidophilus

11. Ceftizoxime

12. Ceftriaxone + Tazobactam

13. Piperacillin + Tazobactam

14. Cefpodoxime +Clavulanate

15. Clarithromycin

16. Cefixime+Ofloxacin

17. Cefpodoxime

18. Ornidazole

19. Doxycycline

20. Ampicillin

21. Cefepime

22. Cefuroxime

23. Azithromycin

24. Cefixime

25. Clotrimazole

26. Moxifloxacin

27. Levofloxacin

28. Pazufloxacin

29. Ofloxacin

30. Cefixime

31. Amoxicillin

32. Cefuroxime

33. Cloxacillin

34. Vancomycin

35. Ceftazidime

36. Cefpodoxime

37. Ticarcillin + Clavulinic Acid

38. Cefuroxime

39. Ceftriaxone+ Tazobactum

40. Ceftriaxone + Sulbactum

41. Ceftriaxone

42. Cefotaxime

43. Cefipirome

44. Cefipime+Tazobactum

45. Cefipime

46. Cefazolin

47. Bleomycin

48. Aztreonam

49. Azithromycin

50. Voriconazole

51. Fluconazole

52. Prulifloxacin

B. LIST OF RESTRICTED ANTIBIOTICS

1. Linezolid

2. Amphotericin B

3. Meropenem +Sulbactam

4. Teicoplanin

5. Ertapenem

6. Tigecycline

7. Faropenem

8. Colistimethate Sodium

9. Meropenem

10. Polymixin B

11. Imipenem + Cilastatin

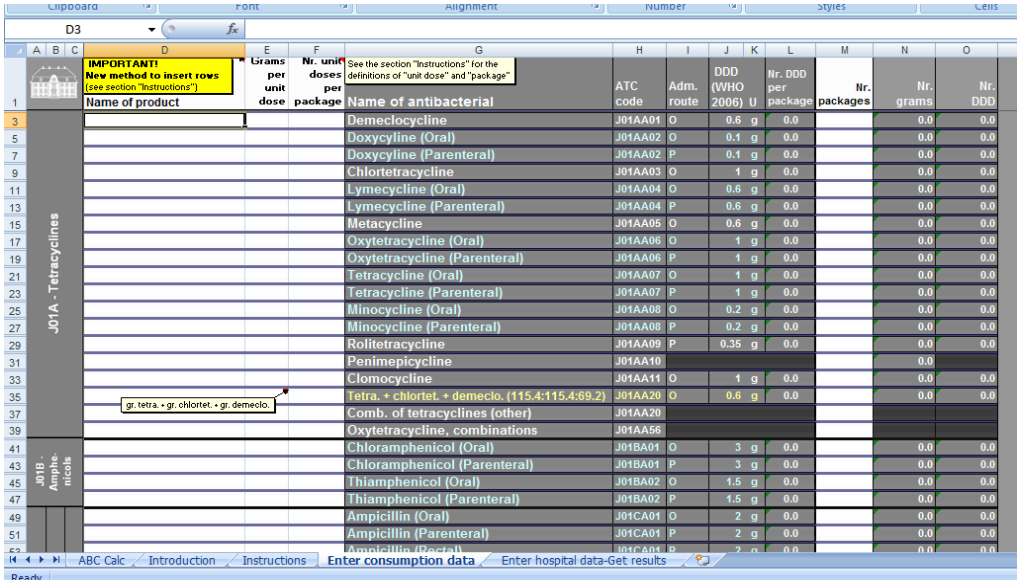
12. Ertapenem

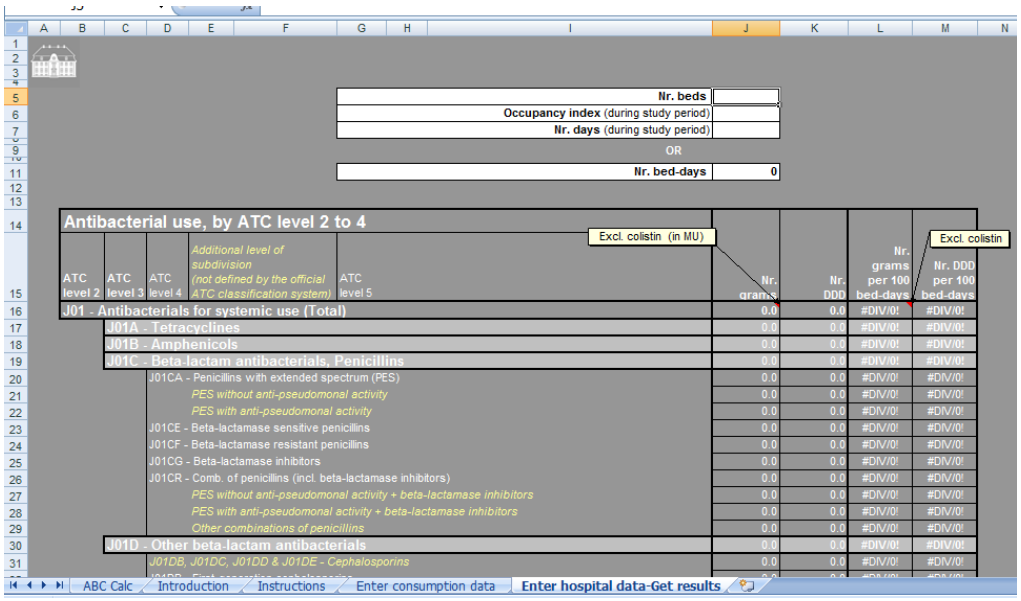
13. Doripenem

14. Daptomycin

15. Caspofungin

C. ANTIBIOTIC MONITOR CALCULATOR





D. TABLE

Item description	Quantity	Antibiotic Class	Restriction	Amount per pack	Total amount