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RESEARCH ARTICLE

A Retrospective Observational Study on Prescription Pattern and Cost Analysis of Proton Pump Inhibitors in a Secondary Healthcare Hospital in Krishnagiri District, Tamil Nadu

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Abstract: Proton Pump Inhibitors (PPIs) is one of the most frequently utilised classes of pharmacotherapeutic agents globally, indicated for a spectrum of acid-peptic disorders. Despite their efficacy, growing evidence suggests a prevalence of irrational prescribing practices, contributing to escalated healthcare expenditures and potential adverse effects. This study evaluated the utilisation patterns, indication appropriateness, and cost implications of PPI therapy within a secondary healthcare facility in Tamil Nadu, India. A retrospective observational study was conducted involving 100 inpatients prescribed PPIs over a six-month period. Clinical data, including demographics, specific drug selection, route of administration, and indication for therapy, were extracted and analysed alongside a cost-minimisation analysis of available brands. The cohort was predominantly male (63%), with the highest usage frequency observed in the 41–60 age group (49%). Pantoprazole was the most commonly prescribed agent (63%), followed by Esomeprazole (17%) and Rabeprazole (15%). Most importantly, intravenous administration was the preferred route in 63% of cases, suggesting a potential area for rationalising therapy conversion to oral forms. Clinical indications revealed that only 9% of patients were treated for active Peptic Ulcer Disease, while a significant proportion received PPIs for co-morbidities (39%) or analgesic prophylaxis (23%) without clear risk stratification, highlighting a trend of defensive or habitual prescribing. Cost analysis showed significant price variation among brands, with Pantoprazole incurring substantial cumulative costs due to high prescription volume. The results indicate a critical need for the implementation of institutional antimicrobial stewardship-like programs for PPIs, emphasising de-escalation from intravenous to oral therapy and adherence to evidence-based guidelines to optimise clinical and economic outcomes.

Keywords: Pharmacoeconomics; Proton Pump Inhibitors; Rational Drug Use; Cost-Minimisation Analysis; Prescribing Patterns.

1. Introduction

The advent of Proton Pump Inhibitors (PPIs) revolutionised the management of acid-related disorders, establishing them as the cornerstone of therapy for conditions such as Gastroesophageal Reflux Disease (GERD), Peptic Ulcer Disease (PUD), and Zollinger-Ellison syndrome [1]. PPIs provide potent and prolonged suppression of basal and stimulated gastric acid secretion By irreversibly inhibiting the H+/K+ ATPase enzyme system at the secretory surface of the gastric parietal cell [2]. Consequently, agents such as omeprazole, lansoprazole, pantoprazole, and rabeprazole have become some of the most widely prescribed medications worldwide, accounting for billions of dollars in annual healthcare expenditure [3].

Despite their established safety profile, the widespread availability and perceived benign nature of PPIs have led to a phenomenon of 'prescribing creep,' where these agents are frequently utilised without a valid clinical indication or prolonged beyond the recommended duration [4]. Current literature suggests that up to 60-70% of PPI prescriptions in hospital settings may be inappropriate, often driven by non-indicated stress ulcer prophylaxis in low-risk patients or routine co-prescription with non-steroidal anti-inflammatory drugs (NSAIDs) lacking adequate gastrointestinal risk assessment [5]. This irrational usage is not merely an economic concern; it is clinically significant due to associated long-term risks, including *Clostridioides difficile* infection, community-acquired pneumonia, micronutrient deficiencies (e.g., magnesium, vitamin B12), and osteoporotic fractures [6]. In the context of developing economies like India, where out-of-pocket expenditure constitutes a major portion of healthcare spending, the

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pharmacoeconomic burden of inappropriate PPI use is profound. The Indian pharmaceutical market is characterised by a plethora of branded generics with wide price disparities, making cost-analysis a vital tool for healthcare administrators [7]. While numerous studies have addressed PPI usage in tertiary care centres, data regarding prescribing habits in secondary healthcare settings where resources are more constrained remains limited.

