Eduvest – Journal of Universal Studies
Volume 6 Number 4, April, 2026
p- ISSN 2775-3735- e-ISSN 2775-3727

Analysis of Predictors Associated with Acid Suppressant Drug Related Problems (DRPs) among Inpatients at Dr. Mintohardjo Naval Hospital in 2024

Deki Yuliya Putra*, Atika Wahyu Puspitasari, Siti Fauziyah
Universitas Indonesia
Email: dekiyp1407@gmail.com*, atikawahyu@farmasi.ui.ac.id, sifauziyah@gmail.com

Keywords
gastric acid suppressants, drug-related problems, pcne, predictors, inpatients

Abstract
The use of gastric acid suppressants such as Proton Pump Inhibitors (PPI) and Histamine-2 Receptor Antagonists (H2RA) is very common in inpatient settings, but inappropriate use is often found, posing risks to patient safety and cost efficiency. This study aims to analyze the relationship of predictors (age, number of drugs, number of comorbidities, and length of stay) to the occurrence of Drug-Related Problems (DRPs) in inpatients using gastric acid suppressants. This study was an observational study with a cross-sectional design was conducted retrospectively using patient medical record data at Rumkital Dr. Mintohardjo from January to December 2024. A sample of 432 patients was taken using a simple random sampling technique based on inclusion criteria. DRPs were identified using the Pharmaceutical Care Network Europe (PCNE) V9.00 instrument. Data analysis used the chi-square test for bivariate analysis and binary logistic regression for multivariate analysis. DRP characteristics were dominated by treatment safety issues (70.4%), particularly adverse drug events, with the most frequent drug interaction being ranitidine and ketorolac. Bivariate analysis showed that comorbidities (p=0.029), length of stay (p=0.010), and number of drugs (p=0.000) significantly influenced the number of DRPs. Multivariate analysis identified the number of drugs as the most influential predictor; inpatients receiving ≥10 drugs had a 2.733 times higher risk of experiencing ≥2 DRPs (p=0.000; OR 2,733; 95% CI 1.767-4.229)

INTRODUCTION

Gastric acid suppressant drugs are one of the groups of therapies that are commonly prescribed globally. This therapy plays a crucial role in the management of various gastrointestinal conditions. The pharmacological approach in this therapy generally involves the utilization of two main classes of therapeutic agents, namely proton pump inhibitors (PPIs) that work by suppressing gastric acid production at the cellular level, or H2 receptor antagonists (H2RA) that selectively inhibit the action of histamine on H2 receptors in gastric parietal cells, thereby reducing acid secretion. The use of PPIs and H2RA, has become a common therapeutic intervention in clinical practice, especially in inpatient settings. These drugs are effective in reducing stomach acid production, making them useful for treating various conditions such as peptic ulcers, gastroesophageal reflux disease (GERD), and as a prophylaxis of stress ulcers in high-risk patients. Although its effectiveness is proven, the data show significant problems regarding the appropriateness of the use of gastric acid suppressants, which have the potential

to have a negative impact on patients and the health system (Begg et al., 2023; Hussain Sabir et al., 2025; Laoveeravat et al., 2020; Posada Bustos et al., 2018; Shanika et al., 2023; Zhou et al., 2019).

Drug-related problems have a fairly high prevalence, reaching 45.1% in various medical specialties in the world, especially in the elderly population who tend to experience polypharmacy and multimorbidity. Meanwhile in Indonesia, patients with chronic diseases have drug-related problems that most often occur are ineffective therapy (74.9%) and untreated indications (68.3%), improper dosage (50.3%), unnecessary therapy (34.7%), and the rarest is an unexpected drug reaction (ROTD) (10.2%). This is in line with the findings of a study conducted in Jordan that found that 86% of the use of PPIs in patients was not necessary, as it did not correspond to the indications p there were patients receiving treatment. This figure reflects a global problem, where 50-70% of patients receive a prescription for gastric acid suppressant therapy without proper indications according to Garin et al., (2021) Alqudah et al., (2016); Tampa et al., (2021) *the Food and Drug Administration* (FDA). Data shows that 65% of the prescription of gastric acid suppressant drugs does not meet clinical guidelines. In addition, from 2011 to 2013, 72-84% of the use of gastric acid suppressant drugs was found to be inappropriate. This problem of inaccuracy of use is not only limited to indications, but also includes the frequency and duration of administration. Prophylaxis of stress ulcers is often administered with a frequency of 1-3 times/day, either singly or in combination, through the oral or intravenous route. Although PPI as a prophylaxis for stress ulcers had an effectiveness of 61.4-77.4%, 56% of patients were identified as using PPIs inappropriately. The rate of patients receiving PPI and H2RA inappropriately reached 76%. Ironically, patients who were supposed to be at high risk of bleeding but did not receive treatment had a four-fold higher risk than patients who received the drug inappropriately. This situation underscores the urgency to address the problem of inappropriateness in the use of gastric acid suppressants in hospitals (Albugeaey et al., 2014; Korayem et al., 2021; Mahdayana et al., 2020; Octavia et al., 2019; Posada Bustos et al., 2018; Singh et al., 2016).

The Indonesian Navy Hospital (Rumkital) Dr. Mintohardjo Jakarta, as the main referral facility of the Indonesian Navy in the western region, has a crucial role in providing health services and medical support for TNI soldiers, especially Indonesian Navy soldiers and their families. Its reputation for providing comprehensive healthcare services, ranging from general services to specialties, makes it an attractive representation of the dynamics and challenges faced by modern hospitals in Indonesia. Not only that, this hospital also serves the general public who need treatment. As an accredited hospital, Rumkital Dr. Mintohardjo is responsible for providing high-quality healthcare services, especially in the inpatient unit, with a focus on patient safety Rumkital Dr. Mintohardjo, as one of the leading hospitals with a long history of serving the community, attracts attention as a significant research location and patient population served, potentially resulting in the discovery of drug-related problems (São Paulo et al., 2024).

