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PRESCRIPTION PATTERN OF DRUGS IN TERTIARY CARE HOSPITAL

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ABSTRACT

A prospective observational study was conducted over six months in a tertiary care hospital, analysing 400 patient prescriptions from the internal medicine and oncology departments. WHO prescribing indicators were used to evaluate drug utilization, while ADRs were assessed using the WHO causality assessment scale and Hartwig's severity scale. Prescription pattern analysis in tertiary care hospitals is crucial for ensuring the rational use of medications, minimizing adverse drug reactions (ADRs), and improving patient outcomes. This study examines drug utilization trends in the internal medicine and oncology departments using WHO prescribing indicators and the Anatomical Therapeutic Chemical (ATC) classification system.

KEYWORDS: Prescription Pattern, Drug Utilization, WHO Prescribing Indicators, ATC Classification, Polypharmacy, Generic Drug Prescribing, Adverse Drug Reactions (ADRs), Rational Drug Use, Internal Medicine, Oncology, Essential Medicines List (EML), Injection Prescribing Trends.

INTRODUCTION

Prescription is written format containing name of medicines, dose of medicines and is dispensed by the pharmacist. The expense of medical care as well as morbidity and mortality are increased by inappropriate prescriptions. The impact of irrational prescription of drugs also leads to an increase in the incidence of adverse drug events. Emergence of resistance is also a major problem in case antibiotics.[1] Assessment of prescription pattern is a useful tool to assure that medications are prescribed, given out, and taken in a way that maximizes therapeutic benefits while minimizing potential hazards and wastage.

Prescription patterns helps to study the extent and profile of drug use, trends, quality of drugs, and compliance with regional, state or national guidelines like standard treatment guidelines, usage of drugs from essential medicine list and use of generic drugs.[2] Understanding prescribing patterns in tertiary care hospitals is crucial for enhancing patient care, ensuring the rational use of medications, and controlling healthcare costs. Drug utilization studies are vital in this context as they provide insights into the prescribing behaviour of healthcare professionals, helping to identify areas for improvement and ensuring that treatment regimens align with best practices.[3] In this study WHO ATC Classification, prescribing indicators were used to assess prescription pattern.

The ATC Classification System

The WHO Anatomical Therapeutic Chemical (ATC) classification system plays a significant role in this endeavour. This system standardizes the categorization of drugs based on their therapeutic use and chemical characteristics, facilitating a structured analysis of prescribing patterns. By employing the ATC classification in this study, we aim to categorize and analyse the drugs prescribed in a tertiary care hospital, providing a clear picture of medication use across different departments. WHO Anatomical Therapeutic Chemical classification uses a hierarchical system for classifying drugs into distinct groups at five different levels according to the organ system which they act on and their therapeutic, pharmacological and chemical properties; anatomical main group (level 1), therapeutic subgroup (level 2), pharmacological subgroup (level3), chemical subgroup (level 4) and chemical substance (level 5). On the basis of these five different levels drugs are classified into fourteen different classes.[4]

The ATC system, managed globally by the WHO, categorizes active medical substances—commonly known as active ingredients in medicines—based on the organ or body system they affect, such as the heart or central nervous system. The ATC classification assigns alphabetical and numerical codes to describe the properties of an active ingredient, organizing it into one of five hierarchical levels.

The first level identifies one of fourteen anatomical or body systems: alimentary tract and metabolism [A], blood and blood-forming organs [B], cardiovascular [C], dermatological [D], genitourinary and sex hormones [G], general anti-infectives for systemic use [J], antineoplastics and immunomodulating agents [L], musculoskeletal [M], central nervous system [N], antiparasitic [P], various [V], respiratory [R], sensory organs [S], and systemic hormonal preparations excluding sex hormones and insulin [H], which includes other therapeutic products.

The second, third, and fourth levels describe the drug's therapeutic and pharmacological actions and its chemical name. For instance, atenolol is categorized as cardiovascular (body system), antihypertensive (therapeutic class), beta-blocker (pharmacological action), and finally as atenolol (chemical descriptor), resulting in the ATC code C07AB03. This system facilitates international communication about drugs, avoiding language and spelling issues. However, there are some inconsistencies. For example, C02-cardiovascular antihypertensives is a therapeutic label, while C03-diuretics and C07-beta blocker agents are pharmacological labels, which can be confusing. Notably, many hypertension treatments are not included in C02-antihypertensives. Accurate coding is crucial in pharmacoepidemiology studies as it helps clearly identify medicines.

The ATC system is associated with the drug's dosage form, meaning a drug available as both a tablet and injection would have two different ATC codes. Clinicians, researchers, health professionals, and patients typically use the chemical or brand name of a medicine. The term “generic” often refers to the active ingredient, but it is commonly used for non-innovator products like diclofenac, branded as Voltaren. The preferred naming convention is the international non-proprietary name (INN), although the United States adopted name (USAN) and the British approved name (BAN) are also used. Using the INN universally is expected to reduce prescribing errors.[5]

To improve the overall drug use, especially in developing countries, international agencies like the world health organization (WHO) and the international network for the rational use of drugs (INRUD) have engaged themselves to evolve standard drug use indicators. Evaluating the quality of prescribing practices requires robust metrics, which is where the WHO prescribing indicators come into play. These indicators serve as a benchmark for assessing drug utilization, offering valuable insights into the efficiency and appropriateness of prescriptions. By applying these indicators, this study seeks to evaluate drug utilization in the hospital, identifying potential areas for improvement and ensuring that prescribing practices meet established standards. The prescribing indicators measure performance in three related areas of ‘prescribing practices, patient care, and facility-specific factors. The core drug use indicators have been recognized as “objective measures that can describe the drug use situation in a country, region or individual health facility”.[6]

A key aspect of this research is the comparative analysis between the internal medicine and oncology departments. These two departments were selected due to their distinct disease profiles and treatment regimens, which may lead to differing prescribing patterns. By comparing these departments, we aim to uncover variations in drug utilization, adherence to treatment guidelines, and the occurrence of adverse drug events, providing a comprehensive understanding of prescribing practices in diverse clinical settings.

Polypharmacy leads to adverse events through drug interactions, increased risk of side effects, non-adherence, reduced quality of life, organ toxicity, medication errors, high healthcare costs, diminished efficacy, cognitive impairment, so it is essential to assess adverse events. Monitoring adverse drug events is essential for patient safety and optimizing therapeutic outcomes. In this study adverse events were assessed using WHO causality assessment scale and severity of adverse events was assessed. The process of determining the probability that a specific treatment is the reason behind an unfavourable occurrence that has been seen is known as causality assessment. It assesses the relationship between a drug treatment and the occurrence of an adverse event contributing to better evaluation of the risk-benefit profiles of medicines.[7] This methodology will help us determine the relationship between prescribed drugs and reported adverse events, contributing to a safer prescribing environment The first step toward raising the standard of patient care and prescription quality is gaining insight into the patterns of physicians in order to spot prescribing issues. In order to comprehend the prescription pattern of inpatients, the current study was designed. This research has significant implications for clinical practice in tertiary care hospitals. By identifying current prescribing patterns and highlighting areas for improvement, our findings can lead to better prescribing practices, enhanced patient outcomes, and more efficient use of healthcare resources. Furthermore, this study will contribute to the existing literature on drug utilization, prescribing patterns, and safety monitoring, providing valuable insights for future research.

