

U.S. PHARMACOPEIA
The Standard of Quality™

USP Home | MER | MEDMARX® Demo | NCC MERP

January 2008

USP Patient Safety
CAPSLink™

PROVIDED BY THE USP CENTER FOR THE ADVANCEMENT OF PATIENT SAFETY

Copyright © 2007 The United States Pharmacopeial Convention, Inc.

In this Issue

USP Patient Safety CAPSLink™

This message has been sent to you as a service of the U.S. Pharmacopeia, Center for the Advancement of Patient Safety (CAPS). USP is a not-for-profit, non-governmental organization that promotes the public health by establishing state-of-the-art standards to ensure the quality of medicines and other health care technologies. CAPS is a component of USP's Patient Safety public health program. The USP Center for the Advancement of Patient Safety was created to encourage medication error reporting, conduct data analysis and research, develop educational programs, and propose standards, recommendations, and guidelines that ultimately improve the safety and quality of patient care.

Editor: John P. Santell, MS, RPh, FASHP
Contributor: W. Michael Heath, MBA, RPh

Section I: Medication Error Analysis

Paying Attention to Anticoagulant Medication Errors: What Have We Learned?

Section II: In the News...

1. USP Publishes Final Revisions to Chapter 797 (Sterile Compounding)
2. New Asthma Guidelines
3. FDA Issues Early Communication for Chantix®
4. Desmopressin Alert Issued by FDA
5. 5 Million Lives Campaign Seeks Alignment with other National Initiatives
6. Epinephrine Commercial Products Not Hazardous Says EPA
7. JAMA Study Finds Antibiotics/Topical Nasal Steroids Not Effective
8. Pre-filled Heparin Lock Flush Syringe Recall



Paying Attention to Anticoagulant Medication Errors: What Have We Learned?

After the preventable deaths of three neonates in September, 2006 resulting from a heparin overdose, it was assumed that a majority of healthcare practitioners and facilities would immediately assess similar risks within their environment and implement

additional safety measures. The recent occurrence of a similar error two months ago at a prominent California medical center begs the question – “Are we learning from each other?” The most recent incident involved several infants to include newborn twins of a prominent actor receiving 10,000 units of heparin versus the appropriate 10 units intended to flush the IV line.¹ No hospital or healthcare facility wants to be part of a front page news story reporting on a harmful medication error event (especially those involving infants). But such stories should spur practitioners and facilities alike to re-examine their current practices involving anticoagulants and possibly bolster their existing safety nets.

Anticoagulants are an important therapeutic modality in today’s drug therapy armamentarium; however research studies indicate that these drugs are frequently involved in errors. As reported by J. Fanikos and colleagues, unfractionated heparin accounted for a majority (66.2%) of errors and that 1.67 medication errors occurred for every 1,000 patients receiving anticoagulation therapy.² Although this study did not document any deaths, it was determined that of all patients who experienced a medication error related to an anticoagulant, 6.2% required some type of medical intervention and 1.5% experienced prolonged hospitalization as a direct result of anticoagulant errors.

In another study by Forster and colleagues, who evaluated the risk of ADEs after hospital discharge in 400 patients, 4 of 55 (7%) of the documented ADEs were caused by warfarin. All were considered preventable with one considered serious and the other three were considered life threatening.³

In July 2007, the Joint Commission (JC) published the 2008 National Patient Safety Goals (NPSGs), which included the addition of several new goals, one of which was goal 3E – *Reduce the likelihood of patient harm associated with the use of anticoagulation therapy*. This goal was added out of concern by the Joint Commission related to continued reports of patient harm directly attributed to anticoagulation therapy.

During the period from January 1, 2001 through December 31, 2006, a total of 59,316 medication errors related to anticoagulants were reported to USP’s MEDMARX[®] program. It should be noted that these data do not include errors involving heparin lock flush; however this may be considered for a future CAPSLink[™] article.

Approximately 32% of the errors were intercepted before reaching the patient (Category B, Table 1) which is lower than the historical MEDMARX average of (39.8%) for the same time period. Conversely, a larger percentage (59.8%) of the errors did reach the patient (Categories C and D) and a larger percentage (2.9 %) resulted in harm or death (Categories E-I). This percentage of harm is approximately 2 times higher than the percentage of harm seen for all errors reported to MEDMARX for the corresponding reporting period (1.5%). This suggests that errors involving anticoagulants are more likely to result in patient harm compared to medication errors in general and should be considered as high-alert drugs.

