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Prescription Patterns and Utilization Trends of Proton Pump Inhibitors among Hospitalized Patients in a Tertiary Care Hospital in Bangladesh

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Abstract

Background: Proton pump inhibitors (PPIs) are widely used for the management of acid-related gastrointestinal disorders. Despite their effectiveness, inappropriate prescribing regarding indication, dose, and frequency is common, contributing to adverse effects, polypharmacy, and increased healthcare costs.

Objective: This study aimed to evaluate the prescription patterns, utilization trends of PPI therapy among hospitalized patients in a tertiary care setting.

Methods: A cross-sectional observational study was conducted from July 2022 to June 2023 at Sylhet MAG Osmani Medical College, in collaboration with Sylhet MAG Osmani Medical College Hospital, Sylhet, Bangladesh. A total of 600 patients admitted to the Departments of Medicine, Surgery, Gastroenterology, and Gynecology & Obstetrics and prescribed at least one PPI were included. Data were collected from treatment sheet and patient interviews, focusing on demographics, PPI type, route, dose, frequency, indication, comorbidities, and concomitant medications. Statistical analysis was performed using SPSS.

Results: Among 600 patients, 59.8% were female, with a mean age of 42.94 ± 17.16 years. The highest PPI prescription rates were observed in gynecology and obstetrics (94.9%), followed by surgery (92.5%), gastroenterology (86%), and medicine (68.6%). Only 47.8% of prescriptions were indicated appropriately, 61% had correct dosing, and 13.7% had correct frequency; fully appropriate therapy was achieved in 4% of patients. Oral administration was most common (58%), with 42% receiving intravenous PPIs. Omeprazole dominated prescriptions (96.2%), primarily supplied by the hospital (96.2%). Common comorbidities included LUCS (17.3%), cardiovascular disease (11%), and hypertension (6.2%), while concomitant use of antimicrobials (79.3%) and analgesics (79.2%) was frequent.

Conclusion: PPI use is widespread among hospitalized patients, with most prescriptions being inappropriate. Gastroenterology showed better guideline adherence, while gynecology and obstetrics had the lowest. Evidence-based protocols and targeted education are needed to optimize use and reduce risks and costs.

Keywords: PPIs; Prescribing patterns; Appropriateness; Hospitalized patients; Tertiary care

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Introduction

Proton pump inhibitors (PPIs) are among the most widely prescribed medications worldwide and are considered the most potent inhibitors of gastric acid secretion. They act by irreversibly blocking the gastric H^+/K^+-ATPase proton pump located on parietal cells, producing profound and prolonged suppression of gastric acid secretion [1]. Since the introduction of omeprazole in 1989, PPIs—including omeprazole, pantoprazole, esomeprazole, lansoprazole, dexlansoprazole, and rabeprazole—have become indispensable in the management of acid-related gastrointestinal disorders. All major PPIs are approved by the United States Food and Drug Administration (USFDA), and omeprazole is also listed on the WHO Model List of Essential Medicines, highlighting its clinical significance [2]. PPIs are recommended by international bodies such as the USFDA, the National Institute for Health and Care Excellence (NICE), the American Gastroenterological Association (AGA), and the American College of Gastroenterology (ACG) for a wide range of indications [3]. These include gastroesophageal reflux disease (GERD), peptic ulcer disease, eradication of *Helicobacter pylori* infection (as part of triple or quadruple therapy), Zollinger–Ellison syndrome, Barrett's esophagus, non-variceal upper gastrointestinal bleeding, stress ulcer prophylaxis in critically ill patients, and prevention of NSAID-induced gastropathy. Due to their strong efficacy, rapid symptom improvement, and generally favourable safety profile, PPIs are often selected over histamine-2 receptor antagonists and other acid-suppressing agents [4]. Over the past decade, concerns have intensified regarding their widespread irrational use. Irrational drug use—including prescribing without appropriate clinical indications, unnecessary high dosing, prolonged therapy, duplicate acid-suppressive therapy, and polypharmacy, has been identified as a major problem by the World Health Organization [5]. Global studies show that 40–70% of PPI prescriptions are inappropriate, particularly in hospitalized patients. Factors contributing to this trend include empirical prescribing, fear of potential bleeding, inadequate awareness of guidelines, and the availability of PPIs as over-the-counter medications [6]. In South Asian countries [7], including Bangladesh, PPIs are frequently used as routine additions to inpatient prescriptions, often without documentation of a valid indication. Several studies in Bangladesh have reported that more than 50–60% of hospitalized patients receive PPIs irrationally, either as part of perioperative prophylaxis, routine admission orders, or general pain management [8]. This unnecessary use significantly increases healthcare costs, especially in resource-constrained settings, and exposes patients to avoidable adverse effects. Although PPIs are generally safe, a growing body of evidence has linked long-term or inappropriate use to clinically important complications. These include increased risks of *Clostridioides difficile* infection, osteoporosis-related fractures, chronic kidney disease, acute interstitial nephritis, micronutrient deficiencies (vitamin B12, magnesium, calcium, iron), pneumonia, dementia, cardiovascular events, and significant drug–drug interactions [9,10]. Such emerging safety concerns have prompted multiple professional societies to issue deprescribing guidelines and recommend periodic reassessment of PPI therapy.

