Research Article

Recognition on Medication Safety and Look-alike/Sound-alike Medication Problems in Thai Public Hospitals

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Abstract

Little is known about medication safety policy recognition and look-alike/sound-alike (LASA) medication error magnitude among Thai public hospitals. We aimed to determine recognition on and implementation of Thai national medication safety policy, and type and frequency of LASA errors. Questionnaires were mailed to all 971 public hospitals during September 2009 to January 2011. We found that, of 479 informants, the majorities of all returned questionnaires were from community hospitals. Of all informants, the majorities consisted of 226 pharmacy department heads and 353 staff pharmacists. The majority knew about the national policy on medication safety (88.52%). Most hospitals reported complete implementation of medication safety measure (MSM) (78.29%) while 19.41% reported partial implementation. Most hospitals (82.46%) ranked LASA incidents the most troublesome cause of medication safety but the most carried out MSM was for preventing high-alert drug errors. Most given LASA errors were commonly found in various hospitals. Generic name LASA errors were most frequently reported. This study aimed to achieve a systematic approach by means of medication safety measures to alleviate the related problems at all healthcare system levels.

***Key Words*:** LASA medication problem; Medication safety; Medication error

Introduction

Medication errors associating with look-alike/sound-alike (LASA) drugs are one of serious yet mostly preventable problems in healthcare system. It has been estimated that LASA errors accounted for 29% of all medication dispensing errors; specifically product name confusion associated with 15 - 25% of the overall medication errors occurring along the process of prescribing, dispensing and administration (The Institute for Safe Medication Practices Canada and The Healthcare Insurance Reciprocal of Canada, 2004). Such problems have long been recognized but unfortunately systematic measures for detection, report and prevention have not been well established locally or worldwide.

In the last decade, there has been an ongoing effort to establish a systematic approach to determine types and magnitudes of LASA medication error problems worldwide including the United States Pharmacopeial Convention (USP), the Institute for Safe Medication Practices (ISMP) of the United States, and the ISMP of Canada. Recently, the most

systematic approach to the problems was initiated by the USP where the incidents of LASA medication errors from 2003 to 2006 were compiled in the MEDMARX® Data Report 2008. In reviewing more than 26,000 error records, the USP could identify 1,470 unique drugs that caused medication errors due to brand and/or generic names that looked and/or sounded alike. Together, these drug name confusions contributed to more than 3,170 error pairs, and 1.4% of these errors resulted in patient harms, including 7 errors that could have contributed to patient deaths (Hicks et al., 2008).

Regarding the problem magnitude, specific number or rate of medication errors in Thai hospitals has not been systematically estimated because of a lack of national data. However, studies in some hospitals might have provided some rate figures. For example, an overall dispensing error of 0.02265% (0.02265 errors per 100 drug items) was found in inpatient dispensing service at a general hospital (Pattanajak, 2005), while prescribing error of 0.089%, transcribing error of 0.324%, pre-dispensing error of 1.569% and administration error of 0.080% were found in inpatient department of a specialized hospital (Somton et al., 2006). In another general hospital's outpatient and inpatient services, a prescription error of 0.061%, pre-dispensing error of 0.255% and administration error of 0.047% were found (Wipaswatcharayothin and Thamasithiboon, 2008).

The Ministry of Public Health (MoPH) announced a policy entitled the National Patient Safety Goal 2007 – 2008 which comprised 2 main issues namely healthcare-associated infections and medication safety. In its medication safety policy, in addition to 1) high-alert drugs (HAD) and 2) severe adverse drug reaction (ADR) and repeated drug allergy, awareness for LASA medication errors was included as the third component. This policy defines LASA medications as drugs with a trade or generic name that looks or reads aloud similar to other drugs, or with package or container that looks similar to other products. Each of these similarities is confusing to distinguish one product from another, and could potentially lead to serious errors (The Department of Health Service Support and The Ministry of Public Health, 2007). However, with its relatively early implementation, a nationwide recognition on and systematic implementation of such policy among healthcare providers especially hospital pharmacists could be suspected.