Prescribing Indicators

Prescribing indicators assess the performance of healthcare providers in five crucial areas related to the proper use of medications. The average number of medicines prescribed per encounter, the percentage of medicines prescribed by generic name, the percentage of encounters with an antibiotic prescribed, the percentage of encounters with an injection prescribed, and the percentage of medicines prescribed from an essential

medicines list or formulary. These indicators are derived from an analysis of patient clinical encounters, which refer to the duration of interaction between a patient and a healthcare provider. Ideally, this interaction encompasses several components: taking the patient's history, diagnosing, selecting non-pharmacological or pharmacological treatments, prescribing (and possibly dispensing) treatments, explaining the treatment and its potential adverse effects, follow-up, and prevention.[8] Encounters can be analysed retrospectively using medical history records or prospectively as patients arrive during data collection. Notably, determining core prescribing indicators does not require information on patients' signs and symptoms, as they reflect general prescribing trends rather than disease-specific practices. These indicators are designed to shed light on specific prescribing behaviours. WHO has proposed reference values for each indicator, although these are not empirically determined.[9] The organization acknowledges that prescribing practices may vary widely from these reference values, especially for indicators like injection use rate, antibiotic use rate, and the average number of medicines per encounter, which can be influenced by the case mix at a facility or within a region. The following sections summarize the various prescribing indicators and their calculation methods.

Indicator 1: Average number of medicines per encounter

This indicator aims to evaluate the degree of polypharmacy. According to the WHO, the optimal value for this indicator should be less than 2.[10] To calculate it, first, the total number of clinical encounters recorded (x) is counted. Next, the total number of medicines prescribed across all these encounters (y) is determined, counting combination medicines as one. The average number of medicines per encounter (p) is then calculated by dividing the total number of medicines prescribed (y) by the total number of encounters (x).[6] This can be expressed mathematically as follows:

Average number of medicines per encounter (p)= y/x

Indicator 2: Percentage of medicines prescribed by generic name

This indicator measures the prescriber's inclination to use generic or international non-proprietary names (INN) for medicines. To accurately determine this indicator, investigators must verify the actual names written on the prescription rather than the names of the dispensed products due to the possibility of product substitution at the pharmacy. The indicator (g) is calculated by dividing the number of medicines prescribed in the INN format (d) by the total number of medicines prescribed (y) and expressing it as a percentage.6 In some cases, common brand names (e.g., aspirin) can be considered generic if used interchangeably with other names. Additionally, local preparations without generic names may be classified as generic. The WHO suggests that ideally, all medicines (100%) should be prescribed by their generic names.[10] This calculation is mathematically expressed as follows:

Percentage of medicines prescribed by generic name (g)=d/y×100%

Indicator 3: Percentage of encounters with an antibiotic prescribed

This indicator evaluates how often antibiotics are prescribed by primary health care (PHC) providers. It is important to clarify which medicines are considered antibiotics in each study, as the indicator is sensitive to this categorization. Decisions must be made regarding whether to include dermatologic creams and eye care products as antibiotics, as their inclusion could significantly affect the results, particularly in areas with high prevalence of conditions like bacterial conjunctivitis and bacterial and fungal skin infections. The WHO/INRUD has provided a list of medicines typically classified as antibiotics and advises that any significant deviations from this list should be explained in the study's methodology. The WHO classification of antibiotics is detailed in FIG 1. The percentage of encounters with an antibiotic prescribed (b) is calculated by dividing the number of clinical encounters where at least one antibiotic was prescribed (f) by the total number of encounters (x) and expressing it as a percentage. The WHO suggests that this value should ideally be less than 30%.[11] The mathematical expression is provided below.

Table 1: World Health Organization Antibiotic Classification.

Medicines usually classified as antibiotic	Medicines which should usually not be classified as antibiotic
Penicillins Anti-infective Dermatological agents Anti-infective ophthalmological agents Antidiarrheal drugs with streptomycin, neomycin, nifuroxazide, or combinations Other antibacterials	Antifilarials Antischistosomals Antileprosy drugs Antituberculosis drugs Antifungals Antiamoebic and antigiardiasis drugs Antileishmaniasis agents Antimalarials Antitrypanosomal drugs

Percentage (%) of encounters with an antibiotic prescribed (b)=f/x ×100%

Indicator 4: Percentage of encounters with an injection prescribed

The provided information describes a measure (j) of how often injectable medications are prescribed by doctors. It emphasizes that vaccinations aren't included as injections in this measure. The calculation involves dividing the number of times a doctor prescribed an injectable medication (t) by the total number of patient visits (x) and then multiplying by 100 to express it as a percentage. According to the World Health Organization (WHO), this percentage should ideally be below 20%.[6]

Percentage (%) of encounters with an injection prescribed (j)= t/x×100%

Indicator 5: Percentage of medicines prescribed from the essential medicines list

The primary goal of this indicator is to evaluate whether prescribing practices align with drug use policies, specifically regarding the use of the Essential Medicines List (EML). The EML comprises medicines that address the most critical health care needs of a population. The concept of the EML is based on the idea that utilizing a limited selection of well-researched and cost-effective medicines can improve health care outcomes, ensure a steady supply of medications over the long term, and promote fair and sustainable access to these products. To assess this indicator, investigators need to acquire a copy of the relevant EML (either national or facility-based) to compare against the prescribed medicines. In cases where an EML is not established, the WHO model EML can serve as a reference. When brand names are prescribed, it is essential to verify if they have generic equivalents listed on the EML. The percentage of medicines prescribed from the EML (k) is determined by dividing the number of medicines prescribed from the EML (m) by the total number of medicines prescribed (y) and then multiplying by 100 to get a percentage. Ideally, all medicines prescribed at primary health care facilities should come from the EML, making the optimal value for this indicator 100%.[11]

Percentage (%) of medicines prescribed from EML (k) = m/y×100%

In this study, Prescription pattern of the medications was examined in a tertiary care hospital using ATC classification and prescribing indicators. Monitoring patient adverse drug reactions (ADRs) is also essential. To reflect this, we have evaluated the adverse drug response using the "WHO Causality assessment scale" and the "Hartwig's severity scale" to determine the severity of the ADR.

MATERIAL AND METHODS

1. **Study Site:-** Sahyadri Specialty Hospital, Deccan, Pune- 411004 India.
2. **Study Design:-** Prospective and Retrospective study
3. **Duration of study:-** 6 months
4. **No. of Subject:-** 400 Patients

Study criteria

Inclusion

1. Inpatients admitted in internal medicine wards.
2. Inpatients admitted to oncology ward.

Exclusion

1. Paediatric population
2. Prescriptions with incomplete information

Materials

- Patient Information Sheet (English and Marathi, Annexure IA and IB)
- Patient Consent Form (English and Marathi, Annexure IIA and IIB)
- Annexure III: Data Collection Form PPF
- Standard Scales Used

For ADR Assessment

- Annexure IVA: WHO Assessment Scale for causality
- Annexure IV B: Hartwig's severity assessment scale

For Prescription Pattern Analysis

- Annexure VA: WHO ATC Classification
- Annexure VB: Prescribing Indicators

RESULT

This study is a prospective observational study which is done amongst 400 inpatients of Internal Medicine and Oncology Department in a tertiary care hospital during the 6 months of the study period. On admission of the patient, the variables recorded were age, gender, treatment chart, and medication parameters (pharmaceutical class, number of medications, generic names). Out of 400 patients 200 were from Internal medicine department and 200 from oncology department.

In Internal Medicine department (43.5%) 87 Females, (56.5%) 113 Males and in Oncology Departement (56%) 112 Females, (44%) 88 Males were recorded. Overall, 201 Male and 199 females were observed according to the combined data from the two departments.

