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THE LAST 100 FEET

EXPERT PANEL

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Reducing Errors in the Last 100 Feet of Medication Administration

MEDICATION ERRORS harm an estimated 1.5 million Americans each year, resulting in upward of $3.5 billion in surplus medical costs.[1] Just over half (51%) of all medication errors causing patient harm are related to medication administration[2]— the last segment of the medication use process—and almost half (41%) of those resulting in a patient fatality are due to the administration of an incorrect dose.[3] Compounding this problem is the fact that a sizable percentage of errors occurring during earlier stages of the process (ie, prescribing, transcribing, and dispensing) are intercepted, whereas only about 2% of errors occurring during administration are caught prior to reaching the patient.[2] Given such statistics and the current meaningful use environment, it makes sense to continually and systematically review medication administration processes and explore evolving technology options that can improve patient safety and workflow efficiencies.

Current Models of Medication Distribution

According to *Pharmacy Purchasing & Products*' 2014 survey of hospital pharmacists regarding pharmacy automation, about half of hospitals employ a point-of-care medication distribution model, approximately one-third use a centralized system, about 15% employ a hybrid system, and only about 4% rely on a purely decentralized medication distribution model (see FIGURE 1: Trends in Medication Distribution Models).[4]

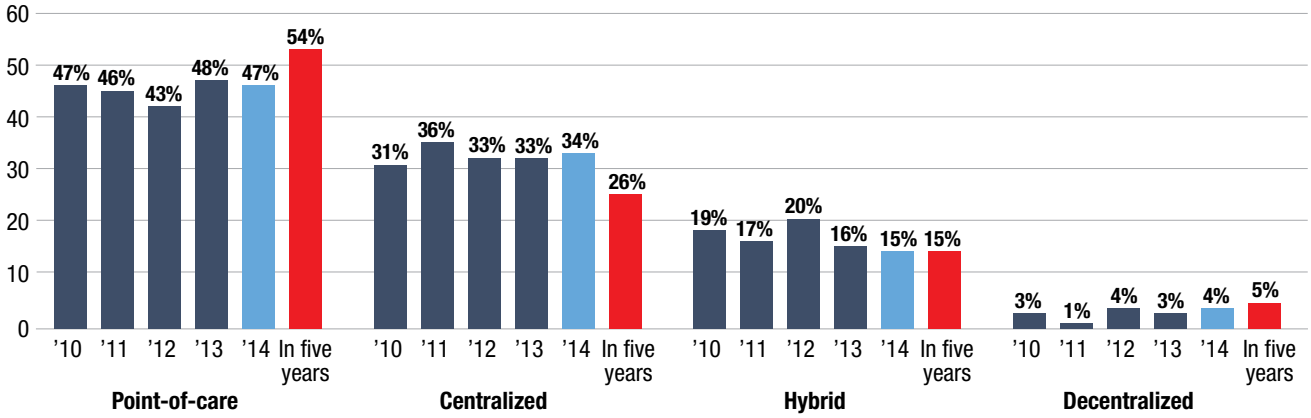
Numerous technologies and automation exist in most hospitals to support the safe and accurate delivery of medications to their destinations on patient units. According to the same *PP&P* survey, 82% of hospitals employ automated dispensing cabinets (ADCs), 47% use pneumatic tubes, 39% utilize mobile computerized workstations or computers on wheels (COWs), and the list goes on (see FIGURE 2: Devices in Use for Medication Distribution).[4]

Regardless of the technology or distribution model employed, the issues concerning patient safety in the last 100 feet to the patient's bedside are the same.

Delivering Safety from the ADC to the Bedside

FIGURE 1

Trends in Medication Distribution Models



About half of hospitals, regardless of size, employ a point-of-care medication distribution model, meaning that 80% or more of their inpatient beds receive medication from unit-based ADCs that are restocked by central pharmacy.[4] Approximately one-third use a centralized system (ie, floor stock, cart fill, or nurse servers filled by central pharmacy; robot/carousel systems with or without pneumatic tubes are the main dispensing platform to unit dose carts or servers), about 15% employ a hybrid system, and only about 4% rely on a purely decentralized medication distribution model (ie, 80% or more of inpatient beds receive medications from satellite pharmacies and/or ADCs are restocked from satellite pharmacies).

