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OPTIMIZING STRESS ULCER PROPHYLAXIS: A CLINICAL AND COST EVALUATION IN RSUD WATES INTERNAL MEDICINE WARD

Mega Octavia[1*], Ade Achmad Firmansyah[1], Ingenida Hadning[1]
[1] *School of Pharmacy, Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta, Indonesia*
**Email corresponding: aptmegaoctavia@gmail.com*

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ABSTRACT

The American Society of Health-System Pharmacists (ASHP) 1999 listed guidelines for providing stress ulcer prophylaxis (SUP) therapy as the standard of care for critical patients in the ICU. However, numerous studies have shown that most patients admitted to non-intensive care units continue to receive acid suppressant prescriptions, without appropriate indications or risk factors. This can lead to increased morbidity and increased patient care costs. This study aimed to determine the utilization profile of stress ulcer prophylaxis, its appropriateness, and the costs incurred by patients for SUP. This was an observational study with a cross-sectional design based on medical records. The study participants were inpatients from the Internal Medicine Polyclinic at Wates Hospital who met the inclusion criteria from January to December 2021. The study revealed that the H2 receptor antagonist (H2RA), proton pump inhibitor (PPI), sucralfate, and antacid groups received 57.9 %, 35.7%, 6.1%, and 0.3% of preventive drugs, respectively. Of the 215 patients, 76 received appropriate indications, whereas 139 received inappropriate indications based on the guidelines. During the study period, the cost of using stress ulcer prophylaxis for patients with appropriate indications was IDR 15,344,812 (76%), whereas the cost of using inappropriate stress ulcer prophylaxis was IDR 5,965,572 (28%) of the total cost. Factors such as the length of stay (LOS), type and cost of each medication, and frequency of medication administration can influence the high cost of inappropriately indicated patients.

Keywords: Stress ulcer prophylaxis (SUP), inpatients at Wates Hospital, therapy evaluation, cost analysis

INTRODUCTION

Stress-Related Mucosal Disease (SRMD) refers to the formation of lesions in the stomach or duodenum, which typically arise as a result of trauma or systemic illness. Histologically, ulcers are damaged in the mucosal layer of the digestive tract. This damage can extend to the muscularis mucosa, submucosa, or even deeper, which could cause serious bleeding in patients who are very sick (Goodman *et al*., 2014). According to a study, 75-100% of ICU patients and 1-6% of patients in regular care units experience upper gastrointestinal mucosal lesions and subepithelial bleeding within 24 hours of hospital admission. Although rare, bleeding from stress ulcers is a severe complication with an estimated mortality rate of 40–50%.(Bardou *et al*., 2015; Plummer *et al*., 2014).

The ASHP criteria evaluate the use of SUP. In short, the use of SUP is considered appropriate and not excessive if there is one absolute indication or two or more relative

indications (Wijaya *et al*., 2020). Stress ulcer prophylaxis (SUP) often uses Acid Suppressive Therapy (AST) or acid-suppressing therapies, such as proton pump inhibitors (PPI) and histamine-2 receptor antagonists (H2RA), to protect against and prevent gastric complications (Alshamsi *et al*., 2016). However, in direct clinical practice, there is often an increase in the use of acid-suppressing medications in hospitalized patients, without appropriate indications for their administration. Research from King Abdullah bin Abdulaziz University Hospital in Saudi Arabia supports this finding, revealing that out of 335 hospitalized patients who met the inclusion criteria, 256 (76.4%) received inappropriate indications for administering AST (Korayem *et al*., 2021). Other research has revealed that more than two-thirds of patients outside the intensive care units (non-ICU) have received inappropriate acid suppression therapy or SUP due to a lack of adequate risk factors (Malhis *et al*., 2019). Octavia, *et al*., (2024) also studied the use of stress ulcer prophylaxis outside of the ICU and found an 83.24% inaccuracy rate in the use of SUP for 283 patients, resulting in a total cost of Rp. 19,933,582.

Recent research has shown little evidence regarding the benefits of stress ulcer prophylaxis outside critical care. Excessive use of SUP can lead to increased healthcare costs and adverse drug events. (ADEs). In addition, undue and inappropriate prescription of AST can lead to long-term risks and complications, including nosocomial pneumonia and Clostridium difficile infection (CDI) (Buendgens, 2016; Mahdayana *et al*., 2020).