Analysis of drug-related problems with the use of gastric acid suppressants plays a crucial role in efforts to improve the quality of health services and cost efficiency. Improper or excessive use not only has the potential to cause adverse side effects such as nausea, vomiting, headaches, and diarrhoea but also contributes to an increase in unnecessary medical costs. Understanding the use of gastric acid suppressant drugs in depth is essential to optimize patient therapy and minimize the risk of side effects. Research shows that several predictors play a significant role in drug-related problems (MTOs) in inpatients. Age, for example, is a known predictor of causing MTO. This data is reinforced by the study of Wilmer et al. (2015), and other studies by Octavia et al. (2019) and Luo et al. (2017) also show a link between age and drug problems. The presence of comorbidities or comorbidities also increases the risk (Korayem et al., 2021). The amount of medication consumed is closely related to the increased

morbidity of the disease that causes MTO, as shown by Zulkarnaini & Martini (2019) as well as Singh et al. (2016) and Posada Bustos et al. (2018). Finally, shorter duration of hospitalization can reduce the risk of adverse events, as concluded by Sinjal et al. (2018). By analyzing these predictors, hospitals and healthcare providers can develop more effective strategies to improve patient safety and treatment efficiency (Kate et al., 2023; Mohamed et al., 2023; Tezel Yalçın et al., 2025).

In the classification of Drug-Related Problems (MTOs), the instrument used, namely *Pharmaceutical Care Network Europe* (PCNE) V9, is used to identify, classify, and document MTOs that occur in patients. The selection of this instrument was based on its ability to provide a comprehensive and standardized framework for MTO data collection. The accuracy and reliability of this instrument have been internationally tested and widely used in a wide range of pharmaceutical nursing studies, making it an ideal choice for ensuring consistency and comparison of results with other studies (Satria et al., 2022). Therefore, research that focuses on the analysis of predictive relationships with MTOs of gastric acid suppressants is important to encourage more rational prescribing practices, improve service quality, and achieve cost efficiency in the health system.

Problem Formulation

The use of acid suppressant drugs is a common practice in managing various conditions related to stomach acid in the hospital environment, including at Rumkital Dr. Mintohardjo. Potential improper or excessive use can have negative implications for patient outcomes and cost efficiency. Therefore, this study aims to analyze the presence of a predictor relationship with MTO in inpatients who use gastric acid suppressant drugs in hospitals. Identifying predictors is critical because it can improve patient safety, optimize clinical outcomes, and reduce health costs due to unnecessary treatment or preventable complications.

Hypothesis

There was an association between predictors such as age, number of drugs, number of comorbidities, and length of hospitalization on the incidence of MTO in inpatients using gastric acid suppressant drugs at Rumkital Dr. Mintohardjo.

Research Objectives

General Purpose

This study aims to analyze the predictor relationships that contribute to the incidence of MTO in inpatients at Rumkital Dr. Mintohardjo.

Special Purpose

a. To obtain an overview of demographic and clinical characteristics in inpatients using gastric acid suppressant drugs at Rumkital Dr. Mintohardjo.
b. Identify the type of MTO based on PCNE V9.00 in inpatients using gastric acid suppressant drugs at Rumkital Dr. Mintohardjo.
c. Identify the cause of MTO based on PCNE V9.00 in inpatients using gastric acid suppressant drugs at Rumkital Dr. Mintohardjo.
d. Analyze the relationship between predictors, namely age, number of drugs, number of comorbidities, and length of hospitalization to the incidence of MTO in inpatients using gastric acid suppressant drugs at Rumkital Dr. Mintohardjo.

Research Benefits

Benefits for Colleges

This research has the potential to generate in-depth and specific new knowledge regarding a variety of complex problems associated with the use of gastric acid suppressants in inpatients. Thus, the findings of this study are expected to fill the existing knowledge gap and provide unique insights into the hospital's clinical practice.

Benefits for Rumkital Dr. Mintohardjo and health workers

The results of this study can provide valuable information about the pattern of use of gastric acid suppressants, so that hospitals can identify areas that need improvement in the practice of prescribing and using drugs. This has the potential to improve the quality of pharmaceutical services and overall patient care. The data from this study can be used as a basis for drafting or updating policies and guidelines for the use of gastric acid suppressants at Mintohardjo Hospital, ensuring more rational practices and in accordance with standards

Benefits for researchers

The results of this study can increase the knowledge and understanding of researchers regarding the appropriate and appropriate use of gastric acid suppressant drugs in inpatients so as to obtain optimal treatment results.

RESEARCH METHODS

Research Design

This study used an observational method with *a cross-sectional* design. The data used were secondary data from the medical records of inpatients at Rumkital Dr. Mintohardjo during the period from January to December 2024. A retrospective approach was chosen to analyze the MTO of gastric acid suppressant drug use by analyzing already recorded data, allowing the identification of patterns and associated factors without direct intervention on patients or clinical practice.

Research Location and Time

The research was carried out at Rumkital Dr. Mintohardjo, a public hospital located on Jl. Bendungan Hilir No.17, RT.4/RW.3, Bendungan Hilir, Tanah Abang District, Central Jakarta City, Special Capital Region of Jakarta. The research time was August to December 2025 and the data collection period: January to December 2024.

Population and Research Sample

Research Population

The population of this study is all inpatients at Rumkital Dr. Mintohardjo during the period from January to December 2024 who received gastric acid suppressant drugs.

Research Sample

The sample of this study is all inpatients at Rumkital Dr. Mintohardjo during the period from January to December 2024 who received gastric acid suppressant drugs that meet the inclusion criteria.

