

# การศึกษาการสั่งใช้ยาRabeprazoleชนิดรับประทานในผู้ป่วยนอก ที่เข้ารับการรักษาที่โรงพยาบาลพระนครศรีอยุธยา A Study of Oral Rabeprazole Prescription for Outpatient Treatment at Phra Nakhon Si Ayutthaya Hospital

## นิพนธ์ต้นฉบับ

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## Original Article

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## บทคัดย่อ

**วัตถุประสงค์:** เพื่อศึกษาการสั่งใช้ยา rabeprazole ชนิดรับประทานทั้งข้อบ่งใช้และขนาดการรักษาเปรียบเทียบกับที่ขึ้นทะเบียนไว้กับสำนักงานคณะกรรมการอาหารและยาของประเทศสหรัฐอเมริกา (US FDA) หรือตามแนวเวชปฏิบัติของสมาคมแพทยระบบทางเดินอาหารแห่งประเทศไทย (GAT) และศึกษามูลค่าทางการเงินของการสั่งใช้ยานี้ที่แผนกผู้ป่วยนอก โรงพยาบาลพระนครศรีอยุธยา **วิธีการศึกษา:** การศึกษาเชิงพรรณนาแบบตัดขวางโดยทบทวนเวชระเบียนย้อนหลังจากฐานข้อมูลอิเล็กทรอนิกส์ของโรงพยาบาลในผู้เข้ารับบริการแผนกผู้ป่วยนอกที่ได้รับยา rabeprazole ชนิดรับประทาน ตั้งแต่วันที่ 1 ตุลาคม พ.ศ. 2560 ถึง 30 กันยายน พ.ศ.2565 **ผลการศึกษา:** มีการสั่งใช้ยา rabeprazole ชนิดรับประทานทั้งหมด 3,062 ครั้ง คิดเป็นมูลค่า 5,671,302 บาท เป็นการสั่งใช้ในสิทธิสวัสดิการรักษายาพยาบาลข้าราชการมากที่สุด (5,437,900 บาท) มีการสั่งใช้ยาที่ไม่เป็นไปตามข้อบ่งใช้และขนาดการรักษาที่ขึ้นทะเบียนไว้กับ US FDA และตามแนวเวชปฏิบัติของ GAT จำนวน 2,526 ครั้ง คิดเป็นมูลค่ารวม 4,751,888 บาท การสั่งใช้ยาที่ไม่เป็นไปตามข้อบ่งใช้ที่มีมูลค่ามากที่สุดได้แก่ ผลเพ็บติกจากยาลดการอักเสบที่ไม่ใช่สเตียรอยด์ (958,330 บาท) อาหารไม่ย่อย (906,912 บาท) และกระเพาะอาหารอักเสบ (266,184.50 บาท) **สรุป:** มีการสั่งใช้ยา rabeprazole ที่ไม่เหมาะสมอยู่มาก ควรกำหนดนโยบายและมาตรการกำกับควบคุมเพื่อให้สั่งใช้ยาอย่างสมเหตุสมผลสอดคล้องกับแนวทางของบัญชียาหลักแห่งชาติและนโยบายของกระทรวงสาธารณสุข

