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ECONOMIC EVALUATION

Factors Influencing Oral Coxibs Utilization and Expenditure at a Thai Teaching Hospital, Fiscal Year 2007 to 2009

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A B S T R A C T

Objective: This study aimed to examine factors that influenced the rising Coxibs expenditure. **Methods:** Retrospective utilization data were retrieved from hospital's database. Changes in Coxibs expenditure in 2007 and 2009, calculated by using the Laspeyres index, were attributed to two factors: cost per patient (P) and number of patients (Q) per year. By measuring quantity as defined daily dose, changes in P comprised two subfactors: cost per day (p) and days of therapy per patient (q); p was weighted average cost of Coxibs per day, and q was weighted average days of therapy of new and current patients. Furthermore, the pattern of concomitant drugs, proton pump inhibitors, was analyzed. **Results:** Expenditure on Coxibs rose from 57.7 to 69.4 million baht from 2007 to 2009. With Laspeyres index, total index of 1.20 was a result of three main factors. The highest impact was from change in cost per day (p index at 1.17), which was a result of a slight increase in

drug cost, mainly weighted by product mix, which tended to switch drug from low to high cost. Another positive impact was the number of Coxibs patients (Q index at 1.04). Finally, the negative impact was from days of therapy per patient (q index = 0.98). Although days of therapy per patient for both new and current patients were decreased, patient mix of more current patients slowed the decrease down. In addition, the percentage of proton pump inhibitors coprescription also rose from 30.8% in 2007 to 32.3% in 2009. **Conclusion:** Switching drug from low to high cost is a major factor that impacted the rising of expenditure on Coxibs.

Keywords: Coxibs, cyclooxygenase (COX)-2-selective inhibitors, drug expenditure, Laspeyres index

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Introduction

Nonsteroidal anti-inflammatory drugs (NSAIDs) are used extensively in health services to relieve pain and health conditions with an inflammatory component. NSAIDs, however, can induce adverse events, especially gastrointestinal (GI) disturbance. A gastroprotective agent can be coprescribed to reduce the risk of a GI event. During the past decade, a new form of NSAIDs called cyclooxygenase (COX)-2-selective inhibitors or Coxibs has been developed. This new drug group can inhibit the cyclooxygenase 2 enzyme that is responsible for the inflammatory effect without inhibiting the cyclooxygenase 1 enzyme that helps protect the mucosa lining of the GI tract [1]. There was also, however, growing evidence to assume that there are increased risks of cardiovascular events instead in patients using Coxibs [2].

Since 1999, with the introduction of Coxibs in Thailand, the total expenditure on NSAIDs has been rising dramatically. In the first 2 years of their launch, expenditures on Coxibs increased from 6.5% in the first quarter of 2000 to 52.1% of NSAIDs' expenditure in the last quarter of 2002 in 18 provincial hospitals in Thai-

land. The use of Coxibs rather than NSAIDs would raise the annual expenditure per person by as much as 11 times [3].

At Ramathibodi Hospital, a 900-bed government teaching facility in Bangkok, expenditure on Coxibs increased 20.4% from 2007 to 2009 (data from Ramathibodi Hospital's database from October 1, 2005, to September 30, 2009) despite the implementation of a drug utilization evaluation program in 2007 for five Coxibs (meloxicam, celecoxib, etoricoxib, lumiracoxib, and nabumetone). Only patients with one of the following four criteria are able to get the drugs: 1) aged more than 70 years without any cardiovascular renal disease, 2) allergic to any of conventional NSAIDs, 3) had significant peptic ulcer/bleeding/perforation in the past, or 4) had GI complication even after taking conventional NSAIDs with gastroprotective agents [4].

Because Coxibs' major benefit over conventional NSAIDs is better GI tract protection [1,5], it is expected that the concomitant use of a proton pump inhibitor (PPI), a gastroprotective agent, would be reduced [6]. Data at the hospital, however, showed that not only Coxibs' expenditure but also PPIs' was still moving up (data from Ramathibodi Hospital database from October 1, 2005, to September 30, 2009).

Conflicts of interest: The authors have indicated that they have no conflicts of interest with regard to the content of this article.

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doi:10.1016/j.vhri.2012.03.003

Table 1 – Oral Coxibs available at Ramathibodi Hospital: market share, product mix, and patient mix (as ratio of days of therapy) between 2007 and 2009.

ATC code	DDD (mg)	Generic name (mg)	% Market share		% Product mix			
			2007	2009	2007		2009	
					Current patients	New patients	Current patients	New patients
M01AC06	15	Meloxicam (7.5, 15)	12.1	8.7	7.1	5.1	5.5	3.2
M01AH01	200	Celecoxib (200, 400)	34.3	40.5	19.3	15.0	27.3	13.2
M01AH05	60	Etoricoxib (60, 90, 120)	31.1	50.7	16.9	14.2	32.5	18.2
M01AH06	100	Lumiracoxib (100, 400)	22.1	0.0	7.9	14.0	0.0	0.0
M01AX01	1000	Nabumetone (500)	0.4	0.1	0.3	0.1	0.1	0.0
					51.5%	48.5%	65.4%	34.6%

ATC, Anatomical and Therapeutic Classification; DDD, defined daily dose.