Rational and evidence-based prescribing of PPIs is therefore essential to optimize patient outcomes, minimize adverse effects, and reduce unnecessary healthcare expenditure. Understanding local prescribing patterns is a crucial first step for developing institutional guidelines, promoting antimicrobial stewardship-style interventions for PPIs, and improving physician awareness regarding appropriate indications. The present study aims to evaluate the prescribing patterns, indications, and utilization trends of proton pump inhibitors among hospitalized patients in a tertiary care setting in Bangladesh.

Methods and Materials

Study Design and Place

This research was designed as a cross-sectional observational study. The study was conducted in the Department of Pharmacology and Therapeutics, Sylhet MAG Osmani Medical College, Sylhet, in collaboration with the Departments of Medicine, Surgery, Gastroenterology, and Gynaecology and Obstetrics of Sylhet MAG Osmani Medical College Hospital. The total duration of the study was one year, extending from July 2022 to June 2023.

Study Population and Sample Size

The study population consisted of all patients admitted to the Departments of Medicine, Surgery, Gastroenterology, and Gynaecology and Obstetrics of Sylhet MAG Osmani Medical College Hospital during the study period. From this population, patients who met the inclusion criteria were selected as study participants. A total of 600 patients were included in the study, selected through a convenient sampling technique based on their availability and eligibility during the study period [11].

Selection Criteria

Inclusion criteria included patients admitted in the Departments of Medicine, Surgery, Gastroenterology, and Gynaecology & Obstetrics who were prescribed at least one proton pump inhibitor during their hospital stay. Exclusion criteria were patients below 18 years of age and those unwilling to provide informed consent for participation.

Data Collection Procedure

Data were systematically obtained from hospital records

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and through direct patient interviews. Prior to data collection, all participants were informed about the objectives and potential benefits of the study, and written informed consent was obtained. A structured and pretested data collection form was employed to gather comprehensive information, including patient demographics, clinical history, medication details, laboratory results, and other relevant clinical data. The primary variables of interest included the indication for PPI therapy, route of administration, dosage, frequency, type of PPI prescribed, concomitant medications, and the presence of co-morbid conditions. Data on the indication, dose, frequency, and route of PPI use were carefully assessed for rationality and adherence to established clinical guidelines. Additional information regarding co-medications and coexisting medical conditions was also recorded to provide a comprehensive profile of each patient. All collected data were verified against hospital records to ensure accuracy, and strict measures were taken to maintain patient confidentiality throughout the study.

Statistical analysis

The collected data were analysed using IBM SPSS Statistics for Windows. Quantitative variables were presented as mean ± standard deviation, while qualitative variables were expressed as frequencies and percentages. Appropriate statistical tests were applied where necessary to evaluate relationships and differences between variables.

Ethical approval

Prior to the commencement of the study, ethical approval was obtained from the Ethical Committee of Sylhet MAG Osmani Medical College (SOMC/2023/03). In addition, written informed consent was obtained from each participant after explaining the purpose and objectives of the study, ensuring voluntary participation and adherence to ethical standards.

Results

Among 600 patients, Table 1 summarizes the distribution of hospitalized patients receiving proton pump inhibitors (PPIs) according to age groups and gender. Among the study population, 359 patients (59.8%) were female, and 241 patients (40.2%) were male, resulting in a male-to-female ratio of 0.6:1, indicating a higher proportion of female patients in the hospital wards studied. The age of the patients ranged from 18 to 90 years, with a mean age of 42.94 ± 17.16 years, reflecting a wide age spectrum of adult patients. The largest age group was 21–30 years (28.5%), followed by 51–60 years (15.8%), 41–50 years (15.3%), and 31–40 years (15.2%), indicating that young adults and middle-aged patients formed the majority of the study population. The smaller proportions of patients were observed in the older age groups: 61–70 years (13.7%), 71–80 years (2.5%), and 81–90 years (2%), while the youngest group, 18–20 years, comprised 7.0% of the patients.