Inclusion Criteria:

- Receive PPI or H2RA gastric acid suppressant drug therapy during treatment.
- Complete and accessible medical records.
- Age ≥ 18 years old

Exclusion Criteria:

- Patients with a length of stay of less than 24 hours.
- Pregnant patients.
- HCU and ICU inpatients.

Sampling Techniques

The number of samples will be determined based on the total population that meets the inclusion criteria. All patients who met the inclusion criteria would be included in the study using *simple random sampling*. The minimum number of samples used in this study is calculated based on the formula for calculating the required samples, with the following formula:

$$n = \frac{Z^2 \cdot P(1-P)}{E^2}$$

Description :

n = minimum sample number required
Z = Z-value of the standard normal distribution corresponding to the level trust (e.g., 1.96 for a 95% confidence level).
P = estimated proportion of the population (if unknown, usually used 0.5 to get the maximum number of samples).
E = margin of error.

So that:

$n = \frac{1,96^2 * 0,5(1+0,5)}{0,05^2} =$

$n = = 384.16 \sim 385 \text{ samples} \frac{0,9604}{0,0025}$

How Sampling Works

The steps taken in sampling are as follows:

1) Access the patient's physical medical records and record them accurately and in accordance with the records contained in the medical records which include:
- Patient Data: Age, sex, primary diagnosis at admission, comorbidities, length of hospitalization.
- Risk Factors: History of use of other medications, dosage and type of gastric acid suppressant medications used, frequency, route of administration, and start/end date of medication administration or duration of treatment.
- Drug-Related Problems: Symptoms of side effects (e.g., nausea, diarrhoea, headache), possible drug interactions, or therapy failure.

2) The data is recorded every day during the patient's treatment and is observed if there are any changes in the medication used (dosage, type of drug, frequency, route of administration, interaction and duration of treatment) as well as symptoms of side effects experienced by the patient during treatment.
3) Once the data is collected, *double-check* to make sure there are no errors

Concept Framework

Figure 1. Research concept framework

Data Processing and Data Analysis

Data was obtained from the medical records of Rumkital Dr. Mintohardjo during the period of 2024.

Data Processing

Editing

This activity is carried out by checking the completeness of the data obtained from medical records.

Coding

This activity is carried out by providing code on the data obtained to facilitate data processing. Coding is carried out on free and bound variables, with code 1 if it has a risk factor and code 0 if it does not have a risk factor.

***Entry* Data**

This activity is carried out by entering the data that has been given a code into the statistics program. In this study, the statistical program used is the SPSS program.

Data Cleaning

This activity is carried out by re-checking the data that has been entered into the program, to ensure that there are no input errors.

Data analysis

Univariate Analysis

This analysis was carried out to obtain an overview of the characteristics of the research subjects consisting of the frequency and proportion distribution of each variable, both independent variables and bound variables. The data will be presented on the frequency distribution table.

Bivariate Analysis

Bivariate analysis was performed to analyze the relationship of bound variables with independent variables. The statistical test for bivariate analysis is presented in table 3.4 below.

Table 1 Bivariate Analysis Statistical Test

Yes	Independent Variables	Dependent Variable	Statistical Test
1	Age	MTO	Chi-square test
2	Number of Drugs	MTO	Chi-square test
3	Number of Comorbidities	MTO	Chi-square test
4	Length of Stay	MTO	Chi-square test

Multivariate Analysis

Multivariate analysis was conducted to analyze the influence of dependent and independent variables on the incidence of MTO. In this study, the multivariate analysis that will be used is the binary *logistic regression test*. The variables that will be included in the multivariate analysis are those that in bivariate analysis have a p< value of 0.25 and variables that based on existing theories have an important substance to the occurrence of MTO. The relationship between variables is expressed by the odds (Hastono & Sabri, 2013) *ratio* (OR) value.

RESULTS AND DISCUSSION

Identifying Drug-Related Problems in Inpatients

Drug-Related Problems in Inpatients

This study succeeded in revealing a significant picture of the complexity of patient treatment, where a total of 759 drug-related problems (MTOs) were found out of a total of 432 patients observed. Statistically, this figure shows that the average burden of treatment risk reaches 1.76 problems per patient, with variations in the number of MTOs that vary from 1 to 4 problems in each individual. To understand the dynamics and root causes of each type of problem, complete data has been presented in Table 2 in this chapter.

Table 2 Number and Type of MTOs in Inpatients for the Period of 2024 (n = 759)

Types of MTO	Causes of MTO	Case	Quantity
P1 Treatment Effectiveness			**44 (5,8%)**
P1.1 No effect of drug therapy			0 (0,0%)