To examine factors affecting drug expenditure, a mathematic model with Laspeyres index [7,8] was applied and computed as follows:

Laspeyres index = (total expenditure where one factor changed to a selected period while holding other factors to its previous period)/(total expenditure in previous period)

Index greater than 1 indicates that the considered factor has a positive impact on total expenditure, while index less than 1 means a negative impact.

This study aimed to describe the trend of Coxibs and PPI utilization from fiscal year 2007 to 2009 and to determine factors attributed to its rising expenditure at a teaching hospital and explain the change by using the Laspeyres index.

Methods

Data of this descriptive study were prescription records of oral drugs under the Anatomical and Therapeutic Classification code "M01A" (Anti-inflammatory and antirheumatic products, non-steroids) and "A02BC" (PPIs), used for both outpatients and inpatients from October 1, 2005, through September 30, 2009 (Thai fiscal year, FY 2006–2009). Each data record comprised patient's hospital number, health insurance schemes (Universal Coverage [UC], Social Security Scheme [SSS], Civil Servants Medical Benefit Scheme [CSMBS], or self-pay) of each visit/admission, prescribing date, drug's code and name, prescribed quantity (e.g., tablet and capsule), and unit selling price. Data were cleaned for any duplication. Dispensed drug quantity was calculated as days of therapy, based on defined daily dose (DDD):

$$\text{Days of therapy} = (\text{prescribed quantity}) \times (\text{strength in milligram}) / \text{DDD}$$

where DDD is the assumed average maintenance dose per day for a drug used for its main indication in adults [9]; see DDD of each drug in Table 1.

For data analysis, Coxibs and PPI utilization rates were compared between the two time periods, FY 2007 (period $t - 1$) and FY 2009 (period t). The previous 1-year data of each time period were also included to identify whether the patient was new or current (e.g., new patients in 2007 were the ones without Coxibs prescription in 2006). Pattern of PPIs use as concomitant drug, determined as percentage of days of therapy, and prescriptions of Coxibs utilization in each time period were compared between the two time periods.

Annual Coxibs expenditure of the two time periods was calculated as summation of (prescribed quantity) \times (unit price), by Microsoft Access 2007 and Excel 2007 for each health scheme. Change in annual expenditure between the two time periods was

presented by total index. Total index and its contributing factors were determined by using the Laspeyres index with the following mathematic model:

$$\text{Total index} = (P \text{ index}) \times (Q \text{ index}) = (p \text{ index} \times q \text{ index}) \times (Q \text{ index})$$

where P is the Coxib's cost per patient per year (Thai baht), Q is the number of patients per year, p is the weighted average cost of Coxibs per day, and q is the weighted average number of days of therapy of new and current patients.

The weighted average cost of Coxibs per day or p was a summation of Coxibs' cost per DDD multiplied by their product mix, while product mix was a ratio of days of therapy of Coxibs prescribed to patient.

$$p = \sum_{n=1 \text{ to } 5} (\text{cost}/\text{DDD})_n \times (\% \text{ days of therapy})_n$$

where n is each Coxibs.

Switching from a lower- to a higher-cost drug then would make the index positive, and vice versa.

Weighted average days of therapy of new and current patients or q were a summation of days of therapy per patient multiplied by their patient mix.

$$q = \sum_{n=1 \text{ to } 2} (\text{days of therapy})_n \times (\% \text{ patient mix})_n$$

where n is new and current patients, and patient mix was a ratio of new and current patients.

Results

Trend of Coxibs and PPI utilization

During the study period, lumiracoxib was removed from hospital list in FY year 2009. Table 2 shows patients' demographic characteristics in each time period. The total number of patients with at least one Coxibs prescription was 36,232 and 37,837 in 2007 and 2009 (4.43% increase), respectively, with the mean age of 54.8 ± 14.5 and 55.1 ± 14.5 years, respectively. One-fourth were males in both time periods. Overall, 66.1% and 52.3% in 2007 and 2009 did not get Coxibs in the previous year. Most patients were under CSMBS and self-pay, which pay by fee-for-services, 96.6% and 97.1% in 2007 and 2009, while the other two insurance schemes pay by capitation. Coxibs expenditure increased 20.4% from 57.7 million baht in 2007 to 69.4 million baht in 2009; per capita, it was a 15.3% increase from 1592 baht in 2007 to 1835 baht in 2009.

Table 2 also shows that the concomitant use of PPI increased from 30.8% to 32.3% of total days of therapy, or from 25.2% to 25.8% of total Coxibs prescriptions in 2007 and 2009, respectively.

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