In an effort to efficiently raise awareness on patient safety among healthcare providers, industries, regulatory agents and policy makers, information regarding magnitude of LASA medication errors in Thailand is needed.

Objectives

This report aimed to identify 1) types and frequencies of LASA medication errors found in Thai public hospitals, and 2) recognition toward the national medication safety policy among responsible healthcare providers. This report is part of our ongoing study entitled the Development of Medication Safety Management System for Look–alike/Sound–alike Drugs in Public Hospitals which aims to understand the situation of LASA medications errors and all levels of management and policy enforcement in Thailand.

Method

In this descriptive research, we used a survey method because it could offer a means methodologically and economically appropriate to obtain information from a large number of hospitals to represent a national picture on the issue. The informants were allowed to complete the questionnaire at their convenience and not influenced by the researchers.

The whole survey process had been conducted during September 16, 2009 to January 16, 2011. For the first round, survey questionnaires were mailed to the pharmacy department in each of all 971 public hospitals in Thailand during September 16, 2009–November 15, 2009. We had waited till December 15, 2009, before the second copy of the questionnaire was mailed to those not returning the first one. After the second mailing round, we had waited till February 15, 2010. Those not returning the questionnaire were

reminded by postcards. Thereafter, we had waited for 2 months for the questionnaire return before a reminder was sent out, with a maximum of 3 consecutive reminders, if necessary. If lost as reported by the informant, another copy of questionnaire was mailed out for replacement. The questionnaire return was followed up to January 16, 2011.

Of 971 public hospitals, 887 were under the MoPH, 64 were under the Ministry of Defense, 13 were university hospitals, and 7 were hospitals of other types. The questionnaire asked the pharmacy department head to identify the informant(s) which could be the pharmacy department head him- or herself, staff pharmacist(s) assigned to the hospital medication safety system, or any other assigned persons. For each hospital, more than one informant was allowed.

The questionnaire was tested for content validity by a convenience sample of 30 pharmacists from 30 hospitals, and revised accordingly. The questionnaire was separated into 4 parts as the following. In Part I (General information), the informants were asked for general information of the hospital and assigned informant(s). These questions were, for example, hospital characteristics, informant's job position, number of pharmacists, and number of prescriptions per day. For a given hospital, the questionnaire could be answered by more than one informant.

In Part II (Medication safety policy), information about pharmacist recognition on medication safety policy, specifically the National Patient Safety Goal 2007 – 2008, was requested. The questions asked the informants whether they knew about the national patient safety policy, and about the source of such information they had learned of which more than one source could be chosen. They were also asked to rank the 3 medication safety problems, i.e., 1) HAD errors, 2) LASA errors, and 3) repeated drug allergy, according to troublesomeness of each problem they had perceived. Finally they were asked whether they had implemented safety measures with given choices of either complete, partial or no implementation. To verify the answer of the proceeding implementation question, the informants were asked to specify which measures they had implemented, i.e., measures for 1) HAD errors, 2) LASA errors, and 3) repeated drug allergy. All 3 kinds of measures must be chosen by those reporting complete implementation, 1–2 kinds by those reporting partial implementation, and none by those reporting no implementation. We found that the answers of the two questions were in accordance in each of all informants.

Part III (Information on management about LASA drugs) consisted of two sections. Section 1 asked the informants to fill in LASA drug pair errors of various types, for example, drug pairs with brand name confusion, generic name confusion, generic/brand name confusion, and drug pairs with confusing labels, packages, tablets or capsules. The informants were asked to fill in up to 3 pairs in each LASA error type. Section 2 asked the informants about methods or measures guided by the medication management system (MMS) that were implemented in their hospitals to prevent LASA medication errors. They were also asked whether such implemented measures were successful. All information could be not only from medication error records documented in the logbook, but also from the informants' experience recall since the errors listed in logbook usually were inconclusive. Part IV asked the informants for additional comments and suggestions on the LASA drug errors policy and implementation they might have had.