Types of MTO	Causes of MTO	Case	Quantity
P1.2 Effects of drug therapy are not optimal			
	C1.4 Improper combination of drugs	Interactions of omeprazole and clopidogrel (P50, P195, P253, P282, P314)	5 (0,7%)
		Interaction of omeprazole and aspilet (P50, P271, P303)	3 (0,4%)
		Interaction of omeprazole and nitrokaf (P50, P271)	2 (0,3%)
		Others (P5, P50, P68, P70, P72, P82, P88, P139, P185, P250, P271, P370, P418)	25 (3,3%)
	C3.1 Drug dose too low	Patients taking lansoprazole at a dose of 1 x 10 mg (P82)	1 (0,1%)
	C3.3 Low-dose regimen	Patients taking ranitidine at doses of 1 x 50 mg (P11, P14, P290, P312, P383, P389)	6 (0,8%)
		Patients taking omeprazole at a dose of 1 x 20 mg (P43, P78)	2 (0,3%)
P1.3 Untreated symptoms or indications			0 (0,0%)
P.2 Medication Safety			**534 (70,4%)**
P2.1 Adverse (probable) drug events occur			
	C1.4 Improper combination of drugs	Interactions of ranitidine and ketorolak (P14, P17,P29, P30, P66, P70, P100, P123, P125, P126, P127, P137, P141, P143, P144, P150, P151, P162, P166, P167, P185,	76 (10,0%)
Types of MTO	Causes of MTO	Case	Quantity
	C1.4 Improper combination of drugs	P187, P189, P192, P203, P207, P212, P216, P218, P219, P225 P226, P230, P244, P248, P256, P263, P266, P268, P269, P274, P275, P276, P278, P280, P285, P287, P288, P290, P296, P309, P317, P318, P319, P320,P326, P329, P340, P341, P355, P357, P368, P371, P375, P383, P387, P388, P389, P390, P392, P396, P401, P408, P411, P416, P422)	76 (10,0%)
		Interactions of omeprazole and atorvastatin (P4, P149, P204, P213, P252, P255, P330, P405)	8 (1,1%)
		Omeprazole and furosemide interactions (P5, P7, P50, P255, P273, P399)	6 (0,8%)
		Other (P1, P5, P7, P8, P9, P14, P25, P50, P53, P54, P68, P81, P82, P83, P84, P88, P94, P100, P116, P120, P138, P139, P141, P154, P168, P169, P185, P192, P220, P254, P255, P271, P281, P284, P313, P314, P328, P342, P359, P399)	120 (15,8%)

	C3.2 Too high a dose of the drug	Patients taking ranitidine injection at doses of 2 x 50 mg (P1, P9, P15, P17, P20, P22,	171 (22,5%)
Types of MTO	Causes of MTO	Case	Quantity
	C3.2 Too high a dose of the drug	P24, P25, P29, P30, P31, P33, P47, P51, P57, P61, P66, P68, P69, P73, P76, P77, P79, P80, P81, P83, P84, P90, P91, P92, P93, P94, P96, P97, P98, P99, P100, P101, P102, P103, P105, P106, P117, P121, P122, P123, P125, P126, P127, P130, P131, P137, P139, P141, P143, P144, P146, P150, P151, P154, P161, P162, P166, P167, P180, P185,P186, P187, P189, P192, P197, P198, P201, P202, P203, P205, P207, P210, P211, P212, P216, P217, P218, P219, P220, P225, P226, P227, P229, P230, P236, P238, P238, P220 239, P244, P245, P248, P251, P256, P262, P265, P266, P268, P274, P275, P276, P280 P281, P287, P288, P296, P299, P306, P309, P317, P318, P319, P320, P321, P322, P323, P326, 329, P335, P336, P340, P341, P344, P355, P357, P367, P368, P369, P371, P372, P375, P379, P380, P385, P386, P387, P388, P390, P391, P392, P393, P395, P396, P402, P404, P406,	171 (22,5%)
Types of MTO	Causes of MTO	Case	Quantity
	C3.2 Too high a dose of the drug	P408, P409, P410, P411, P413, P422, P423, P424, P426, P429, P430, P431, P432)	171 (22,5%)
		Patients taking lansoprazole at doses of 2 x 30 mg (P74, P181, P346, P418)	4 (0,5%)
	C3.4 Overdose regimen	Patients taking omeprazole at doses of 2 x 40 mg (P2, P3, P7, P8, P10, P12, P13, P18, P19, P21, P26, P28, P32, P34, P37, P38, P39, P41, P48, P49, P50, P52, P58, P59, P60, P62, P64, P65, P67, P70, P71, P72, P75, P85, P87, P107, P108, P109, P110, P111, P113, P114, P115, P116, P118, P119, P120, P128, P132, P133, P134, P140, P145, P147, P148, P152, P156, P159, P163, P168, P171, P172, P174, P176, P177, P191, P193, P194, P204, P208, P214, P215, P221, P223, P231, P231, P231, P191, P193, P204, P208, P214, P215, P221,	145 (19,1%)

		P223, P231, P231, P191 234, P237, P242, P246, P247, P250, P253, P254, P258, P260, P264, P267, P270, P273, P277, P279, P282, P283, P292, P294, P295, P297, P300, P301, P303, P305, P307, P311, P320, P325, P327, P328, P330,	
Types of MTO	Causes of MTO	Case	Quantity
	C3.4 Overdose regimen	P331, P333, P334, P337, P339, P342, P343, P345, P347, P350, P351, P352, P354, P358, P359, P360, P361, P362, P364, P365, P366, P370, P374, P377, P381, P382, P384, P394, P397, P400, P403, P412, P414, P420, P421, P425, P427, 428)	145 (19,1%)
		Patients taking ranitidine injection at a dose of 3 x 50 mg (P70, P320, P401)	3 (0,4%)
		Patients taking omeprazole at a dose of 3 x 40 mg (P104)	1 (0,1%)
P3 Others			**181 (23,8%)**
P3.1 Treatment issues related to cost-effectiveness			0 (0,0%)
P3.2 Unnecessary treatment			
	C1.1 Drugs are not in accordance with the guidelines/formulary	Patients using omeprazole for more than 3 days (P7, P8, P10, P13, P21, P32, P34, P38, P39, P49, P50, P58, P64, P67, P71, P75, P85, P87, P95, P108, P110, P111, P113, P114, P116, P120, P124, P133, P134, P145, P148, P159, P164, P169, P170, P171, P172, P176, P177, P191, P193, P194, P195, P214, P215, P221, P231, P234, P237, P240, P247, P250, P253, P257, P264, P270,	93 (12,7%)
Types of MTO	Causes of MTO	Case	Quantity
	C1.1 Drugs are not in accordance with the guidelines/formulary	P279, P283, P294, P295, P300, P301, P305, P307, P311, P315, P330, P331, P342, P345, P347, P349, P351, P354, P358, P359, P360, P361, P364, P365, P366, P374, P377, P382, P384, P394, P400, P414, P415, P420, P421, P427)	93 (12,7%)
	C1.3 No indication for the drug	Patients were using unindicated acid suppressants (P3, P9, P21, P27, P40, P73, P74, P78, P80, P83, P86, P88, P90, P108, P115, P116, P117, P121, P124, P131, P136, P139, P146, P147, P153, P158, P160, P161, P164, P173, P174, P177, P180, P182, P190, P195, P197, P198,	82 (10,8%)