Whether a nurse removes a drug from an ADC, cart, or nurse server, or whether the drug arrives via pneumatic tube or from a centralized or satellite pharmacy, the nurse still must transport the medication from a relatively secure device or location some number of feet to a patient in a room. Because that transport may occur in a pocket, cup, baggie, or on a COW or workstation on wheels (WOW), the last segment of medication administration is often an undocumented and unsecured journey.

Potential for Error at the ADC

Ideally, ADCs are strategically located on hospital units, situated in quiet zones away from highly trafficked areas in an effort to minimize interruptions and discourage unauthorized access. By utilizing cabinets, the goal is to safely, securely, and efficiently bring medications closer to patients, yet medication errors persist. Consider the following:

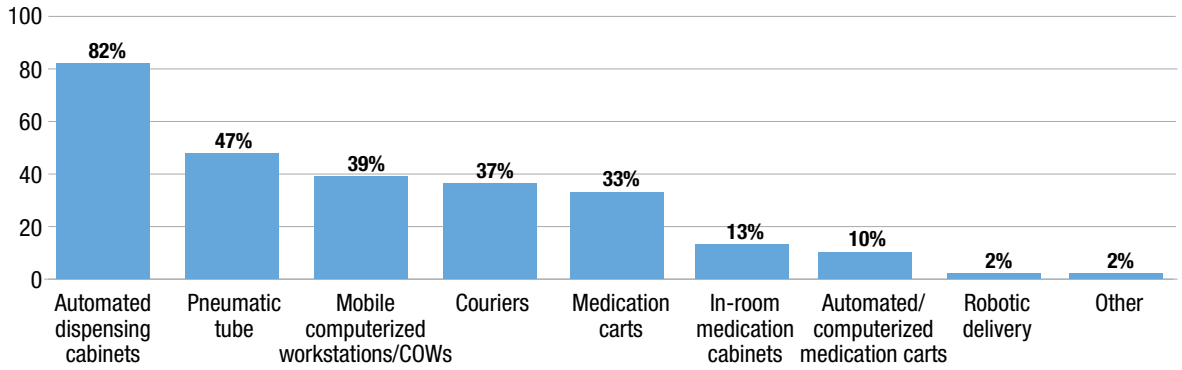
Stocking Errors and Misfills. Some facilities do not mandate bar code scanning during the ADC stocking process and instead rely on robust QA processes to ensure they are doing what they can to minimize errors. Even those that use bar coding are subject to the risk of workarounds being employed during the scanning process. For example, a technician may scan the label on a bag containing multiple doses, assuming all are identical. If one of the items in the bag is not what it should be—perhaps a look-alike/sound-alike (LA/SA) drug—the potential to administer the wrong medication is established. Theoretically, bar code scanning by the nurse at the bedside of both the medication and the patient would avert the error, but should the nurse require two doses of a medication, yet scan only one, the wrong medication may reach the patient.

Challenges in Profiling 100% of ADCs. Most facilities have profiled at least three-quarters of their cabinets, but the number of profiled cabinets has remained flat over the past 2 years, and only about 18% of facilities have successfully profiled all of their ADCs (see FIGURE 3: Percentage of Profiled ADCs).[4] Without profiling, no link exists between pharmacist verification of the order and the medication that is removed from the ADC.

Overrides. Overrides have the potential to introduce the same system vulnerability as non-profiling. Anytime an ADC is overridden, accuracy and traceability are potentially sacrificed. To help minimize this risk, pharmacy should limit the number of medications on override lists. Likewise, it is important to continually monitor who is requesting overrides, which drugs are most commonly overridden, and the reasons provided for overrides in an effort to track and identify dosing

FIGURE 2

Devices in Use for Medication Distribution



The vast majority of hospitals today employ ADCs in some capacity. Pneumatic tubes, mobile computerized workstations (COWs), couriers, and medication carts are also frequently used.[4] Regardless of the medication distribution devices in use, the final segment of the distribution process often involves medications traveling an indeterminate and undocumented distance to the patient's bedside.

issues, cases of diversion, etc. Override lists should be relatively small and include emergency medications, such as naloxone, flumazenil, and dextrose 50%.