**คำสำคัญ:** รูปแบบการสั่งใช้ยา, rabeprazole, ผู้ป่วยนอก, ข้อบ่งใช้, มูลค่ายา, การใช้อย่างสมเหตุสมผล

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## Abstract

**Objective:** To determine prescribing pattern of rabeprazole both indications and dosages according to those approved by the US FDA or recommended by the Gastroenterological Association of Thailand (GAT), and associated expenditures, in out-patient department of Phra Nakhon Si Ayutthaya Hospital. **Method:** In this cross-sectional descriptive study, retrospective, electronic database of out-patient medical records was used. Rabeprazole prescriptions from October 1, 2017, to September 30, 2022, were analyzed. **Results:** A total of 3,062 rabeprazole prescriptions were found with a cost of 5,671,302 Baht with the most expenditure for patients under the Civil Servant Medical Benefit Scheme (5,437,900 Baht). A total of 2,526 prescriptions were with indications and dosage not approved by US FDA and not recommended by the GAT with an expenditure of 4,751,888 Baht. Indications most inappropriately prescribed were nonsteroidal anti-inflammatory drugs-induced peptic ulcer, functional dyspepsia, and gastritis with a total cost of 958,330, 906,912 and 266,184.50 Baht, respectively. **Conclusion:** A large portion of inappropriate prescriptions of oral rabeprozole were found. Policy and measures to monitor and control rabeprazole prescription should be implemented to promote rational drug use according the national list of essential drugs and the Ministry of Public Health.

**Keywords:** prescribing pattern, rabeprazole, outpatients, indications, drug expenditure, rational drug use

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## Introduction

Proton pump inhibitors (PPIs) are more effective than other medications in acid suppression. Unlike histamine-2 receptor antagonists (H<sub>2</sub>RAs), PPIs exert their actions through inhibiting H<sup>+</sup>/K<sup>+</sup> ATPase enzyme. With their greater efficacy, PPIs' high prescription volume is associated with a high financial burden. Based on the data from the Health Insurance System Research Office, the reimbursement of PPIs under the Civil Servant Medical Benefit Scheme (CSMBS) indicates that expenditure of PPI medications both listed and not listed in

the Thailand National List of Essential Drugs (NLED) for outpatient prescriptions in the fiscal year of 2009 in 26 public hospitals was 580 million Baht which was the third highest value following lipid-lowering agents and nonsteroidal anti-inflammatory drugs (NSAIDs).<sup>1</sup>

In Thailand, in 2007, there were 22,584 PPI prescriptions with a 5,160,645 Baht cost. In 2010, the use of PPIs increased to 26,155 prescriptions and 8,820,280 Baht cost. The use of

PPIs has been extended to non-gastrointestinal disorders. In certain cases, PPIs were prescribed for no definite diagnosis documented in medical records.<sup>2</sup> The use of PPIs is troublesome not only for non-recommended indications but also the recommended ones. PPIs use is associated with an increased risk of hospital-acquired pneumonia by 1.3 folds when compared with no PPIs (adjusted odds ratio (OR) of 1.3, 95% confidence interval (CI) of 1.1 - 1.4).<sup>3</sup> It also has been found that PPIs increases the risk of *Clostridium difficile* infection.<sup>4,5</sup> A retrospective study on the appropriate prescriptions of PPIs in 2018 showed 47% PPI prescriptions with unapproved indications, 73% with dosage too high (73%), 57% and 76% inappropriate use of PPIs with NSAIDs and glucocorticoids, respectively. Unnecessary use of high-dose PPIs could lead to osteoporosis, bone fracture, hypomagnesemia, community-acquired pneumonia, *Clostridium difficile* colitis, and cardiovascular morbidity.<sup>6,7</sup> A study of omeprazole for gastric ulcer prevention in a medical ward showed that many prescriptions were without indication for in-patient and after-discharge use which increase the risk of adverse effects and wasteful expenditure.<sup>8</sup>

A number of PPIs including omeprazole, esomeprazole, lansoprazole, dexlansoprazole, pantoprazole and rabeprazole are approved for different indications by different the Food and Drug Administration in various countries.<sup>9</sup> In Thailand, PPIs listed in the 2022 NLED include oral omeprazole capsule (class I), sterile powder omeprazole (class II), and sterile powder pantoprazole (class III).<sup>10</sup> Rabeprazole is available only in oral form and not listed in the NLED.