Motivated by this finding, the researchers aimed to understand the profile of stress ulcer prophylaxis usage and evaluate the therapeutic outcomes and costs incurred by patients undergoing inpatient care in the internal medicine department at Wates Regional Hospital between January and December 2021. Previous studies have shown that the use of stress ulcer prophylaxis that does not adhere to guidelines is extremely high in both healthcare services in Indonesia and abroad.

RESEARCH METHODS

Equipment and Materials

A medical record data collection sheet, writing tools for taking notes, and laptop were used. The laptop was utilized for processing patient therapy data and associated costs using Microsoft Excel and IBM SPSS Version 27. To ensure data accuracy, independent verification was conducted by another researcher. Patient medical records and guidelines for stress ulcer prophylaxis, specifically the American Journal of Health-System Pharmacy (ASHP) from 1999 and the Practice Management Guidelines for Stress Ulcer Prophylaxis from Stanford Hospitals and Clinics (2015), were used as references.

Research Procedure

1. Research Design and Participants

   We conducted an observational study using a cross-sectional design to assess the therapy and cost of preventing stress ulcers in hospitalized patients in the internal medicine ward. Medical records, obtained retrospectively at a single point in time, serve as the basis for patient therapy data collection, while the finance department of RSUD Wates sources treatment cost data for patients. All patients in the internal medicine ward at the RSUD Wates who received prophylactic stress ulcer therapy during the medical record period from January 2021 to December 2021 were included in this study.

   This study included all hospitalized patients in the internal medicine ward who received stress ulcer prophylactic agents and met the inclusion criteria. Eligible patients were those in the internal medicine ward who were receiving acid-suppressing drugs for stress ulcer prevention during treatment and were completely and legible**.** Patients with pre-existing gastric disorders, such as peptic ulcers and dyspepsia, were excluded, as were those diagnosed with gastrointestinal bleeding, evidenced by hematemesis or melena.
2. Sampling Size Calculation

We used the proportion estimation formula for the sample size calculation, making the following assumptions: the proportion of improper SUP usage was 83.2% (Octavia *et al*., 2024), the margin of error was 5%, and the confidence interval was 95%.

$$n = \frac{(1,96)^2 0,832(1-0,832)}{(0,05)^2} = 214,78 \qquad n = \frac{Z_{a/2^2} P(1-P)}{d^2}$$

We used a sample of 215 inpatients based on the sampling and population formula.

Data Analysis

In this study, we conducted a descriptive analysis to describe patient characteristics, such as gender, age, length of hospitalization, and risk factors. This analysis aimed to identify the profile of SUP used by inpatients in the internal medicine ward of the Sleman Regional Public Hospital. We also assessed the accuracy and inaccuracy of the indications for SUP use and calculated costs by multiplying the total number of appropriate and inappropriate therapeutic doses administered during hospitalization by the price of the drug used. Drug costs were determined based on standard prices from hospital records.

Based on published evidence-based guidelines and previous literature on SUP clinical practice, we established criteria to evaluate the appropriateness of SUP medication. We judged SUP medication to be appropriate for inpatients in the internal medicine department if they had one major or at least two minor risk factors (Armstrong *et al*., 1999; Parsons *et al*., 2015) (**Table I**.

Table I. Risk Factor for Stress Ulcer

The Presence of of one major risk factor from the following:
1. Respiratory failure: mechanical ventilation >48 h
2. Coagulopathy: platelet count <50,000/mm3 (50 × 109 /L), international normalized ratio >1.5, or partial thromboplastin time >2.0 times the control value
The presence of at least two minor risk factors of the following:
1. Head injury with a Glasgow Coma Score of ≤10 or an inability to obey simple commands
2. Thermal injury involving >35% of the body surface area
3. Partial hepatectomy
4. Hepatic or renal transplantation
5. Multiple traumas with the Injury Severity Score of ≥16
6. Acute renal failure or hepatic failure
7. Traumatic brain injury or spinal cord injury
8. Renal Insufficiency
9. Sepsis
10. Occult or overt bleeding for ≥6 days
11. Length of stay > 7 days
12. Corticosteroid therapy (>250 mg/d hydrocortisone or equivalent daily)
13. Using antiplatelet