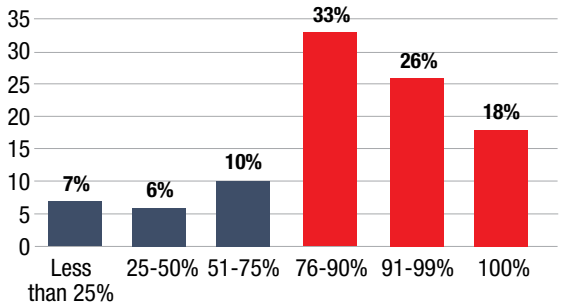
Nurses should be educated to understand that a drug's presence on an override list does not mean that it should be overridden; rather, each patient's situation should be examined to evaluate whether an override is warranted. Also, nurses must understand that by opting to override, all of the built-in safety measures will be bypassed, which means that the nurse then becomes responsible for screening patient allergies, correct dose, contraindications, etc.

Risk Points: From ADC to the Bedside

Generally, it is expected that once pulled, a medication will be administered within 30 minutes, but considerable process variation occurs once a medication is removed from an ADC, cart, pneumatic tube, etc. We know that most hospitals have policies against nurses placing medications in their pockets as a means of transporting medications to the patient's bedside. Similarly, most have policies about servicing one patient at a time. In fact, ADCs are commonly programmed with settings that prohibit users from removing more than one patient's medications and more than one patient's scheduled dose during a single encounter. Yet all of the above continue to occur, increasing the likelihood of a medication administration error.

FIGURE 3

Percentage of Profiled ADCs



Fewer than one in five facilities have 100% of their ADCs profiled despite its value in reducing medication errors.

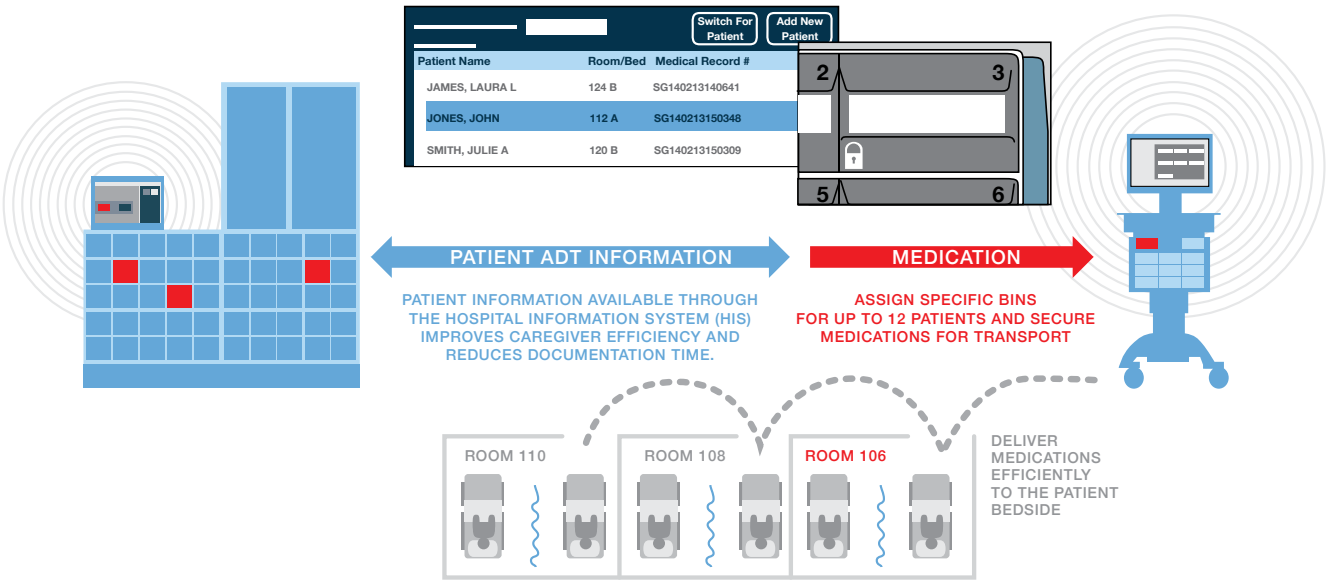
Common challenges include:

Interruptions. Nurses are plagued by interruptions. One study looked at two Midwestern hospitals (an academic medical center and a community-based teaching hospital) and found that nurses were interrupted on average 10 times per hour or once every 6 minutes.[5] Whether there is a patient in need, a phone call, or a visitor asking for directions, the nature of the job mandates that all parts of the medication administration process be as close to interruption-proof as possible. All technology should allow for nurses to resume administration where they left off with as little opportunity for error as possible.