Table 1. Severity of Anticoagulant Medication Errors

Error Category ^a	n	% ^b
Potential errors		

A	3,319	5.6
Non-harmful errors		
B	18,832	31.7
C & D	35,441	59.8
Harmful or fatal errors		
E-I	1,724	2.9
Total	59,316	100%

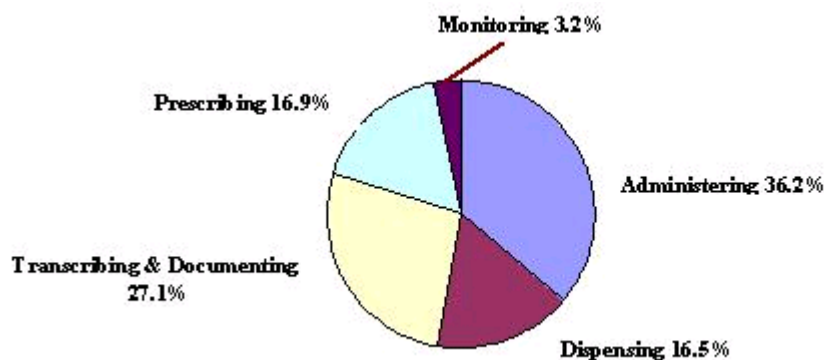
a. For complete definition of error categories see <http://www.nccmerp.org/>

b. Based on 59,316 records reported to MEDMARX during the period 01/01/01 -12/31/06

Origination Node (Phase)

A majority of anticoagulant errors occurred during the administering phase of the medication-use process (36.2%, Figure 1). This percentage is 5% higher when compared to historical MEDMARX data for the same time period. Correspondingly, the nursing (patient care) unit is the location where the majority (60%) of errors occurred. After the administering node, errors were reported to have originated during transcribing and documenting (27.1%), prescribing (16.9%) and dispensing activities (16.5%). The pharmacy department (inpatient and outpatient) was the 2nd most reported location (20%) where anticoagulant errors occurred. Errors originating during monitoring activities made up 3.2% of the total, while those occurring during drug procurement were less than 1%. Overall, these data suggest that the administration of anticoagulant medications represents the most problematic phase and one with the greatest opportunity for focused improvement strategies.

**Figure 1. Nodes (Phases) Where Anticoagulant Errors Originated
(MEDMARX® 2001-2006)**



Products Involved

The product group most associated with anticoagulant errors was heparin which included heparin, heparin sodium in dextrose and heparin sodium in sodium chloride (Table 2). These three products combined accounted for almost 35% of all reported anticoagulant errors. Closely behind in frequency was warfarin (all strengths) at 29.1%. As evidence that anticoagulants continue to be among the most problematic drug products, heparin,

warfarin and enoxaparin were all among the top twelve medications listed within USP's top 50 drug products most often associated with medication errors as documented for the period July 2002 to June 2003.⁴

Table 2. Anticoagulant Products Most Frequently Involved in Errors^a

Drug Product	n	%
Heparin (all products)	20,661	34.8
Warfarin	17,262	29.1
Enoxaparin	13,983	23.6
Clopidogrel	3,617	6.1
Dalteparin	1,581	2.7
Eptifibatide	1,526	2.6
Alteplase, Recombinant	462	2.5
Abiciximab	294	<1
Tirofiban	230	<1
Cilostazol	197	<1

a. Based on 59,316 records with 60,635 selections reported to MEDMARX Jan 1, 2001- Dec 31, 2006. Does not include heparin flush.

Types of Error

Omission error was the most frequently reported type of error (29%) indicating that approximately 1/3 of all patients did not receive their intended medications. The second most frequently reported type was *Improper dose/quantity* (27.9%) followed by *Prescribing error* (14.5%) (Table 3). Both *Omission* and *Improper dose/quantity* error types related to anticoagulants were higher than the same types of error as documented in MEDMARX overall for the same reporting period.