Cost-Minimisation Analysis (CMA) serves as a pragmatic method in pharmacoeconomics to compare the costs of therapeutic alternatives that are assumed to have equivalent clinical efficacy [8]. Given the structural similarity and comparable clinical outcomes of various PPIs at equipotent doses, CMA is particularly suitable for identifying the least costly alternative to minimise the financial burden on patients and the hospital administration.

This study was designed to evaluate the current prescribing patterns of PPIs among inpatients in a secondary healthcare hospital in the Dharmapuri/Krishnagiri region. The primary objectives were to determine the demographic distribution of users, identify the clinical indications driving prescription, analyse the route of administration, and perform a cost analysis to determine the economic effects of current brand selection.

2. Materials and Methods

2.1. Study Design

A retrospective observational study was conducted at a secondary healthcare hospital located in the Dharmapuri District, Tamil Nadu, India. The study site serves a semi-urban and rural population, providing a representative setting for analysing prescribing behaviours outside of major metropolitan tertiary centres. The study duration spanned six months, evaluating patient records from September 2024 to February 2025.

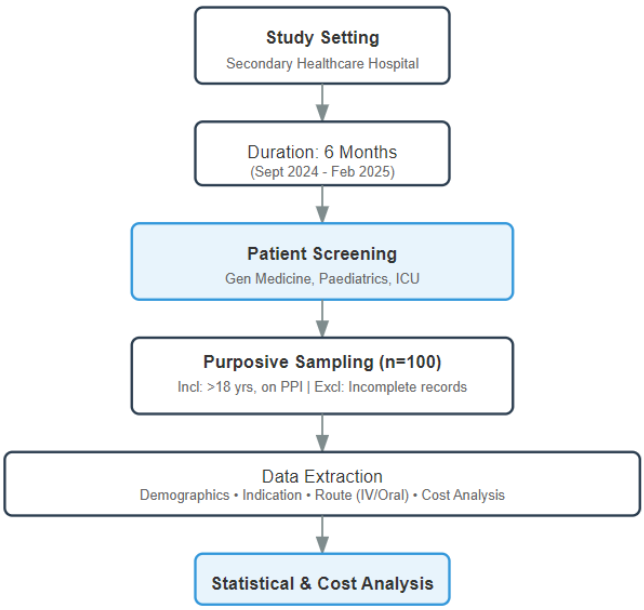

Figure 1. Study Design

2.2. Study Population and Sampling

The study population comprised inpatients admitted to the General Medicine, Paediatrics, and Intensive Care Units (ICU). A total of 100 patient case records were selected using a purposive sampling technique based on specific inclusion and exclusion criteria.

2.2.1. Inclusion Criteria

All inpatients of either gender, aged 18 years and above, who were prescribed at least one Proton Pump Inhibitor during their hospital stay were included.

2.2.2. Exclusion Criteria

Patients with incomplete medical records, those discharged against medical advice, and pregnant or lactating women were excluded to ensure data homogeneity.

2.3. Data Collection

Data were extracted from patient medical records and medication charts using a pre-designed data collection form. The parameters recorded included:

- Demographic Details: Age and gender.
- Drug Utilisation Data: Name of the PPI (generic and brand), dosage, frequency, and route of administration (Intravenous vs. Oral).
- Clinical Data: Documented diagnosis and specific indication for PPI prescription (e.g., PUD, Gastritis, Prophylaxis/Analgesia co-prescription).
- Economic Data: Cost of the prescribed therapy. Pricing data was sourced from the hospital pharmacy for available stock and from standard commercial drug indices (Current Index of Medical Specialties - CIMS, Drugs Today) for outside purchases [9].

The collected data were subjected to descriptive statistical analysis. Continuous variables were expressed as means, while categorical variables (gender, indication, route of administration) were presented as frequencies and percentages. A cost-minimisation approach was utilised to compare the unit cost of prescribed brands against the lowest-priced alternatives available in the market. All analyses were performed using Microsoft Excel 2019. The study protocol was reviewed and approved by the Institutional Ethical Committee (IEC) prior to the commencement of data collection. Patient confidentiality was maintained by anonymising all data points during the extraction process.