In the hospital formulary of Phra Nakhon Si Ayutthaya Hospital, rabeprazole is listed in the non-NLED section and classified as a high-cost drug. In Thailand, rabeprazole is approved by the Thai Food and Drug Administration for the indications of active duodenal ulcer, active benign gastric ulcer, anastomotic ulcer, erosive or ulceration gastro-oesophageal reflux disease (GERD), gastro-oesophageal reflux disease long-term management (GERD maintenance), moderate to severe symptomatic GERD, Zollinger-Ellison syndrome, combination use with antibiotics for *Helicobacter pylori* eradication in gastro-intestinal ulcer, recurrence prevention of low-dose aspirin-induced gastric and duodenal ulcer.<sup>11</sup> In the US, rabeprazole is not approved for gastric ulcer, anastomotic ulcer, or recurrence prevention of low-dose aspirin-induced gastric and duodenal ulcer which is in

accordance with the clinical guideline of the Gastroenterological Association of Thailand (GAT). The GAT has not recommended rabeprazole for the first-line therapy of any of the above indications. The GAT only recommends the combination use with antibiotics for *Helicobacter pylori* eradication in gastro-intestinal ulcer.<sup>12</sup> All approved indications of rabeprazole could be substituted by with omeprazole.

Phra Nakhon Si Ayutthaya Hospital is a tertiary hospital of 615 beds serving residence of 16 districts and those from nearby provinces. On average, Phra Nakhon Si Ayutthaya Hospital serves 2,570 patients daily. Since being included in the hospital formulary, prescriptions of rabeprazole have not been reviewed. With its high-cost profile, there was a need to determine prescribing patterns of rabeprazole in Phra Nakhon Si Ayutthaya Hospital. Findings could be useful in planning strategies for monitoring and controlling rabeprazole prescriptions, as well as promoting more rational prescriptions according to the NLED policy and the Ministry of Public Health's health service plan on medication safety. Such rational prescriptions could offer economy use of drugs and a better control on drug expenditures. Specifically, this present study aimed to determine prescriptions of oral rabeprazole with indications and dosages not approved by the US FDA and not recommended by the GAT and cost of prescribed oral rabeprazole in out-patient department of Phra Nakhon Si Ayutthaya Hospital.

## Methods

The study was approved by the Ethics Committee for Human Study of Phra Nakhon Si Ayutthaya Hospital (approval number: COA022/2566). In this cross-sectional descriptive research, we performed a retrospective database analysis on electronic database of medical records on out-patient oral rabeprazole prescriptions from October 1, 2017 (firstly introduced into the hospital), to September 30m, 2022, i.e., a duration of 5 fiscal years.

### Research instruments

Two data collection forms were used. The first form was used to extract demographic and clinical characteristics of the patients with rabeprazole prescriptions including hospital number (HN), number of visits (VN), sex, age at first prescription of rabeprazole during the study period,

reimbursement scheme, and related diagnosis. The second part collected prescription data including prescribed rabeprazole based on RBP20 code, dosage, administration, number of rabeprazole dosage units prescribed, and rabeprazole cost.

Study population was records of rabeprazole prescriptions in out-patient department of Phra Nakhon Si Ayutthaya Hospital. In-patient prescriptions were not studied because of negligible number of rabeprazole prescriptions. Study sample was those prescriptions in the study population of visits from October 1, 2017 (the start of the fiscal year) to September 30, 2022 (the end of the fiscal year).

To be eligible, the prescription records had to be those for patients who were 12 years or older. This was because the indication of rabeprazole for GERD in children approved by the US FDA was for those aged 12 years or older. Rabeprazole prescriptions with no data in medical records both electronic and hardcopy were excluded.

In this study, appropriate indications and dosage of oral rabeprazole were those approved by the US FDA or the GAT (Table 1) and cost of rabeprazole was the price the hospital charged the patients or the insurers. The price of rabeprazole was set according to the 2019 rule of the Ministry of Public Health (MOPH).<sup>1,2</sup> During the study period, the cost the hospital paid the drug company was steadily at 18.80 Baht per 20-mg tablet. The charge price as suggested by the MOPH was  $13 + [1.2 (18.8 - 10)] = 23.56$  or 23.50 Baht per 20-mg tablet to be used in this study.<sup>12</sup>