Delivering Safety from the ADC to the Bedside

FIGURE 4

Metro's AccessPoint Rx MD Mobile Medication System



The AccessPoint Rx MD Mobile Medication System enables nurses to log in once on the workstation and have full access to the hospital information system. It also provides 12 individually locking bins, facilitating secure bedside delivery of medications for up to 12 patients consecutively without returning to an ADC or other centrally located repository.

Security. Maintaining security in the last segment of medication administration is of paramount importance. Laying a medication on a mobile COW or WOW and rolling it to the bedside presents opportunities for loss and diversion.

Medication Removal. Workarounds, such as removing multiple doses of medication for one patient, removing more than one patient's medications during a single ADC encounter, and removing medications for a coworker, often occur in an effort to save time, but all of these actions increase the possibility of a medication administration error.

Bar Code Scanning. As is the case with all technology, a BCMA system is only as good as its users. Medication administration errors can arise when nurses scan empty medication packages (nurses may keep an empty package of a medication that frequently has scanning problems in their pocket); administer a medication before it is scanned; administer a medication without scanning the patient wristband and/or the medication; or administer a medication without having the eMAR on hand. Leaving a mobile workstation in the hallway, for example, means that the nurse will not be privy to any alerts until after the medication has been administered.

Although incorporating scanning compliance numbers into nurses' annual evaluations can serve as an important incentive, setting goals too high can backfire by encouraging nurses to find creative ways to meet their goals. In some hospitals, nurses have gone to extremes by printing patient wristbands, to allow for scanning in locations other than at the bedside.

Bulk Medications. Additional problems surround unlabeled medications, including bulk or multi-dose medications and any agents a nurse must prepare. A liquid, for example, that the nurse must draw up and then walk to the patient's bedside to administer, presents an opportunity for error. To help minimize risk, many facilities package all liquid medications in unit of use. The goal should be for pharmacy to take ownership of as much of the medication preparation as possible so that nurses need only scan the drug and the patient in order to administer the medication.

SIDEBAR 1

Profile of a Mobile Medication Workstation in Use

Iroquois Memorial Hospital (IMH), a member of Presence Health, is a small hospital in Watseka, Illinois, with two hospital units: medical/surgical/ICU and OB. Most of IMH's medications are distributed from an ADC to the patient's bedside using a mobile cart. But the carts used in the past had multiple issues.

First, the previous carts had poor quality bar code scanners that frequently gave failure-to-read messages or indicated a medication was not for a particular patient even when it was. In addition, the carts did not house full PCs; rather, they carried thin clients that often lost network connectivity. Without reliable connectivity, the nurses could not chart at the bedside, which was one of the primary reasons for purchasing the carts.

The process for assigning drawers on the mobile workstations to patients was not straightforward, the drawers did not open easily, and they did not unlock individually. Thus, when nurses attempted to access a patient's medication in one drawer, all of the drawers unlocked and opened simultaneously, providing ample opportunity for errors.

The drawers were so problematic that the nurses largely stopped using them. When it came to frequently used medications, such as insulin pens, nurses preferred to pull new ones from the ADC rather than check to see if one was already in the patient's drawer in the mobile unit; this resulted in tremendous waste and needless restocking work by pharmacy.

Without reliable bar code scanners, network connectivity, and operational, patient-specific drawers, nurses began leaving the mobile carts in the hallway

or at the nurses' stations. Not having them at the bedside meant that nurses were scanning medications outside patient rooms, carrying medications to the bedside, and scanning patients' wristbands out of the vicinity of any alerts that presented on the mobile units.

In late 2013, IMH became one of the first deployment sites for Metro's mobile medication system (see FIGURE 4: Metro's AccessPoint Rx MD Mobile Medication System). The pharmacists and nurses have been using five of the units for a year and have noted many improvements to the medication administration process.