		P200, P205, P210, P214, P217, P229, P232, P234, P237, P239, P241, P243, P245, P253, P254, P261, P262, P264, P265, P270, P272, P275, P276, P278, P280, P286, P289, P298, P302, P306, P313, P328, P335, P337, P344, P347, P351, P364, P370, P374, P391, P394, P397, P407, P412, P431)	
Types of MTO	Causes of MTO	Case	Quantity
	C1.5 Duplication of inappropriate therapeutic groups or active ingredients	The patient used 2 acid-suppressant drugs, namely ranitidine and omeprazole (P9, P80, P83, P104, P415, P431)	6 (0,8%)
P3.3 Unclear drug-related issues that require further clarification (please use only as an alternative)			0 (0,0%)
Total 432 Patients			759 (100%)

Remarks: MTO, drug-related issues.

The type of MTO in this study was dominated by treatment safety (70.4%) with a secondary domain in the form of adverse drug events (possible) occurring. Drug-drug interactions (210), treatment safety problems are mostly caused by overdose of drugs (175), and over-dosing regimens (149). The drug-drug interactions were dominated by the interactions of ranitidine and ketorolak (76), omeprazole and atorvastatin (8), and omeprazole and furosemide (6). This can be caused because the therapy of acid-suppressing drugs, ranitidine and omeprazole is a therapy that is widely used by inpatients at Rumkital Dr. Mintohardjo. Overdose of the drug was most commonly found in the use of ranitidine (171) and lansoprazole (4). Overdose regimens are found in the use of ranitidine (3), and omeprazole (1). In line with these findings, previous research referring to the PCNE classification system version 9.1 revealed that drug-related problems in the patient population were significantly dominated by drug safety. The findings in this study show significant consistency with the previous literature, which collectively confirms that the main barrier to treatment effectiveness centers on the achievement of suboptimal therapeutic effects. This indicates that even if medical interventions have been given, the expected clinical outcomes are often not met to the fullest (Febriani et al., 2020; Titiesari et al., 2022).

The problem of non-optimal therapeutic effects is mostly caused by drug-drug interactions (35), under-dose regimens (7), and over-dose drugs (1). The drug interactions were dominated by the interactions of omeprazole and clopidogrel (5), omeprazole and aspilet (3), and omeprazole and nitrokaf (2). This can be caused because the therapy of acid-suppressing drugs, namely omeprazole, is a therapy that is widely used by inpatients at Rumkital Dr. Mintohardjo. Too low doses of the drug were found in the use of lansoprazole (1). Lower dose regimens were found in the use of ranitidine (6) and omeprazole (2), respectively. In this study, other problems were dominated by secondary domains in the form of drugs not in accordance with the guidelines/formularies (93). Other problems are the lack of indications for the drug (82) and the lack of duplication of the therapeutic group or inappropriate active ingredient (6).

Causes of Drug-Related Problems in Inpatients

The causes of MTO in this study were dominated by drug selection (56.1%) and dose selection (43.9%). The causes of MTO in inpatients can be seen in Table 4.2. In this study, the causes of MTO dosage selection were too high a drug dose (23.1%), too frequent a dosing

regimen (19.6%), under-dose regimen (1.1%), and too low a dose (0.1%). Overdose selection of drugs is dominated by ranitidine use (174), and overdose regimens are caused by omeprazole use (146). Based on the literature, the recommended dose of ranitidine in patients is 50 mg/day, while the dose of omeprazole is 40 mg/day (DiPiro et al., 2020). In line with the conclusions of Fahmi et al. (2020), the data obtained in this study show a tendency where too high doses dominate the spectrum of drug-related problems. These findings confirm the importance of a more rigorous pharmacotherapy evaluation in the aspect of dose selection to minimize the risk of toxicity or unwanted side effects for patients. (Fahmi et al., 2020) A low-dose regimen was found in the use of the drug ranitidine (6). The selection of too low a dose of the drug is due to the use of lansoprazole (1). Based on the information on omeprazole drugs, the recommended dose of omeprazole for patients is 20-40 mg/day. Meanwhile, lansoprazole is recommended with a dose of 15-30 mg/day.

The next cause of MTO was drug-drug interactions (32.3%). The drug interactions were dominated by the interactions of ranitidine and ketorolak (76), omeprazole and atorvastatin (8), and omeprazole and furosemide (6). This is because acid suppressant drug therapy is a therapy that is widely used by inpatients at Rumkital Dr. Mintohardjo. The determination of drug interactions is based on the time of administration of drugs recorded in the patient's medical records, so that the likelihood of drug interactions can be estimated. Of the total 759 MTOs, 18 problems were caused by drug interactions of major severity, 117 problems were caused by drug interactions of moderate severity, and 110 problems were caused by drug interactions of minor severity.

The causes of MTO drug selection were dominated by drugs not in accordance with the guidelines/formulary (12.3%), no indication of drugs (10.8%), and duplication of therapeutic groups or inappropriate active ingredients (0.8%). The use of drugs not in accordance with the guidelines/formularies was found in the use of omeprazole (93), while no indication of the drug was found in the use of omeprazole (43) and ranitidine (36). The occurrence of duplication of therapeutic groups or inappropriate active ingredients was found in patients taking the drugs ranitidine and omeprazole simultaneously (6).