3. Results

3.1. Demographic Characteristics

The analysis of 100 inpatients revealed a male predominance in the utilisation of PPIs. Males constituted 63% of the study cohort, while females accounted for 37%. Regarding age distribution, the highest frequency of PPI prescription was observed in the middle-aged population (41–60 years), comprising 49% of the total patients. Young adults (18–40 years) represented 36%, while the geriatric population (>60 years) accounted for 15%. (Table 1)

Table 1. Demographic Distribution of the Study Population

Characteristic	Category	Frequency (n=100)	Percentage (%)
Gender	Male	63	63.0
	Female	37	37.0
Age Group	18 - 40 Years	36	36.0
	41 - 60 Years	49	49.0
	> 60 Years	15	15.0

3.2. Prescribing Patterns of Proton Pump Inhibitors

Five distinct brands representing four generic molecules were identified in the prescribing trends. Pantoprazole was the most frequently utilised agent, prescribed to 63% of the patients. This was followed by Esomeprazole (17%) and Rabeprazole (15%, combined across two brands). Omeprazole was the least prescribed agent, accounting for only 5% of the total usage. (Table 2)

Table 2. Distribution of Prescribed Proton Pump Inhibitors

Generic Name	Brand Name	Frequency (n=100)	Percentage (%)
Pantoprazole	Pan	63	63.0
Esomeprazole	Esomac	17	17.0
Rabeprazole	Rablet / Rabicip	15	15.0
Omeprazole	Omez	05	5.0

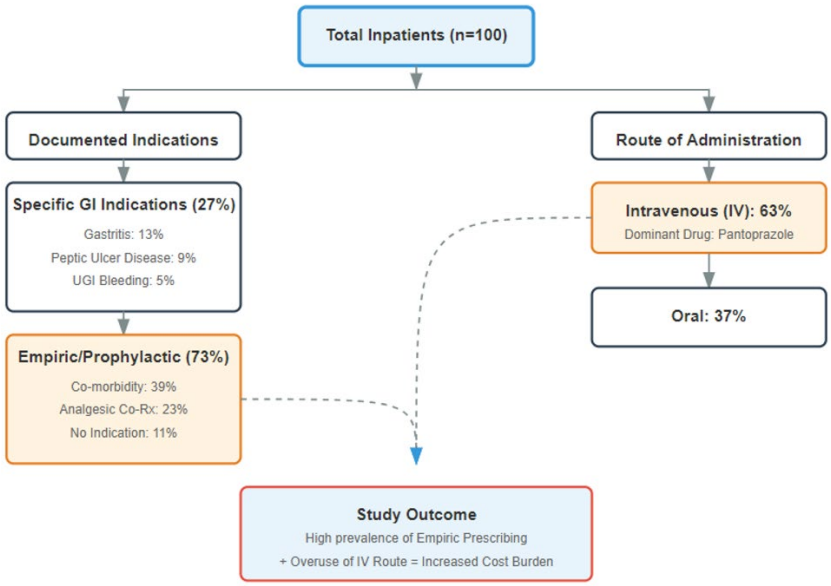

Figure 2. Distribution of clinical indications, route of administration, and prescribing outcomes observed in the study cohort (n=100).

3.3. Analysis of Clinical Indication

The analysis of clinical indications revealed a disparity between confirmed acid-peptic diagnoses and PPI prescription. Only 9% of patients had a documented diagnosis of Peptic Ulcer Disease, and 13% were diagnosed with Gastritis. A significant proportion of prescriptions were attributed to 'Co-morbidity' management (39%) and 'Analgesic' co-prescription (23%), suggesting a prophylactic intent. Notably, 11% of prescriptions had no documented indication in the case files. Furthermore, 5% of patients received PPIs for Upper Gastrointestinal (UGI) bleeding. (Table 3)

Table 3. Clinical Indications for PPI Administration

Indication	Frequency (n=100)	Percentage (%)
Co-morbidity Management	39	39.0
Analgesic Co-prescription	23	23.0
Gastritis	13	13.0
No Indication Documented	11	11.0
Peptic Ulcer Disease	09	9.0
UGI Bleeding	05	5.0