First, when nurses sign in on a mobile unit, they are automatically logged in to the EHR and eMAR. The software makes it easy to assign a drawer to a patient and makes it impossible to assign one drawer to multiple patients. It is possible, however, to assign multiple drawers to one patient should the patient require more medications than fit in a single drawer.

In addition, interfacing the mobile workstations through the eMAR and EHR has addressed the problem with commonly used medications, such as insulin pens. Because the drawers are easy to open and unlock individually, the nurses do not mind opening a patient's drawer to see if it contains an insulin pen before pulling a new one.

IMH consolidates from using four mobile workstations during the day to using two at night. With the old carts, this daily transfer of medications was extremely prone to error. Medications could be placed in the incorrect patient drawer when transferred. Sometimes not all of a patient's medications would be moved, leading to waste and extra work. But the new system alerts the user if a patient has drawers in more than one cart, which helps to ensure the process is error-free.

The mobile workstations' battery life—about 18 hours—is sufficient to last through a shift. Nurses on the night shift plug them in, as do day nurses if a unit is not in use. The units are kept at nurses' stations where nurses often use them for charting, placing orders, etc.

The carts are thoroughly cleaned on a daily basis. Surfaces are wiped between patients using a container of wipes mounted on the workstation.

Metro's Rx MD mobile medication systems have made a significant impact on the last 100 feet of medication administration at IMH by reducing waste; improving workflow, efficiency, and security; and by increasing patient safety.

Delivering Safety from the ADC to the Bedside

Patient Transfers and Medication Changes. Moving a patient or changing a medication dosage can present unique medication safety challenges. Unused medications must be removed from various storage locations, whether it is from the ADC, a mobile medication cart, a nurse server, or the patient's bedside table drawer. Similarly, if a patient's dose or medication changes, former agents must be removed and replaced with new ones.

Missing Documentation. Medications missing bar code labels are particularly problematic. If, for example, a nurse administers a drug and then goes off shift without documenting administration, the next nurse will not know the medication was administered and may administer an additional dose.

Exceptions. Medications, such as inhalers and insulin pens and those medications brought from home, are sometimes kept at the patient's bedside, which presents challenges to safety and security. It is also not unusual to find bulk medications stowed within isolation rooms. In-room storage is particularly common with pediatric patients requiring compounded agents that are dosed by weight or may be administered by a parent.

Solving the Challenges of the Last 100 Feet

Reducing medication errors in the last 100 feet of the medication distribution process requires bringing additional controls to the situation to minimize the likelihood of distractions and interruptions.

Many solutions proposed to date have drawbacks. For example, some suggest that pharmacists or pharmacy technicians pull medications from ADCs and ready them for nurses in patient rooms, but most agree this would be time-prohibitive for pharmacy.

Another proposed solution is to store medications in each patient room, using nurse servers, for example. This approach would serve the dual purpose of storing patient valuables and medications brought from home, in addition to storing hospital-provided medications. Unfortunately, keeping such units properly stocked, especially considering the frequency of patient transfers and medication changes, could lead to other patient safety and staffing issues.

The Benefits of the Smart Cart

One solution that provides safety and security for the last 100 feet is the use of a smart cart. More advanced than a traditional COW/WOW, smart carts provide not only a computer interface to hospital systems and a work surface, but also facilitate secure dispensing to multiple patients consecutively without the need to return to the ADC between each and every patient. It is important that such a mobile workstation incorporate a computer and software that interfaces with hospital systems, including eMARs and EHRs, to facilitate bedside charting with minimal data reentry; bar code scanners to facilitate bedside scanning; and individually locking patient medication drawers to provide secure access to each patient's medications, allowing nurses to administer medications to patients consecutively without returning to the ADC or other centralized dispensary between patients (see SIDEBAR 1—Profile of a Mobile Medication Workstation in Use). Some mobile workstation options even offer tracking capability so that pharmacy can locate stations at any time. Increased maneuverability, ergonomic features, and battery life are making them an attractive and viable option for many facilities, as they allow nurses to chart at the bedside and spend more time in patient rooms, which increases patient and nurse satisfaction (see SIDEBAR 2—Considerations for Purchasing Mobile Medication Workstations).