Our primary outcome variable involved evaluating the appropriateness of SUP prescription patterns for inpatients in the Internal Medicine Department, as well as assessing the direct medical costs associated with stress ulcer prophylaxis. . This analysis specifically included the cost of prophylactic therapy and medical supplies related to drug administration**,** while other hospitalization costs were not considered

RESULTS AND DISCUSSION

1. Patient Characteristics

This study was conducted on inpatients in the internal medicine clinic who were prescribed acid-suppressing drugs for stress ulcer prophylaxis at Wates Regional General Hospital between January and December 2021. The study was approved by the ethics committee of Wates Hospital with the approval number KEPK/128/RS/XII/2022. Based on the analysis, the population of this study consisted of 332 patients; however, only 215 patients met the inclusion criteria, while 117 cases were excluded. This exclusion was due to several patients having a primary diagnosis of gastrointestinal bleeding, indicated by hematemesis or melena (3 patients), as well as diagnoses of stomach disorders, such as gastric ulcers and dyspepsia (9 patients). Additionally, some patients were excluded due to incomplete or untraceable medical records, which resulted from administrative issues, such as missing documentation or record misfiling, as well as actual patient data loss within the facility. This included **86** patients who did not receive stress ulcer prophylaxis agents, 19 patients whose inpatient progress notes were missing, and patients with other administrative issues that prevented proper data retrieval**.**

Table II. Characteristics of Inpatients in the Internal Medicine Clinic Receiving Stress Ulcer Prophylaxis at Wates Regional General Hospital for the Period of January-December 2021

Characteristic	Numbers of Inpatients (n=215)	
	Numbers	Percentage
Gender:		
Male	118	54,9%
Female	97	45,1%
Age (years):		
0 – 5	1	0,5%
5 – 11	1	0,5%
12 – 16	6	2,8%
17 – 25	16	7,4%
26 – 35	12	5,6%
36 – 45	35	16,3%
46 – 55	37	17,2%
56 – 65	50	23,3%
> 65	57	26,5%
Length of stay:		
≤ 7 days	153	71,2%
> 7 days	62	28,8%
Occupation:		
Farmer	49	22,8%
Entrepreneur	38	17,7%
Housewife	28	13,0%
Retiree	19	8,8%
Employee	16	7,4%
Civil Servant	12	5,6%
Laborer	6	2,8%
Educator	3	1,4%
Student	2	0,9%
Trader	2	0,9%

Sector Worker	2	0,9%
Military Personnel	1	0,5%
Others	37	17,2%
Risk Factors		
Major Risk Factors:		
Coagulopathy	29	13,5%
Minor Risk Factors:		
Renal Insufficiency	22	10,2%
Liver Failure	12	5,6%
Antiplatelet Use	50	23,3%
Congestive Heart Failure (CHF)	24	11,2%
Sepsis	25	11,6%
Anticoagulant Therapy	29	13,5%
High-Dose Corticosteroids	14	6,5%
Head Injury	9	4,2%
History of GI Bleeding	1	0,5%

The gender-based characteristics in this study showed that the majority of patients were male, with 118 individuals (54.9%), while female patients accounted for only 97 individuals (45.1%). These results are consistent with studies indicating that males are more at risk of experiencing gastrointestinal bleeding than females, with a ratio of (10.8% to 12.1%) (Tyas *et al*., 2020). Unhealthy lifestyle habits, such as smoking, can reduce mucus production, which protects the stomach from irritation. Thus, smokers are more susceptible to gastritis and peptic ulcers (Rujiantie *et al*. 2018).

The age range over 65 years was the most common group receiving stress ulcer prophylaxis, accounting for 57 individuals (26.5%). Research has revealed that the decline in stomach mucosal function, decreased stomach acid production, and the loss of nutritional factors in the stomach mucosa tend to worsen with age. The risk of gastric ulcers increases in patients over 60 years of age, with a recurrence rate twice as high as that in younger patients (Jiang *et al*., 2016).