Predictor Relationship and Number of Drug-Related Problems

Bivariate analysis was performed using the chi-square test. The chi-square test was used to determine the relationship between age type, number of comorbidities, length of hospitalization, and number of medications to the number of MTOs. The results of bivariate and multivariate analysis of the relationship between risk factors and the number of MTOs can be seen in Table 3.

Table 3 Results of Bivariate and Multivariate Analysis of Predictor Relationships and Number of MTOs

Predictors	Number of MTOs		Bivariate Analysis	Multivariate Analysis		
	<2 MTO	>2 MTO	Value p	OR	95% KI	Value p
Gender			0,171			
Male	105 (52,5%)	137 (59,1%)				
Women	95 (47,5%)	95 (40,9%)				
Age			0,313			
18-44 Years	93 (46,5%)	101 (43,5%)				
45-59 Years	62 (31,0%)	64 (27,6%)				
≥60 Years	45 (22,5%)	67 (28,9%)				
Comorbidities			0.102	1,059	0,705-1,591	0,782
None	140 (70,0%)	143 (61.6%)				

1-2 Comorbidities	56 (28,0%)	78 (33,6%)				
3-4 Comorbidities	4 (2,0%)	11 (4,8%)				
Predictors	Number of MTOs		Bivariate Analysis	Multivariate Analysis		
	<2 MTO	>2 MTO	Value p	OR	95% KI	Value p
Length of Stay			0.010	1,366	0,878-2,125	0,167
<4 Days	70 (35,0%)	55 (23,7%)				
≥4 Days	130 (65,0%)	177 (76,3%)				
Number of Drugs			0.000	2,733	1.767-4,229	0.000
<10 Drugs	120 (60,0%)	79 (34,1%)				
≥10 Drugs	80 (40,0%)	153 (65,9%)				

Description: MTO, drug-related problems

Based on the results of bivariate analysis, it can be concluded that three predictors of MTO have a significant effect on the number of MTOs, namely comorbidities (p 0.029), length of hospitalization (0.010) and number of drugs (p 0.000). If it is based on the results of bivariate analysis with a p-value of <0.25, then the predictor can be continued in multivariate analysis. The results of the multivariate analysis showed that the number of drugs was the risk factor that had the most influence on the number of MTOs. In patients who received ≥10 drugs had a 2.733 times higher risk of developing >2 MTOs when compared to patients who received <10 drugs (p 0.000). The results of this study are in line with other studies that report that the number of drugs has a significant effect on the number of MTOs (Andrajati et al., 2024). The greater the amount of medication a patient receives, the more likely it is to develop MTO (Gona et al., 2020). Polypharmaceuticals can increase the risk of drug interactions and can cause adverse drug events, so this can increase the number of MTOs (Krustev et al., 2022; Sharp et al., 2019).

Advantages and Limitations of Research

This study has a significant novelty because it is the first study conducted at Rumkital Dr. Mintohardjo in analyzing Drug-Related Problems (MTO) in inpatients using acid-suppressive drugs with reference to the international standard instrument PCNE V9.1. In addition, the strength of this study lies in the depth of its analysis which not only identifies problems, but also statistically evaluates the relationship between various specific predictive factors such as age, number of drugs, number of comorbidities, and length of stay against the incidence of MTO. This provides a comprehensive overview of the risk profile of patients at the hospital during the 2024 period.

While providing valuable insights, the study has limitations because it relies entirely on secondary data from the patient's medical records. This led to analysis limited to written documentation in the absence of confirmation through direct clinical observation to validate conditions in the field. In addition, the design of this study was observational and did not provide direct clinical intervention, so the effectiveness of treatment improvement suggestions could not be measured in this study period.

CONCLUSION

This study demonstrates that Drug-Related Problems (DRPs) associated with the use of gastric acid suppressants among inpatients at Rumkital Dr. Mintohardjo remain a significant clinical concern. The findings reveal that treatment safety issues dominate the DRP profile, particularly adverse drug events, drug interactions, and inappropriate dosing regimens. Among the identified predictors, the

number of drugs emerged as the most influential factor, where patients receiving ≥10 medications had a substantially higher risk of experiencing multiple DRPs. Additionally, comorbidities and length of stay were also associated with DRP incidence in bivariate analysis, although their influence was less significant in multivariate testing. These results highlight the critical role of polypharmacy in increasing clinical risks and emphasize the need for rational prescribing practices, comprehensive medication review, and adherence to clinical guidelines to enhance patient safety and therapeutic outcomes. For future research, it is recommended to conduct prospective and interventional studies to evaluate the effectiveness of clinical pharmacy services in reducing DRPs, particularly through medication reconciliation and real-time monitoring. Further studies should also incorporate broader clinical variables such as disease severity, prescribing patterns, and healthcare provider behavior to obtain a more comprehensive understanding of DRP determinants. Expanding the research scope to multicenter settings would improve generalizability and allow comparison across different healthcare systems. In addition, qualitative approaches exploring prescribers' decision-making processes could provide deeper insights into inappropriate drug use. Ultimately, integrating advanced clinical decision-support systems and evaluating their impact on reducing polypharmacy-related risks would be a valuable direction for future investigations.

