



# Nurse Advise-ERR™

Educating the healthcare community about safe medication practices

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## It doesn't pay to play the percentages

The concentration of most injectable medications is expressed as mg/mL or mcg/mL. But a few drugs have concentrations expressed as a dilution ratio (e.g., epinephrine 1:1,000) or percent (e.g., lidocaine 1%). Studies have shown that practitioner knowledge of dilution ratio and percent concentrations is inadequate, even among physicians.<sup>1-3</sup> While expressing concentrations this way may be less dangerous for topical products or local anesthetics, harmful errors have occurred with IV medications.

For instance, there are numerous reports of practitioners administering undiluted epinephrine 1:1,000 (1 mg/mL) IV to patients instead of using the 1:10,000 (0.1 mg/mL) concentration. One such error happened to a nurse in radiology who administered medications on an infrequent basis. Her patient had developed a reaction to the contrast media, with visible hives and respiratory distress. The physician prescribed 3 mL of epinephrine 1:10,000 IV, but the nurse administered the 1:1,000 concentration by mistake. The two concentrations are hard to differentiate; on the small label, 1:1,000 could look like 1:10,000. The same error occurred in an urgent care clinic after a physician's assistant ordered the wrong concentration. The nurse who gave the dose did not notice the mistake.

**Harmful errors have occurred with IV medications that have concentrations expressed as a dilution ratio (1:1,000).**

In fact, the ampul bears no warning that the 1:1,000 concentration must be diluted before IV administration. In both cases, the patients developed rapid heart rates and increased blood pressures, requiring unplanned overnight hospital stays.

Most alarming, these poorly understood expressions of concentration are particularly prevalent with drugs used for resuscitation (e.g., calcium, epinephrine, lidocaine, magnesium sulfate, neostigmine, sodium bicarbonate). Thus, an inappropriate dose or a life-threatening delay in treatment is possible, even more so if these drugs are prescribed in mg (which requires knowledge of dilution ratio or percent concentrations and calculations) or mL (a problem if multiple concentrations of the drug exist). At a neonatal code, a physician ordered a dose of epinephrine in mL, assuming that only the 1:10,000 concentration was available. The order caused much confusion because both concentrations were stocked on the code cart.

To prevent these types of errors, see the suggestions in **Check it Out!**

(1) Rolfe S, Harper NJ. Ability of hospital doctors to calculate drug doses. *BMJ* 1995;310:1173-1174. (2) Jones SJ, Cohen AM. Confusing drug concentrations. *Anaesthesia* 2001;56:195-196. (3) Nelson LS, Gordon PE, Simmons MD, et al. The benefit of house officer education on proper medication dose calculation and ordering. *Acad Emerg Med*. 2000;7:1311-1316.

### check it out! ✓✓✓✓

Consider these suggestions to help avoid errors with IV medications that have concentrations expressed as a dilution ratio or percent.

- ✓ **Ask pharmacy to create a dose conversion chart** for all concentrations of epinephrine, lidocaine, calcium, magnesium sulfate, sodium bicarbonate, and other emergency drugs with concentrations expressed as a dilution ratio or percent.
- ✓ **Post dose conversion charts on code carts** and in other areas where emergency medications may be prepared and administered.
- ✓ **Refer to the dose conversion chart** before giving these products, since an independent double check may not be possible in emergencies.
- ✓ **Review the dose conversion chart during CPR certification** and discuss the potential for confusion with emergency drugs that have concentrations expressed as a dilution ratio or percent.
- ✓ **Store a single concentration** of these drugs if possible (e.g., on a code cart, you may be able to store epinephrine in 1:10,000 prefilled 10 mL syringes only).
- ✓ **Ask pharmacy to apply warning labels** to alert staff to the different concentrations if more than one concentration is available.
- ✓ **Ask pharmacy to affix bold warning labels on epinephrine 1:1,000 ampuls** to alert nurses to dilute before IV use.
- ✓ **Have a pharmacist attend all codes** to help with medication preparation and dosing if needed.

### safety wire

**⚡ Patient swallows unit-dose package.** You may think you've heard all the reasons to avoid leaving medications at your patient's bedside, but here's an unusual one. A nurse opened a unit-dose package of prednisone, peeled off the foil backing, and placed the medication, still in its plastic package, in a medication cup. The patient was in the Cont'd on bottom of page 2 ▶

**do you know... the meaning of midnight, noon, a.m., and p.m.?**

**?** Many people admit that they are sometimes confused by a.m. and p.m. time designations, especially when it comes to 12 noon and 12 midnight. For example, is noon 12 p.m. or 12 a.m.? Actually, neither is correct according to the Time Service Department of the US Naval Observatory in Washington, DC. The abbreviations a.m. and p.m. represent “ante meridiem,” or before noon, and “post meridiem,” or after noon. Noon is neither before nor after noon; it is simply noon. So technically, neither a.m. nor p.m. designations for noon are correct.



Midnight is another problem. Since midnight is both 12 hours before noon and 12 hours after noon, either 12 a.m. or 12 p.m. could be considered correct. Of course, if you omit a.m. or p.m. designations for noon, or use *either* designation for midnight, one could never be sure of the intended time (or date for midnight). Adding to the confusion, while most believe that each day *ends* at midnight, the Time Service Department notes that, technically, each day *begins* at midnight.

While people are not losing sleep over this, confusion about a.m. and p.m., and the definition of midnight, could lead to an error. For example, if

a prescriber writes an order to start (or stop) a medication at “midnight” on August 30, does she mean at the end of August 29, or at the end of August 30? If a nurse documents that she gave a pain medication at 12 p.m., might it be interpreted as either noon or midnight? On which date should a nurse document a midnight dose of medication – the end of one day or the beginning of the next? Misinterpretation of “midnight” could also affect which date appears on medication administration records, especially for q6h medications that are given at 12-6-12-6.