For inpatients with a length of stay ≤ 7 days, 153 individuals (71.2%) had an average stay of 5 days, while 62 individuals (28.8 %) stayed for > 7 days. Farsaei *et al*. (2017) stated that excessive use of stress ulcer prophylaxis can be attributed to longer hospital stays. Another study revealed that extended prophylactic care affects the duration and frequency of hospitalization, which tends to increase the costs borne by the patients (Admaja *et al*., 2023). Additionally, a cross-sectional study in a government hospital's Internal Medicine Department found that 83.2% of inpatients received SUP without appropriate indications, leading to unnecessary costs. These findings indicate that inappropriate prophylaxis use significantly contributes to healthcare costs. Further analysis is needed to determine whether inappropriate prophylaxis occurred, such as prescribing SUP to low-risk patients or continuing therapy beyond the recommended duration. Identifying these patterns would provide deeper insights into the impact of prolonged prophylactic use on both clinical outcomes and healthcare costs (Octavia *et al*., 2024).

Farming is the most common profession among patients, accounting for 22.8% or 49 individuals. According to a survey conducted by Sani *et al.* (2017), farmers dominate the factors causing gastric diseases. This is due to their lack of attention to food types, such as overly spicy, acidic, and high-fat foods, as well as habits such as smoking and drinking coffee. Consuming 150 mg of caffeine, equivalent to 2-3 cups of coffee, increases stomach acid production, leading to excessive gas production in the stomach and resulting in complaints of bloating and irritation of the gastric mucosa (Zak *et al*., 2014).

The risk factors for inpatients in the internal medicine ward at Wates Regional General Hospital indicated in the research findings show that the use of antiplatelet agents is the most significant risk factor, accounting for 23.3%, with 50 patients receiving this treatment. Statistical analysis indicates that antiplatelet agents can significantly affect the occurrence of bleeding (Octavia *et al*., 2019). This aligns with studies indicating that dual antiplatelet therapy (clopidogrel, aspirin, and ticagrelor) can be a risk factor for gastrointestinal bleeding. Therefore, prophylactic gastric protection is recommended for patients receiving dual antiplatelet therapy (Bez *et al*., 2013; Lee, 2021).

2. Drug Usage Profile

The depiction of stress ulcer prophylaxis usage among inpatients in the Internal Medicine Clinic at Wates Regional General Hospital from January to December 2021 has been classified based on the types of medications used, as outlined in **Table III.** The table indicates that the most commonly used therapy for stress ulcer prophylaxis is acid suppressive therapy (AST), which includes the use of PPI (Proton Pump Inhibitors) and H2RA (H2 Receptor Antagonists). PPI and H2RA are used more frequently than antacids and sucralfate because of their ease of administration and higher effectiveness.

This study found that H2-receptor antagonists (H2RAs) were the most frequently prescribed agents for stress ulcer prophylaxis (SUP), despite proton pump inhibitors (PPIs) being known for their superior acid suppression. Several factors may contribute to the lower prescription rate of PPIs, including cost considerations, availability constraints, and physician's prescription habits. Studies have shown that H2RAs are often preferred in resource-limited settings because of their lower cost compared to PPIs, particularly in government hospitals, where budget constraints play a significant role in formulary decisions (Octavia *et al*., 2024).

Intravenous (IV) ranitidine was more frequently administered than oral formulations, which may be attributed to the hospital protocols that prioritize IV administration in critically ill or high-risk patients. Patients in the internal medicine ward who were unable to tolerate oral medications because of conditions such as gastrointestinal dysfunction or severe illness were more likely to receive IV formulations. Additionally, some physicians may perceive IV administration as providing more immediate and reliable acid suppression, leading to a preference for this route among hospitalized patients (Admaja *et al*., 2023).