In addition to the survey, another convenience sample of 16 pharmacist informants, each from a public hospital was in-person interviewed. Seven of them were those who returned the questionnaire and the other 9 were those who did not. They were asked to provide detail of LASA medication problems in their hospitals.

Data analysis

This research report included only findings from Parts I, II and section 1 of Part III, of the questionnaire. Additional information regarding LASA drug pairs from the in-person interview was also added to that from the survey. All reported LASA errors were

identified and categorized by the researchers. For example, a comprehensive drug list consisting of all generic and brand names available in Thailand, Losec® and Lasix® was identified as an actual LASA error pair with a category of brand name confusion, and diclofenac and dicloxacillin with a generic name confusion. These two LASA errors were further grouped into a broader category of LASA name confusion. Other categories were LASA errors attributable to look-alike labels, packages, or tablets/capsules. Results were presented as descriptive statistics including frequencies and percentages. To represent the healthcare setting situation on the issue, unit of analysis was the hospital, not the informant.

Results

Of all questionnaires mailed to 971 hospitals, 470 were returned (a response rate of 48.40%) with the highest response rate was found among hospitals under the MoPH (439 of 887 hospitals, or 49.49%). Among 439 MoPH hospitals, the highest response rate (345 of 736, or 46.88%) and the majorities of all returned questionnaires (345 of 470, or 73.40%) were from community hospitals. Taking interview data from 9 hospitals (3 regional hospitals, 2 general hospitals, 2 community hospitals, 1 Hospitals under Department of Medical Service and 1 Hospitals under Department of Mental Health) not returning the mailed questionnaire into account, a total of 479 hospitals provided the information. Regarding characteristics of informants from 479 hospitals, the majorities were 226 pharmacy department heads and 353 staff pharmacists responsible for medication safety system.

Recognition on the national medication safety policy

Of 479 hospitals, the majority knew about the National Patient Safety Goal (424 hospitals, 88.52%) while 9.18% did not know and the rest (2.30%) did not answer this question. Of 424 hospitals that reported knowing the policy, 414 hospitals answered the question about the sources they had learned about the policy, while another 10 hospitals did not. The most reported channel was learning from the national conference for pharmacy department heads and/or the hospital pharmacy department meeting (330 informants) and from other academic conferences, Internet news and academic journals (139 informants).

Regarding perceived priority of medication safety problems regardless of policy recognition or actual implementation, most hospitals (395 of 479 hospitals or 82.46%) ranked LASA incidents the most troublesome cause of medication safety problems, followed by HADs and severe ADR and repeated drug allergy, respectively.

Of 479 hospitals, most hospitals reported complete implementation of the medication safety measure (375 hospitals, or 78.29%); while 93 hospitals (19.41%) reported partial implementation, 6 hospitals (1.25%) reported no implementation, and 5 hospitals did not answer. Of 468 hospitals reporting either complete or partial implementation, the medication safety measure reportedly implemented by most number of hospitals was the one for HAD problems (453 of 468 hospitals, or 96.79%), followed by that for LASA medication errors (435 hospitals, or 92.94%), and lastly for severe ADR and repeated drug allergy (425 hospitals, or 90.81%).

Specific LASA medication pair errors

Data regarding drug pairs associating with LASA medication errors were from 476 of 479 hospitals by means of survey and 16 pharmacists (from 16 hospitals) from in-person interviews. Of all 7,964 pairs of LASA medications reported, 3,205 unique pairs were identified.