BIBLIOGRAPHY

Albugeaey, M., Alfaraj, N., Garb, J., Seiler, A., & Lagu, T. (2014). Do hospitalists overuse proton pump inhibitors? Data from a contemporary cohort. In Journal of Hospital Medicine (Vol. 9, Issue 11, pp. 731–733). John Wiley and Sons Inc. https://doi.org/10.1002/jhm.2249

Alqudah, M. A. Y., Al-Azzam, S., Alzoubi, K., Alkhatatbeh, M., & Rawashdeh, N. (2016). Overuse of proton pump inhibitors for stress ulcer prophylaxis in Jordan. International Journal of Clinical Pharmacology and Therapeutics, 54(8), 597–602. https://doi.org/10.5414/CP202533

Begg, M., Tarhuni, M., N. Fotso, M., Gonzalez, N. A., Sanivarapu, R. R., Osman, U., Latha Kumar, A., Sadagopan, A., Mahmoud, A., & Khan, S. (2023). Comparing the Safety and Efficacy of Proton Pump Inhibitors and Histamine-2 Receptor Antagonists in the Management of Patients With Peptic Ulcer Disease: A Systematic Review. Cureus. https://doi.org/10.7759/cureus.44341

Delyana Pratiwi, P., Rokhmiati, E., & Ghanesia Istiani, H. (2024). The Relationship between Age and Gender and the Risk of Non-Communicable Diseases (NCDs) Based on BPJS South Jakarta Health Screening Data in 2022. Journal of Nursing and Public Health, 13(1), 32–43.

Dewi Awali, J., Yuliyanda Pardilawati, C., Umiana Soleha, T., Zakiah Oktarlina, R., & Polypharmacy on Drug Safety in Geriatric Patients, K. (2024). Polypharmaceutical Study on Drug Safety in Geriatric Patients. Medula, 4(4), 739–745

Dewi, R. M., Perdhana, M. S., & Management, J. (2016). The Role of Gender, Age, and Education Level on Organizational Citizenship Behavior (OCB). Diponegoro Journal Of Management, 5(2), 1–9. http://ejournal-s1.undip.ac.id/index.php/dbr

Diamantidis, M. D., P. M., & H. E. (2021). Primary gastric non-Hodgkin lymphomas: Recent advances regarding disease pathogenesis and treatment. World Journal of Gastroenterology, 5, 5932–5945.

Yours truly, Joseph. T., Yee, Gary. C., Haines, Stuart. T., Nolin, Thomas. D., Ellingrod, Vicki. L., & Posey, L. M. (2013). Drug Information Handbook 22nd Ed (22nd ed., Vol. 22).

Eusebi, L. H., Ratnakumaran, R., Bazzoli, F., & Ford, A. C. (2018). Prevalence of Dyspepsia in Individuals With Gastroesophageal Reflux–Type Symptoms in the Community: A Systematic Review and Meta-analysis. Clinical Gastroenterology and Hepatology, 16(1), 39-48.e1. https://doi.org/10.1016/j.cgh.2017.07.041

Fahmi, M. Z., Karuniawati, H., & Ismail, W. I. (2020). Drug-Related Problems in Chronic Obstructive Pulmonary Disease: Literature Review. Journal of Pharmaceutical Sciences, 2025(3), 1916–1922. https://doi.org/10.36490/journal-jps.com

Febriani, R. E., Karuniawati, H., & your Rahman, A. (2020). Incidence of Drug-Related Problems in Inpatients with Diabetes Mellitus Based on PCNE Criteria: A Literature Review. Journal of Pharmaceuticals and Science, 2025(3), 1937–1945. https://doi.org/10.36490/journal-jps.com

Garin, N., Sole, N., Lucas, B., Matas, L., Moras, D., Rodrigo-Troyano, A., Gras-Martin, L., & Fonts, N. (2021). Drug related problems in clinical practice: a cross-sectional study on their prevalence, risk factors and associated pharmaceutical interventions. Scientific Reports, 11(1). https://doi.org/10.1038/s41598-020-80560-2.

Gumi, V. C., Larasanty, L.P.F., & Udayani. (2013). Identification of Drug Related Problems in the Handling of Hypertension Patients at the Jembrana Health Center UPT. Udayana Journal of Pharmacy, 1(1), 50–57.

Hastono, Sutanto. P., & Sabri, Luknis. (2013). Health Statistics. Rajawali Press. ISBN: 978-979-769-691-7.

Hussain Sabir, S., Osama Talat, S., Ahmed Moinuddin, I., Aslam, M., Sardar Muhammad, N., Mahmood, A., Naz Tahir, F., & Professor, A. (2025). Efficacy of Proton Pump Inhibitors vs. H2-Receptor Antagonists in GERD Patients: A Double-Blind RCT Sajjad Hussain Sabir et al/Randomized Controlled Trial of Low-Dose Aspirin in Reducing Pregnancy Loss in Women with Antiphospholipid Syndrome Efficacy of Proton Pump Inhibitors vs. H2-Receptor Antagonists in GERD Patients: A Double-Blind RCT. International Journal of Pharmacy Research & Technology, 15(1), 1241–1249. https://doi.org/10.48047/ijprt/15.01.192

Indrawati, Teti. (2012). Gastroretentive Oral Drug Delivery System. National Institute of Science and Technology, 1, 8.

J. Dana, W., A. Fuller, M., P. Goldman, M., A. Golembiewski, J., P. Gonzales, J., Fisher Lowe, J., & Snoke, J. (2013). Drug Information Handbook (J. F. Alexander, A. Al-Jazairi, & N. Alqadheeb, Eds.; 22nd ed., Vol. 22).

Kate, S., Bodke, V., Badekar, R., Bagul, P., Birajdar, P., Dhoble, P., Pharm, M., & Dharkar, G. R. (2023). Assessment and Monitoring of Adverse Effect of Ranitidine with pharmacovigilance study. World Journal of Pharmaceutical Research, 12(11), 566. https://doi.org/10.20959/wjpr202311-28841.

Korayem, G. B., Alkanhal, R., Almass, R., Alkhunaizan, S., Alharthi, G., Sheraim, N. Bin, Alqahtani, S., & Alkofide, H. (2021). Patients, prescribers, and institutional factors associated with inappropriate use of acid suppressive therapy in medical wards: An experience of a single-center in saudi arabia. International Journal of General Medicine, 14, 5079–5089. https://doi.org/10.2147/IJGM.S328914.