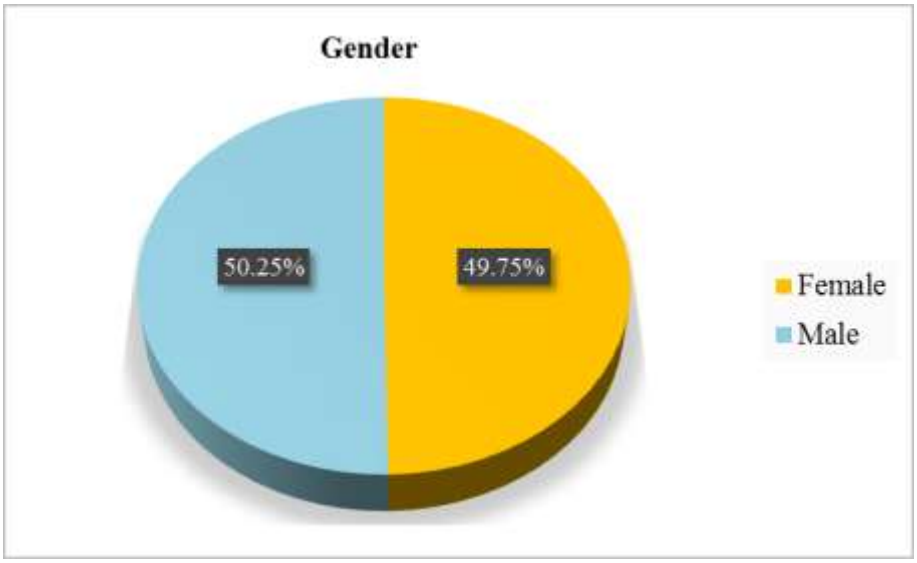

Fig. 1: Distribution of Patients by Gender Wise.

Age distribution of patients revealed that the maximum patients belonged to the age group of 61-70 years (n=87), followed by age group 51-60 years with 81 patients, 71-80 years with 67 patients, 41-50 years with 56 patients, 31-40 years with 53 patients, 21-30 years with 33 patients, 11-20 years with 13 patients and 81-90 years with 10 patients were recorded.

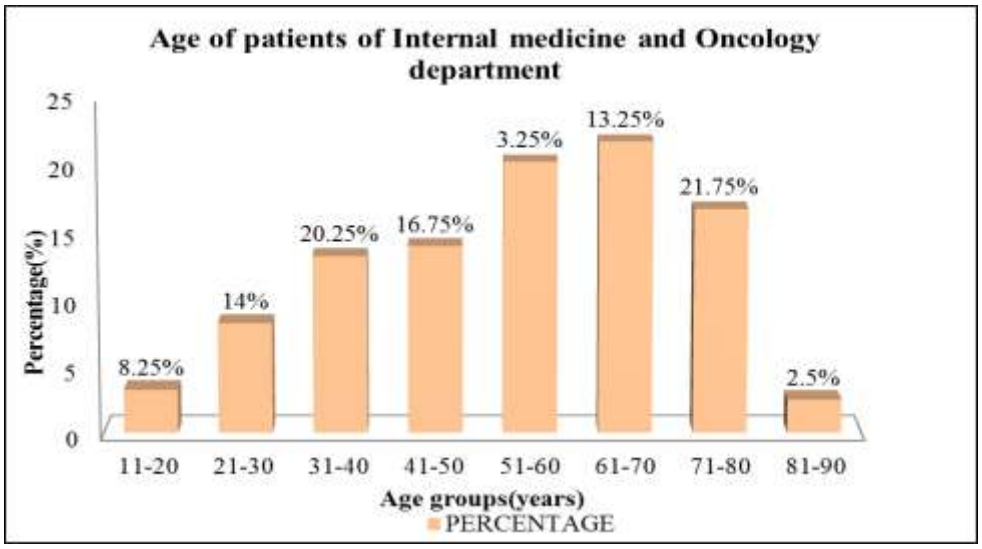

Fig. 2: Distribution by Age.

Out of 400 patients in a tertiary care hospital who were diagnosed with disease, 60 (30%) patients from Internal Medicine department were diagnosed with LRTI (Disease of Respiratory System according to ICD Classification), and 55 (27.5%) patients in Oncology Department were diagnosed with Breast Cancer constituting the maximum number.

Total 1049 drugs were prescribed to the patients. Out of 1049 drugs, 640 drugs were from Internal Medicine Department and 409 drugs were from Oncology department. The maximum drugs prescribed from Internal Medicine department were from ATC Class A (Alimentary tract and metabolism) with 680 drugs, ATC Class B (Blood and blood forming organs) with 145 drugs, Class C (Cardiovascular system) with 202 drugs, Class J (Anti-infective for systemic use) with 329 drugs, Class N (Nervous system) with 251 drugs, Class R (Respiratory system) with 216 drugs, with 150 drugs were Nutritional Supplements and Class G (Genito-urinary system and sex hormones), Class H (Systemic hormonal preparations, excluding sex hormones and Insulin), Class L (Antineoplastic and immunomodulating agents), Class M (Musculo-skeletal system), Class P (Antiparasitic products, insecticides and repellents), Class S (Sensory organs), were less than 5%.

The maximum drugs prescribed from Oncology department were from ATC Class A (Alimentary tract and metabolism) with 965 drugs, ATC Class L (Antineoplastic and immunomodulating agents) with 449 drugs, Class N (Nervous system) with 246 drugs, Class R

(Respiratory system) with 174 drugs, with 489 drugs were Nutritional Supplements and Class C (Cardiovascular system), Class D (Dermatologicals), Class H (Systemic hormonal preparations, excluding sex hormones and Insulin), Class J (Anti-infective for systemic use), Class M (Musculo-skeletal system), Class P (Antiparasitic products, insecticides and repellents), Class S (Sensory organs), Class B (Blood and blood forming organs), Class V (Various) were less than 5%.

With the comparison of both the departments of Internal Medicine and Oncology the ATC Class A was utilised the maximum times and it was seen that it is more utilised in Oncology Department as well.

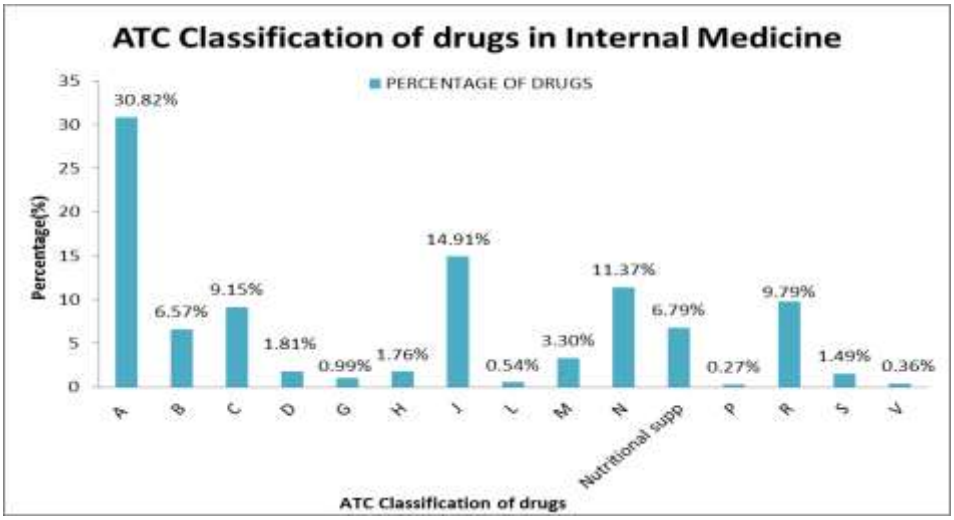

Fig. 3: ATC Classification of Drugs In Internal Medicine.