**Table 1** Indications and dosage of rabeprazole.<sup>13-17</sup>

Indications <sup>a</sup>	Diagnosis code (ICD-10) <sup>b</sup>	Recommended dose per day <sup>c</sup>
Gastroesophageal reflux disease GERD)	K21	20 mg
Duodenal ulcer (DU)	K26	20 mg
Gastrointestinal ulcer associated with <i>Helicobacter pylori</i> infection	B98	40 mg
Gastric hypersecretion), e.g., Zollinger-Ellison syndrome (ZES)	E16.4	60 - 120 mg

<sup>a,c</sup> US Food and Drug Administration, 2014; Centers for Medicare & Medicaid Services, 2015; the Gastroenterological Association of Thailand, 2016; Thai Neurogastroenterology and Motility, 2020.

<sup>b</sup> Office of Plan and Strategy, Ministry of Public Health, 2016.

## Data analysis

Descriptive statistics including frequency with percentage were used to summarize number of rabeprazole prescriptions by indications and related costs, and demographic and clinical characteristics of the patients.

## Results

A total of 3,114 out-patient prescriptions were found between October 1, 2017, to September 30, 2022. With 52 prescriptions excluded because of no medical records, a total of 3,062 prescriptions were analyzed.

Of the 3,062 prescriptions, 756 prescriptions (24.69%) were with indications approved by US FDA or recommended by the Gastroenterological Association of Thailand (GAT). Of these 756 prescriptions, only 536 (17.50%) were with approved dosages; while the rest 220 (7.18%) were with non-approved dosages. Of the 2,306 prescriptions (75.31%) with non-approved and non-recommended indications, 1,455 (47.52%) were identifiable. Finally, 851 prescriptions (27.79%) had no diagnosis in medical records, therefore, the indications were unidentified (Table 2).

**Table 2** Appropriateness of rabeprazole prescriptions according to indications and dosage (N = 3,062).

Prescriptions with indications approved by US FDA or recommended by the GAT (n = 756)	N (%)	Prescriptions with indication non-approved by US FDA and not recommended by the GAT (n = 2,306)	N (%)
With approved dosage	536 (17.50)	Identifiable indications	1,455 (47.52)
With non-approved dosage	220 (7.18)	Unidentified indications	851 (27.79)
Total	756 (24.68)	Total	2,306 (75.31)

**Note:**

US FDA = US Food and Drug Administration

GAT = Gastroenterological Association of Thailand

**Table 3** Characteristics of the patients with rabeprazole prescriptions (N = 3,062).

Characteristics of the patients	Number of prescriptions	%
<b>Sex</b>		
Male	979	31.97
Female	2,083	68.03
<b>Age (years)</b>		
12 - 30	32	1.05
31 - 40	128	4.18
41 - 50	199	6.50
51 - 60	498	16.26
61 - 70	808	26.39
71 or greater	1,397	45.62
<b>Reimbursement scheme</b>		
Civil Servant Medical Benefit Scheme	2,848	93.01
Social security scheme	25	0.82
Universal Health Coverage	82	2.68
Out-of-pocket or private insurers	106	3.46
Others*	1	0.03
<b>Fiscal year</b>		
2018	591	19.30
2019	588	19.20
2020	647	21.13
2021	568	18.55
2022	688	21.82

\* Right under Section 8.

Of the 3,062 prescriptions, majority was for women (2,083 prescriptions or 68.03%), those 71 years or older (45.62%), and those under the Civil Servant Medical Benefit Scheme (93.01%). It was found that the number of prescriptions in each fiscal year was relatively comparable (Table 3).

Among 3,062 rabeprazole prescriptions with approved or recommended indications, the most prescribed indication was GERD (721 prescriptions or 23.55%) followed by duodenal ulcer and *Helicobacter pylori* associated gastrointestinal ulcers (0.98% and 0.16%, respectively). Of all 1,455 prescriptions with indications not approved by the US FDA or not recommended by the GAT, the most prescribed indication was functional dyspepsia (616 prescriptions), followed by NSAIDs induced peptic ulcer and gastritis (434 and 155 prescriptions, respectively). Based on the number of tablets prescribed, the highest associated cost was for NSAIDs induced peptic ulcer (958,330 Baht), followed by functional dyspepsia (906,912 Baht) and gastritis (266,184.50 Baht). Finally, the cost of 851 prescriptions with unidentified indications was 1,697,311 Baht (Table 4).