Of all 7,964 pairs of LASA medication pairs reported, generic drug name LASA errors were the most frequently reported type of LASA problems (1,158 of all 7,964 pairs, or 15.05%). However, once unique pairs were identified, this generic drug name LASA error pairs were reduced to only 220 unique pairs, resulting in a ratio of unique pairs to all pairs of 19.00% (or 81% reduction). The top frequently reported drug pair was diclofenac vs dicloxacillin (reported by 100 hospitals). This finding on the

Table 1 Number of drug pairs by type of LASA medication errors

Type of LASA medication errors	Number of all pairs	Rank based on number of all pairs	Number of unique pairs	Rank based on number of unique pairs	% number of unique pairs per all pairs
Brand name look-alike/sound-alike	775	2	254	6	32.77
Brand/generic name look-alike/sound-alike	461	10	226	8	49.02
Generic name look-alike/sound-alike	**1,158**	**1**	220	10	19.00
Look-alike labeling by **the same company**	620	5	340	3	54.84
Look-alike labeling by the different companies	254	14	220	11	86.61
Look-alike ampoule or vial injectable drug by **the same company**	590	6	166	13	28.14
Look-alike ampoule or vial injectable drug by the different companies	417	12	254	6	60.91
Look-alike tablet or water drug bottle by **the same company**	500	8	226	8	45.20
Look-alike tablet or water drug bottle by the different companies	262	13	200	12	76.34
Look-alike drug box by **the same company**	440	11	268	5	60.91
Look-alike drug box similar by the different companies	109	15	101	15	92.66
Look-alike drug foil or blister by **the same company**	724	3	269	4	37.15
Look-alike drug foil or blister by the different companies	462	9	360	2	77.92
Look-alike tablet or capsule by **the same company**	632	4	153	14	24.21
Look-alike tablet or capsule by the different companies	558	7	**419**	**1**	75.09
Total number	7,964		3,205		40.24

largest reduction of all generic name LASA errors to the unique error pairs suggests that many specific error pairs were commonly found in many hospitals. Among the unique pairs, however, the problem with the greatest magnitude was LASA errors associating with similar tablets or capsules from different pharmaceutical companies (419 of all 3,205 unique pairs, or 13.07%) (Table 1).

In terms of specific LASA medication errors with the greatest magnitude, 10 unique pairs most frequently reported were selected (Table 2). These consisted of 3 brand name and 7 generic name LASA pairs. Among various error types, Losec® and Lasix® was the most found pair for brand name LASA errors, as reported by 122 hospitals (25.63 % of 476 hospitals), and diclofenac and dicloxacillin for generic name LASA errors as reported by 100 hospitals (21.01% of 476 hospitals).

In addition to the brand name and generic name LASA errors shown in Table 2, brand/generic name LASA errors were also of interest and specific examples were as follows: 1) Norflex® (Inova) and norfloxacin (22 hospitals), 2) Prenolol® (Berlin) and propranolol (20 hospials), 3) Norgesic® (Inova) and norfloxacin (14 hospitals), 4) Berodual® (Boehringer Ingelheim) and budesonide (14 hospitals), and 5) Madopar® and methyldopa (14 hospitals).

For package LASA errors, about 3 to 4 specific types of errors in each unique pair were found. For example, among 182 error pairs of amoxicillin 250 mg and amoxicillin 500 mg oral solid dosage form (tablet or capsule) reported from 127 hospitals, 4

Table 2 Top-ten drug pairs with LASA medication errors

Order	Drug name	Drug name	Number of hospitals reporting the error	Type of LASA error problem
1	Losec® (AstraZeneca)	Lasix® (Sanofi-aventis)	122	Brand name LASA error
2	Voltaren® (Novatis)	Ventolin® (GlaxoSmithKline)	104	Brand name LASA error
3	diclofenac	dicloxacillin	100	Generic name LASA error
4	hydralazine	hydroxyzine	99	Generic name LASA error
5	loratadine	lorazepam	96	Generic name LASA error
6	glibenclamide	glipizide	67	Generic name LASA error
7	hyoscine	hydroxyzine	52	Generic name LASA error
8	Aldactone® (Pfizer)	Aldomet® (M&H)	37	Brand name LASA error
9	metformin	metronidazole	31	Generic name LASA error
10	simethicone	simvastain	29	Generic name LASA error

types of package LASA problems were identified including 1) look-alike labels from the same company, 2) look-alike boxes from the same company, 3) look-alike package foils or blisters from the same company and 4) look-alike tablets or capsules from the same company. The top 5 drug pairs with look-alike packaging problems are presented in Table 3 and Figures 1 - 5.

