

Unused Medication Costs from Electronic Database of Out-patient Prescriptions

มูลค่ายาเหลือใช้จากฐานข้อมูลอิเล็กทรอนิกส์ใบสั่งยาสำหรับผู้ป่วยนอก

Payom Wongpoowarak, Ph.D.*; Thida Ninsananda, M.S. (Pharmaceutic)**, Wibul Wongpoowarak, M.Sc.*; Wipin Kanjankarun, B.Sc.Pharm.***; Amnouy Preukpakpoom, M.Sc.****; Pranee Pinyowatayakorn, B.Sc.Pharm.**; Thitima Payakasiri, M.Sc. (Social and Administrative Pharmacy)****; Jinda Piyasiriwat, M.Sc. Pharm.*****; Tiamjai Tungcharoenpaisal, B. Pharm.*****; Jantima Yothapitak, BCP.*****; Pramanas Toomtong, M. Pharm. (Clinical Pharmacy)*****; Prapaporn Boonme, Ph.D.*

Wongpoowarak P, Ninsananda T, Wongpoowarak W, Kanjankarun W, Preukpakpoom A, Pinyowatayakorn P, Payakasiri T, Piyasiriwat J, Tungcharoenpaisal T, Yothapitak J, Toomtong P, Boonme P. Unused Medication Costs from Electronic Database of Out-patient Prescriptions. Thai Journal of Hospital Pharmacy 2012; 22(3): 191-8.

This study aimed to analyze the unused medication costs from electronic databases of out-patient prescriptions. Retrospective prescriptions from 4 hospitals in different provinces of Thailand were retrieved from January 2010 to December 2010. All electronic prescriptions of out-patients who had at least one of these chronic diseases, hypertension, diabetes mellitus (DM), asthma, or chronic obstructive pulmonary disease (COPD), were analyzed for finding unused medications. In this study, “unused medications” were defined as medications which were prescribed more than 2 days of the required amount for the next hospital appointment. The costs and possible causes of unused medications were also investigated. The results showed that of 57,916 patients identified, 35,306 unused medication cases were observed. Total unused medication costs were 18,383,209 Baht or 4.04% of total prescription costs. Around half of them was caused by the first nine unused medication items. Patients who had full reimbursement scheme, i.e., government employees and patients with Universal Coverage Scheme (UCS) had higher unused medication costs than those who paid out of pocket. The elderly had obviously higher unused medication costs than the younger. Respiratory drugs contributed to the highest unused medication costs in 3 hospitals. It could be concluded that medicines, patients’ right of treatment, and patients’ age were directly related with unused medication costs.

Keywords: Electronic databases, unused medications, unused medication costs, out-patients

*Faculty of Pharmaceutical Sciences, Prince of Songkla University

**The Association of Hospital Pharmacy (Thailand)

***Department of Pharmacy, Buriram Hospital

****Department of Pharmacy, Samutsakorn Hospital

*****Department of Pharmacy, Pichit Hospital

*****Department of Pharmacy, Uttaradit Hospital

*****Department of Pharmacy, SuratThani Hospital

ไพยม วงศ์สุวรรณ, ธิดา นิงสานนท์, วิบูล วงศ์สุวรรณ, วิพิน กาญจนการุณ, อำนวย พฤษภักดาภูมิ, ปราณีย์ ภิญญไธวัญญากร, ฐิติมา พยัสมศิริ, จินดา ปิยสิริวัฒน์, เทียมใจ ตั้งเจริญไพศาล, จันทิมา โยธาพิทักษ์, ประมณัส ตุ่มทอง, ประภาพร บุญมี. มูลค่ายาเหลือใช้จากฐานข้อมูลอิเล็กทรอนิกส์ในสิ่งยาสำหรับผู้ป่วยนอก. วารสารเภสัชกรรมโรงพยาบาล 2555, 22(3): 191-8.