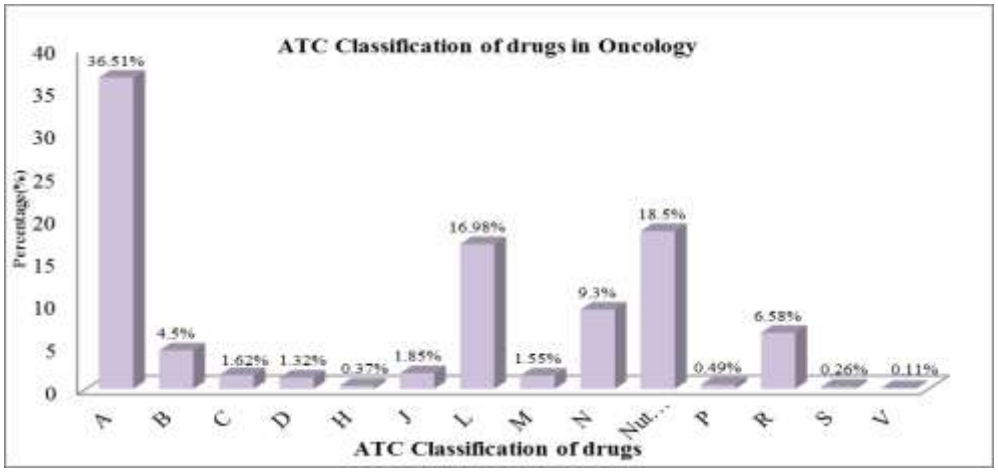

Fig. 4: ATC Classification of drugs in Oncology.

Oral route was the most preferred route in Internal Medicine and Oncology Department accounting for 52.21%, following by Intravenous route 36.50%, Paranasal (2.52%), Rectal 2.25%, Sub cutaneous 3.64%, Topical 1.97%, Intra Ocular (0.25%), Auricular 0.02%, and Intra muscular (0.27%). After investigating the patient encounters it was observed that, 1740 prescriptions have generic names, 201 patients were prescribed with Antibiotics, 395 patients were prescribed with injection, 2921 drugs were included in the WHO EML list.

Table 2: Prescribing Indicator Comparison.

Prescribing Indicator	Average/percentage/SD		Standard reference range/optimal value	Comments
	Internal Medicine	Oncology		
Average number of drugs per patient encounter	10.68±4.22	12.64±5.14	1.6-1.8	Indicates Polypharmacy
Percentage of drugs prescribed by generic names	31.11%	42.52%	100%	Can be improved
Percentage of patient encounters with an antibiotic	81%	19.5%	20.0%-26.8%	Irrational in Internal medicine

Percentage of patient encounters with an injection	98.5%	99%	13.4%-24.1%	Irrationality in both departments
Percentage of drugs from essential drugs list	58.86%	65.78%	100%	Reasonably good

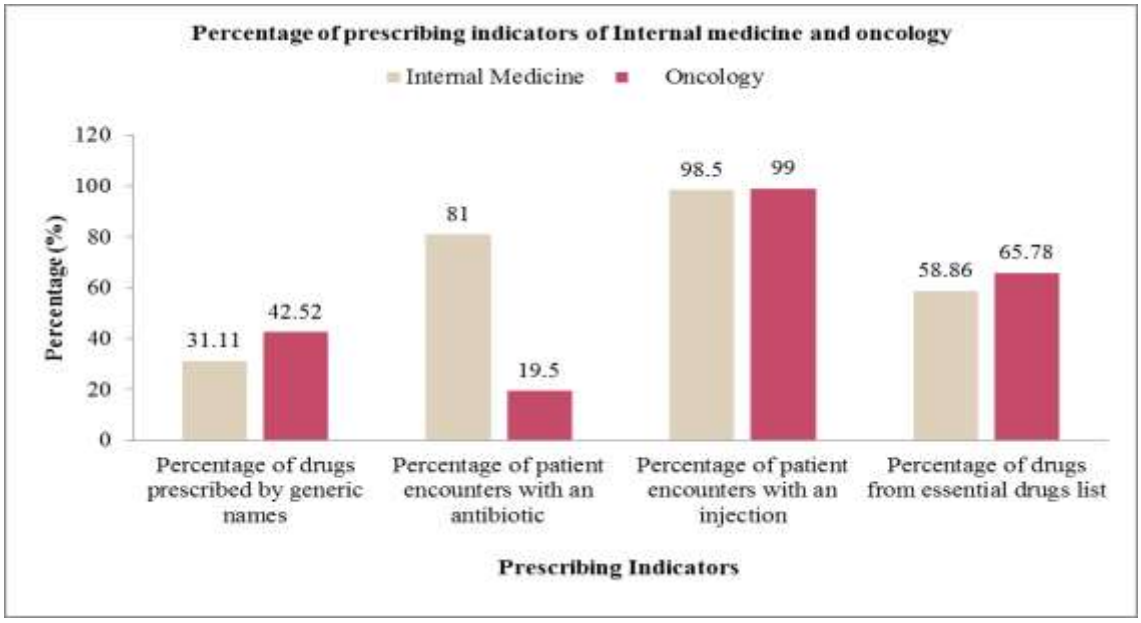

Fig. 5: Combined Frequency distribution of Prescribing indicator of Internal Medicine and Oncology department.

The combined values for the internal medicine and oncology departments in our study were 11.66 for the average number of medicines per encounter, 37.29% for the percentage of medicines prescribed by generic name, 50.25% for the percentage of encounters with antibiotics prescribed, 98.75% for the percentage of encounters with injections prescribed, and 62.61% for the percentage of medicines prescribed from the essential medicines list.

A total number of 281 ADR's were reported amongst which 104 ADR were seen to be from Internal Medicine Department and 177 ADR from Oncology department. From overall 400 patients, 119 patients were not reported with any ADR. Nausea and Alopecia were observed to be the highest reported ADR in Oncology Department and, Rash and Hyponatremia were the maximum number of ADRs in Internal Medicine.

Table 3: List of ADR in Internal Medicine department and Oncology department.

Affected System (Internal medicine)	No. of ADR's	Affected System(Oncology)	No. of ADR's
Digestive and Excretory Systems			
Diarrhea	4	Nausea	54
Oral Ulcers	4	Diarrhea	15
Dysuria	1	Gastritis	9
Sore throat	4	Decreased Appetite	11
AKI	2	Oral Ulcers	1
Abdominal pain	1	Haematuria	3
Dry Tongue	2		
Constipation	4		
Musculoskeletal System			
Pain in Joints	3		
Hemiparesis	2		
Spasms	5		
Respiratory System			
Dsypnea	4	Dsypnea	2
Pulmonary Oedema	1		
Cardiovascular System			
Hypertension	4		
Hypotension	4		
Tachypnoea	1		

Chest Pain	2		
Bradycardia	1		
Affected System(Internal medicine)	**No. of ADR's**	**Affected System (Oncology)**	**No. of ADR's**
Central Nervous System			
Drowsiness	5	Drowsiness	7
Unconsciousness	1	Palpitation	2
Seizures	2	Insomnia	1
Insomnia	1	Headache	3
Hearing Defect	1		
Blurred Vision	1		
Haematology			
Thrombocytopenia	2	Neutropenia	6
		Anaemia	3
		Thrombocytopenia	3
		Leukopenia	36
Electrolytes & Endocrine System			
Hypokalemia	4	Electrolyte Imbalance	3
Hyponatremia	6	Hyponatremia	6
Increased Creatinine	7	Oedema	1
Hypernatremia	2		
Dyslipidemia	3		
Oedema	5		
Dermatological			
Rash	7	Rash	3
Itching	3	Itching	2
Blackish Patch over chest	1	Peeling of Skin	1
		Alopecia	48
Affected System(Internal medicine)	**No. of ADR's**	**Affected System(Oncology)**	**No. of ADR's**
Liver Function			
Increased SGOT/SGPT	3		
Hyperbilirubinemia	1		
Hypoalbuminemia	1		

Table 4: Depicts the WHO Causality percentage within 400 patients.