For detail of individual measures implemented (Section 2 of Part III of the questionnaire), measures to prevent LASA errors were, for example, avoiding drugs with LASA drug names in the hospital formulary and not buying drugs from companies that have products looking similar to products of their own or other companies. Detail of individual measures implementation both at hospital and national levels will be presented in another publication.

Discussion

The survey questionnaires were firstly mailed to the pharmacy department in public hospitals in September 16, 2009 and we waited for 2 months for the questionnaire. The cause of the long waiting time for questionnaires was a low response rate following the first mailed survey. For those hospitals not returning the questionnaire, the second survey questionnaire was mailed out. Following the second questionnaire mailing, post cards were sent and telephone calls were made to encourage the response until January 16, 2011. Since, we aimed to obtain as much information regarding hospital experience as possible, this long survey period did not cause bias but rather ensured the saturation of the information.

Recognition on and implementation of the national medication safety policy

In this survey on the recognition on national patient safety policy and LASA medication errors among public hospitals, we found that the national policy was recognized by most hospitals (88.52%), through the National Patient Safety Goal 2007–2008 announcement. This recognition rate seems to be in accordance with the official implementation of the policy; however, since the announcement was carried out by an authoritative agent, a 100% recognition rate should be aimed for an effective implementation. Of 226 pharmacy department heads completing the questionnaire, the majorities (211 or 93.36%) knew the policy. This disparity on policy recognition, together with a 78.29% implementation, might have happened from 1) lack of communication among healthcare providers in the hospital pharmacy department, and 2) no official request for performance report or systematic performance assessment tools by the MoPH. This indicates an urgent need for an effective communication method both at national and hospital levels. Staff pharmacists should be able to learn such policy from their department head through various channels. Most importantly, an

Table 3 Top 5 drug pairs with look-alike packaging problems

Order	Drug pair	Number of drug pair	Number of responding hospitals	Type of problem	Number of drug pair by LASA type
1	Amoxicillin 250 mg and Amoxicillin 500 mg solid dosage from (tablet or capsule) (GPO) See figure 1	182	127	- Look-alike labels from **the same company**	36
				- Look-alike boxes from **the same company**	31
				- Look-alike foils or blisters from **the same company**	54
				- Look-alike tablets or capsules from **the same company**	61
2	Diazepam 10 mg/2 ml and Furosemide 20 mg/2 ml injections (GPO) See figure 2	121	112	- Look-alike labels from **the same company**	11
				- Look-alike ampoules or vials from **the same company**	109
				- Look-alike boxes from **the same company**	1
3	Propranolol 10 mg and Propranolol 40 mg solid dosage form (tablet or capsule) (GPO) See figure 3	120	84	- Look-alike labels from **the same company**	23
				- Look-alike boxes from **the same company**	15
				- Look-alike foils or blisters from **the same company**	57
				- Look-alike tablets or capsules from **the same company**	25
4	Vitamin K 1 mg/0.5 ml and Vitamin K 10 mg/ml injections (Atlantic Lab) See figure 4	88	76	- Look-alike labels from **the same company**	10
				- Look-alike ampoules or vials from **the same company**	71
				- Look-alike boxes from **the same company**	7
5	Enalapril 5 mg and Enalapril 20 mg solid dosage form (tablet or capsule) (Berlin Pharm) See figure 5	82	67	- Look-alike labels from **the same company**	22
				- Look-alike boxes from **the same company**	8
				- Look-alike foils or blisters from **the same company**	51
				- Look-alike tablets or capsules from **the same company**	1

official measure for hospital performance evaluation should be initiated from the MoPH.

