



Ephedrine-epinephrine mix-ups

Confusion between epinephrine and ephedrine has been reported on numerous occasions. Not only do these drug names look similar, but their use as vasopressors or vasoconstrictors makes storage near each other likely. Both products also may be similarly packaged in 1 mL ampuls or vials.

As the following event shows, these mix-ups can have serious consequences, especially if concentrated epinephrine is administered in error. In a labor and delivery unit, a healthy young woman became hypotensive after administration of epidural anesthesia. The nurse immediately called the resident, who impatiently ordered ephedrine 10 mg to be given slow IV push. When gathering the medication, the nurse was distracted by the resident's demeanor and subsequently made a mental slip, confusing ephedrine with epinephrine. With only a few ampuls of epinephrine 1 mg on the unit, she decided to borrow more from the nursery. She found a 30 mL multi-dose vial of epinephrine 1:1,000 (1 mg/mL), withdrew 10 mL, and returned to administer that amount to the patient. Almost immediately, the patient developed tachycardia, severe hypertension, and pulmonary edema. Fortunately, an anesthesia staff member was present and recognized the

problem immediately. The patient was treated successfully and the baby was safely delivered. However, other mix-ups like this have been fatal.

An eerily similar scenario played out at a different hospital where yet another patient was hypotensive from epidural anesthesia. A nurse called pharmacy to report that the automated dispensing cabinet did not have enough epinephrine to administer a 5 mg IV dose. A pharmacist immediately reviewed a copy of the order in which the physician had actually prescribed ephedrine 5 mg IV. Had there been enough epinephrine in the cabinet, a 5 mg IV dose might have been given to the patient.

We've also received reports where ephedrine was administered in error instead of epinephrine. In one case, a patient received an irrigation solution during an orthopedic procedure in which ephedrine, not epinephrine, had been incorrectly added to the irrigation solution container. In yet another hospital, ephedrine was used to mix an epinephrine infusion. In these cases, both patients experienced minor complications, but serious harm was averted because the patients were being monitored very closely. See **check it out!** in the right column for suggestions to help avoid mix-ups between ephedrine and epinephrine.

nicecatch



Furosemide or midazolam? A nurse received a ziplock bag from pharmacy that she expected to contain two vials of furosemide 20 mg (10 mg/mL in 2 mL vial) for injection. The bag was appropriately labeled for a single patient and checked by a pharmacist. Upon closer inspection, the nurse discovered that one of the vials was midazolam. Both vials (both from Hospira) are the same size, shape, and color, with identical orange caps. The text for drug name, lot numbers, and expiration are also very similar. The only distinguishing characteristic is some blue text on the midazolam label. Look-alike packaging can be an easy error trap during drug dispensing or administration. This is a good example of how a system of double checks between pharmacists and nurses can work to stop medication errors. However, bar-coding systems would be a more reliable system of double checks. ISMP interacts with drug manufacturers to facilitate label changes based upon reports just like this one. So send us your reports about labeling via: <https://www.ismp.org/orderforms/reporterrortolSMP.asp>.

check it out! ✓✓✓✓

To avoid mix-ups between ephedrine and epinephrine:

✓ **Distinguish.** Ask pharmacy to help distinguish the appearance of these drug names on product labels, medication administration records, and automated dispensing cabinet screens by using highlighting, bold face, color, circling, or tall man letters for the parts of the names that are different (e.g., **EPINEPH**rine, e**PHED**rine).

✓ **Confirm.** If epinephrine and ephedrine are both available in an automated dispensing cabinet, configure the screen to request confirmation by asking: "EPINEPHrine has been entered; is this what you want? YES or NO;" or ePHEDrine has been entered; is this what you wanted? YES or NO."

✓ **Have pharmacy prepare.** To ensure the performance of multiple independent double-checks of the product before administration, have pharmacy prepare all infusions and bolus doses for these drugs whenever possible.

✓ **Separate.** Never store the products side-by-side, or allow the drug names to appear sequentially on a computer screen from which drugs are selected.

✓ **Reduce access.** To the extent possible, limit the storage of concentrated epinephrine to crash carts (and pharmacy) to reduce the risk of dilution errors or administration of the wrong product. Epinephrine 1:1,000 in 30 mL vials represents a particular threat and should be removed from all patient care units. (The 30 mL vials of epinephrine have also been mistaken as lidocaine with epinephrine.) In fact, 30 mL vials may no longer be needed on most units since high-dose epinephrine use during CPR is no longer supported.