Laoveeravat, P., Thavaraputta, S., Vutthikraivit, W., Mingbunjerdsuk, T., Motes, A., Nugent, K., Islam, E., & Islam, S. (2020). Proton Pump Inhibitors and Histamine-2 Receptor Antagonists on the Risk of Pancreatic Cancer: A Systematic Review and Meta-analysis. 3 Short running head: Association of PPI and H2RA and pancreatic cancer. QJM: An International Journal of Medicine, 113(2), 100–107. https://doi.org/10.1093/qjmed/hcz234/5567107

Luo, H., Fan, Q., Xiao, S., & Chen, K. (2017). Impact of clinical pharmacist interventions on inappropriate prophylactic acid suppressant use in hepatobiliary surgical patients undergoing elective operations. PLoS ONE, 12(10). https://doi.org/10.1371/journal.pone.0186302.

Mohamed Mohamed, A. E., Kamel, M. A., & Abd el Wahab, H. S. (2023). Adverse Drug Reactions of Proton Pump Inhibitors: A Review. Journal of Advanced Veterinary Research, 13(3), 553–557.

Octavia, M., Ikawati, Z., Tri, D., & Andayani, M. (2019). Study on the Effectiveness of Lansoprazole and Pantoprazol as Prophylaxis for Stress Ulcers in the Intensive Care Unit (ICU). In Media Pharmaceutica Indonesiana (Vol. 2, Issue 3).

Posada Bustos, S., De León Fernández, N., González Morales, R., Tihanyi Feldman, J., & Vera Chamorro, J. F. (2018). Prevalence of inappropriate prescription of acid suppression therapy among adults hospitalized at a general hospital in Bogotá. Colombian Journal of Gastroenterology, 33(1), 16–21. https://doi.org/10.22516/25007440.236

Satria, M. A., Andrajati, R., & Supardi, S. (2022). The Translation Process of Pharmaceutical Care Network Europe v9.00 to Bahasa Indonesia: An Instrument to Detect Drug-Related Problem. Malaysian Journal of Medical Sciences, 29(3), 133–144. https://doi.org/10.21315/mjms2022.29.3.13

Shanika, L. G. T., Reynolds, A., Pattison, S., & Braund, R. (2023). Proton pump inhibitor use: systematic review of global trends and practices. In European Journal of Clinical Pharmacology (Vol. 79, Issue 9, pp. 1159–1172). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1007/s00228-023-03534-z

Singh, A., Bodukam, V., Saigal, K., Bahl, J., Wang, Y., Hanlon, A., Lu, Y., & Davis, M. (2016). Identifying Risk Factors Associated with Inappropriate Use of Acid Suppressive Therapy at a Community Hospital. Gastroenterology Research and Practice, 2016. https://doi.org/10.1155/2016/1973086

Sinjal, J., Wiyono, W., & Mpila, D. (2018). Identification of Drug Related Problems (DRPs) in Congestive Heart Failure (CHF) Patients at the Inpatient Installation of Prof. Dr. R. D. Kandou Manado Hospital. In PHARMACONJurnal Scientific Pharmacy-UNSRAT (Vol. 7, Issue 4).

Tampa, R., Sumombo, J., & Lengkey, Y. (2021). Description of Drug Related Problems (DRPs) in Type 2 Diabetes Mellitus Patients at Tuminting Public Health Center. Indonesian Journal of Pharmacy, 11(1), 49–55. https://doi.org/10.2

Tezel Yalçın, H., Yalçın, N., & Allegaert, K. (2025). Real-World Safety Profile of Proton Pump Inhibitors in Infants as Reported in the FDA Adverse Event Reporting System (FAERS): Tiny Tummies, Key Decisions. Pharmaceuticals, 18(5), 2–17. https://doi.org/10.3390/ph18050730

Titiesari, Y. D., Nursalim, H. Y., & Nathania, J. (2022). Drug-Related Problems in Oncology Patients: What Should Pharmacists Look Out For? Pharmaceutical Magazine, 18(1), 51. https://doi.org/10.22146/farmaseutik.v18i1.71911

Utami, V. W., Pharmacy, S., Aini, S. R., & Puspitasari, C. E. (n.d.). Profile of Drug Related Problems (DRPs) in Schizophrenia Patients at the Inpatient Installation of Mutiara Sukma Mental Hospital, NTB Province in 2020. Pharmaceutical Jpournal of Imdonesia, 8(1), 87–94. Retrieved http://.pji.ub.ac.id

Wilmer, C. M., Huiskes, J. B., Natsch, S., Johannes, A., Rennings, M., Johannnes, B., Van Den Bemt, F., & Bos, J. M. (2015). Drug Related Problems in a clinical setting: a literature review and cross-sectional study evaluating factors to identify patients at risk. European Journal of Hospital Pharmacy, 1(1), 1–7. https://doi.org/10.1136/ejhpharm.

Yasta, P. A. (2023). Overview of Prescription Writing Compliance in BPJS Poly Internal Medicine Specialist Patients with National Formulary for the Period January – February 2021 AT RSI PKU Muhammadiyah Pekajangan. Journal of Adijaya, 440–447.

Zhou, X., Fang, H., Xu, J., Chen, P., Hu, X., Chen, B., Wang, H., Hu, C., & Xu, Z. (2019). Stress ulcer prophylaxis with proton pump inhibitors or histamine 2 receptor antagonists

in critically ill adults-a meta-analysis of randomized controlled trials with trial sequential analysis. BMC Gastroenterology, 19(1). https://doi.org/10.1186/s12876-019-1105-y

Zulkarnaini, A., & Martini, R. D. (2019). Overview of Polypharmacy of Geriatric Patients in Several Polyclinics of Dr. M. Djamil Padang Hospital. In Andalas Health Journal (Vol. 8). http://jurnal.fk.unand.ac.id.