Table 1: Distribution of Patients According to Age Groups and Gender (n = 600).

Variables	Category	Number of Patients	Percentage (%)
Gender	Male	241	40.2
	Female	359	59.8
Male: Female Ratio	0.6:1		
Age Groups (Years)	18–20	42	7
	21–30	171	28.5
	31–40	91	15.2
	41–50	92	15.3
	51–60	95	15.8
	61–70	82	13.7
	71–80	15	2.5
	81–90	12	2
Mean ± SD (Range)	42.94 ± 17.16 (18-90 Years)		

Table 2 showed total 705 prescriptions were reviewed from medicine, surgery, gynecology and obstetrics, gastroenterology department and of these 600 patients were prescribed with PPIs. That was 85.1% of the admitted patients of medicine, surgery, gynecology and obstetrics, gastroenterology department.

Table 2: Distribution of study patients treated by PPIs based on the department.

Department	No. of case sheets reviewed	No. of patients on PPIs	Patients on PPIs Percentage (%)
Medicine	210	144	68.6
Surgery	200	185	92.5
Gynecology and Obstetrics	195	185	94.9
Gastroenterology	100	86	86
Total	**705**	**600**	**85.1**

Table 3 shows that out of 600 hospitalized patients prescribed PPIs, 287 patients (47.8%) received them for appropriate indications, while 313 patients (52.2%) were prescribed without valid reasons. Of those with correct indications, 175 patients (61%) received the appropriate dose, but only 24 patients (13.7%) received the correct frequency. Considering all three aspects—indication, dose, and frequency—only 24 patients (4%) received fully appropriate PPI therapy, whereas 576 patients (96%) had at least one aspect of their prescription inappropriate.

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Table 3: Appropriateness of PPI Use by Indication, Dose, and Frequency (n = 600).

Parameter	Appropriate	Number of Patients (n)	Percentage (%)
Indication	Yes	287	47.8
	No	313	52.2
Dose	Yes	175	61
	No	112	39
Frequency	Yes	24	13.7
	No	151	86.3
Overall Appropriateness	Yes	24	4
	No	576	96

Table 4 presents the departmental variations in the appropriateness of PPI prescriptions across four parameters—indication, dose, frequency, and overall use—among 600 patients. Appropriate indications were most observed in the gastroenterology department (66.3%) and least in gynecology and obstetrics (31.9%), showing a highly significant difference ($p < 0.001$). Among patients with valid indications, appropriate dosing also varied significantly ($p = 0.003$), with gastroenterology demonstrating the highest compliance (82.5%) and gynecology and obstetrics showing lower adherence (52.5%). The appropriateness of dosing frequency was poor across all departments but remained statistically significant ($p = 0.015$), with gastroenterology again performing best (23.4%) and gynecology and obstetrics reporting no appropriate cases (0%). When all three parameters were combined, only 24 patients (4%) received fully appropriate therapy, with the highest proportion from gastroenterology (12.8%) and none from gynecology and obstetrics. Overall, the findings indicate substantial departmental differences and widespread inappropriate PPI prescribing, supported by statistically significant p-values across all parameters.

Table 5 summarizes the overall pattern of PPI usage among 600 patients by route of administration, generic type, and source of supply. Most patients received PPIs orally (58%), while 42% were administered intravenously. Omeprazole was overwhelmingly the most prescribed PPI, accounting for 96.2% of all prescriptions, whereas other PPIs such as rabeprazole (1.3%), esomeprazole (1.2%), pantoprazole (0.8%), and lansoprazole (0.5%) were used only minimally, and no patient received dexlansoprazole. Regarding availability, most PPIs were supplied directly by the hospital (96.2%), with only a small proportion (3.8%) obtained from outside sources. This distribution highlights a strong reliance on hospital-supplied omeprazole and a limited diversity in PPI prescribing practices.