Type of reaction	Percentage (%)
Certain	1%
Probable/ likely	19.25%
Possible	38%
Unlikely.	11.25%
Conditional/ unclassified	0.5%
Unassessable/ unclassifiable	0%
No ADR	29.75%

Causality assessment had majority of ADR with possible causal association in 153 patients, probable in 77 patients, certain in 4 patients, unlikely in 45 patients, unclassified in 2 patients. In the Internal Medicine department, causality assessment of adverse drug reactions (ADRs) revealed that 33 ADRs were possible, 29 were probable, 37 were unlikely, 2 were unclassified, and 3 were certain. Severity assessment showed that 73 ADRs were mild, 28 were moderate, and 3 were severe.

In contrast, the Oncology department had a higher incidence of possible ADRs, with 120 cases, and a lower incidence of unlikely ADRs, with only 8 cases. The Oncology department also had 48 probable ADRs and 1 certain ADR. Severity assessment in Oncology revealed that 144 ADRs were mild, 32 were moderate, and 1 was severe. Causality assessment in both departments is depicted in table 4.

The Hartwig severity scale used to assess severity of ADR is shown in the following table 5

Table 5: Severity assessment by modified Hartwig Severity scale.

Type or severity of ADRs	Number of cases	Percentage (%)
Mild	217	77.22%
Moderate	60	21.35%
Severe	04	1.42%

DISCUSSION

The study found that male patients were more prevalent in the internal medicine ward compared to female patients, although the difference was not significant. This observation aligns with the findings of a study conducted by Judith A Hall, et.al.[23] which also reported a higher proportion of male patients in internal medicine wards. The higher representation of male patients in internal medicine wards can be attributed to their increased likelihood of being admitted for specific conditions commonly treated in these settings. Male patients tend to have a higher incidence of cardiovascular diseases, gastrointestinal issues, and stroke risk factors, which may contribute to their overrepresentation in internal medicine wards.[23] This susceptibility could be linked to the immunosuppressive effects of testosterone in males and the immunoenhancing effects of oestrogen in females. One possible explanation is the random selection of cases without considering gender, leading to a higher number of male patients.[24] As a result, the immune responses of females, both innate and adaptive, are often considered more robust than those of males. In oncology ward females were more as compared to males but difference was not significant.

In the present study, the majority of patients were in the 70-80 age range. Lower respiratory tract infections (LRTIs) were prevalent among individuals aged 20-30 years, while cardiovascular diseases were more common in patients over 50 years old. The study conducted by Balsubramaniam R, et.al.[25] reported that the most common age group was 36-50 years, while the research by Shende TR, et.al.[26] found a higher number of patients above 50 years old. In contrast, the study by Gor AP, et.al.[27] observed a predominance of younger patients aged between 18-30 years. These studies, with sample sizes ranging from 100 to 200, were carried out in inpatient departments. During their 40s, individuals may prioritize work and childcare, potentially leading to neglect of their health. As people enter their 50s, weight gain becomes more common, increasing the risk of cardiovascular and other health issues. Furthermore, reduced physical activity and lifestyle changes can also contribute significantly to the development of diseases. The internal medicine ward had a predominance of patients in the 70-80 age range, while the oncology department saw a higher prevalence of patients aged 60-70. Older individuals in the 70-80 age group may be more susceptible to conditions commonly managed in internal medicine wards, such as respiratory complications, pneumonia, and overall health deterioration. Conversely, the increased number of patients aged 60-70 in the oncology department may be linked to the rising incidence of cancer in this age group.[28] As the global population continues to age, the number of older adults with cancer is expected to grow, necessitating the development of specialized geriatric oncology services to provide tailored, comprehensive care for this vulnerable population.

In our study, we found that in the Oncology department, there was a higher utilization of ATC Class A (36.51%) drugs compared to the Internal Medicine department (30.82%). The study conducted by Mittal N, et.al.[30] observed that ATC Class A drugs, which include medications for alimentary tract and metabolism, accounted for 31.02% of the total drugs utilised. This difference can be attributed to the need for supportive care in cancer treatment. Patients undergoing cancer therapy often require supportive care to address the side effects of treatments like chemotherapy and radiation. ATC Class A drugs, which are related to the alimentary tract and metabolism, play a crucial role in managing these supportive care needs. They include medications such as antiemetics for nausea and vomiting, antidiarrheals, laxatives, and nutritional supplements to support the patient's nutritional well-being during treatment.[29]

In our study we found that ATC class J drugs were utilised more in Internal medicine(14.91%) department as compared to oncology department(1.85%).The Internal Medicine department's broader scope of practice, encompassing a wide range of medical conditions beyond cancer, contributes to the higher utilization of Class J anti-infectives compared to the Oncology department. Internal Medicine manages various infectious diseases and conditions, including cardiovascular, respiratory, and endocrine disorders, which require the use of systemic anti-infectives from Class J. In contrast, the Oncology department primarily focuses on the diagnosis and treatment of cancer. While infections can occur in cancer patients, the primary emphasis in Oncology is on cancer-specific therapies such as chemotherapy, radiation, and targeted therapies.[31] As a result, the need for Class J anti-infectives may be relatively lower in the Oncology setting compared to Internal Medicine. The prevalence of infectious diseases like pneumonia, urinary tract infections, and sepsis in the Internal Medicine department necessitates the use of Class J drugs to manage these conditions effectively.[30]

The study findings indicate that in the Internal Medicine department, Class L drugs accounted for (0.54%) of total drug utilization, whereas in the Oncology department, the utilization of Class L drugs was significantly higher at (16.98%). Oncology department's primary focus on

cancer treatment using antineoplastic and immunomodulating agents from Class L contributes to the significantly higher usage of these drugs compared to the Internal Medicine department. As a study by Kamlekar, et.al.[32] found, Class L drugs, which include medications for the treatment of neoplasms, are the cornerstone of cancer therapy and are extensively utilized in the Oncology setting. In contrast, the Internal Medicine department manages a broader range of medical conditions beyond cancer. While Class L drugs may be used in certain cases, their utilization is relatively lower compared to the Oncology department, which specializes in the diagnosis and treatment of cancer using these agents. Their findings highlighted the extensive use of Class L medications in the management of various types of cancer.

According to the study findings, the utilization of nutritional supplements in the Internal Medicine wards was (6.79%), while in the Oncology ward, the utilization of these supplements was notably higher at (18.50%). The higher utilization of nutritional supplements in the Oncology department compared to the Internal Medicine department can be attributed to the supportive care needs of cancer patients. Oncology patients often require nutritional supplements as part of their supportive care to manage symptoms like poor appetite, nausea, and difficulty swallowing that can impair oral intake. Oncologists frequently prescribe nutritional supplements to prevent and treat malnutrition in their patients, as maintaining adequate nutrition is crucial during cancer treatment. Furthermore, certain types of cancer, such as gastrointestinal, head and neck, and oesophageal cancers, can directly impact the digestive system and lead to unique nutritional challenges. Oncology patients with these types of cancers may require specialized nutritional interventions, including oral supplements, to maintain their nutritional status and support their overall well-being. A study by Gulistan Bahat, et.al.[34] highlighted the importance of nutritional supplements in the Oncology setting, demonstrating their use in addressing the specific nutritional needs of cancer patients.

In this study, we found that the average number of drugs prescribed per encounter was 10.68 ±4.22in the internal medicine ward and 12.64±5.14 in the oncology ward of our tertiary care hospital. The combined average across both wards was 11.66±4.79. This exceeds the WHO's recommended range of 1.6–1.8, indicating a high degree of polypharmacy. A similar study conducted by Chandelkar, et.al.[14] in Goa reported an average of 1.8 drugs per encounter, lower than our findings. Other Indian studies by Upadhyay et al.[43] (3.76) and Raj et al.[44] (4.98) also showed lower averages compared to our study.