Regarding safety measure implementation, while LASA errors were the most troublesome problems as reported by most hospitals (82.46%) because of a larger list of error-prone products, measures to prevent HADs were the most implemented (96.79%). This finding was reasonable since measures for HAD errors 1) had been introduced more than 6 years along with the nationwide trend of hospital accreditations (The Healthcare Accreditation Institue (Public Organization), 2006), 2) had a smaller list of suspect drugs with serious intrinsic undesirable effects, and 3) possessed specific detection and prevention strategies.

LASA name errors

Generic drug name LASA errors were the most frequently reported, and most commonly shared

among hospitals as indicated by the largest reduction of number of all pairs to unique pairs. With an ongoing effort to encourage generic name prescribing practice, generic name LASA errors could potentially remain a problem. However, for those errors with severe consequences, a switch to brand name prescribing should help prevent the errors. More importantly, given that look-alike tablets or capsules from different companies were the most frequently found LASA error unique pairs, the problem could largely remain since simultaneous co-operation from various companies is needed.

With a large number of diverse pairs of problematic drugs found, this was likely due to the differences in drugs lists among hospitals and in brand names of any given generic drug from various pharmaceutical companies. In accordance with our findings, drug pairs with 1) LASA drug name, 2) look-alike label, 3) look-alike package, and 4) look-alike tablet or capsule have been reported worldwide and some incidents caused severe consequences as reported in other countries (The Institute for Safe MedicationPractices Canada et al., 2004; WHO Collaborating Centre for Patient Safety Solutions, 2007; Hicks et al., 2008).

First, LASA name error, the most frequently found LASA error, could be further classified into 3 groups namely LASA brand name errors, LASA generic name error, and LASA generic/brand name errors. For LASA brand name errors, confusion between Losec® (omeprazole) and Lasix® (furosemide) was the most common in our study. This pair was reported in several countries including the US, Australia, Canada and Belgium (WHO Collaborating Centre for Patient Safety Solutions, 2007). A case of death of taking Lasix® instead of Losec® was reported in the US (Faber et al., 1991). As a consequence, Merck, the owner of Losec® in the US, changed the product trade-name to Prilosec® (Hoffman, 1990). In Thailand, both omeprazole and furosemide have been manufactured by many local manufacturers. Even with several brands of generic omeprazole and generic furosemide products available, physicians are used to prescribing the drug with original brand name, i.e., Losec® and Lasix®, respectively. The second drug pair error was Voltaren® (diclofenac, a non-steroidal anti-inflammatory drug) and Ventolin® (salbutamol, a bronchodilator) where the possible outcome of taking Voltaren® in asthmatic patients is that diclofenac could potentially exacerbate bronchospasm. The third drug pair was Aldactone® (spironolactone) and Aldomet® (methyldopa). In the US MEDMARX® 2008 report, medication error of this pair was classified as severity class C – D (Hicks et al., 2008), where both classes denote an error that reaches the patient; while no patient harm was observed in class C, class D required monitoring to confirm no harm and/or intervention to preclude harm (National Coordinating Council for Medication Error Reporting and Prevention, 2001).

For LASA generic name errors, we found diclofenac - dicloxacillin confusion was the most reported pair. This LASA name pair could be unique to Thailand since it has not been reported in any other countries. This problem was attributable to the confusing physician handwriting which could potentially lead to dispensing error. The second most reported confusing pair was hydralazine and hydroxyzine. Furthermore, with a similar availability of 10 and 25 mg tablets of both hydralazine and hydroxyzine in Thailand, a greater likeliness of error by these two generic drugs could be reasonably expected. This drug pair was reported in USA in MEDMARX® 2008 indicating a severity class C to D (Hicks et al., 2008). The third pair of loratadine and lorazepam, also indicated as class C –D in MEDMARX® 2008 (Hicks et al., 2008), also arose from confusing handwriting.

