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Looking for Meds in All the Wrong Places

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The Case

A 40-year-old uninsured woman with anxiety ran out of her prescribed clonazepam and had a seizure. She went to the emergency department (ED) where she was given the prescription, but before the patient was discharged she had another seizure. The ED doctor saw the patient and made plans to discharge her after she received an intravenous (IV) administration of phenytoin (another antiseizure medication), assuming she was doing well and had stable vital signs.

The order was written correctly in the electronic medical record (EMR) for phenytoin, 800 mg IV. The drug-dispensing machines stocked phenytoin in 250 mg/1 mL vials. The correct dose therefore would require 4 vials and be equal to 3.2 mL to be added to a small IV bag. The nurse misread the order as 8000 mg (8 g) and proceeded to administer that dose to the patient, which was a 10-fold overdose and 2 to 3 times the lethal dose. The patient died several minutes after the infusion.

The error was noted during the code blue. The nurses responding to the code noticed the dozens of vials and the IV bag, which had a notation indicating the medication and the dose. An audit of the pharmacy system revealed that the nurse had taken 32 vials out of 3 different pharmacy dispensing machines to accumulate 8 g of IV phenytoin. Moreover, the nurse had to use two IV bags and a piggyback line to give that large a dose. Within 100 feet of the ED nurses' station were several ED doctors, a number of nurses, and a pharmacy with a PhD pharmacist on duty. The nurse did not ask anyone to check her calculations, nor did anyone notice or comment when she was moving around the unit amassing the vials needed for the dose.

The Commentary

Patients who present to the emergency department (ED) are highly vulnerable to medication mismanagement because of the unscheduled nature of their presentation and the urgency and severity of their condition. EDs are time-pressured environments in which decisions are often made quickly based on limited clinical information and in which clinicians are required to provide care to an unlimited number of people seeking urgent treatment. As a result, medication errors occur regularly in the ED, ranging from

about 5.4 to 16.1 medication errors for every 100 medication orders.(1,2)

In this case, the nurse made a series of cognitive errors that contributed to a 10-fold overdose of phenytoin. The nurse did not recognize that it was unusual to use 32 vials of phenytoin to obtain the required dose. She did not acknowledge that it was uncommon to need two intravenous (IV) fluid bags to administer the single dose of phenytoin. The nurse also did not double-check the IV medication with another clinician. Most important, she appeared not to know the toxic dose of the medication she was administering.

There are a number of things that nurses and other clinicians can do to prevent medication errors. If clinicians lack knowledge about a particular medication, they should check resources before the medication is administered. Nurses should also be sure that each medication order has all aspects of the prescription clearly documented before they administer the medication. These aspects include the following: the generic name of the medication, dose, directions, and duration of therapy.

In addition to these hard-and-fast rules, nurses and other clinicians should train themselves to identify certain warning signs of potential medication errors. For example, not being able to focus on the medication activity, being distracted by constant interruptions, carrying an unmanageable workload, and working with a high proportion of inexperienced clinicians are all risk factors for medication errors. Clinicians also need to be aware of high-alert medications, which can have catastrophic consequences if errors occur. Lists of high-alert medications are readily available as a reference source for clinicians.(3) IV phenytoin is an example of a high-alert medication that has a narrow window between the therapeutic and toxic doses.

Double-checking can help to reduce administration errors. For double-checking to be effective, however, it should be undertaken independently by two clinicians before the medication is administered.(4) For instance, for a medication that requires a dose calculation, each clinician needs to independently follow a series of steps in calculating the required dose. This approach can prevent bias arising when a clinician blindly accepts and agrees with what the previous person has worked out as the required dose.

Clinicians also need to be cognizant of the safety features of automated pharmacy dispensing systems.(5,6) Dispensing systems can be programmed to alert clinicians when several machines are accessed for the same medication and the same patient. It is also possible to program machines to make it impossible to select a patient's medication from more than a single machine. Moreover, limits should be placed on the number of vials that can be removed from a single dispensing machine. In this case, the limit for phenytoin should have been 4 vials. If a nurse decides that larger amounts should be removed, an alert should prompt the nurse to investigate the original order. There are also ways to program extra checks for dispensing requests associated with unusually high doses. For all IV infusions, especially those involving high-alert medications such as IV phenytoin, the pharmacist should provide instructions on the screen of the dispensing system. Such instructions should include explicit details about how to prepare the correct amount of medication to be added to an infusion bag. Furthermore, the system should be programmed so that it is only possible to retrieve medications from a machine when it is in a "pharmacy-profiled mode" in which the order has been verified by a pharmacist.

Many of the steps and techniques described above fall under the field of medication safety engineering (7), which can help identify the physical and mental strengths and weaknesses of clinicians and how these affect whether or not a medication error occurs. Unfortunately, there are limits to medication-safety

engineering. Every day, well-intentioned clinicians carry out their medication activities in environments that are set up to fail them. Mistakes with medications occur not because a clinician has been incompetent by making an error, but rather because this single act is the final link in a chain of failures.

It is impossible to think of all the ways in which a clinician completes a well-intentioned but fatally flawed task. Nevertheless, particular factors can influence the risk of patient harm from medication errors. These factors include fatigue, heavy and stressful work hours and workload, poor team behaviors, and negative leadership and communication styles. Fatigue occurring through sleep deprivation, night shifts, and shift rotation can affect staff performance, judgment, and reaction times. Excessive work hours and workloads can lead to burnout and lack of motivation and concentration, causing failure to complete medication tasks competently. Lack of teamwork and leadership can contribute to poor quality care and harm from medication mismanagement. Communication through active listening and engagement is crucial for effective interactions between clinicians, patients, and family members.

In this case, one can imagine a well-meaning nurse trying to do everything she could to collect the medication for her allocated patient. Although her persistence is laudable, it is probably also an example of anchoring bias.(8) When the order is so difficult to complete and so unusual, it is far more likely to be in error than to reflect an idiosyncrasy of the prescribing physician or the patient. While the nurse was undoubtedly trying to be helpful, the instinct of all clinicians has to change from one of "this is unusual, but I'll just get it done" to "this is unusual, I wonder whether it is correct."

Although clinicians can do more to minimize their own risks for medication errors, it is important to acknowledge that medication errors generally occur as a result of system failures rather than faults produced by particular people. Subsequently, the environmental culture needs to support and encourage clinicians to report medication errors and near misses. Clinicians should listen to each other's concerns, model good behavior, and facilitate change by learning from past mistakes in an effort to avoid medication errors.

Take-Home Points

- Good communication between clinicians is a key factor to minimizing the risk of producing a medication error.
- Clinicians can train themselves to recognize warnings associated with medication errors.
- Medication errors generally occur as a result of system failures rather than faults produced by particular people.

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