The disparity in the average number of medications prescribed per encounter between the internal medicine and oncology wards in a tertiary care hospital can be attributed to several factors, such as the nature of the treated diseases, the complexity of patient conditions, and the specific treatment protocols employed in each ward. Oncology patients often require a more aggressive and multidrug approach to manage cancer and its associated symptoms, which may lead to a higher average number of medications prescribed per encounter in the oncology ward compared to the internal medicine ward, where patients may be treated for a broader range of conditions that may not necessitate as many medications.[35] Studies have demonstrated significant variations in the average number of drugs prescribed per patient across different wards and departments. For instance, a study conducted by Tripathi, et.al.[36] in a critical care unit found an average of 13.54 drugs prescribed per patient, while another study conducted by Verma JN, et.al.[37] in a rheumatoid arthritis population reported an average of 4.87 drugs per prescription. These disparities highlight the differences in treatment approaches and patient needs among various wards and patient populations. A study conducted by Bepari, et.al.[3] that evaluated the utilization of anticancer drugs using WHO prescribing indicators found an average of 6.01 drugs prescribed per patient, with a high percentage of drugs prescribed by generic name and from the essential drug list. This finding suggests that the oncology ward in the current study may have a higher average number of drugs prescribed due to the specific treatment requirements for cancer patients.

The elevated average number of medications per prescription exceeding the WHO's recommended range indicates a significant prevalence of polypharmacy in our study setting. This trend can be attributed to the shifting epidemiological landscape marked by a rising incidence of non-communicable diseases like diabetes, hypertension, and coronary artery disease. These conditions often coexist, necessitating the treatment of multiple ailments in the same patient simultaneously. Managing such cardiometabolic conditions in a single patient often requires prescribing multiple drugs for a single clinical indication, especially when faced with the challenge of treating multiple concurrent diseases. Our study underscores this observation, with a substantial proportion of participants diagnosed with non-communicable diseases, notably diabetes being the most prevalent at 54%.

The aging population in our country is another factor contributing to the high prevalence of polypharmacy observed in the study. As the demographic landscape shifts towards an increasingly older population, this epidemiological transition perpetuates the current scenario of elevated medication use. The study findings reflect this trend, with approximately 41.24% of the participants aged over 60 years. This substantial proportion of elderly individuals in the study population suggests that the growing aging demographic is a significant driver of the polypharmacy phenomenon seen in the tertiary care hospital setting. Firstly, the

pharmaceutical industry exerts a strong influence by aggressively promoting supplementary products to healthcare providers through biased information that advocates for the necessity of prescribing these items. Secondly, patient's misconceptions regarding the health benefits of supplements lead to their persuasion and insistence on including these products in their prescriptions. However, the optimal approach towards such patients involves educating them rather than succumbing to their misguided beliefs.

The investigation revealed that in the internal medicine department, merely 31.11% of the prescribed medications were generic, whereas the oncology ward exhibited a more favourable rate of 42.55%. However, when considering the combined data from both wards, the overall percentage of medicines prescribed by their generic names amounted to only 37.29%. This finding falls considerably short of the World Health Organization's (WHO) recommended ideal of 100% generic prescriptions.[6] This low rate of generic prescribing may be attributed to several factors: Firstly, a study by Wang, et.al.[38] revealed that as doctors' education and clinical experience increase, they tend to prescribe fewer drugs by generic name. A similar study conducted by S.Shanmugapriya, et.al.[12] had generic prescribing appalingly low. Additionally, consultants in low- and middle-income countries exhibit different attitudes towards generic prescribing compared to those in high-income nations. Another likely explanation is the aggressive and persuasive promotion of branded products by pharmaceutical companies. In some cases, clinicians may feel compelled to acquiesce to the demands of affluent patients who insist on receiving innovator drugs. Some prescribers may also harbour the belief that differences in bioavailability between generic and branded drugs could negatively impact therapeutic outcomes. Such prejudices can adversely influence their tendency to prescribe generic medications. Finally, the role of pharmaceutical industries in hindering generic prescribing by offering financial incentives to prescribers cannot be overlooked. Evidence suggests that generic prescribing is more prevalent in public healthcare centres compared to private sector hospitals.

Increasing awareness about generic prescribing is crucial given the high costs associated with prescribing brand-name drugs. A study by Nicolosi A, et.al.[39] in South Africa found that chronic disease patients could save over 40% per defined daily dose per month by using generic medications instead of brand-name versions. Similarly, an analysis of drug prices by Cameron et.al[40] across 17 countries revealed potential savings of 9-89% by switching from brand-name to generic equivalents. To promote a shift towards generic prescribing, a multi-pronged approach is warranted. This should include educating medical students, the future prescribers, on the pharmacoeconomic benefits of generic drugs. Additionally, continuing medical education programs for practicing clinicians can help alleviate their concerns about the bioequivalence of generic medications. Experts have also recommended various strategies to overcome barriers to generic prescribing. Key among these is enforcing statutory obligations, establishing clear guidelines for generic prescribing, and legally disincentivizing the prescription of brand-name drugs. By implementing these measures, healthcare systems can drive a transition towards more cost-effective and accessible generic medications, ultimately improving patient access to essential treatments

The World Health Organization (WHO) recommends that 20-26.8% of patient encounters involving antibiotic prescriptions.[6] In contrast, the internal medicine ward in our study had a significantly higher rate of 81%, exceeding the WHO standard. The oncology ward had a lower rate of 19.5%, which is closer to but still below the WHO indicator. The combined rate across both wards was 50.25%, nearly double the WHO recommended range. This is similar to a study by Demoz GT, et.al.[45], which reported a rate of 52.3%. However, a study by William, et.al.[46] found a much higher rate of 95% of patients receiving antibiotics, which is higher compared to the antibiotic prescribing rate in internal medicine departments reported in our study. The difference in antibiotic prescribing patterns between the internal medicine and oncology wards can be attributed to several factors such as disease complexity and treatment protocols, prescribing practices and stewardship, compliance with guidelines, empiric therapy and culture testing.

The study by Tadesse TY, et.al.[46] in Ethiopia reported a higher percentage of antibiotic prescriptions compared to our findings, with a rate of 60.6%. Oncology patients often require a more targeted and selective approach to antibiotic use to prevent infections during immunosuppressive cancer treatments. In contrast, internal medicine wards manage a broader spectrum of conditions, which may lead to higher rates of empirical antibiotic prescribing. Antibiotic prescribing practices in internal medicine are influenced by non-patient-related factors such as personal preferences of doctors, established local routines, and risk-averse attitudes.[46] Implementing antibiotic stewardship programs that incorporate clear guidelines, educational initiatives, and continuous monitoring can help optimize prescribing practices in these settings. Promoting culture and sensitivity-guided antibiotic therapy can help reduce unnecessary use of broad-spectrum antibiotics. In conclusion, the internal medicine ward exhibited a significantly higher percentage of encounters with antibiotic prescriptions compared to the oncology ward and WHO standards. Implementing antibiotic stewardship interventions can help optimize antibiotic use in both wards.

In the internal medicine ward, 98.5% of encounters involved a prescribed injection, while in the oncology

ward, this figure was 99%. When considering both wards together, the combined percentage of encounters with an injection prescribed was 98.75%. These values significantly exceed the WHO prescribing indicator range of 13.4-24.1% for the percentage of encounters with an injection.[6] This indicates a significantly higher rate of injection prescribing in your study compared to the 78.86% reported by Tadesse TY, et.al.[46] This high rate of injection prescribing can be attributed to several factors. The patients included in this study were inpatients admitted to the internal medicine and oncology wards. Inpatients are more likely to require injectable medications compared to outpatients, as they are often critically ill and require rapid parenteral therapy. The physical need for rapid effect, especially in critically ill patients who require parenteral therapy. Some patients may be unable to take oral doses, necessitating injections.[41] While the high injection use in this study may be partially justified by patient needs, unjustifiable injection prescribing should be discouraged to minimize risks and costs associated with injections. Prescribers should aim to prescribe non-parenteral routes whenever possible. A study conducted by Demoz GT, et.al.[45] demonstrated a high rate of patient encounters involving injections at 84.85%, similar to our findings.