The most prescribed type of H2RA was intravenous ranitidine, with a total of 1,485 administrations (49.3%). This aligns with research indicating that ranitidine has a faster onset of action than PPI, approximately 30 minutes, with a duration of action of up to 10 hours. Additionally, intravenous ranitidine has better solubility, which is advantageous for managing stress ulcer symptoms as patients require a quicker response (Goodman *et al*., 2014). Another study showed that H2 antagonists rarely cause nosocomial infections, particularly pneumonia (Mahdayana *et al*., 2020). The lower risk of nosocomial infections associated with H2 antagonists than with PPIs may be attributed to differences in their mechanisms of action. PPIs provide stronger acid suppression, leading to increased gastric pH, which can disrupt the gut microbiota and create a more favorable environment for opportunistic pathogens, such as *Clostridium difficile* (Freedberg *et al*., 2017). Additionally, higher gastric pH may facilitate bacterial overgrowth and aspiration, increasing the risk of ventilator-associated pneumonia in hospitalized patients (Barrett, Keely, Cole, 2021). In contrast, H2 antagonists provide moderate acid suppression without significantly elevating the gastric pH, thereby reducing the likelihood of such complications.

Table III. Profile of acid-suppressing medication usage as stress ulcer prophylaxis at the Wates Regional General Hospital for the periJanuary od–December 2021.

Stress Ulcer Prophylaxis	Numbers	Percentage
H2 Receptor Antagonist	190	57,9%
Proton Pump Inhibitor	117	35,7%
Sucralfate	20	6,1%
Antacid	1	0,3%
Total	**328**	**100%**

According to a study, H2RA (H2 Receptor Antagonists) are more effective than Proton Pump Inhibitors (PPI) as prophylaxis to prevent stress ulcers in patients with septic shock. The incidence of bleeding was reported to be 2.3% in the group of patients receiving H2RA, whereas in the PPI therapy group, the bleeding incidence rate was reported to be as high as 10% (Barletta, 2014).

Table IV. Classes of Stress Ulcer Prophylaxis Medications at Wates Regional General Hospital

Classes	Medication	Quantity	Frequency	Percentage
Proton Pump Inhibitor (PPI)	Injection Omeprazole	71	627	20,8%
	Injection Lansoprazole	16	79	2,6%
	Injection Esomeprazole	5	25	0,8%
	Omeprazole Capsules	14	86	2,9%
	Lansoprazole Tablets	11	74	2,5%
H2-Receptor Antagonist (H2RA)	Injection Ranitidine	163	1485	49,3%
	Ranitidine Tablets	26	344	11,4%
Sucralfate	Sucralfate Syrup	20	281	9,3%
Antacid	Antacid Syrup	1	14	0,5%
TOTAL		**327**	**3.015**	**100%**

The H2 receptor antagonist (H2RA) class, particularly ranitidine, is the most frequently prescribed acid-suppressing medication for inpatients in the internal medicine clinic at the Wates Regional General Hospital. Notably, the administration of intravenous ranitidine significantly exceeded that of the oral route, with 1,485 administrations (49.3%) compared to 344 administrations (11.4%) of ranitidine tablets. This finding corroborates the findings of Duffet *et al.* (2020), who reported that H2RAs account for 73% of prescribed medications, with intravenous ranitidine being the single most commonly prescribed agent at 63%. Similar results were observed in a study conducted at Dr. Soetomo General Hospital in Surabaya, where intravenous ranitidine was the predominant stress ulcer prophylaxis administered to patients undergoing digestive surgery, comprising 62% of the cases (Mahdayana *et al*., 2020).

The enhanced effectiveness of intravenous ranitidine compared to its oral counterpart is significant; intravenous ranitidine exhibits a substantially shorter onset of action, with intravenous administration requiring less than 15 minutes for onset, whereas oral ranitidine necessitates an onset time of 2-3 hours. Additionally, the superior

solubility of intravenous ranitidine further contributes to its efficacy in managing stress ulcer symptoms, allowing for a more rapid therapeutic response, which is essential for patient care in acute settings (Clark *et al*., 2009).

3. Evaluation of the Appropriateness of Prophylaxis Use

The evaluation of the appropriateness of stress ulcer prophylaxis use in **Table V** is based on the risk factors identified in patients, as documented in two guidelines for administering stress ulcer prophylaxis: the American Journal of Health-System Pharmacy (ASHP) from 1999 and the guidelines from Stanford Hospital and Clinics from 2015. Essentially, if a patient has at least one major risk factor or has two or more minor risk factors, then the use of stress ulcer prophylaxis is considered in accordance with therapeutic guidelines.