การศึกษานี้มีวัตถุประสงค์เพื่อวิเคราะห์มูลค่ายาเหลือใช้จากการสั่งใช้ยาในโรงพยาบาลจากฐานข้อมูลอิเล็กทรอนิกส์ ด้วยการวิเคราะห์ข้อมูลย้อนหลัง ตั้งแต่ มกราคม พ.ศ. 2553 ถึง ธันวาคม พ.ศ. 2554 จากโรงพยาบาล 4 แห่งที่อยู่ในจังหวัดต่างกันในประเทศไทย โดยใช้ข้อมูลของการสั่งใช้ยาทุกชนิดในผู้ป่วยนอก 4 โรค คือ ความดันโลหิตสูง เบาหวาน หืด และปอดอุดกั้นเรื้อรังซึ่งอาจมีหรือไม่มีโรคอื่นร่วม ในการศึกษาครั้งนี้ “ยาเหลือใช้” หมายถึง ยาที่มีการสั่งใช้มากกว่าที่ผู้ป่วยจะใช้ได้หมดก่อนถึงวันนัดมาโรงพยาบาลครั้งต่อไป (โดยอนุญาตให้บวกเพิ่มอีก 2 วัน) วิเคราะห์ทั้งมูลค่าและสาเหตุของยาเหลือใช้ ผลการศึกษาพบว่าจากผู้ป่วยทั้งหมด 57,916 ราย พบว่าผู้ป่วยที่มียาเหลือใช้มี 35,306 รายและยาเหลือใช้มีมูลค่าเท่ากับ 18,383,209 บาท/ปี หรือคิดเป็นร้อยละ 4.04 ของมูลค่าในใบสั่งยา รายการยาเหลือใช้ที่มีมูลค่าสูง 9 อันดับแรกของแต่ละโรงพยาบาลมีมูลค่าเกือบประมาณครึ่งหนึ่งของมูลค่ายาเหลือใช้ทั้งหมด ผู้ป่วยที่ไม่ต้องรับผิดชอบค่าใช้จ่ายเอง ได้แก่ ข้าราชการและผู้ใช้สิทธิหลักประกันสุขภาพ มีมูลค่ายาเหลือใช้สูงกว่าผู้ป่วยที่ต้องรับผิดชอบค่าใช้จ่ายเอง ผู้สูงอายุมีมูลค่ายาเหลือใช้สูงกว่าผู้ที่มีอายุน้อยกว่าอย่างเด่นชัด ยาเกี่ยวกับทางเดินหายใจมีมูลค่ายาเหลือใช้สูงสุดใน 3 โรงพยาบาล จากผลการศึกษาสรุปได้ว่า ชนิดของยา สิทธิในการรักษาพยาบาลของผู้ป่วย และอายุของผู้ป่วย มีความสัมพันธ์โดยตรงกับมูลค่ายาเหลือใช้

คำสำคัญ: ฐานข้อมูลอิเล็กทรอนิกส์, ยาเหลือใช้, มูลค่ายาเหลือใช้, ผู้ป่วยนอก

Introduction

Unused medications or medications left over by the patients caused from any reason have been one of important drug related problems.¹ They lead to economic wastage, microbial resistance (in cases of antibiotics), sub-optimal management of chronic disease (in cases of required continuous medications), and terrible effects on global environment (in cases of wrong disposal). Additionally, the problem of unused medications has occurred in worldwide areas. For example, the massive quantity of unused medications returned to community pharmacies was collected and reported in

Alberta, Canada.² A cross-sectional survey of a random sample of 931 households in the Songkhla province of Thailand, 1,004 unused medication items were found from 523 respondents and the average unused medication cost was 0.8 Euro per household.³ Unused medications returned to community pharmacies located in Otago, New Zealand were also identified and large amounts of medication wastage were found, especially “stat” medications.⁴ It was reported that approximately 11,515.40 RM of unused medications were wasted by female students (undergraduates and postgraduates) in the Universiti Sains

Malaysia main campus.⁵ The total wholesale price of returned drugs to 20 community pharmacies located in Cairo, Egypt in one month was approximately 1,962.32 USD. A large amount of drugs were returned to 60 community pharmacies located in Alexandria, Egypt and these costs were about 825.10 USD per month.⁶ Moreover, all types of unused drugs were disposed like common household waste.⁷ Pharmaceutical contamination in environment has been concerned since it destroys drinking water quality and accumulates in fish.⁸

In Thailand, the issue on unused medications of out-patients has not formerly been deeply studied. Therefore, this study aimed to analyze the electronic databases on prescriptions of out-patients who were diagnosed with at least one chronic disease in four Thai hospitals to find associated factors on and costs of unused medications.

Methods

Study design and data collection

The retrospective study used prescriptions from the electronic databases during January 2010 to December 2010 from four hospitals located in different provinces of Thailand. The data providers were three general hospitals with 400-600 beds and a center hospital with 800 beds. All specific data of the patients (ID or HN) were arbitrarily changed by the data providers and recorded as unrepeated numerical codes which could not be

linked to the real identity. The methods of data collection were approved by the Ethic Committee of Faculty of Pharmaceutical Sciences, Prince of Songkla University, Thailand.