In the internal medicine ward, 58.86% of medications were prescribed from the Essential Medicines List, while in the oncology ward, this figure was 65.78%. When combining both wards, the overall percentage of medicines prescribed from the Essential Medicines List was 62.61%. The study by Shanmugapriya et al.[12] found that 92.54% of prescribed drugs adhered to the WHO Essential Medicines List, which is higher than the 62.78% reported in our study. While the percentage of drugs aligning with the WHO Essential Medicines List in our study was 62.61%, which is lower than the WHO's recommended 100% target, it is still quite good in comparison to other studies. The study by Chenchula S, et.al.[47] found that only 27.58% of prescriptions were from the essential medicines list. The discrepancy in adherence to the Essential Drugs List may be attributed to prescriber's lack of awareness and the absence of enforced regulations mandating compliance with the list. Similar to generic prescribing practices, adherence to this indicator varies between private and public healthcare sectors, emphasizing the need to promote widespread adoption of prescribing from the Essential Drugs List, especially in private healthcare settings.

The study reported a total of 281 adverse drug reactions (ADRs), with 104 ADRs observed in the Internal Medicine Department and 177 ADRs in the Oncology Department. The causality assessment using the WHO scale showed that the majority of ADRs had a possible causal association (38%), followed by probable (19.25%), certain(1%), unlikely (11.25%). Out of the 400 patients included in the study, 119 patients did not report any ADRs. The assessment of ADR severity revealed that 77.22% were mild, 21.35% were moderate, and 1.42% were severe. These findings are similar to a previous study by Chopra et.al.[42], which reported that 80% of the ADRs were possible, 20% were probable, and the severity assessment showed 86.97% were mild, 12.8% were moderate, and 0.17% were severe. The primary reason for the prevalence of "possible" adverse drug reactions (ADRs) could stem from several factors. It may be due to a common dosing interval among prescribed drugs, or the presence of another drug or underlying medical condition potentially contributing to the observed events in patients. The majority of ADRs being categorized as mild could be attributed to their self-limiting nature, lack of extension in hospital stays, or the ability to manage them by adjusting dosing schedules or substituting one drug for another without requiring antidotes or additional treatments.

CONCLUSION

The analysis of prescribing indicators revealed that practice of antibiotic use and injection administration were irrational, while conformity to the essential drugs list was reasonably good but could be further improved. However, the degree of polypharmacy was higher than the standard which is concurrent use of 5 or more medications. Generic prescribing was another area that required significant improvement. To ensure rational and safe prescribing, the administrative team and policymakers should implement appropriate measures to reduce polypharmacy and increase generic prescribing by clinicians. The study suggests that there is scope for improving the prescribing habits of clinicians through educational interventions. The study underscores the need for targeted interventions to promote rational prescribing practices among healthcare providers. Although the reported ADRs were mild and did not cause severe harm, such as organ failure, impairment, toxicity, or death, in the study population, close monitoring is still necessary whenever ADRs occur. Even if ADRs are mild to moderate, many preventable ADRs can be minimized by close monitoring.

REFERENCES

1. Mohanty BK MD, Aswini M, Hasamnis A, Patil S, Murty K, Jena S. Prescription pattern in the Department of Medicine of a tertiary care hospital in south India. Journal of Clinical and Diagnostic Research, 2010 Feb; 2047-51.
2. Patel S, Shah A, Shah R, Buch J. Evaluation of drug utilization pattern of antimicrobials using ATC/DDD system in intensive care unit of a tertiary-care teaching hospital. International Journal of Medical Science and Public Health., 2016 Jan 1; 5(1): 80.
3. Pathak A, Gupta V, Maurya A, Kumar A, Singh A. Assessment of drug prescribing pattern using WHO indicators in hospitalized patients at a tertiary care teaching hospital in rural area of India. International Journal of Basic and Clinical Pharmacology, 2016 Jan 1; 651–5.

4. Rashed AN, Wong ICK, Wilton L, Tomlin S, Neubert A. Drug utilisation patterns in children admitted to a paediatric general medical ward in five countries. Drugs - Real World Outcomes., 2015 Nov 18; 2(4): 397–410.
5. World Health Organization. 66th Consultation on International Non-proprietary Names for Pharmaceutical Substances. World Health Organization. 2018. https://www.who.int/docs/default-source/international-nonproprietary-names-%28inn%29/67th-executive-summary.pdf
6. Ofori-Asenso R. A closer look at the World Health Organization's prescribing indicators. Journal of Pharmacology and Pharmacotherapeutics, 2016 Mar 1; 7(1): 51–4.
7. Munshi R, Belhekar M, Taur S. A study of agreement between the Naranjo algorithm and WHO-UMC criteria for causality assessment of adverse drug reactions. Indian Journal of Pharmacology, 2014 Jan 1; 46(1): 117.
8. Trap B. Prescription habits of dispensing and non-dispensing doctors in Zimbabwe. Health Policy and Planning, 2002 Sep 1; 17(3): 288–95.
9. Yin X, Song F, Gong Y, Tu X, Wang Y, Cao S, et al. A systematic review of antibiotic utilization in China. The Journal of Antimicrobial Chemotherapy, 2013 Jun 25; 68(11): 2445–52.
10. Matsoso P, Velasquez G, Forte G, et al. Using indicators to measure country pharmaceutical situations. Fact Book on WHO Level I and Level II monitoring indicators, 2006.
11. Dumoulin J, Kaddar M, and Velasquez G Guide to Drug Financing Mechanisms. Chemistry International -- Newsmagazine for IUPAC., 1999; 21(2): 50-51.
12. Shanmugapriya S, Saravanan T, Rajee S, Venkatrajan R, Thomas P. Drug prescription pattern of outpatients in a tertiary care teaching hospital in Tamil Nadu. Perspectives in Clinical Research, 2018 Jan 1; 9(3): 133.
13. Sultana F, Rahman A, Paul TR, Sarwar M, Islam M, Prescribing pattern and prescription errors: A study at a tertiary care hospital of Bangladesh. Bangladesh Pharmaceutical Journal, 2015; (18): 20-4.
14. Chandelkar U, Rataboli P. A study of drug prescribing pattern using WHO prescribing indicators in the state of Goa, India. International Journal of Basic and Clinical Pharmacology, 2014 Jan 1: 1057.
15. Natraj G, Bharathi D. A study on Prescribing pattern in geriatric patients. Asian Journal of Pharmaceutical and Clinical Research, 2019 Jul 11; 120–3.
16. Satir AN, Pfiffner M, Meier CR, Good AC. Prescribing Patterns in Paediatric General Wards and Their Association with Prescribing Errors: A Retrospective Observational Study. Drugs Real World Outcomes., 2023 Oct 13; 10(4): 619–29.
17. Zito S, Poluzzi E, Pierantozzi A, Onder G, Da Cas R, Ippoliti I, et al. Medication use in Italian nursing homes preliminary results from the national monitoring system. Frontiers in Pharmacology, 2023 May 17; 14.
18. Reddy RS, Patil LV. Causality assessment and the severity of the adverse drug reactions in tertiary care hospital: a pharmacovigilance study. International Journal of Basic and Clinical Pharmacology, 2017 Nov 23; 6(12): 2800.
19. Acharya TA, Trivedi D, Joshi KJ, Chhaiya SB, Mehta DS. A Study of Agreement between WHO-UMC Causality Assessment System and the Naranjo Algorithm for Causality Assessment of Adverse Drug Reactions Observed in Medical ICU of a Tertiary Care Teaching Hospital. Biomedical and Pharmacology Journal/Biomedical & Pharmacology Journal., 2020 Mar 25; 13(1): 79–83.
20. V.M. Motghare, C.S. Bajait, A. Turnakar, S.D. Sontakke, S. Chavan. Prescription pattern and adverse drug reaction profile of drugs prescribed in dermatology out-patient department at a tertiary care teaching hospital. Indian Journal of Pharmacy and Pharmacology, 2016 March; 173-177.
21. Galappatthy P, Ranasinghe P, Liyanage CK, Wijayabandara M, Warapitiya DS, Jayasekara D, et al. Core Prescribing Indicators and the Most Commonly Prescribed Medicines in a Tertiary Health Care Setting in a Developing Country. Advances in Pharmacological and Pharmaceutical Sciences, 2021 Jan 29; 2021: 1–8.
22. Bhat MY, Farhat S, Nabi U, Post-Graduate Department of Pharmacology, Government Medical College, Srinagar. An evaluation of causality, severity, and preventability of adverse drug reactions reported by undergraduate medical students in a tertiary care hospital. Vols. 7-7, Pharmacology and Clinical Pharmacy Research, 2022 Dec: 108-9.
23. Hall JA, Roter DL. Do patients talk differently to male and female physicians. Patient Education and Counselling, 2002 Dec 1; 48(3): 217–24.
24. Sergeant A, Saha S, Shin S, Weinerman A, Kwan JL, Lapointe-Shaw L, et al. Variations in Processes of Care and Outcomes for Hospitalized General Medicine Patients Treated by Female vs Male Physicians. JAMA Health Forum, 2021 Jul 16; 2(7).
25. Joshi N, Falke A, Saji S, Diwan A, Raut A. Evaluation of prescribing pattern and rationality of fixed dose combinations in patients of general medicine department. International Journal of Basic and Clinical Pharmacology, 2019 Dec 24; 9(1): 122.
26. Shende TR, Siddiqui RA, Mahajan HM. A drug utilization study of fixed dose combinations used in hypertension in rural tertiary healthcare centre of central India. International Journal of Current Research and Review., 2016; 8(12): 30-34.
27. Gor AP, Ajbani A, Dalal K. Use of fixed dose combinations of antibiotics in surgical department of a tertiary care teaching hospital. International

