IJPSR (2026), Volume 17, Issue 2 **(Research Article)**

INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH

Received on 18 July 2025; received in revised form, 19 September 2025; accepted, 26 October 2025; published 01 February 2026

DRUG UTILIZATION PATTERN OF CANCER CHEMOTHERAPEUTIC DRUGS IN HOSPITALIZED PATIENTS IN A TERTIARY CARE TEACHING HOSPITAL IN GOA: A CROSS-SECTIONAL OBSERVATIONAL STUDY

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Keywords:

Drug utilization, chemotherapy, WHO indicators, Goa Medical College

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ABSTRACT: Chemotherapy remains a cornerstone of cancer management but is often accompanied by significant toxicity and economic burden. Drug Utilization Studies (DUS) are essential for evaluating prescribing practices and ensuring rational, cost-effective therapy. This retrospective cross-sectional study analyzed the drug utilization patterns of 400 oncology patients at Goa Medical College between February and March 2024. Data was assessed using WHO prescribing indicators and descriptive statistics. Of the patients, 70% were female, and breast cancer being the most common diagnosis (49.5%). Paclitaxel (38%), trastuzumab (35%), and cyclophosphamide (28%) were the most frequently prescribed chemotherapeutic agents. The supportive drugs included palonosetron (82%), dexamethasone (70%), and ranitidine (63%). Advanced agents such as Zoledronic Acid and Leuprolide were used for bone metastases and hormone-sensitive cancers. High-cost biologics, such as Bevacizumab and Rituximab, were provided under the MJPJAY scheme, ensuring universal access. Injectable formulations accounted for 87% of prescriptions, 97.3% of which were prescribed by generic name, and 100% were listed in the WHO Essential Medicines List. Antibiotic use was low (3%), indicating strong antimicrobial stewardship in the unit. The findings reflect high adherence to rational prescribing practices and demonstrate the effectiveness of a government-funded model for delivering equitable cancer care.

INTRODUCTION: Cancer is a complex disease marked by dysregulated growth and spread of abnormal cells, posing a major public health burden worldwide. Management of this disease requires a comprehensive strategy that integrates prevention, early diagnosis, and timely, and effective therapeutic interventions [1].

QUICK RESPONSE CODE

DOI: 10.13040/IJPSR.0975-8232.17(2).749-56

This article can be accessed online on www.ijpsr.com

DOI link: https://doi.org/10.13040/IJPSR.0975-8232.17(2).749-56

Cancer remains one of the foremost causes of morbidity and mortality worldwide, necessitating a comprehensive approach to management that integrates prevention, early detection, and multimodal treatment [2].

Current cancer management relies on a diverse array of treatment modalities, including surgery, radiotherapy, chemotherapy, targeted therapies, immunotherapy, and hormonal interventions, which are often used in combination to maximize clinical efficacy and improve patient outcomes [3]. Chemotherapy remains a fundamental component of cancer treatment and is widely applied across various malignancies either as a standalone

approach or in combination with surgery, radiotherapy, immunotherapy, or targeted agents. Cytotoxic drugs used in chemotherapy exert their therapeutic effects by interfering with vital cellular processes, such as DNA replication, mitosis, and protein synthesis, ultimately inhibiting the proliferation of malignant cells [4].

Although chemotherapy remains highly effective in cancer management, its clinical use is often limited by narrow therapeutic window, substantial toxicity, and high treatment costs. Owing to its non-selective action on rapidly dividing cells, it frequently affects healthy tissues, such as the bone marrow, gastrointestinal mucosa, and hair follicles, leading to adverse effects such as myelosuppression, nausea, vomiting, and alopecia [5]. Moreover, the growing complexity of treatment regimens, frequently involving multiple drug classes like alkylating agents, antimetabolites, antitumor antibiotics, and tubulin inhibitors, further increases the risk of drug-related problems and contributes to polypharmacy [5].