Table 3. Types of Medication Errors Involving Anticoagulants

Error Type	n^a	%	MEDMARX Overall %^b
Omission	16,725	29.0	23.2
Improper dose/quantity	16,127	27.9	23.4
Prescribing error	8,351	14.5	19.6
Unauthorized/wrong drug	5,682	9.8	12.4
Extra dose	5,012	8.7	5.6
Wrong time	4,428	7.3	6.8

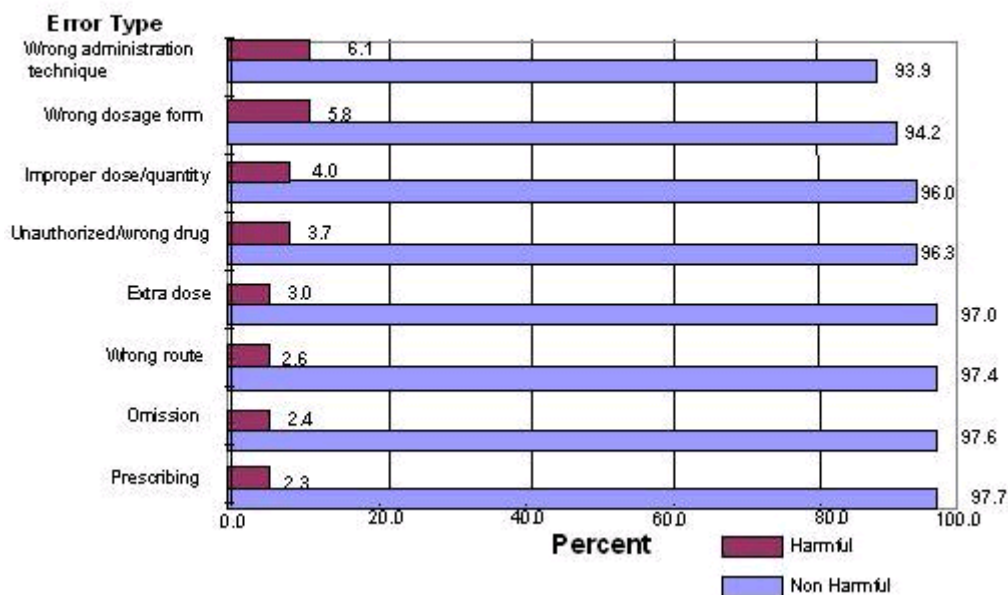
Wrong patient	2,541	4.4	4.9
Wrong administration technique	1,000	1.7	1.4
Drug prepared incorrectly	908	1.6	3.5
Wrong route	619	1.1	1.6

a. Based on 57,746 records documenting 62,139 selections reported to MEDMARX for the period 01/01/10-12/31/06

b. Based on 1,156,330 records reported to MEDMARX for the period 01/01/01-12/31/06

In addition to frequency, examining the types of error by harm uncovers another dimension of risk that can identify improvement priorities. For example, although *Omission error* (n=16,725) accounted for nearly one-third of all error types, it accounted for only 2.4% of all harmful anticoagulant errors (Figure 2). In contrast, *Wrong administration technique* (n=1,000) accounted for only 1.7% of the total error types, but accounted for 6.1% of all harmful anticoagulant errors. This suggests that although approximately one-third of all anticoagulation errors resulted in a patient not receiving a dose of medication, it was poor technique in the administration of anticoagulants that most contributed to patient harm. Wrong administration technique includes failure to follow the five basic rights in medication administration (right patient, right drug, right dose, right time and right route). For anticoagulants poor administration technique most often related to wrong drug, wrong dose and the wrong time or complete omission of a dose. As previously noted, the percentage of harmful errors associated with anticoagulants (2.9%) was nearly twice the percentage of harm seen for all errors (1.5%) reported to MEDMARX for the same time period. *Improper dose/quantity* (4.0%) and *Unauthorized/wrong drug* (3.7%) types of error also had a higher percentage of harm than what was seen for MEDMARX overall.

Figure 2. Cross Tabulation of Types of Error by Harmful versus Non Harmful



Error Causes

Performance deficit (40.6%) was the most frequently reported cause of all anticoagulant errors (Table 4). When combined with errors caused by procedures or protocols not

followed (23.9%) this accounts for almost two-thirds of all errors associated with anticoagulants, which can be attributed to causes related to human factors issues. These documented causes should serve as a reminder to facilities to ensure that staff are aware, understand, and adhere to established policies and procedures regarding anticoagulants. Other frequently reported causes of error involving anticoagulants included communication failures, omitted or inaccurate order transcription, computer entry failures, and knowledge deficit.