Clearly, use of a 24-hour clock can help avoid confusion between a.m. and p.m. After all, 1200 for noon is unambiguous. However, even with a 24-hour clock, there’s still an issue with midnight. To avoid confusion, the Time Service Department suggests using 2400 if you are designating the end of a given day (or date), and 0000 if you are designating the beginning of the day (or date). Another option is to use either 2359 or 0001 (or 11:59 p.m. or 12:01 a.m. as used in legal contracts). You can also reduce confusion by scheduling q6h doses for 10-4-10-4. In the end, your organization should decide what works for you, then standardize and publicize the decision.

**All is not as it seems...**

**Q** What medication has been prescribed in the order below?

*Zyrtec 10, 180, 5d*

**A** The order is for the antilipidemic drug **LIPITOR** (atorvastatin), but the pharmacist misread the physician’s poor handwriting and dispensed the antihistamine **ZYRTEC** (cetirizine). While these drug names seem dissimilar, this error has been reported frequently, as have other mix-ups with seemingly dissimilar drug names. For example, handwritten orders for the antidiabetic drug **AVANDIA** (rosiglitazone) have repeatedly been misread as the anticoagulant **COUMADIN** (warfarin). Seems unlikely? Check out this Avandia prescription.

*Avandia 4mg po*

The resemblance to Coumadin is not apparent until you look at poorly handwritten orders. To prevent errors, always confirm that the medication you’re giving makes sense for the patient’s diagnosis.

**Q** What medication has been prescribed in the order below?

*IV Vanc 1 gm*

**A** The order is for the antibiotic **INVANZ** (ertapenem), but the pharmacist who dispensed the medication and the nurse who transcribed the order onto the medication administration record misinterpreted it as “IV Vanc” (vancomycin) 1 gram. The patient received one dose, but suffered no harm. Word stems used for drug names (like “Vanc”) are error-prone. Although the prescriber had not used a word stem when writing this order, this error might not have happened if the pharmacist or nurse had called to verify their interpretation of what they thought was a word stem for vancomycin.

**safetywire** continued

bathroom when the nurse entered his room. The nurse put the medication cup on the bedside table, advised the patient’s family that she would return momentarily, and left the room. When the patient came out of the bathroom, he picked up the medication cup and swallowed the entire contents, including the plastic package. When the nurse returned, the patient told her he had taken the medication, but stated that it felt like something was stuck in his throat. Visual inspection did not reveal a problem. Five days after discharge, the patient came into the ED complaining of hemoptysis. Laryngoscopy revealed a large blood clot partially occluding the glottic larynx. Once the clot was removed, the plastic medication package was observed in the larynx and removed without further incident.

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To report medication errors to ISMP, please call 1-800-FAIL-SAF(E).

Please participate in our *readership survey* on page 3

## ISMP Nurse Advise-ERR Readership Survey

Please take a few minutes to let us know what you think of the ISMP **Nurse Advise-ERR**. Complete the survey below and submit your responses to our website by clicking [here](#) or by faxing us (215-914-1492) by **October 17, 2003**. Your participation will help us improve the newsletter and widen its distribution to better serve you and your patients.

**Tell us your thoughts about the content and format of Nurse Advise-ERR by checking the box that best describes your opinion. Use the following scale: 1=strongly disagree with the statement; 5=strongly agree with the statement.**

Content and Format Statements	Disagree ..... Agree				
	1	2	3	4	5
1. The newsletter increases my understanding of the causes and prevention of errors.					
2. The recommendations for error prevention are practical and helpful.					
3. The information is relevant to my practice.					
4. The information is presented in an easy-to-read, organized manner.					
5. The content is presented at an appropriate academic level.					
6. The content stimulates discussion among my colleagues.					
7. The number of pages is just right.					
8. The newsletter print is clear and legible.					

**Please check the appropriate responses to these statements. (NA/DN = "Not Applicable" or "Don't Know")**

General Statements	Yes	No	NA/DN	Comments
9. I have used information from the newsletter to:				
a. make changes in my workplace.*				
b. make changes in my individual practice.*				
c. collaborate with the pharmacy department on medication error prevention.*				
10. I receive the newsletter:				
a. directly from ISMP as an emailed PDF file.				
b. in a forwarded email message from a colleague.				
c. as a color or black and white copy or photocopy.				
d. attached to one of my hospital's newsletters.				
e. excerpted in one of my hospital's newsletters.				
f. posted on my unit.				
g. posted on my hospital's Intranet site.				
h. at staff meetings, brought by my manager or colleague.				
11. I read the newsletter:				
a. in sections.				
b. in its entirety in one sitting.				
c. at home.				
d. at work.				
12. I can receive email at work.				
13. I can open email attachments at work.				
14. I have time to read email at work.				
15. I have access to the Internet at work.				
16. My hospital has an internal Intranet site.				
17. I can receive email at home.				
18. I can open email attachments at home.				
19. I have access to the Internet at home.				
20. I have visited the ISMP website for information.*				
21. I have reported an error to the Institute for Safe Medication Practices (ISMP).				

**\*If you answered "Yes" to statements 9 and 20, please use the comments section to provide an example.**

**What topics would you like to see covered in Nurse Advise-ERR?**

22. In future issues:	
23. In a readership survey:	

**Please check the category that best describes your practice.**

( ) Staff RN    ( ) Staff LPN    ( ) Nurse Manager/Supervisor    ( ) Nurse Executive    ( ) Quality/Risk Management    ( ) Other

**Thank you for participating!**