Table 6 showed among the 600 patients receiving PPIs, the most common comorbidities were lower uterine cesarean section (LUCS, 17.3%), cardiovascular disease (CVD, 11%), hypertension (HTN, 6.2%), malignancy (5.8%), and cholelithiasis (5.2%). Other notable conditions included diabetes (5%), acute abdomen (4.7%), COPD (4.5%), and CNS disorders (4.3%). Less frequent comorbidities accounted for smaller percentages, with a variety of other conditions collectively representing 15.8% of patients. This distribution indicates that PPI therapy was often prescribed in patients with multiple underlying medical or surgical conditions.

Table 7 showed concomitant drug use with PPIs was common. The most frequently co-prescribed drugs were antimicrobials (79.3%) and analgesics (79.2%), followed by antiemetics (26.2%) and antihypertensives (18.5%). Other medications included antidiabetics (10.2%), corticosteroids (9.5%), diuretics (9.2%), vitamins (8.7%), and minerals (6.8%). Less commonly used drugs included sedatives, bronchodilators, lipid-lowering agents, laxatives, antiplatelets, and antihistamines, each accounting for <7% of patients, indicating high rates of polypharmacy in hospitalized patients on PPI therapy.

Table 4: Appropriateness of PPI Prescription in Different Departments by Indication, Dose, Frequency, and Overall Use (n = 600).

Parameter	Category	Gastroe-nterology	Medicine	Surgery	Gynaecology & Obstetrics	p-value
Indication	Appropriate	57 (66.3%)	86 (59.7%)	85 (45.9%)	59 (31.9%)	**p < 0.001**
	Inappropriate	29 (33.7%)	58 (40.3%)	100 (54.1%)	126 (68.1%)	
Dose	Appropriate	47 (82.5%)	50 (58.1%)	47 (55.3%)	31 (52.5%)	**p = 0.003**
	Inappropriate	10 (17.5%)	36 (41.9%)	38 (44.7%)	28 (47.5%)	
Frequency	Appropriate	11 (23.4%)	09 (18.0%)	04 (8.5%)	0 (0%)	**p = 0.015**
	Inappropriate	36 (76.6%)	41 (82.0%)	43 (91.5%)	31 (100%)	
Overall Appropriateness	Appropriate	11 (12.8%)	09 (6.3%)	4 (2.2%)	0 (0%)	**p < 0.001**
	Inappropriate	75 (87.2%)	135 (93.7%)	181 (97.8%)	185 (100%)	

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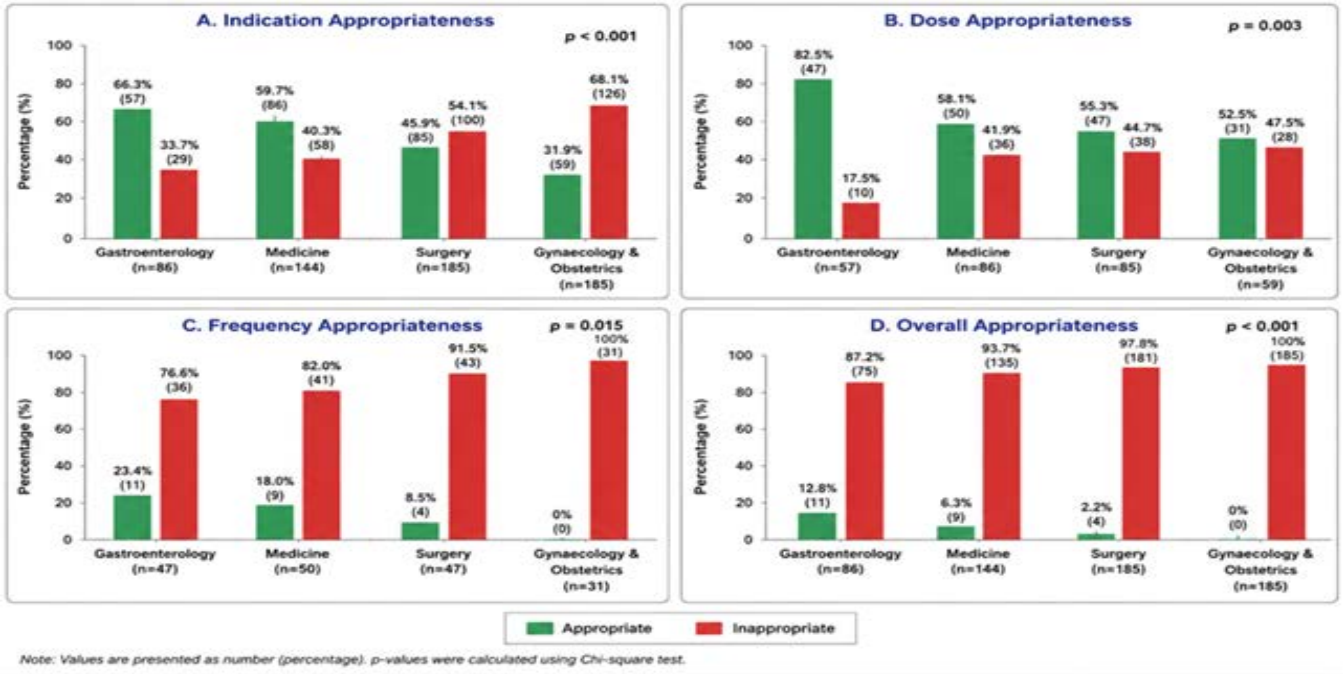