The samples were all electronic prescriptions of out-patients who had at least one of four chronic diseases. Four included diseases were hypertension, diabetes mellitus (DM), asthma, and chronic obstructive pulmonary disease (COPD) since the medications to treat these diseases have usually been "stat" dispensed (i.e., a three-month supply given at the time of dispensing).

All data providers were informed to use International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10)⁹ for disease identification in their reports. The data of patient-code, date of prescription, patients' right of treatment, age of the patients, medications (trade-names or generic-names, strength, dose, usage duration, dispensing amounts, prices) and total costs were collected and analyzed. The dosage forms with calculable maximal dose per day (e.g., tablets, inhalers, nasal sprays, and insulin injections) were selected for investigation. In contrast, the dosage forms with incalculable maximal dose per day (e.g., topical creams, eye ointments, and eye drops) were excluded.

Data analysis

Descriptive statistics were used in data analysis. In the current study, "unused

medications” were defined as medications which the amount was prescribed more than 2 days of the required supply for the next appointment. If the amount of medications prescribed were not higher than 2 days, they were not classified as unused medications. The pharmacists in the investigated hospitals usually dispense the medications with the required supply and additional 2-day supply to ensure that the patients still have medications although they delay the doctor appointment for 2 days. Four steps of calculation for each unused medication were as follows.

1. Supply of medication per day was calculated according to the prescription.

2. Amount of medication that the patient should receive in each appointment interval with 2 additional days was calculated.

3. Amount of unused medication was calculated by the difference step 1 and step 2.

4. Costs of unused medication were calculated by multiply amount of unused medication with its price referred to the cost estimate of Ministry of Public Health, Thailand.

Example of calculation

If a patient received a medication in amount of 650 tablets on 1 March and received the same medication on 31 May and supposed that dose was 2 tablets three times per day and the price was 2 Baht per tablet, then the costs of unused medication were calculated as follows.

1. Dose of medication per day = $2 \times 3 = 6$ tablets

2. Amount of medication that the patient should receive in each appointment interval (13 weeks + 2 days) = $[(13 \times 7) + 2] \times 6 = 558$ tablets

3. Amount of unused medication = $650 - 558 = 92$ tablets

4. Costs of unused medication = $92 \times 2 = 184$ Baht

Results and Discussion

The numbers of patients with unused medications and medication items per prescription are shown in Table 1. Total outpatients with at least one chronic disease from four hospitals (designated as A, B, C and D) were 57,916. It was found that more than 50% of the patients had unused medications in all studied hospitals. The average medication items per prescription for pooled data were 5.36 items. Although Hospital D had the highest percentage of prescriptions with ≥ 10 medication items (9.10%), it had the lowest percentage of patients who had unused medications (50.65%). In contrast, Hospital B had the lowest percentage of prescriptions with ≥ 10 medication items (5.15%), it had the highest percentage of patients who had unused medications (67.28%). This implied no direct relationship between prescription size and unused medication.

Unused medication costs are exhibited in Table 2. It could be seen that total unused

Table 1. Data of out-patients with four determined chronic diseases and prescriptions in four hospitals

	Hospital A	Hospital B	Hospital C	Hospital D	Overall
Number of out-patients	18,125	9,585	16,967	13,239	57,916
Number of patients who had unused medications	11,309	6,449	10,843	6,705	35,306
Percentage of patients who had unused medications	62.39	67.28	63.91	50.65	60.96
Number of medication items per prescription (SD)	4.98 (2.61)	5.51 (2.33)	5.52 (2.71)	5.57 (2.78)	5.36 (2.64)
Number of prescriptions	67,464	45,227	71,264	48,021	231,976
Number of prescriptions with ≥ 10 medication items	3,904	2,327	5,606	4,371	16,208
Percentage of prescriptions with ≥ 10 medication items	5.79	5.15	7.87	9.10	6.99