In this context, Drug Utilization Studies (DUS), as defined by the World Health Organization (WHO), play a pivotal role in evaluating prescribing patterns, rationalizing therapy, identifying areas for improvement, and informing policy-level decisions [6]. They are particularly valuable for optimizing therapeutic outcomes, minimizing adverse drug reactions, and ensuring efficient resource utilization. The choice, dosing, route of administration, and duration of chemotherapeutic regimens are shaped by multiple factors, such as cancer type and stage, patient-specific considerations, established treatment guidelines, and institutional practices. Evaluating these drug utilization patterns is essential for improving therapeutic outcomes, reducing treatment-related toxicity, and promoting the efficient use of healthcare resources [7, 8].

Although Drug Utilization Studies (DUS) are well-established in high-income settings, there is a notable paucity of such data from low- and middle-income countries like India, particularly within the public healthcare system. Given the considerable inter-state variability in cancer burden, healthcare infrastructure, and treatment access, region-specific assessments of prescribing practices are essential [9]. Tailored region-specific evaluations of drug use can help develop standardized protocols that address local challenges and ensure equitable, evidence-based cancer care across diverse Indian populations [1, 10].

The state of Goa, with its unique demographic profile and government healthcare structure, presents a relevant setting for this research. Goa Medical College, the premier government-run tertiary care and apex teaching hospital in the state, provides comprehensive cancer care. Importantly, under the Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY), all chemotherapeutic agents and supportive medications are supplied free of cost to patients [11]. This offers a unique opportunity to evaluate prescribing trends without financial influence on clinical decisions, allowing for an unbiased evaluation of prescribing practices that are uninfluenced by out-of-pocket expenditures or insurance constraints.

Therefore, this study was undertaken to systematically assess the drug utilization patterns of chemotherapeutic and supportive medications in hospitalized patients at Goa Medical College. By analysing real-world prescribing trends in a setting where financial considerations are eliminated, the findings aim to contribute to rational oncology pharmacotherapy and support evidence-based cancer care practices applicable to other similar government-run institutions.

Addressing the financial burden of cancer treatment remains a key challenge for clinicians and cancer care institutions [12]. By evaluating real-world prescribing trends in a government-funded tertiary care setting, this study can support the development of context-specific, evidence-based interventions aimed at enhancing the quality and accessibility of oncology care in Goa and other similar settings.

MATERIALS AND METHODS:

Study Design and Setting: This retrospective cross-sectional observational study was conducted at Goa Medical College and Hospitalto identify commonly prescribed chemotherapeutic drugs and assess drug utilization patterns for cancer in hospitalized patients in the Medical Oncology ward.

Ethical Considerations: Approval for this study was obtained from the Institutional Ethics Committee (IEC) of Goa Medical College under the project title: "Drug Utilisation Pattern of Cancer Chemotherapeutic drugs in Hospitalised Patients in a Tertiary Care Hospital in the state of Goa". The IEC Approval number was GMCIEC/2024/253. Strict confidentiality of patient data was maintained, and the records were anonymized during data extraction and analysis.

Data Collection: Patient data were retrieved through a manual review of case records, including chemotherapy drug charts, from the Medical Records Department. Records of 400 admitted patients receiving cancer chemotherapeutic drugs, of all ages and both sexes, from February 2024 to March 2024 were evaluated. Records that were incomplete or illegible were excluded. Additionally, patients admitted exclusively for non-therapeutic supportive procedures, such as blood transfusions, hydration (commonly seen in head and neck malignancies), wound dressings, chemo port flushing or removal, bone marrow aspiration, and biopsies, were also excluded to ensure focus on active chemotherapy administration.

Statistical Analysis: Data were compiled, and descriptive statistical analysis was performed using Microsoft Excel to evaluate demographic variables, cancer diagnoses, chemotherapy regimens, supportive medication usage, and follow-up records. This study employed WHO prescribing indicators to assess rational drug utilization practices.

RESULTS: Between February 2024 and March 2024, records of admitted patient data were retrieved through a manual review of case records, including chemotherapy drug charts, from the Medical Records Department. Case record sheets of patients admitted exclusively for non-therapeutic supportive procedures, such as blood transfusions, hydration (commonly seen in head and neck malignancies), wound dressings, chemotherapy port flushing or removal, bone marrow aspiration, and biopsies, were excluded. Additionally, incomplete case records were excluded. To avoid duplication, repeat admissions and follow-up visits of the same patients during the study period were not considered as separate cases. Thus, data from 400 patients' case record sheets were included in the final evaluation of this study.