Figure 1: Department-wise Appropriateness of PPI Prescription by Indication, Dose, Frequency, and Overall Use.

Table 5: Overview of PPI Administration Route, Generic Type Used, and Source of Supply (n = 600).

Parameter	Category	Number of Patients (n)	Percentage (%)
Route of Administration	Oral	348	58.0
	Intravenous	252	42.0
Generic Name of PPI Used	Omeprazole	577	96.2
	Rabeprazole	8	1.3
	Esomeprazole	7	1.2
	Pantoprazole	5	0.8
	Lansoprazole	3	0.5
	Dexlansoprazole	0	0.0
Source of PPI Supply	Hospital Supply	577	96.2
	Outside Supply	23	3.8

Table 6: Distribution of comorbidities in patients receiving PPIs (n=600).

Disease condition	No. of patients	Percentage (%)
LUCS	104	17.3
CVD	66	11
HTN	37	6.2
Malignancy	35	5.8
Cholelithiasis	31	5.2
DM	30	5
Acute abdomen	28	4.7
COPD	27	4.5
CNS disease	26	4.3
Appendicitis	19	3.2
Tuberculosis	19	3.2
Renal stone	18	3
CLD	17	2.8
UV Prolapse	16	2.7
Hydronephrosis	15	2.5
Jaundice under evaluation	15	2.5
UTI	14	2.3
Wound infection	14	2.3
Fibroid uterus	11	1.8
Pneumonia	11	1.8
Anemia under evaluation	10	1.7
Skin and Soft-tissue infection	9	1.5
CKD	7	1.2
Others*	95	15.8

Table 7: Distribution of concomitant drugs use along with PPIs (n = 600).

Drug group	No. of patients	Percentage (%)
Antimicrobials	476	79.3
Analgesics	475	79.2
Antiemetics	157	26.2
Antihypertensive	111	18.5
Antidiabetics	61	10.2

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Corticosteroid	57	9.5
Diuretics	55	9.2
Vitamins	52	8.7
Minerals	41	6.8
Sedatives	37	6.2
Bronchodilator	32	5.3
Lipid lowering agents	24	4
Laxatives	19	3.2
Antiplatelet	19	3.2
Antihistamine	10	1.7