**Table 4** Number of rabeprazole tablets prescribed and associated cost (N = 3,062).

Rebaprazole prescriptions (N = 3,062)	Number of prescriptions (%)	Number of tablets	Cost (Baht)
<b>Indications approved by US FDA OR recommended by GAT regardless of dosage approval (n = 756)</b>			
GERD	721 (23.55)	59,493	1,398,085.50
Dueodenal ulcer	30 (0.98)	1,540	36,190
Gastrointestinal ulcer associated with <i>Helicobacter pylori</i> infection	5 (0.16)	312	7,332
Total	756 (24.69)	61,345	1,441,607.50
<b>Indications not approved by US FDA AND not recommended by GAT (n = 1,455)</b>			
NSAIDs induced peptic ulcer	434 (14.17)	40,780	958,330
Functional dyspepsia	616 (20.12)	38,592	906,912
Gastritis	155 (5.06)	11,327	266,184.50
Glucocorticoid induced peptic ulcer	64 (2.09)	5,128	120,508
Gastric ulcer	38 (1.24)	3,005	70,617.50
Other and unspecified abdominal pain	49 (1.60)	2,499	58,726.50
Gastrointestinal hemorrhage	22 (0.72)	1,897	44,579.50
Acute hemorrhagic gastritis	12 (0.39)	1,175	27,612.50
Irritable bowel syndrome (IBS)	15 (0.49)	1,008	23,688
Laryngopharyngeal reflux (LPR)	17 (0.56)	1,000	23,500
Gastroenteritis	17 (0.56)	570	13,395
Gastroduodenitis	6 (0.20)	360	8,460
Gastroparesis	2 (0.07)	150	3,525
Epigastric pain	4 (0.13)	102	2,397
Glossitis	1 (0.03)	60	1,410
Serrated colonic polyp	1 (0.03)	60	1,410
Polyp of stomach	1 (0.03)	28	658
Duodenitis	1 (0.03)	20	470
Total	1,455 (47.52)	107,761	2,532,383.50
<b>Indications unidentified (n = 851)</b>	<b>851 (27.79)</b>	<b>72,226</b>	<b>1,697,311</b>
<b>Total</b>	<b>3,062 (100)</b>	<b>241,332</b>	<b>5,671,302</b>

Note: GAT = Gastroenterological Association of Thailand.

Cost of rabeprazole prescriptions was found the most in patients with Civil Servant Medical Benefit Scheme (5,437,900 Baht or 95.88% of all cost). The Rabeprazole prescriptions of

this group of patients were those with indications not approved by US FDA and not recommended by the GAT with the cost of 2,424,307 Baht, followed by unspecified indications (1,636,140.50 Baht), indications approved by US FDA or recommended by the GAT with approved dosage (883,106.50 Baht), and Indications approved by US FDA or recommended by the GAT with non- approved dosage (494,346 Baht) (Table 5).

**Table 5** Cost of prescribed rabeprazole by reimbursement schemes.

Indications and dosage	Cost of prescribed rabeprazole (Baht) by reimbursement schemes					Total
	Civil Servant Medical Benefit Scheme	Social Security Scheme	Universal Health Coverage Scheme	Out-of-pocket or private insurers	Others	
Indications approved by US FDA or recommended by the GAT with approved dosage	883,106.50	7,402.50	8,742.00	17,343.00	2,820.00	919,414.00
Indications approved by US FDA or recommended by the GAT with non-approved dosage	494,346.00	No prescription	14,687.50	13,160.00	0	522,193.50
Indications not approved by US FDA and not recommended by the GAT	2,424,307.00	7,849.00	44,603.00	55,624.50	0	2,532,383.50
Indications unidentified	1,636,140.50	2,749.50	5,193.50	53,227.50	0	1,697,311.00
<b>Total</b>	<b>5,437,900.00</b>	<b>18,001.00</b>	<b>73,226.00</b>	<b>139,355.00</b>	<b>2,820.00</b>	<b>5,671,302.00</b>