Of the 400 patients included, 70.5% were female. The most frequent malignancy was Breast cancer (42.5%), followed by Multiple Myeloma (7.75%), Non-Hodgkin's Lymphoma (6.75%) and ovarian cancer (5.75%). The distribution of the most common cancer diagnoses in the study population is shown in **Fig. 1.**

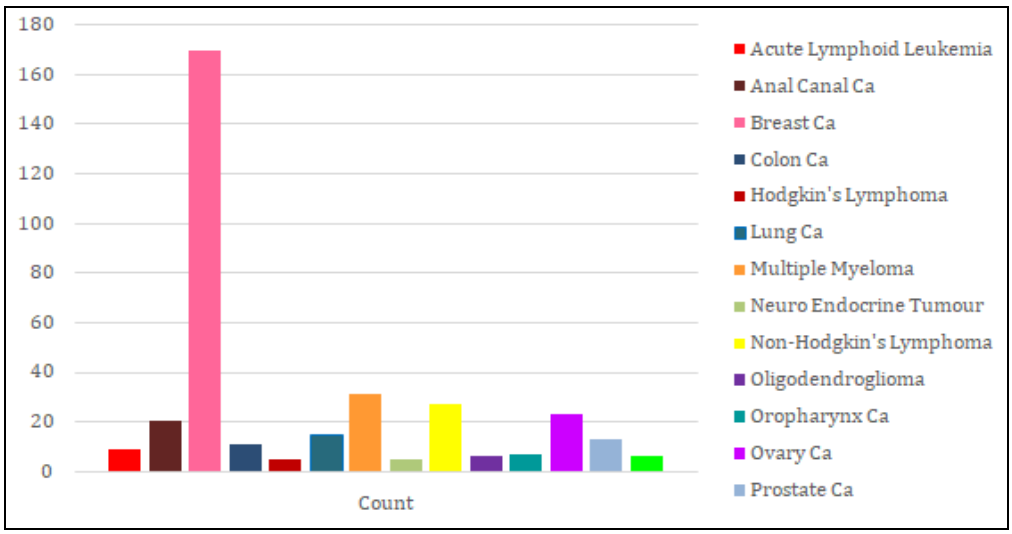

FIG. 1: COMMON CANCER DIAGNOSES

Paclitaxel and Trastuzumab were the most commonly usedanticancer drugs. Other agents included Cyclophosphamide, Doxorubicin and Carboplatin. **Fig. 2** illustrates the commonly prescribed cancer chemotherapy drugs.

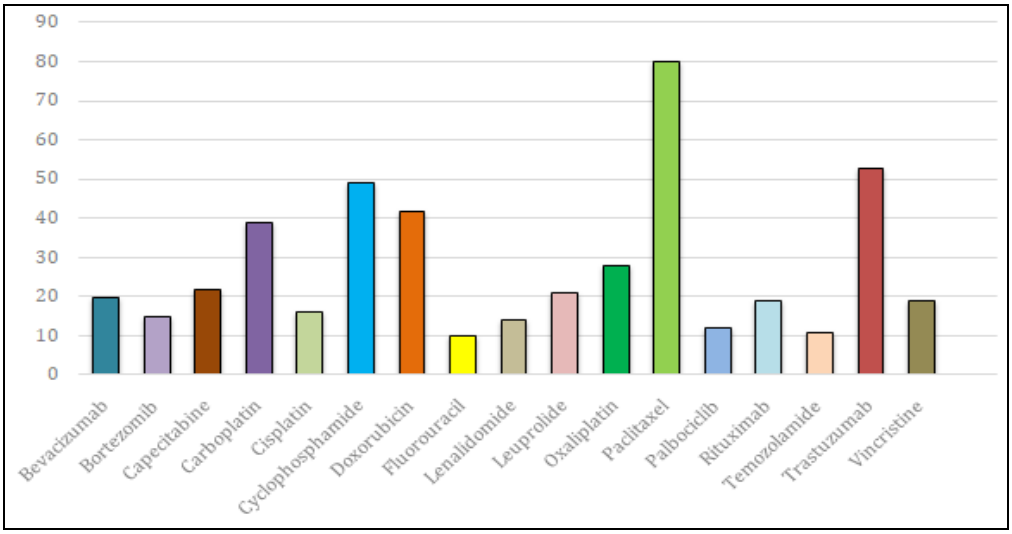

FIG. 2: COMMONLY PRESCRIBED CANCER CHEMOTHERAPY DRUGS

The three most commonly used Ameliorant drugs were Palonosetron, Dexamethasone, and Aprepitant.