Table 2. Unused medication costs: effect of medication prices

	Hospital A	Hospital B	Hospital C	Hospital D	Overall
Costs of prescribed medications (Baht/year)	50,637,403	66,149,764	218,582,526	119,999,296	455,368,989
Costs of unused medications (Baht/year)	2,633,073	3,635,658	8,414,804	3,699,674	18,383,209
Percentage of unused medications costs per year	5.20	6.91	3.85	3.08	4.04
Costs of the first nine unused medication items (Baht/year)	1,479,953	1,663,372	3,863,474	1,520,789	8,527,588
Percentage of the first nine unused medication items	56.21	45.75	45.91	41.10	46.39

medication costs were 18,383,209 Baht or 4.04% of total prescription costs. It could be seen that Hospital C had the highest unused medication costs but it is not the largest hospital. Hence, it was possible that unused medication costs related to drug prices since the highest prescribed medication costs were also found in Hospital C. Costs of the first nine unused medication items were around 41-56% of total unused medication costs. The lists of the first fifteen unused medication items in

these four hospitals were illustrated in Table 3. If unused costs in these items can be reduced, the unused medication costs can be saved.

According to patients' right of treatment in Table 4, unused medication costs were found in government employees > patients with Universal Coverage Scheme (UCS) > patients with Social Security Scheme (SSS) > patients who paid out of pocket. It could be obviously seen that unused medications were mostly found in patients who had full reimburse-

Table 3. Lists of the first fifteen unused medication items found in four studied hospitals

Hospital A	Hospital B	Hospital C	Hospital D
Fluticasone/Salmeterolinhaler	Berodual inhaler	Clopidogrel tablet	Atorvastatin tablet
Losartan tablet	Clopidogrel tablet	Rosuvastatin tablet	Clopidogrel tablet
Nifedipine tablet	Valsartan tablet	Salmeterol/Fluticasone inhaler	Valsartan tablet
Budesonide/Formoterolinhaler (60 doses)	Pioglitazonetablet	Budesonide inhaler	Manidipine tablet
Simvastatin tablet	Atorvastatin tablet	Metformin tablet	Simvastatin tablet
Pioglitazone tablet	Irbesartan tablet	Telmisartan tablet	Telmisartan tablet
Valsartan tablet	Nifedipine tablet	Irbesartantablet	Cilostazol tablet
Amlodipine tablet	Candesartan cilexetil tablet	Atorvastatin tablet	Rosuvastatin tablet
Budesonide/Formoterolinhaler (120 doses)	Metformin tablet	Amlodipine tablet (5 mg)	Metformin tablet
Rosuvastatin tablet	Human premixed insulin	Pioglitazone tablet	Aspirin tablet (81 mg)
Atenolol tablet	Rosiglitazone tablet	Simvastatin tablet	Amlodipine/Valsartan tablet
Enalapril tablet	Simvastatin tablet	Ipratropium Br/Fenoterol HBr inhaler	Glimepiride tablet
Budesonide inhaler	Donepezil tablet	Enalapril tablet	Fenofibrate capsule
Metformin tablet	Carvedilol tablet	Amlodipine tablet (10 mg)	Pioglitazone tablet
Theophylline tablet	Manidipine tablet	Valsartan tablet	Losartan tablet

Table 4. Average costs of unused medications by patients' right of treatment

Patient group	Average costs of prescribed/unused medications (Baht/person/year)				
	Hospital A	Hospital B	Hospital C	Hospital D	Overall
Government employees	521.75	1204.07	-	941.09	940.30
Patients with UCS	179.22	448.50	332.81	244.61	273.60
Patients with SSS	193.60	229.50	210.10	198.80	198.90
Patients who paid out of pocket	84.43	290.10	-	140.80	141.80
No classification	260.68	-	1481.97	-	1303.20

ment scheme such as Civil Servant Medical Benefit Scheme (CSMBS). This could be caused by any stakeholder, i.e., patients or physicians, who involved in the medication use process. Patients who had full reimbursement health insurance scheme may pay less attention in their drug usage and might be

over-prescribed by the physicians. In previous report, the patients who were employed had higher unused medications than those who are unemployed.⁸

As expected, patients who were older than 60 years had the highest unused medication costs when compared with those younger

as illustrated in Table 5. Usually, the elderly have a high risk of chronic diseases which leads to receive many kinds of drugs. Moreover, they usually have been forgettable. In this study, it was found that patients who were older than 60 years old was 1.7-1.8 times more likely to receive medications than those who were 31-60 years old which leads to 1.7-2.0 folds increase in unused medications costs. This finding was consistent with the previous article reporting that the highest unused medication costs were found in patients aged 60 years or above.⁸ Therefore, prescriptions

for the elderly patients should be carefully considered.