Table V. ***Evaluation of the appropriateness of stress ulcer prophylaxis at RSUD Wates for the period January–December 2021.***

Risk Factor	Numbers	Percentage
Appropriate Indication:		
1 major risk factor	30	14,0%
≥ 2 minor risk factors	46	21,4%
Total Appropriate Indication	**76**	**35,3%**
Inappropriate Indication:		
1 minor risk factor	73	34,0%
No risk factors	66	30,7%
Total Inappropriate Indication	**139**	**64,7%**
Total Patients	**215**	**100%**

The data in **Table V** aligns with the findings of Shin (2015), which reported that 52.2% of non-ICU patients received inappropriate acid suppression therapy prescriptions. Similar results were observed in a study by Sheikh-Taha *et al.* (2012), who noted that among 130 patients (85%) who received acid suppression therapy (AST), 16 (12.3%) had major indications for stress ulcer prophylaxis, 59 (45.4%) had two or more minor indications, and 44 (33.8%) received acid suppression therapy without appropriate indications.

A study conducted at a university hospital in Saudi Arabia identified several institutional factors that contribute to the inappropriate use of acid suppression therapy, including patient health conditions, age, and concurrent use of other medications. This finding aligns with research conducted at Wates Regional Hospital, which identified a Drug Related Problem (DRP) involving the use of stress ulcer prophylaxis (SUP) alongside other treatments that may reduce the effectiveness of the primary therapy. For instance, the use of proton pump inhibitors (PPIs) in combination with antiplatelet therapy has been shown to increase the risk of intracranial or gastrointestinal bleeding (Dewi, 2020; Tahir *et al*., 2021). Another institutional factor involves the perspective of prescribing physicians, as many healthcare providers in inpatient units perceive acid suppression therapy to be low-risk (Korayem *et al*., 2021).

Several studies have raised concerns regarding the practice of prescribing stress ulcer prophylaxis to low-risk patients such as those in general medical units, without supporting evidence. This practice is problematic because of the excessive use of acid suppression therapy without appropriate indications for stress ulcer prophylaxis or other acid-peptic disorders, which are often associated with increased risks, such as *Clostridium difficile* colitis and nosocomial pneumonia. Proton pump inhibitors (PPIs), such as omeprazole and lansoprazole, reduce gastric acid production. Gastric acid

serves as a natural physiological barrier to ingested pathogens. When gastric acid is reduced, the stomach environment becomes more alkaline, which significantly diminishes protective factors and renders patients vulnerable to intestinal infections (e.g., *Clostridium difficile*-associated diarrhea) and extra-intestinal infections (e.g., nosocomial pneumonia) (Buendgens, 2016).

4. Cost of Prophylaxis

According to Suherman *et al*., (2022), patients receiving stress ulcer prophylaxis (SUP) without appropriate indications experience a significant increase in medication costs. Consequently, an economic evaluation of prophylaxis costs was conducted at Wates Regional Hospital. Cost analysis was performed by calculating the total usage of injectable and oral SUP medications, using the unit prices for each drug. As shown in **Table VI,** the average treatment cost for patients with appropriate indications was significantly higher, with a difference of Rp. 210,905 compared with patients without appropriate indications, whose costs were approximately Rp. 42,918. The higher costs for patients with appropriate indications are likely influenced by several factors, such as the length of stay (LOS), unit prices of the medications, types of drugs administered, and frequency of drug administration.

Table VI. Cost of Stress Ulcer Prophylaxis Utilization at Wates Regional Hospital from January to December 2021

Indication	Numbers	Total Cost	Average	%
Inappropriate indication	139	Rp. 5.965.572	Rp. 42.918	28%
Appropriate indication	76	Rp. 15.344.812	Rp. 210.905	72%
Total cost		**Rp. 21.310.384**	**Rp. 99.118**	**100%**

In line with the study conducted by (Rachim *et al*., 2019), it can be concluded that there is a positive correlation between the duration of patient hospitalization and the associated costs of care. This finding is consistent with the results from the Wates Regional Hospital, where the average length of stay for patients with appropriate indications was longer, reaching an average of 8 days, compared to 6 days for patients without appropriate indications.