The **Table 1** lists the various drugs prescribed to ameliorate toxicity.

TABLE 1: THE AMELIORANT DRUGS

Ameliorant drugs	Route count	
Ondansetron	iv	Ondansetron
Palonosetron	iv	Palonosetron
Zoledronic Acid	iv	Zoledronic Acid
Calcium	iv	Calcium
Leucovorin		Leucovorin
Mesna	iv, oral	Mesna
Fosaprepitant	iv	Fosaprepitant
Denosumab	iv	Denosumab
G-CSF	iv	G-CSF
Dexamethasone	iv	Dexamethasone
Octreotide	sc	Octreotide
Aprepitant	oral	Aprepitant
Allopurinol	oral	Allopurinol
Olanzapine	oral	Olanzapine
Dexamethasone	Eye-drops	Dexamethasone
Antibiotics	iv, oral	Antibiotics
Metoclopramide	oral	Metoclopramide

Additional agents included Paracetamol, Ranitidine and Pheniramine. **Table 2** lists the supportive medications prescribed alongside cancer chemotherapeutic agents and ameliorative therapy.

TABLE 2: OTHER SUPPORTIVE MEDICATIONS

Other supportive drugs	Route Count	
Ranitidine	iv	225
Pheniramine	iv	39
Paracetamol	iv	72
Paracetamol	oral	85
Iron Sucrose	iv	12
Vitamin B12	im	4
Folic Acid	oral	4
Vitamin D3	im	2
Calcium	oral	2
Cremaffin	oral	7
Tramadol	iv	7
Morphine	oral	2
Prednisone	oral	2
Mannitol	iv	14
NaHCO3-KCl-MgSO4	iv	19
NaHCO3 infusion	iv	3

Breast cancer patients frequently received Paclitaxel, Trastuzumab, Cyclophosphamide, and Doxorubicin, while patients with hematologic malignancies (e.g., Hodgkin's and Non-Hodgkin's lymphoma) were treated with protocols including Bleomycin, Vinblastine, Dacarbazine, and Rituximab. Biologics such as Bevacizumab, Trastuzumab, and Sunitinib were administered for ovarian, renal, and breast cancers. **Table 3** presents the common chemotherapy regimens used for specific cancers.

TABLE 3: DIAGNOSIS-WISE COMMON CHEMOTHERAPY REGIMENS

Diagnosis	Common Regimen
Acute Lymphoid Leukemia	Methotrexate, Vincristine, Asparaginase
Breast Ca	Paclitaxel, Trastuzumab, Cyclophosphamide, Doxorubicin
Bladder Ca	Gemcitabine, cisplatin
Cervical Ca	Cisplatin, Gemcitabine
Colon Ca	Folic Acid, Fluorouracil, Oxaliplatin> Irinotecan
Hodgkin's Lymphoma	Bleomycin, Vinblastine, Dacarbazine Doxorubicin

Multiple Myeloma	Lenalidomide
Neuro Endocrine Tumor	Cisplatin, Etoposide, Octreotide
Non-Hodgkin's Lymphoma	Cyclophosphamide, Doxorubicin, Vincristine, Rituximab,
Ovary Ca	Bevacizumab, Carboplatin, Paclitaxel
Prostate Ca	Leuprolide, Abiraterone
Renal Ca	Bevacizumab, Sunitinib

Analysis of WHO prescribing indicators revealed that 97.3% of the prescribed drugs were written using generic name. Injectable formulations accounted for 87% of all administered medications. All drugs prescribed during the study period were included in the WHO Essential Medicines List (EML). Notably, antibiotic usage was limited to only 3% of prescriptions.