Discussion

This study assessed the prescription patterns and utilization trends of proton pump inhibitors (PPIs) among hospitalized patients in a tertiary care setting, revealing a very high prevalence of PPI use (85.1%) across major hospital departments. Such extensive use is consistent with global and regional studies that have reported widespread and often excessive PPI prescribing in inpatient care. The high proportion of female patients receiving PPIs in this study (59.8%) may reflect the overall demographic distribution of admissions in the selected departments, particularly the large number of patients from gynecology and obstetrics. The mean age of 42.9 years indicates that PPI use was common not only among elderly patients—who are traditionally considered high-risk for gastrointestinal disorders—but also among younger adults. The present study reveals a considerable extent of inappropriate PPI prescribing among hospitalized patients. Although 47.8% of patients received PPIs for valid clinical indications, adherence to correct dosing (61%) and dosing frequency (13.7%) was markedly low. When all three parameters—indication, dose, and frequency—were evaluated collectively, only 4% of prescriptions were fully appropriate. This pattern is consistent with previous research conducted in various healthcare settings, where PPI misuse ranged from 40% to 70%, particularly due to prophylactic prescribing and empirical treatment without guideline support. Similar studies from India, Nepal, and Saudi Arabia have reported high rates of inappropriate indications, often involving prescription for functional dyspepsia, unexplained abdominal discomfort, routine post-operative care, or as a standard medication for all admitted patients even in the absence of gastrointestinal risk factors [12,13]. Significant departmental variations were observed in PPI prescribing patterns. The gastroenterology department demonstrated comparatively better adherence to appropriate indication and dosing ($p < 0.001$ and $p = 0.003$), which is expected given the specialized expertise and greater familiarity with current clinical guidelines among gastroenterologists. In contrast, the gynecology and obstetrics department showed the lowest compliance, with 0% of prescriptions meeting fully appropriateness criteria. Such variation between departments has also been reported in studies from India, Pakistan, and Malaysia, where non-gastroenterology units frequently exhibited higher rates of irrational PPI use due to routine prophylactic prescribing and limited guideline awareness [14]. Furthermore, the present study found that dosing frequency was poorly maintained across all departments, with significant inconsistency ($p = 0.015$), suggesting a widespread systemic challenge rather than an isolated departmental problem. Similar patterns were documented in previous research where incorrect dosing intervals, particularly unnecessary twice-daily prescriptions—were attributed to habitual prescribing practices and insufficient pharmacist involvement in medication review [15]. The study revealed a striking dominance of omeprazole, which accounted for 96.2% of all PPI prescriptions, indicating minimal therapeutic diversity and suggesting that hospital formulary limitations strongly influenced prescribing behavior. Similar trends have been documented in low-resource settings, where reliance on a single, inexpensive generic PPI is common due to procurement constraints and cost-saving priorities. The fact that 96.2% of PPIs were supplied directly by the hospital further supports the presence of institutional prescribing patterns shaped by availability rather than individualized clinical need. In terms of administration route, 58% of patients received PPIs orally, while 42% received them intravenously—an IV usage rate considerably higher than that reported in several international studies, where inappropriate IV administration has been widely criticized. Although certain clinical scenarios in the present study (e.g., postoperative care, nil per mouth status, or severe gastritis) may justify IV use, the proportion remains high and raises the possibility of unnecessary parenteral prescribing. Comparable findings from studies in India, Nepal, and Saudi Arabia also highlight excessive IV PPI use, often unrelated to evidence-based indications, suggesting a global trend of preference for IV administration in inpatient settings despite its higher cost and limited added benefit [16,17]. Comorbidity analysis showed that PPI use was widespread among patients with various medical and surgical conditions, including LUCS (17.3%), cardiovascular diseases (11%), hypertension (6.2%), malignancy (5.8%), cholelithiasis (5.2%), diabetes (5%), and acute abdomen (4.7%). The high burden of comorbidities, especially postoperative and chronic conditions, may partly explain the elevated PPI prescription rates, as clinicians often use PPIs prophylactically or empirically in hospitalized patients. Similar patterns have been reported in countries such as India, Pakistan, Nepal, Sri Lanka, Malaysia, and Turkey, where PPIs are frequently prescribed even without guideline-supported indications [18]. However, international recommendations emphasize that routine PPI use is not justified unless clear risk factors exist,

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such as active gastrointestinal bleeding, high-risk NSAID therapy, mechanical ventilation, or confirmed acid-related disorders. These findings suggest that many PPI prescriptions in the study setting may reflect habitual or protocol-driven practices rather than evidence-based clinical need [19]. Concomitant drug use was prevalent, with antimicrobials (79.3%) and analgesics (79.2%) being the most common. Many of these medications, particularly NSAIDs and steroids, can increase gastrointestinal risk, which may partly justify PPI co-prescription. However, routine or blanket prescribing remains inappropriate in low-risk patients. The high rates of polypharmacy also elevate the risk of drug interactions, unnecessary costs, and adverse effects.

Conclusion

The study reveals widespread use of proton pump inhibitors (PPIs) among hospitalized patients, with many prescriptions being inappropriate in terms of indication, dose, and frequency; only 4% of patients received fully appropriate therapy. Gastroenterology showed the highest adherence to proper prescribing practices, while gynecology and obstetrics had the lowest. Oral omeprazole, mainly hospital-supplied, was the predominant PPI, with a significant portion administered intravenously. These findings highlight the urgent need for evidence-based guidelines, standardized protocols, and targeted educational interventions to optimize PPI use, minimize adverse effects, and ensure cost-effective patient care.

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