Practitioners agree on medication reconciliation value, but frustration and difficulties abound

More than 1,400 healthcare providers responded to our April/May 2006 survey on medication reconciliation, primarily nurses (75%) and pharmacists (21%) from hospitals (89%) and outpatient settings (6%). Most respondents (91%) were familiar with the Joint Commission National Patient Safety Goal (NPSG) related to medication reconciliation, but only three quarters had attended inservice education about the process. Pharmacists, and managers or administrative professionals, were most familiar with the NPSG and had attended inservices more frequently than nurses and staff-level practitioners, despite the significant role that staff nurses play in reconciliation.

More than a quarter of respondents reported that a medication reconciliation process upon admission had been in place for a relatively short period of time (3-6 months). Just 18% reported a duration of more than 1 year. Similar results were found with medication reconciliation upon transfer and discharge, with the most common duration cited as 3-6 months (23%). Again, only 19% of respondents reported a transfer reconciliation process in place for more than 1 year, and 17% reported this duration for discharge reconcilia-

tion. Thus, many respondents were in the beginning stages of developing a workable medication reconciliation process.

The distribution of responsibilities for the different aspects of the admission, transfer, and discharge medication reconciliation process can be found in Table 1. Of particular interest is that roughly a quarter of respondents did not know who was responsible for sending the patient's discharge medication list to the patient's physician or next provider upon discharge from an inpatient or outpatient setting. Similarly, many respondents were unsure of the time in which medications must be reconciled. Thirty-six percent of nurses were unsure of the required timeframe, as were 49% of staff-level respondents, and 63% of practitioners working in outpatient/office settings. The most common timeframe for reconciliation reported by all respondents was within 24 hours of obtaining an admission medication history. Less than 15% of all respondents required a different timeframe depending upon the critical nature of the drugs on the patient's medication history, with one exception: 27% of homecare respondents employed different timeframes for reconciliation of critical drugs. But again, about a

continued on next page

Table 1. Responsibilities for Medication Reconciliation (more than one category could be chosen)

Medication Reconciliation Process: Who is primarily responsible for the following?	Nurse	Pharmacist	Physician/ Prescriber	Medical Records	Other	Don't Know
a. Collecting an initial medication history	92%	6%	30%	1%	3%	0
b. Assuring the medication history is accurate	76%	21%	45%	1%	2%	3%
c. Reconciling medications between the history and the admission orders	63%	26%	50%	1%	2%	5%
d. Reconciling medications upon transfer of a patient to another level of care	67%	21%	51%	0	2%	5%
e. Reconciling medications at the time of discharge	67%	12%	57%	0	2%	6%
f. Sending the patient's discharge medication list to the patient's physician/next provider	50%	4%	18%	9%	10%	24%

Table 3. Excerpts of Selected Comments

We have spent more time on the forms and this process than on any other safety project. We have also had to increase staffing in pharmacy without reimbursement from insurance or another payer.
This is a very hard process to implement, regulate, and track in our facility. Some of the NPSGs were very straight forward; this one is not. While I think most of our staff feel it is important and do some level of reconciliation, the process is still foggy.
This is a complex process that, when applied universally, creates points of contention with the medical staff, especially surgeons. Unfortunately our Information System vendor is not providing the solutions required.
Policy makers have not obtained valuable input from nurses and physicians. The result is a complicated, disjointed, and time consuming process in which compliance is low.
Until there is a national database for patient medication histories, reconciliation will be continue to be problematic for all.
We had an interdisciplinary team implement the process, but it seems like every unit is different and has its own cultural reaction to the change.
We still struggle with this whole process. We need to come up with a way to get medical staff fired up over this.
The reconciliation goal is important to patient safety, however the information rises and falls on the information the patient provides to the health care team. There needs to be a major advertising blitz on the television and radio asking people to put together an accurate list of their medications.
It would have been easier if computerized software for medication reconciliation had been perfected before implementation. There is too much paperwork and duplication now.
Leadership and providers don't agree with the necessity of medication reconciliation. Therefore, our current process meets a superficial "check the box" requirement for inspection purposes only.
Until nursing leadership makes it a priority for nurses, and hospital administration makes it a priority for physicians, I fear we will swim in circles on this issue.
I really feel that the reconciliation on admission is an accident waiting to happen. We have had some severe near misses. Physicians take these reconciliation sheets as gospel.
Communication between facilities and retail pharmacies is poor at best, and would benefit if a formalized universal method of communicating med profiles can be instituted, preferably via electronic processing.
I know this is needed, but it is very stressful trying to get it done along with all the other safety issues and caring for other patients. To make this happen, I think the government should be looking at ways to reimburse hospitals for this process so more staff could be available to make this happen.
I think that faculty in universities should also be learning about this initiative to introduce the concepts to students.
A resource intensive process to start, this will take a culture shift to get everyone on board. This is a journey that will take 12-24 months to get significant measurable results.
Perhaps JCAHO will give healthcare systems a little more time.
I may never know, but I am sure I have prevented medication errors in the home by reconciling medications.