DISCUSSION: The frequent use of Paclitaxel-Trastuzumab regimens in this study aligns with the established global and national treatment protocols for HER2-positive breast cancer. The supportive medication patterns, particularly with Palonosetron and Dexamethasone, reflect adherence to antiemetic and gastroprotective guidelines, similar to trends observed in other Indian studies. Notably, minimal antibiotic use (3%) highlights the strong antimicrobial stewardship.

Analysis of WHO prescribing indicators revealed that 97.3% of the prescribed drugs were written using generic names, reflecting a strong adherence to rational prescribing principles. Injectable formulations constituted 87% of all administered medications, consistent with hospital-based chemotherapy and supportive care delivery. All drugs prescribed during the study period were listed in the WHO Essential Medicines List (EML), ensuring alignment with the globally accepted standards for essential cancer pharmacotherapy. Notably, antibiotic usage was limited to only 3% of prescriptions, indicating judicious antimicrobial use and effective stewardship in the inpatient oncology setting.

However, the co-prescription of Ranitidine- mostly alongside dexamethasone and emetogenic regimens- despite regulatory concerns regarding N-nitroso dimethylamine impurities, underscores the need for critical re-evaluation [13]. The use of safer alternatives, such as proton pump inhibitors or famotidine, may enhance rational supportive care. Paracetamol use was documented in 34.6% of patients, with approximately 6.7% receiving both injectable and oral formulations concurrently. This dual administration may reflect appropriate therapeutic transitions, such as from IV dosing during acute febrile episodes to oral continuation but could also indicate overlapping prescriptions or communication lapses between clinical teams. These findings highlight the need for better coordination among prescribers, pharmacists, and nursing staff to prevent redundancies and ensure safe prescribing.

Importantly, the availability of all chemotherapeutic and supportive medications under the state-sponsored Mahatma Jyotiba Phule Jan Arogya Yojana (MJPJAY) ensures that drug choices are guided solely by clinical indications rather than financial constraints [11]. Despite the absence of a cost burden, irrational prescribing was not observed, as evidenced by the high generic use and minimal polypharmacy. This underscores the Goa Medical College's commitment to equitable and rational oncology care in a publicly funded setting.

The pharmacoeconomic implications of this model are significant. The state-funded provision of high-cost agents such as Bevacizumab, Rituximabalongside newer agents like Pertuzumab, demonstrates that quality cancer care is achievable without compromising clinical standards, even in resource-limited environments. These findings provide a model for policy development in other Indian states and LMICs. Goa Medical College is among the first public hospitals in India to provide Pertuzumab-Trastuzumab combination under government sponsorship, reaffirming the state's proactive approach to oncology care and strengthening the contextual relevance of the present findings [14].

Unlike insurance-regulated systems in developed countries, where access to high-cost drugs can be delayed due to administrative or formulary restrictions, the Goa model allows for seamless and equitable access to evidence-based regimens.

This ensures the timely initiation of therapy and mitigates treatment disparities. Comparable Drug Utilization Studies (DUS) from regions such as Andhra Pradesh, Maharashtra, and Gujarat have similarly reported high rationality in oncology prescribing [15, 16]. Bepari *et al.* (2019) and Efraim *et al.* (2022) documented supportive therapy adherence, also documented high rationality in oncology prescribing, essential drug usage, and minimal antibiotic prescription. Additionally, a low prescription error rate was reported in an Indian tertiary-care setting; all findings echoed in this study [9, 10].

This study offers important insights into the real-world utilization patterns of chemotherapeutic agents and supportive medications among hospitalized cancer patients at a government tertiary care centre in Goa. The observed prescribing trends strongly aligned with established treatment guidelines, particularly for prevalent malignancies such as breast and haematological cancers. High adherence to WHO prescribing indicators, such as generic prescribing, reliance on essential medicines, and limited antibiotic use, underscores a commitment to reinforce rational, cost-effective pharmacotherapy within the institution. These findings have significant implications for multiple stakeholders, including clinicians, hospital pharmacists, policy planners, and academic researchers [17]. This study provides a baseline for monitoring trends in chemotherapy utilization over time, allowing for a foundation for refining institutional protocols and the evaluating of the impact of new guidelines, treatment modalities, and interventions on prescribing practices. The observed utilization patterns also reflect the interplay between cancer type, disease stage, and treatment modality, factors central to informed clinical decision-making. By mapping actual prescribing behaviours against recommended standards, this study highlights both the strengths and opportunities for improvement in the delivery of cost-effective, guideline-driven cancer care.