The errors associating with LASA brand name/ generic name were also of great concern even though not in the top-ten list (Table 2). Our survey found the pair of Norflex® (orphenadrine), a muscle relaxant, and norfloxacin, an anti-infectives, was most frequently reported. As previously reported in the US, norfloxacin 400 mg tablet was prescribed but the patient was given Norflex® since the physician used the abbreviation “norflox” rather

than the full name norfloxacin. This error resulted in the patient experiencing side effects of Norflex® including being weak, dizzy, and hallucinated (Pincus and Ike, 1992). The second drug pair was Prenolol® (atenolol) and propranolol both of which were beta-adrenergic blocker antihypertensive drugs. Prenolol® is brand name of atenolol from a local pharmaceutical company in Thailand. Mistaking Prenolol® (100 mg tablet atenolol) for the intended propranolol (e.g., a prescribed regimen of 40 mg 3 times daily) could lead to an overdosed atenolol of 300 mg. per day, i.e., 100 mg atenolol 3 times daily was given. Overdosing atenolol could lead to various cardiovascular and respiratory harmful effects (Micromedex 2.0, 2012b; Micromedex 2.0, 2012a).

Errors from look-alike labels, packages, tablets and capsules

The likeness of labels, packages, capsules or tablets among products in a given company may be based on the unique brand identity concept especially very obvious in the case of product labels of a given drug with different strengths. In addition, it is not unusual to find the look-alike label of products of different drugs from different companies, for example, simvastatin 20 mg tablet (GPO) and aspirin 81 mg tablet (Osoth Interlab).

The errors associated with look-alike packages could be found in various forms of containers including ampoule and vial for injectable drugs, bottles for tablets or liquid drugs, and pill box, foil or blister for tablets or capsules. The package-related problem was also originated from brand identity concept of the manufacturer. Even with different drugs from different companies, small look-alike ampoules, and if worse, with look-alike printed font, size, and color on both ampoules could have workers mistake one for another. For vials of a given drug product with two different strengths, their plastic caps with similar color could cause strength confusion. For bottles with similar actual size, but with different volumes of the filled liquid drug, especially dry syrup for children could also cause confusion. Regarding foils or blisters for tablets or capsules, the common silver-colored patterns with look-alike labels on the packages of various products could easily confuse the workers.

Look-alike tablets or capsules were more likely to arise from a given drug with different strengths, in a given company. The most frequently found error pair in this category was amoxicillin 250 mg capsule and 500 mg capsule from the GPO.

There has been an effort to inform the companies to differentiate the look-alike products. To date, some manufacturers had changed their product package in response to such requests. These included the differentiation of amoxicillin 250 mg capsule and 500 mg capsule of GPO (both in yellow-black color) by changing the color of 500 mg capsule to blue-green as well as changing the color of 250 mg box (Figure 6). Another example from GPO was the change of label on diazepam injection ampoule to differ from furosemide injection ampoule (Figure 7). Package change was also seen in Anapril® (enalapril) 5 mg and 20 mg tablets of Berlin Pharma, where the box of 5 mg tablet was changed from red to pink and a solid blue line was placed in the middle of the 20 mg tablet foil (Figure 8).

Regarding study limitations, in addition to a relatively low response rate, another obvious drawback was that we could not determine the impact of the policy implementation precisely. In Thailand, before the medication safety policy was implemented in 2007, most hospitals had not collected data regarding medication error incidents. To estimate the impact of the policy on the error incidents by comparing the incidents before and after the policy implementation was thus unreliable.