## Discussions and Conclusion

In this analysis of retrospective data of out-patient rabeprazole prescriptions of Phra Nakhon Si Ayutthaya Hospital, of the 3,062 prescriptions, only 24.69% were with indications approved by US FDA or recommended by the Gastroenterological Association of Thailand (GAT), while as high as 75.31% were with indications non-approved by US FDA and not recommended by the GAT. Total cost of oral rabeprazole prescriptions was 5,671,302 Baht which was 26.15% of 21,685,847 Baht of all PPIs prescribed in the out-patient department.

A high rate of inappropriate rabeprazole prescriptions is of great concern. With no previous studies on rabeprazole, the extent of problematic prescription of rabeprazole in our study could not be comparatively confirmed. We thus could not compare our study with other PPIs. As a non-NLED drug, rabeprazole is prone to irrational prescription not worth using compared with other PPIs listed in the NLED.<sup>18</sup> A study showed omeprazole prescriptions with no indications for patients in general medicine ward significantly increased drug expenditure.<sup>8</sup> Even though the increased drug expenditure in irrational in-patient use of omeprazole is lower than that in the out-patient department like our study, drug expenditure surge

could not be avoided.<sup>8</sup> Another study also showed that as high as 55.24% of PPIs prescribed with no indications and incorrect dosage.<sup>19</sup> A study of Pitragool revealed 44% of PPIs prescribed for non-gastrointestinal disorders and 18% with no indications.<sup>2</sup> Our study also found rabeprazole prescribed for other indications but all of them were still gastrointestinal orders and some indications were approved by the Thai FDA. We also found 27.79% of rabeprazole prescribed with unidentified indications which resulted in a cost of 1,697,311 Baht. This finding indicated that data entry to medical records was defective which needs immense correction. A study in a community hospital revealed that omeprazole was prescribed with no indications and the largest economic loss was in patients with Universal Coverage scheme.<sup>20</sup> On the other hand, our study determined rabeprazole in a tertiary hospital. Prescription discrepancy between rabeprazole and omeprazole is inevitable since community hospital has no rabeprazole due to a lack of specialists, a noncomprehensive diagnostic capability, and a low chance for rabeprazole, a non-NLED drug, to be listed in the hospital formulary. The prescription discrepancy could also be attributable to the difference in reimbursement schemes which could affect drugs to choose.

Reimbursement schemes influence drugs to be prescribed. Universal Coverage scheme is under jurisdiction of the National Health Security Office, while Social Security scheme is under the Social Security Office. These two schemes' reimbursement is capitation-based. The Civil Servant Medical Benefit Scheme is under the Comptroller General's Department and it is fee-for-service based.<sup>21</sup> As a non-NLED drug, rabeprazole is costly which could lead to a high drug expenditure of the hospital. With capitation-based reimbursement, the high cost of rabeprazole usually surpasses the budget. On the other hand, patients with the fee-for-service Civil Servant Medical Benefit Scheme could be prescribed with rabeprazole with no reimbursement limit.<sup>21</sup> Hence, a large number of prescriptions and associated cost of rabeprazole was found in our study.

Inappropriate prescriptions of rabeprazole could also be attributable to a lack of specialists in gastrointestinal disorders which forces specialists in other fields to prescribe rabeprazole. Indications not approved by US FDA and not recommended in the GAT could be prescribed by specialists other than gastroenterologists. Even worse, unidentified