When considered the unused medication costs according to the diseases as shown in Table 6, COPD seemed to be the most major cause of the unused medication costs in Hospitals B and C. Hospital A provided COPD and asthma data together which the highest unused medication costs could be also observed. Many respiratory drugs were inhalers which are difficult or inconvenient to apply and use. They were also expensive. Hence, patients' poor medication compliance of these

Table 5. Average costs of prescribed/unused medications by patients' age

Age of patients	Average costs of prescribed/unused medications (Baht/year)				
	Hospital A	Hospital B	Hospital C	Hospital D	Overall
> 60 years					
Costs of prescribed medications	28,374,900	43,305,828	157,010,862	81,926,618	310,618,208
Costs of unused medications	1,456,111	2,540,331	6,179,389	2,605,704	12,781,535
31-60 years					
Costs of prescribed medications	21,362,701	21,260,257	60,644,615	37,112,186	140,379,759
Costs of unused medications	1,110,053	1,073,675	2,172,675	1,079,561	5,435,964
12-30 years					
Costs of prescribed medications	650,251	282,730	530,033	773,170	2,236,184
Costs of unused medications	46,674	10,507	29,274	12,962	99,417
< 12 years					
Costs of prescribed medications	249,551	220,563	397,016	187,322	1,054,452
Costs of unused medications	20,233	11,145	33,466	1,447	66,291

Table 6. Average costs of unused medications by patients' diseases

Chronic disease	Average costs of prescribed/unused medications (Baht/person/year)				
	Hospital A	Hospital B	Hospital C	Hospital D	Overall
Hypertension	144.30	380.80	535.70	310.20	144.30
DM	116.97	519.20	812.67	422.47	455.73
Asthma	309.02*	183.90	673.40	138.60	302.93
COPD	—*	711.20	1,071.90	145.30	676.90

Note: * COPD and asthma were reported in the same class.

drugs could result in escalated unused medication costs. It was in agreement with the data in Table 3 that inhalers were in the first fifteen unused medication items. In Hospital D, DM and hypertension drugs contributed to the first two highest unused medication costs. This finding was also consistent with the data in Table 3. Overall, it could be noticed that all drugs for treatment of chronic diseases could increase unused medication costs since they have generally been “stat” dispensed. In an investigation in Otago, New Zealand, the top 20 most returned unused medications were “stat” drugs.⁴

Conclusions

This hospital-based study found 35,306 unused medication cases in 57,916 prescribed out-patients with at least one chronic disease

gathered from four Thai hospitals in 2010. Drug type, patients’ right of treatment, and patients’ age were associated with unused medications. The highest unused medication costs were caused by respiratory drugs in 3 of 4 hospitals. Patients who had full reimbursement and who were older than 60 years had very high costs of unused medications.

The results were useful for the hospital pharmacists to find the causes of unused medications. Subsequently, the solutions can be purposed to solve the unused medication problem, leading to decrease of lost budget and environmental risk.

Acknowledgements

The authors would like to thank the Hospital Pharmacy Association (Thailand) for funding this research.

References

1. Committee of Medication System Analysis of Thailand. The report of medication system analysis in Thailand. Bangkok: Thai Ministry of Public Health; 2002.
2. Cameron S. Study by Alberta pharmacists indicates drug wastage a “mammoth” problem. *CMAJ* 1996; 155: 1596-8.
3. Wongpoowarak P, Wanakamane U, Panpongtham K, et al. Unused medications at home-reasons and costs. *IJPP* 2004; 12: 141-8.
4. Braund R, Yuen YC, Jung J. Identification and quantification of medication returned to Otago pharmacies. *NZFP* 2007; 34: 258-62.
5. Ali SE, Ibrahim MIM. Extent of medication wastage and cost among female students in a University Setting. *Mahidol Univ J Pharm Sci* 2009; 36: 34-43.
6. Ibrahim SZ, Mamdouh HM, El-Haddad IZ. Analysis of medications returned to community pharmacies in Alexandria, Egypt. *Life Sci J* 2012; 9: 746-51.
7. El-Hamamsy ML. Unused medications: how cost and how disposal of in Cairo, Egypt. *IJPSR* 2011; 2: 21-7.
8. Main E. Get rid of unused prescription drugs without contaminating your drinking water. Available at: <http://www.rodale.com/print/1760>. Accessed May 2, 2012.
9. World Health Organization. International Statistical Classification of Diseases and Related Health Problems 10th Revision (ICD-10). Available at : <http://apps.who.int/classifications/icd10/browse/2010/en>. Accessed March 4, 2010.