Conclusion

This survey showed that most hospitals recognized medication safety policy through the Thai National Patient Safety policy and implemented such policy to prevent medication errors from HADs, LASA drugs, and severe ADR and repeated drug allergy. Medication errors attributable to LASA drug names with several drug pairs were found. In addition, the problems associating with look-alike

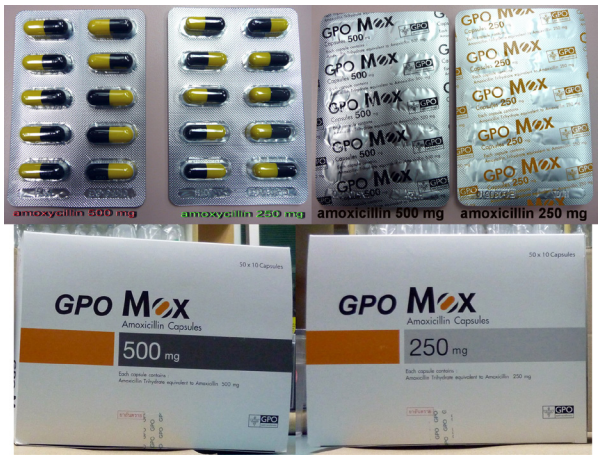


Figure 1 Amoxicillin 500 mg and 250 mg (GPO)

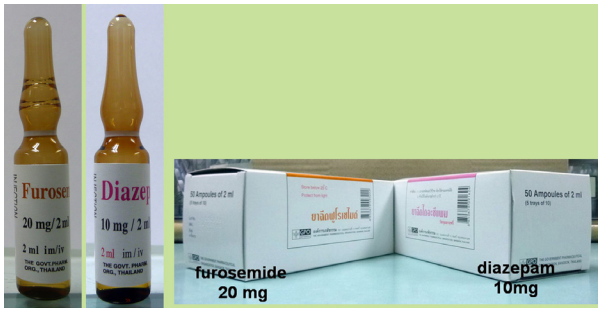


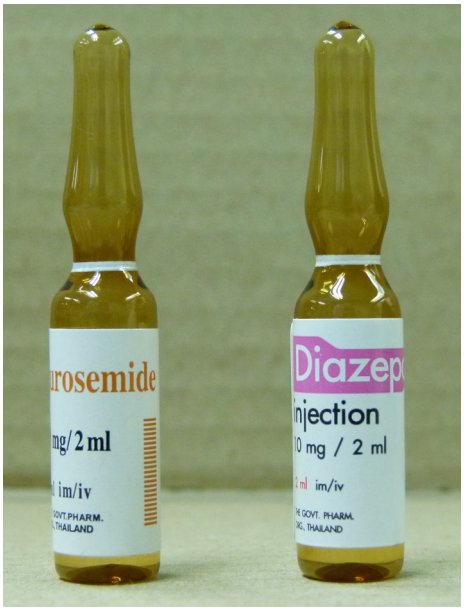
Figure 2 Diazepam injection 10 mg/2 ml and furosemide injection 20 mg/2 ml (GPO)

Figure 3 Propranolol 40 mg and 10 mg (GPO)

Figure 4 Vitamin K1 10 mg and 1 mg (Atlantic Lab)

Figure 5 Enalapril 5 mg and 20 mg (Berlin pharm)

Figture 6 The changes of amoxicillin 250 mg and 500 mg (GPO)



Figture 7 The changes of diazepam injection and furosemide injection (GPO)

Figture 8 The changes of Enalapril 5 mg and 20 mg (Berlin Pharm)

labels, package and tablet/capsule were found mostly among products from the same company and among generic drugs.

We hope that the findings on LASA errors could contribute to healthcare practice advancement in at least two aspects. Data of medication pairs that led to LASA errors could raise vigilance awareness among healthcare practitioners especially for errors arising from generic names confusions. In a larger context, we hope to advocate national policy makers to recognize the problems and try to find solutions at the national level.

Recommendations

The findings suggest a need for developing LASA database both at hospital and national levels and studying effectiveness of the database implementation. The data should be collected on the severity of LASA drug problems and the frequency of error to prioritize the problems. Risk matrix should be used to analyze and select the serious problems to prior solve.

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