The chemotherapy utilization trends observed here also contribute to a broader understanding of real-world oncologic practices. The identification of regimen choices, frequencies, and supportive drug pairings helps to highlight areas for further optimization, especially regarding polypharmacy, drug interaction risks, and documentation quality [18]. The increasing use of chemotherapy, particularly in metastatic and palliative contexts, demands careful assessment of real-world practices to inform regimen selection. As precision medicine gains traction, tailoring drug combinations to individual tumor biology and comorbidities is becoming standard. Integrating findings from ongoing DUS with these innovations can refine clinical pathways [18, 19].

Despite the strengths of this study, our research has limitations inherent to record-based drug utilization studies. First, the accuracy and completeness of the data extracted from medical records are subject to the quality of documentation and data entry practices, which may introduce errors or omissions. Second, the study design was cross-sectional, providing a snapshot of drug utilization patterns at a single point in time and limiting the ability to establish causal relationships or assess long-term outcomes [20, 21]. Third, the study population was confined to patients admitted to a single tertiary care hospital, which might not fully represent the broader population of cancer patients in Goa. In addition, information on patient-related outcomes, such as treatment response, survival rates, and quality of life, was not available in the medical records, precluding a comprehensive assessment of the clinical impact of chemotherapy utilization patterns in this cohort. Furthermore, underreporting or misclassification due to incomplete documentation cannot be ruled-out. Despite these limitations, the study provides valuable insights into the drug utilization patterns of cancer chemotherapeutic drugs in hospitalized patients in Goa, and provides a strong foundation for future research, prospective studies, protocol audits, and quality improvement initiatives.

To build upon the insights generated by this study, future investigations should aim to identify the multifactorial determinants influencing chemotherapy prescribing behavior, including institutional policies, physician preferences, patient-specific factors, and evolving clinical guidelines. Expanding drug utilization research to include outpatient settings and longitudinal follow-ups would offer a broader perspective on adherence trends, treatment continuity, and evolving therapeutic needs. Furthermore, documenting

regimen modifications, adverse drug reactions, and cumulative toxicities would provide critical data for assessing real-world tolerability and informing personalized oncology care in the future. There is also a need to develop regionally adapted chemotherapy protocols that reflect the local cancer burden and healthcare infrastructure, thereby improving the consistency of treatment practices. Importantly, incorporating pharmacoeconomic assessments into such studies will help evaluate the sustainability and value of different therapeutic strategies, particularly in publicly funded institutions, where cost containment and equitable access remain key priorities.

CONCLUSION: The present study highlights Goa Medical College's rational, protocol-driven cancer chemotherapy practices of prescribing chemotherapeutic drugs in a government-funded tertiary care setting. High adherence to WHO prescribing indicators, minimal antibiotic use, and standardized supportive care protocols were also observed. Furthermore, the provision of chemotherapy free of cost under the MJPJAY promotes universal and equitable cancer care without compromising rational use. The Goa model provides a replicable example of how public-sector healthcare can deliver safe, cost-effective oncology care in India. It also sets a precedent for government-funded institutions aiming to deliver quality oncology care without compromising clinical outcomes or economic sustainability.

ACKNOWLEDGMENT: The author sincerely thanks Dr. Pradip Babu Misal for his unwavering support throughout the data collection process and preparation of this manuscript. The author sincerely acknowledges Dr. Preet Sood, SGRDIMSR Amritsar, and the INTPCON-GoaCON 2024 team for their valuable input. The author also extends heartfelt gratitude to the Dean, Goa Medical College and Hospitalfor providing the necessary permissions and the staff at the Department of Medical Records for their cooperation and for providing institutional support to conduct this study.

CONFLICTS OF INTEREST: Nil

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How to cite this article:
Dani NA and Rataboli PV: Drug utilization pattern of cancer chemotherapeutic drugs in hospitalized patients in a Tertiary Care Teaching Hospital in Goa: a cross-sectional observational study. Int J Pharm Sci & Res 2026; 17(2): 749-56. doi: 10.13040/IJPSR.0975-8232.17(2).749-56.