PROBLEM: What do the errors in the following cases have in common?

Case 1
A physician ordered a heparin infusion with directions to follow a weight-based nomogram for laboratory monitoring and dose adjustments. Later that evening, the nomogram indicated an intravenous (IV) bolus dose of heparin 1,700 units should be administered based on the patient’s activated partial thromboplastin time (aPTT) level.

The patient’s nurse removed a 10-mL vial of heparin (1,000 units/mL) from an automated dispensing cabinet to prepare the dose. However, she miscalculated the volume that was needed as 17 mL, not 1.7 mL.

The nurse, concerned that she would be using a second vial of heparin to prepare the bolus, quickly asked another nurse to look at her math to make sure that she had not made an error. However, the other nurse did not actually recalculate the volume needed; she thus made the same error when looking over her colleague’s work. The patient received 17,000 units of heparin. A physician’s assistant discovered the error after her colleague’s work. The patient experienced severe epistaxis.

Although multiple system failures clearly contributed to these errors, in both cases, faulty double-checks allowed the errors to reach the patients.

Why did the double-checks fail? In part, the answer lies with how they were performed and with the differences between endogenous and exogenous errors.1

Case 2 (An Endogenous Error)
An endogenous error arises solely from within an individual, from a random and unpredictable cognitive event such as miscalculating a dose or prescribing a drug at a dose appropriate for the next medication being contemplated.

In Case 1, the nurse made an endogenous error when calculating the volume of heparin to administer. Because endogenous errors arise within a single person, another person performing the same function does not usually make the same error. Thus, endogenous errors can probably be detected if a double-check is performed independently by another person as a separate, redundant action. This way, the checker is not misled into the same faulty thinking as the person who originally made the error.

In Case 1, if the person performing the double-check had acted independently as a redundant function without prior knowledge of the first nurse’s work, it is far more likely that the error would have been detected.

Case 2 (An Exogenous Error)
An exogenous error arises from conditions in the external environment, for example, poorly designed packages and labels, the complex nature of the task, or an unclear presentation of information. In this instance, the nurse made an exogenous error related to the look-alike packaging. A subsequent check by another nurse did not uncover the error.

Double-checks are often less successful in revealing exogenous errors, compared with endogenous errors, even when the check is performed independently. Some of the same external factors that initially led to the error may still be present, and employees with similar training can easily make the same mistake during the double-checking process.

SAFE PRACTICE RECOMMENDATION:
Here are some principles to help avoid errors in performing double-checks:

1. The best advice is to avoid relying solely on double-checks. Although double-check systems sometimes do fail—even more so with exogenous errors—they still play a vital role in error-detection strategies when they are placed at the most vulnerable points of medication use and when they are performed independently. However, the hoped-for improvement in system reliability is illusory if health care professionals rely on these manual double-check systems alone to catch all errors.

2. System changes must also be made to reduce the frequency of errors.

3. For the endogenous error in Case 1, system-based error-reduction strategies can be used to prevent calculation errors. For example:
   a. dosing charts that eliminate the need for calculations.
b. pharmacy preparation of non-emergency drugs.

4. For the exogenous error in Case 2, better labeling of the products is necessary, as follows:
   a. The hospital that reported this error now applies large yellow labels that read “FENTANYL/BUPIVACAINE For Epidural Use Only” (to match the yellow stripe in the epidural tubing) or blue labels that read “CONTAINS MORPHINE Not for Epidural Use” on the bags (Figure 1) and on the overwraps.
   b. The labels are applied to both sides of the bags and overwraps so that they can be seen, regardless of the bag’s orientation in the pump or storage area.
   c. The labels are also applied to the cartons stocked in the pharmacy.
   d. The products are stored separately in both the pharmacy and in automated dispensing cabinets.
   e. The pharmacy mandates that these look-alike products not be delivered on the same day in order to prevent mix-ups during the order-fulfillment process or upon receipt in the hospital.

REFERENCE

The reports described in this column were received through the USP–ISMP Medication Errors Reporting Program (MERP). Errors, close calls, or hazardous conditions may be reported on the ISMP (www.ismp.org) or the USP (www.usp.org) Web site or communicated directly to ISMP by calling 1-800-FAIL SAFE or via e-mail at ismpinfo@ismp.org.