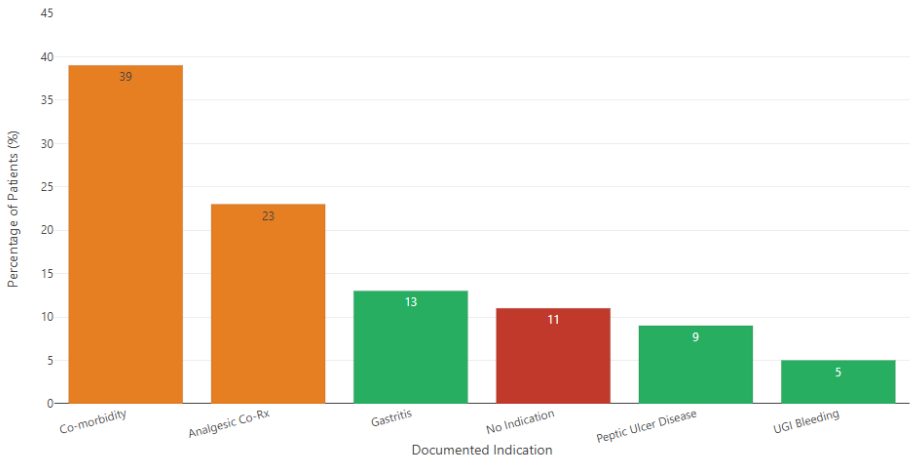

Figure 3. Stratification of Clinical Indications for PPI Therapy

3.4. Route of Administration

A critical evaluation of the route of administration demonstrated a preference for parenteral therapy. Sixty-three percent (63%) of patients received PPIs via the Intravenous (IV) route, while 37% were treated with oral formulations. This aligns with the high utilisation of Pantoprazole, which is frequently available and administered as an IV injection in hospital settings. (Table 4)

Table 4. Route of Administration Profile

Route	Frequency (n=100)	Percentage (%)
Intravenous (IV)	63	63.0
Oral	37	37.0

3.5. Cost Analysis

The cost analysis highlighted significant price variations between different PPI molecules and brands. Pantoprazole (Brand: Pan 40) was priced at 8.20 INR (Oral) and 49.43 INR (IV). While Omeprazole (Brand: Omez) was the most economical option at 8.40 INR (Oral) and 34.76 INR (IV), it was infrequently prescribed. In contrast, Rabeprazole and Esomeprazole brands commanded significantly higher prices, with some IV formulations exceeding 100 INR per unit. The cost-minimisation comparison indicates that while Pantoprazole is moderately priced, the aggregate cost burden is high due to the volume of prescriptions. (Table 5)

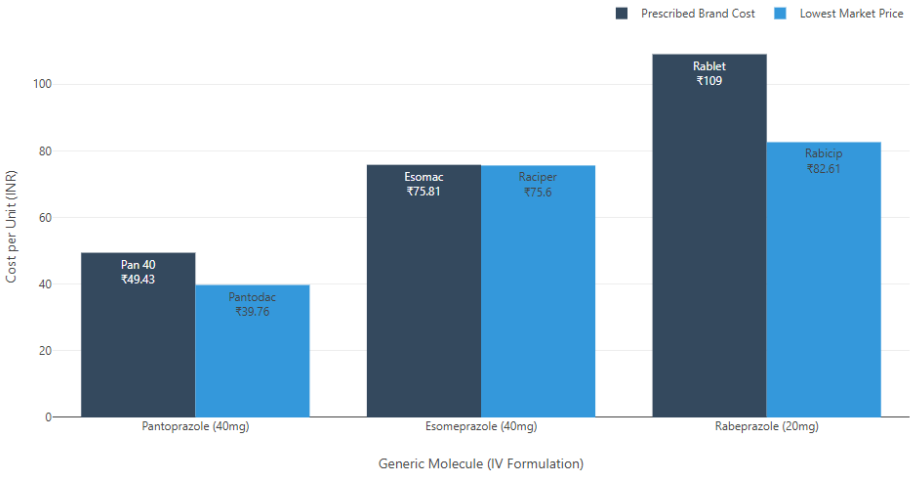

Figure 4. Cost Minimization Analysis of Intravenous PPIs

Table 5. Cost Comparison of Prescribed PPI Brands vs. Market Alternatives (in INR)