Table 4. Causes of Error for Anticoagulants

Error Cause	n	%
Performance deficit	23,533	40.6
Procedure/protocol not followed	13,867	23.9
Communication-related ^b	9,795	16.8
Computer-related ^b	9,273	16.0
Transcription inaccurate /omitted	9,172	15.8
Written order-related ^b	8,709	15.0
Documentation	8,262	14.2
System safeguards-related ^b	7,647	13.2
Knowledge deficit	6,131	10.6
Monitoring inadequate/lacking	2,825	4.9
Product name/package/label ^b	2,724	4.7
Calculation error	2,449	4.2
Workflow disruption	1,514	2.6
IV Pump-related ^b	1,468	2.5
Patient identification failure	719	1.2
Reconciliation failures ^b	532	<1

a. Based on 57,967 records reported to MEDMARX during the period 01/01/01-12/31/06

b. Represents the combination of several related causes of error.

Case Examples^a

1. A patient was admitted to the surgical intensive care unit following a femur fracture repair and was observed to be non-responsive with labored breathing, a disconjugate gaze, fixed pupils, and unable to be aroused. Upon review of the medication orders following a CT scan, it was discovered that the patient was receiving 130 mg of enoxaparin twice daily. The dose had been incorrectly calculated based on the patient's weight in pounds versus kilograms. The patient was intubated and was given protamine and fresh frozen plasma. Additionally, a neurosurgical consult was ordered to confirm a suspected subdural hematoma. The patient's condition continued to deteriorate, and eventually the patient expired.

2. Heparin 5,000 units was used to flush a patient's quinton catheter (Quinton Perm cath[®]), which is a large-bore, 2 or 3-lumen catheter used for hemodialysis. It

functions as a bridge device for long-term vascular access for hemodialysis. Additionally, the catheter flush was done incorrectly with the systemic administration of the heparin. The patient had previously received approximately 10,000 units of heparin soon after surgery, and rapidly developed hypotension and bleeding. Protamine, ephedrine, epinephrine, phenylephrine, dopamine and sodium bicarbonate were administered to the patient. Approximately 10 hours later, the patient went into cardiac arrest and could not be revived. A detailed root-cause analysis of the case determined that the policy related to quinton catheters was outdated. The policy was revised to include a requirement to notify a dialysis nurse to flush all quinton catheters.

3. An ICU patient was administered an entire 500mL IV bag of premixed Heparin, although the intended drug that was ordered was Hespan®. Both premixed heparin and Hespan were stocked side by side in an automated dispensing device (ADD) in the ICU. The patient required an intervention to sustain life, but eventually recovered. The close proximity of the medications in the ADD, in addition to human error, contributed to this harmful medication event. Actions taken by the facility to prevent future occurrences included utilizing the ADD technology interface that requires the ADD user to answer the question “Do you want HEParin or HESpan” prior to the drug being released for administration to the patient.

Recommendations to Prevent Anticoagulant Medication Errors:

- Require the indication for use on all medication orders
- Require an independent double-check of IV heparin before administration
- Involve pharmacists in managing patient anticoagulation therapy for both inpatients and outpatients.⁵
- Use forcing functions and targeted error prevention strategies on high-risk patients such as newborns or the elderly.⁵
- Limit the number of dosage forms and concentrations of anticoagulant medications available on patient care units to those most often used and dispense all others from the pharmacy.⁵
- Dispense all anticoagulant medications in ready-to-use (unit dose) form prepared by the pharmacy to the greatest extent possible.⁵
- Limit, to the greatest extent possible, any additional preparation steps prior to the administration of anticoagulants.⁵
- Always label anticoagulants and all medications with the drug name and strength if not given immediately.⁵
- Implement barcode medication administration (BCMA) bedside scanning technology in the administration of all medications.⁵
- Seek and use knowledge, experiences and best practice information from other facilities that have experienced and solved anticoagulant therapy problems.⁵
- Continually assess the potential for error during the selection, storage, preparation, and administration processes in areas where anticoagulants will be used, including anticoagulants stored in and dispensed from automated dispensing devices.⁵
- Develop and implement standards of care and practice that comply with the intent of the Joint Commission’s 2008 National Patient Safety Goal 3e related to safe anticoagulation therapy.

^a Case reports reflect actual MEDMARX[®] error descriptions but may have been modified for clarity.