indications of rabeprazole could be prescribed. Reimbursement of fee-for-service Civil Servant Medical Benefit Scheme potentially encourages bypassing omeprazole to rabeprazole. In our study, patients with the Civil Servant Medical Benefit Scheme were prescribed with rabeprazole with a cost as high as 5,437,900 Baht which was higher than other schemes. In addition, these prescriptions were with approved and recommended indications but non-approved dosage (494,346.00 Baht), indications not approved by US FDA and not recommended by the GAT (2,424,307.00 Baht) and unidentified indications (1,636,140.50 Baht) resulting in total of 4,554,793.5 Baht or 80.31% of all prescribed rabeprazole costs and 21% of all oral PPIs prescribed in the out-patient department. The total cost of rabeprazole prescribed with indications approved by US FDA or recommended by the GAT with non-approved dosage, indications not approved by US FDA and not recommended by the GAT, and indications unidentified was 4,751,888 Baht which was 21.91 when compared with the total cost of 21,685,847 Baht of all PPIs prescribed in the out-patient department.

Inappropriate prescription of oral rabeprazole contributed to a huge economic burden. As a non-NLED drug with a high unit cost, a few PPIs listed in the NLED could be used for most indications for gastrointestinal disorders. Typically omeprazole is recommended as a first-line therapy for duodenal ulcer, gastric ulcer, GERD, non-erosive reflux disease, stress-related mucosal disease, and NSAIDs induced peptic ulcer, with efficacy comparable to other PPIs and a lower cost.<sup>1,22,23</sup> All approved and recommended indications of rabeprazole in this study could be treated with omeprazole. Phra Nakhon Si Ayutthaya Hospital had certain oral PPI drugs and strengths including omeprazole 20 mg capsule (1.5 Baht) and rabeprazole 20 mg tablet (23.5 Baht). For GERD and duodenal ulcer, recommended dose of omeprazole and rabeprazole was similar (20 mg per day); while gastrointestinal ulcer associated with *Helicobacter pylori* infection requires a dose of the two drugs of 40 mg per day.<sup>15</sup> The cost per day of rabeprazole is higher than that of omeprazole by 15 folds. Therefore, the use of a NLED drug for a given indication costs much less than a non-NLED one. Since PPIs offer similar cost-effectiveness profiles, the high cost of rabeprazole, a non-NLED drug, is unnecessary.

This prescribing pattern could be seen in other tertiary hospitals including general hospital and medical center under the Ministry of Public Health and large-sized hospitals under other authorities. The pattern could also be seen in other groups of drugs given no controlling strategies for rational drug use. The NLED offers rational drug use strategies. Drugs listed in the NLED have been extensively scrutinized from various professional bodies to assure its effective list of drugs for various pharmaceutical benefit scheme including the Universal Coverage Scheme, Social Security Scheme, Civil Servant Medical Benefit Scheme, and others. It promotes cost-effective drug use suitable for the health system and socioeconomic context of the country. Our findings could be useful in controlling and monitoring the prescribing pattern of rabeprazole in tertiary hospitals. The Pharmacy and Therapeutic Committee of the hospital of the hospital should develop clear policy and strategies to control and monitor drug prescribing to promote the use of drugs listed in the NLED to limit unnecessary drug expenditures. After implementing the policy and strategies, prescribing patterns of rabeprazole, other non-NLED drugs, and drugs with high cost should be determined.

This study has certain limitations. Prescribing pattern of rabeprazole was examined based on the indications approved by US FDA and recommended by the Gastroenterological Association of Thailand; other sources recommendations were not included. Therefore, recommendations from other authorities and experts and more perspectives of prescribers, patients, and insurers should be included. With 851 unidentified prescriptions (27.79% of all prescriptions), the detail of drug prescriptions could not be determined. This data loss could be attributable to the omission of documentation and/or the transfer of hardcopy medical records to the electronic database system. The loss of diagnosis information from the electronic database made determining the indication of rabeprazole impossible.

In conclusion, prescriptions of rabeprazole in out-patient department of Phra Nakhon Si Ayutthaya Hospital were with indications approved by US FDA or recommended by the Gastroenterological Association of Thailand but with non-approved dose, other non-approved or recommended indications, and unidentified indications. Prescriptions for patients with Civil Servant Medical Benefit Scheme costed the

most drug expenditure with 4,554,793.5 Baht or 80.31% of all rabeprazole cost.

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