S.No	Generic Name	Prescribed Brand	Cost (Oral)	Cost (IV)	Alternative Brand	Cost (Oral)	Cost (IV)
1	Pantoprazole	Pan 40	8.20	49.43	Pantodac	11.60	39.76
					Pantium	9.08	48.50
2	Esomeprazole	Esomac	9.25	75.81	Raciper	8.41	75.60
					Nexpor	8.32	82.61
3	Omeprazole	Omez	8.40	34.76	Omicap	5.48	-
4	Rabeprazole	Rablet 40	7.82	109.00	Veloz 20	10.41	88.92

4. Discussion

The present study provides a snapshot of PPI utilisation within a secondary care setting, revealing patterns that warrant clinical and economic scrutiny. The demographic profile showed a male predominance (63%), which is consistent with epidemiological data suggesting a higher prevalence of risk factors such as smoking and alcohol consumption key contributors to acid-peptic disorders among males in this region [10]. The age distribution, peaking at 41–60 years, correlates with the typical onset of lifestyle-related metabolic and gastrointestinal disorders.

A major finding of this study is the potential irrationality in PPI prescribing. While PPIs are indicated for PUD, Gastritis, and UGI bleeding, these specific diagnoses accounted for only 27% of the total cohort. The majority of patients received PPIs for "Co-morbidity" (39%) and "Analgesic" use (23%). While gastro-protection is valid for patients on long-term NSAIDs with high risk factors (e.g., age >65, history of ulcers), routine prophylaxis for all hospitalised patients or those on short-term analgesics is not supported by evidence [11]. The 11% of prescriptions with no documented indication shows a clear gap in documentation standards and clinical reasoning. This aligns with global trends where inappropriate PPI prescribing in hospitalised non-critically ill patients ranges from 40% to 81% [12].

The predominance of the intravenous route (63%) is a significant concern. International guidelines recommend IV PPIs primarily for conditions like active gastrointestinal bleeding or when the patient cannot tolerate oral intake (NPO status) [13]. For uncomplicated stress ulcer prophylaxis or symptom management, oral therapy is equally effective and significantly cheaper. The excessive use of IV Pantoprazole in this study suggests a need for an automatic "IV-to-Oral" conversion protocol, which could substantially reduce nursing time, infection risk from cannulation, and direct drug costs.

The cost analysis reveals that while Pantoprazole is not the most expensive molecule per unit compared to Rabeprazole, its sheer volume of use drives the total cost. Omeprazole remains the most cost-effective option, yet it was underutilised (5%). The preference for newer agents like Rabeprazole and Esomeprazole in 32% of patients contributes to higher costs without necessarily offering superior efficacy for standard indications like stress ulcer prophylaxis. Shifting prescribing habits toward Omeprazole or oral Pantoprazole where clinically appropriate could yield significant savings for the hospital and patients.

5. Conclusion

This study shows a high prevalence of empiric Proton Pump Inhibitor use in a secondary healthcare hospital, characterised by a preference for Pantoprazole and the intravenous route of administration. A significant proportion of prescriptions lacked specific, evidence-based indications, driven largely by co-morbidity management and prophylaxis. While Pantoprazole offers a middle ground in terms of cost, the underutilisation of cheaper alternatives like Omeprazole and the overuse of parenteral formulations contribute to avoidable healthcare expenditures. It is imperative to establish institutional prescribing guidelines that define clear criteria for PPI initiation and mandate the reassessment of the need for continued therapy at discharge to promote rational drug use. Implementation of clinical audits and educational interventions focusing on IV-to-Oral conversion could improve patient safety and ensure the efficient allocation of healthcare resources.

Compliance with ethical standards

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Conflict of interest statement

The authors declare that they have no conflict of interest regarding the publication of this manuscript. No external funding was received for this study.

Statement of ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study protocol was approved by the Institutional Ethics Committee prior to the commencement of the study.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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