References:

1. The Los Angeles Times. Dennis Quaid's newborns reportedly harmed by medical mix-up. Los Angeles Times Home Edition, Local News. November 21, 2007. [Click here for link.](#) (accessed 2007 Dec 17).
2. Fanikos J, Stapinski C, Koo S, Kucher N, Tsilimingras K, Goldhaber SZ. Medication errors associated with anticoagulant therapy in a hospital. *Am J Cardiol.*2004; 94(4):532-5.
- 3 Forster AJ, et. al. Adverse drug events occurring following hospital discharge. *J Gen Intern Med.* Apr 2005; 20(4):317-23.
4. U.S. Pharmacopeia. Top 50 drug products associated with medication errors. <http://www.usp.org/hqi/patientSafety/resources/top50DrugErrors.html> (accessed 2007 Dec 5).
5. ASHP Press Release, November 21, 2007. ASHP Responds to Medication Errors Harming Actor's Babies. Available from the ASHP website: http://www.ashp.org/s_ashp/article_press.asp?CID=168&DID=2037&id=23201 (accessed 2007 Nov 30).



1. USP Publishes Final Revisions to Chapter 797 (Sterile Compounding)

The U.S. Pharmacopeia has recently announced that changes to General Chapter *Pharmaceutical Compounding – Sterile Preparations* <797> have been finalized and are now available online prior to becoming official. These revisions tighten standards and conditions for sterile compounding over the previous version of <797>, with the primary goal of improving patient safety. As of December 3, 2007, the full chapter has been posted on USP's Web site at <http://www.usp.org/USPNF/pf/generalChapter797.html>. These revisions will become official on June 1, 2008, and will be included in *USP 32–NF 27* and the second edition of the *Pharmacists' Pharmacopeia*, which will be published in March 2008. The revised standards are being published online to give the compounding community time to implement changes before the official date. After June 1, the current version in *USP 31–NF 26* will no longer be considered the official chapter.

USP is providing a variety of ways for practitioners and other interested parties to become familiar with the revised sterile compounding provisions prior to the June 1 official date. The next edition of the *Guidebook on USP General Chapter* <797> *Pharmaceutical Compounding – Sterile Preparation* will be available soon. In addition, USP will be offering a variety of educational Webinars and workshops. For information on availability, pricing, dates and content, please visit <http://www.usp.org/USPNF/pf/generalChapter797.html>

2. New Asthma Guidelines

The National Heart, Lung and Blood Institute released new asthma guidelines and are included in the organization's *National Asthma Education and Prevention Program*. These guidelines, which were initially released in the summer of 2007, place greater emphasis on patient education, with the intent of empowering patients to better understand their asthmatic disease and potential symptom exacerbation triggers. The guidelines are available at: <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm>

3. FDA Issues Early Communication for Chantix®

After initial evaluation of post marketing adverse event reports for Chantix® (varenicline), the FDA has issued an "Early Communications" about an ongoing safety review of the drug. This communication reflects FDA's current analysis of available data concerning this drug and does not mean that FDA has concluded that there is a causal relationship between the drug and the emerging safety issue. Pfizer, Inc., the manufacturer of Chantix recently submitted reports to the agency describing suicidal ideation (thoughts). In the wake of a case report citing erratic behavior in an individual who had used Chantix, FDA has also asked the company for any information on additional cases that may be similar in patients who have taken the drug. Until further notification, the FDA recommends that health care providers monitor all patients taking Chantix for behavior and mood changes. Patients taking Chantix should be instructed to contact their doctor or other healthcare provider if they experience behavior or mood changes. Full text of the FDA communication about the ongoing safety review is available at: http://www.fda.gov/cder/drug/early_comm/varenicline.htm.

4. Desmopressin Alert Issued by FDA

In an alert issued on December 4, 2007, the FDA has requested the manufacturers of desmopressin update their prescribing information that includes important new information about severe hyponatremia and seizures. Certain patients taking desmopressin are at risk for developing severe hyponatremia that can result in seizures and death. Children treated with desmopressin *intranasal* formulations for primary nocturnal enuresis (PNE) are particularly at risk for experiencing these adverse effects. Desmopressin *intranasal* formulations are no longer indicated for the treatment of primary nocturnal enuresis and should not be used in hyponatremic patients or patients with a history of hyponatremia. Additionally, PNE treatment with desmopressin *tablets* should be interrupted during acute illnesses that may lead to fluid and/or electrolyte imbalance. *All* desmopressin formulations should be used cautiously in patients at risk for water intoxication with hyponatremia. For additional information, see: <http://www.fda.gov/cder/drug/InfoSheets/HCP/desmopressinHCP.htm>

5. 5 Million Lives Campaign Seeks Alignment with other National Initiatives

The Institute of Healthcare Improvement's (IHI) 5 Million Lives Campaign is a voluntary initiative that is focused on protecting patients from five million incidents of medical harm over the two year period December 2006 – December 2008. IHI is now spearheading a plan to foster the national alignment of the areas of focus of this campaign and others from a variety of national organizations and agencies to include the Agency

for Healthcare Research and Quality (AHRQ), the Centers for Medicare and Medicare Services (CMS), the Centers for Disease Control and Prevention (CDC), the Institute of Medicine (IOM), the Joint Commission (JC) and others. Additional information on this national health care improvement initiative alignment is available at: [Click Here](#).