Journal of Pharmacy and Pharmaceutical Sciences, 2015; 7(11): 259-262.
28. Çalık Başaran N, Aktaş BY, Şener YZ, Ceylan S, Yekedüz E, Başpınar B, Şimşek C, Özışık L, Sain Güven G, Öz ŞG, Durusu Tanrıöver M. Mortality Facts in Internal Medicine Wards: A Descriptive Study from a University Hospital. Acta Medica., 2018 Dec. 25; 49(4): 6-13.
29. Nappo G, Funel N, Laurenti V, Stenner E, Carrara S, Bozzarelli S, et al. Ampullary Cancer Histological subtypes, Markers, and Clinical Behaviour-State of the Art and Perspectives. Current Oncology, 2023 Jul 22; 30(7): 6996–7006.
30. Mittal N, Mittal R, Singh I, Shafiq N, Malhotra S. Drug utilisation study in a tertiary care center. Indian J Pharm Sci., 2014 Jul; 76(4): 308-14.
31. Anand N, Nayak IMN, Advaitha MV, Thaikattil NJ, Kantanavar KA, Anand S. Antimicrobial agents utilization and cost pattern in an Intensive Care Unit of a Teaching Hospital in South India. Indian Journal of Critical Care Medicine Indian Journal of Critical Care Medicine., 2016 Jan 1; 20(5): 274-9.
32. Kamlekar S, Agarwal A, Gupta S. Evaluation of drug of anticancer drugs in oncology department of a tertiary care teaching hospital of Southern Rajasthan. National Journal of Physiology, Pharmacy and Pharmacology, 2019 Jan 1; (0): 1.
33. Baik HW, Sung MK, Lee YS, Song MK, Bae YJ. The palatability of cereal based nutritional supplements in cancer patients. Clinical Nutrition Research, 2014 Jan 1; 3(1): 48.
34. Bahat G, Akmansu M, Gungor L, Halil M, Bicakli DH, Koc N, et al. Optimal use of oral nutritional supplements (ONS) in medical nutrition therapy: ONS consensus report from KEPAN. European Journal of Clinical Nutrition., 2022 Nov 9; 77(7): 705–9.
35. Bepari A, Sakre N, Rahman I, Niazi SK, Dervesh AM. The Assessment of Drug Utilization Study of anticancer drugs using WHO prescribing indicators in a Government Tertiary care hospital of the Hyderabad - Karnataka region of India. Open Access Macedonian Journal of Medical Sciences., 2019 Apr 13; 7(7): 1203–8.
36. Tripathi C, Patel M, Barvaliya M, Patel T. Drug utilization pattern in critical care unit in a tertiary care teaching hospital in India. International Journal of Critical Illness and Injury Science., 2013 Jan 1; 3(4): 250.
37. Varma JN, Kumar ES, Subair A, Sunil G, Swamy VBN, Patil S. A cross-sectional study on drug utilization and it's cost analysis in the urological disorders and other health issues in patients of a tertiary care hospital. Indian Journal of Pharmacy and Pharmacology, 2024 Jan 15; 10(4): 309–18.
38. Wang H, Li NN, Zhu H, Xu S, Lu H, Feng ZC. Prescription pattern and its influencing factors in Chinese county hospitals: A Retrospective Cross-Sectional Study. PloS One., 2013 May 10; 8(5).
39. Nicolosi E, Gray A. Potential cost savings from generic. South African Family Practice., 2009 Jan 1; 51(1): 59–63.
40. Cameron A, Laing R, World Health Organization. Cost savings of switching private sector consumption from originator brand medicines to generic equivalents. World Health Report. 2010.
41. Perpétuo C, Plácido AI, Aperta J, Herdeiro MT, Roque F. Profile of prescription medication in an internal medicine ward. Healthcare., 2021 Jun 10; 9(6): 704.
42. Chopra D, Rehan H, Sharma V, Mishra R. Chemotherapy induced adverse drug reactions in oncology patients A prospective observational survey. Indian Journal of Medical and Paediatric Oncology., 2016 Jan 1; 37(01): 42–6.
43. Upadhyay DK, Palaian S, Ravi Shankar P, Mishra P, Sah AK. Prescribing pattern in diabetic outpatients in a tertiary care teaching hospital in Nepal. Journal of Clinical and Diagnostic Research., 2007 Aug; 248–55.
44. Raj K, Kamlesh K, Kajal HL. A study of drug prescribing pattern and cost analysis among diabetic patients in a tertiary care teaching institute in North India. Journal of Drug Delievery and Therapeutics., 2013; 3(2): 56-61.
45. Demoz GT, Kasahun GG, Hagazy K, Woldu G, Wahdey S, Tadesse DB, et al. Prescribing Pattern of Antibiotics Using WHO Prescribing Indicators Among Inpatients in Ethiopia., 2020 Aug 1; (13): 2783–94.
46. Williams A, Mathai AS, Phillips AS. Antibiotic prescription patterns at admission into a tertiary level intensive care unit in Northern India. Journal of Pharmacy and Bioallied Sciences., 2011 Jan 1; 3(4): 531.
47. Tadesse TY, Molla M, Yimer YS, Tarekegn BS, Kefale B. Evaluation of antibiotic prescribing patterns among inpatients using World Health Organization indicators: A cross-sectional study. SAGE Open Medicine., 2022 Jan 1; 10.
48. Chenchula S. Assessment of WHO core drug use indicators at a tertiary care Institute of National importance in India. Bioinformation., 2022 Oct 31; 18(10): 888–93.