Reconciliation continued

third of hospital respondents and two-thirds of outpatient staff were unsure of the required timeframe for reconciling medications after admission.

More than half of all respondents documented the reconciliation process on paper; about one in ten used computer documentation; and a quarter employed both paper and computer documentation. Results were split regarding the prescribing of admission medications on the same form or screen used to document the initial history, with 32% using and 46% not using the same form or screen. However, another 14% reported that the patient's initial medication history form or screen was *sometimes* used when prescribing admission orders, suggesting inconsistencies that could lead to overlooked orders.

The relative importance of success factors and barriers encountered by respondents during the implementation of medication reconciliation process can be found in Table 2. Regardless of the respondents' profession, staffing level, or type of facility in which they worked, *teamwork among disciplines* and *clearly defined protocols* were ranked the most important factors for success. In fact, there was almost no variation in the relative ranking of success factors among all respondents, even those with

reconciliation processes in place for differing lengths of time, from 0 months to more than 1 year. Although the most significant barriers encountered by all respondents included *unreliable patients* and *lack of physician leadership*, the ranking varied among respondents from differing professions, staffing levels, and workplaces. For example, compared to hospital staff, outpatient staff reported that not having clearly defined protocols was a more significant barrier, and not having physician leadership was a less significant barrier.

While the vast majority of respondents (82%) felt that medication reconciliation is of great value to patient safety, more than 300 insightful comments submitted with the survey clearly showed a high level of frustration with implementing these processes. Excerpts of a few selected comments can be found in Table 3 (on page 2). A larger list of excerpts and full survey reports (including unedited comments) can be found at: www.ismp.org/survey/survey200604r.asp. We encourage you to read the respondents' comments to help paint a more vivid picture of the challenge we still face with successfully implementing medication reconciliation. For more on medication reconciliation, visit: www.ismp.org/Newsletters/acutecare/articles/20050421.asp.

Table 2. Percent of Respondents Ranking Success Factors and Barriers as Most Important

Success Factors	%	Barriers	%
Teamwork among disciplines	57%	Unreliable patient	42%
Clearly defined protocols	39%	Lack of physician leadership	31%
Centralized history form/screen	32%	Lack of teamwork among disciplines	30%
Awareness of the role of each contributor	24%	Extra burden	21%
Reasonable expectations for "complete" history	23%	Documentation from other sources	19%
Easy communication with outpatient providers	15%	Lack of frontline staff input into process	17%
History collection by pharmacist	10%	Lack of administrative leadership	15%

safetywire



Textbook errata. Mosby's 2006 *Nursing Drug Reference* contains incorrect information regarding administration of **AGGRASTAT** (tirofiban). On page 940, in the second entry under the "Administer, IV route" heading, the information reads: "Dilute inj: withdraw and discard 100 mL from a 500 mL bag of sterile 0.9% NaCl or D5W and replace this vol with 50 mL of tirofiban inj from one vial." This is incorrect. It should say: "Dilute injection: withdraw and discard 100 mL from a 500 mL bag of sodium chloride injection 0.9% or 5% dextrose in water and replace this volume with **100 mL** of tirofiban injection from **two vials**." This error was first introduced in Mosby's 2000 *Nursing Drug Reference*, so it also occurs in the 2001 through 2005 editions. The publisher plans to correct future editions. For additional reports of textbook errata, visit www.ismp.org/Errata/default.asp.

► Special Announcements

► **Teleconference.** Join us **August 3** (repeated August 10) for our next teleconference, **JCAHO 2006-2007 Update: Requirements Related to Medication Use**. Visit: www.ismp.org/educational/teleconferences.asp for details.

► **Free Webinar.** On **August 2**, the Nursing Leadership Congress will be sponsoring **Using Human Centered Design to Improve Patient Safety**. For details, visit: www.nursingleadershipcongress.com/nursingcongress/webinars.asp.

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