Longer hospitalization duration was associated with an increased frequency of medication administration. In this study, patients with appropriately indicated prophylaxis received an average of 17 doses, whereas those with inappropriate indications received an average of only 12 doses. As noted in previous studies, increased medication costs may result from several factors, including a higher number of secondary diagnoses. In this study, it was found that among 76 patients with appropriate indications, there was an average of at least three secondary diagnoses per patient, whereas among 139 patients with inappropriate indications, there was an average of only two secondary diagnoses per patient (Wahyuni, Witcahyo and Herawati, 2023). Furthermore, patient costs can be influenced by the type of medication administered. The cost details were categorized based on the class of the acid-suppressing drugs, as shown in **Table VII**.

Table VII. Costs Based on Stress Ulcer Prophylaxis Drug Classes at Wates Regional Hospital, January-December 2021

Indication	Drug Class	Total Cost	Average
Appropriate Indication	PPI	Rp. 13.934.777	Rp. 278.696
	H2RA	Rp. 1.168.007	Rp. 34.353
	Sucralfate	Rp. 242.028	Rp. 34.575
TOTAL		**Rp. 15.344.812**	**Rp. 168.624**
Inappropriate Indication	PPI	Rp. 3.669.479	Rp. 74.887
	H2RA	Rp. 2.130.892	Rp. 15.668
	Sucralfate	Rp. 157.536	Rp. 17.504
	Antacid	Rp. 7.665	Rp. 7.665
TOTAL		**Rp. 5.965.572**	**RP. 30.593**

The cost calculation consists of two components: medical costs, which include the price of individual medications used, and non-medical costs, which include medical equipment related to the administration of prophylaxis, such as injection syringes. The analysis shows that the average cost of care for patients with appropriate indications is significantly higher than that for those without, with a difference of approximately Rp. 168,624. Additionally, the average cost of PPI medications was also higher, reaching approximately Rp. 278,696 compared with other AST therapies. These factors may explain why the average cost of inappropriate stress ulcer prophylaxis tends to be lower than that of the appropriate prophylaxis.

Based on the findings presented, it can be concluded that collaboration among clinical pharmacists, physicians, and trained pharmaceutical technology departments can significantly contribute to more cost-effective patient care, ultimately leading to reduced healthcare costs and improved quality of medical services. Therefore, it is crucial to establish and adhere to SRMD prophylaxis guidelines to enhance patient care standards (Hong *et al*., 2015; Mahmoudi *et al*., 2019).

The present study had several limitations. As an observational study with a cross-sectional design, a causal relationship exists between inappropriate stress ulcer prophylaxis (SUP) use and increased healthcare costs or morbidity. Additionally, because the analysis was based on medical records, some undocumented patient risk factors may have influenced the accuracy of determining appropriate or inappropriate indications. A significant amount of data was excluded due to missing or incomplete medical records, such as the absence of inpatient progress notes, lack of documentation on SUP administration, or cases where patients did not receive SUP agents. These exclusions may have impacted the representativeness of the study population and introduced potential selection bias. Furthermore, the study was conducted in a single hospital setting, limiting the generalizability of the findings to other healthcare institutions with different prescribing patterns and policies. Future research should consider prospective study designs to capture more detailed clinical data and assess the direct impact of inappropriate SUP use on patient outcomes, such as the incidence of nosocomial pneumonia or *Clostridium difficile* infection. Additionally, further studies should explore the effectiveness of guideline-based interventions or educational programs to optimize SUP prescription practices and reduce unnecessary medication use in non-ICU settings.

CONCLUSION

The research concluded that the H2RA class accounts for 57.8% of stress ulcer prophylaxis administration in inpatient internal medicine patients at Wates Regional Hospital during the 2021 period, followed by proton pump inhibitors (PPI) at 35.8%, sucralfate at 6.1%, and antacids at 0.3%. 139 patients (64.7%) out of a total of 215 patients fell into the category of inappropriate indication, while 76 patients (35.3%) received appropriate

prophylaxis. The expenditure on the use of stress ulcer prophylaxis according to indications amounted to Rp. 15,344,812, with an average Rp. 210,905, whereas the cost of stress ulcer prophylaxis was not in accordance with the indications was Rp. 5,965,572 with an average Rp. 42,918.

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