6. Epinephrine Commercial Products Not Hazardous Says EPA

The Environmental Protection Agency (EPA) recently determined after collaborating with the FDA that commercially available products containing epinephrine salts are not considered “hazardous wastes, “ and will be removed from the EPA’s list of regulated hazardous medical waste. Additional information is available from:

<http://www.epa.gov/EPA-IMPACT/2007/September/Day-20/i4663.htm>

7. JAMA Study Finds Antibiotics/Topical Nasal Steroids Not Effective

In a study recently published in the *Journal of the American Medical Association* (JAMA), the researchers concluded that neither an antibiotic nor a topical steroid alone or in combination was effective as a treatment for acute sinusitis in the primary care setting.

The study involved providing patients with dose of 500 mg of amoxicillin 3 times per day for 7 days and 200 mcg of budesonide in each nostril once per day for 10 days. Acute sinusitis is a common clinical problem that usually results in a prescription for antibiotics but the role of antibiotics is debated. Anti-inflammatory drugs such as topical steroids may be beneficial, however additional research is needed. Full article available at: [Click here](#).

8. Pre-filled Heparin Lock Flush Syringe Recall

The FDA and AM2PAT, Inc. recently issued a nationwide recall of one specific lot of Pre-Filled Heparin Lock Flush Solution (5 ml in 12 mL Syringes), Lot # 070926H. The heparin IV flush syringes were found to be contaminated with *Serratia marcescens*, which has been documented to result in patient infections. Patients could experience serious infection as a result of this bacteria that could present serious adverse health consequences to include life-threatening injuries and/or death. Consumers and health care providers should examine all lots of Heparin Lock Flush, and if this specific lot is discovered, immediately stop using the product, quarantine it and return the affected product to the appropriate pharmaceutical distributor. Entire FDA press release on this subject is available at: http://www.fda.gov/oc/po/firmrecalls/am2pat12_07.html

USP Medication Error Reporting Programs:



MEDMARX[®]—USP’s comprehensive, Internet-accessible, anonymous medication errors reporting program, and quality improvement tool. The program facilitates productive and efficient documentation, tracking, trending, and prevention of medication errors.



Medication Errors Reporting (MER) Program—presented in cooperation with the Institute for Safe Medication Practices, this nationwide program makes it possible for health professionals to report medication errors confidentially and anonymously to USP.

Other USP patient safety resources:

- [MEDMARX Annual Data Summary reports](#)—provides readers with a wealth of information on reported error events including patterns in the types, causes, and level of harm associated with medication errors.
- [Understanding and Preventing Medication Errors: A Resource for Healthcare Practitioners](#)—a CD toolkit with practical guidelines, forms, and templates to help healthcare facilities improve error-reduction initiatives.
- [Advancing Patient Safety in U.S. Hospitals: Basic Strategies for Success](#)—a book in which hospitals share stories about how they reduced medication errors and promoted safer patient care.
- Medication Safety Pocket Reference—a pocket-sized reference booklet containing listings of similar drug names and dangerous abbreviations that could cause medication errors. Contact custsvc@usp.org and ask for item #3227702.
- Similar Drug Names Poster—a wall poster for easy reference listing look-alike and sound-alike drug names known to cause confusion and potential medication errors when handwritten or communicated verbally. Posters are packaged in quantities of 1 (item # 3728251) 10 (item # 3728252) and 50 (item # 3728253). Contact custsvc@usp.org and ask for the appropriate item number.

-
- Refer your colleagues to [subscribe](#) to this newsletter.
 - If you no longer desire or consent to receive this newsletter, you can [unsubscribe now](#).

USP does not sell or distribute email addresses. Questions about USP CAPSLink™ may be sent to caps@usp.org.

Copyright 2007, U.S. Pharmacopeia. All rights reserved