Pharmacy and Nursing: A Collaborative Effort

Direct observation is a powerful teacher. One of the best ways for pharmacy to understand the needs of nurses concerning medication administration is to observe nurses administering doses to see if they are using the available technology and systems as intended. Technology requires ongoing monitoring of use. Building the safest possible medication administration process is a useless endeavor if the procedures are not followed correctly or at all.

Take care not to flood the environment with unnecessary technology; think strategically about where in the process technology is needed and why. Technology investments should be based on sound data that address the challenges you are attempting to solve. Is the goal to reduce medication errors, nurse interruptions,

nurses' steps, bulk or pre-pulling at the ADC, overrides, time from medication pull to administration, or wait time at the ADC? Do you aim to improve nurses' workflow or medication traceability? Unnecessary technology induces process fatigue and increases the likelihood of users developing workarounds and short cuts.

Although pharmacists are the medication experts in the hospital, nurses' input on medication administration processes is imperative for a jointly successful technology adoption. Because any change to the medication administration process will have a strong impact on nurses' daily workflow, nurses should be encouraged to participate in the evaluation process. The process should involve not just the nurse leader, but charge nurses on the front lines of patient care. Look for opportunities to build interdisciplinary relationships and share expertise, whether through regular

SIDEBAR 2

Considerations for Purchasing Mobile Medication Workstations

While purchase price is undoubtedly an important factor, the following checklist contains many essential criteria that should be considered when deciding on the right mobile medication workstation for your facility. Be certain to have both nurses and pharmacists test potential models in real-world circumstances.

- ❑ **Run Time.** Ensure that the power system of the selected workstation meets the demands of the service areas where the units will be deployed.
- ❑ **Compact Footprint.** Choose a workstation that fits easily in crowded patient rooms, in storage spaces, and in hallways, and does not interfere with nurses' proximity to patients.
- ❑ **Maneuverability.** Select a workstation that is lightweight, fits through all doorways, and rolls easily in tight spaces, over door thresholds, around corners and obstacles, and over various floor surfaces, including carpets.
- ❑ **Durability.** Make sure the workstation can survive the daily rigors of constant use in a health care environment.
- ❑ **Ergonomics.** Ensure that the work surface, keyboard, and monitor of the workstation can be conveniently adjusted to accommodate staff members of varying heights.
- ❑ **Patient Drawers.** Select a workstation that is configurable with drawers of multiple sizes to accommodate medications in all types of packaging. To facilitate servicing more than one patient at a time, patient drawers MUST have the capability to be individually locked.
- ❑ **Security.** Confirm that the workstation locks automatically when left unattended. Be certain to select a workstation in which the individual patient drawers are secure and cannot be forced open.
- ❑ **Waste.** Be sure the workstation offers saddlebags or containers for disposal of sharps and waste.
- ❑ **Infection Control.** Verify that the workstation contains antimicrobial protection (eg, Microban) and that it is incorporated into the cart's material, rather than sprayed on after manufacture. (For units used in isolation areas, disinfecting procedures must be outlined.)
- ❑ **Computer Interface.** Confirm the workstation's computer will interface with the facility's EHR and eMAR to facilitate charting at the bedside and to reduce needless and potentially error-ridden data reentry. Nurses should not have to batch chart after servicing a number of patients.
- ❑ **Interruptions.** Ensure that technology accommodates interruptions, allowing nurses to easily resume where they left off.
- ❑ **Supplies.** Choose a workstation that provides convenient access to commonly used supplies.
- ❑ **Scalability.** Select a workstation that is easily upgradable as the needs of your facility evolve. Utilizing workstations from a scalable platform also allows your entire fleet to share a common set of replacement parts.
- ❑ **Maintenance.** Establish a plan for maintaining and servicing the units, either through in-house resources or a manufacturer's service plan.

Delivering Safety from the ADC to the Bedside

safety calls, daily huddles on the units, or more formal means.

To investigate solutions for medication errors in the last 100 feet of administration, it is important to have a clear picture of the medication workflow and to answer such questions as:

- Are certain medications causing the majority of problems in the last 100 feet of administration?
- How are medications transported in the last 100 feet?
- What are the risks associated with these methods?

Equally important is being able to demonstrate the value that will be accrued by adopting a new technology. This requires gathering accurate pre-implementation data to calculate an accurate return on investment, for example. Consider incorporating factors such as increased patient safety, satisfaction, or time spent by nurses at the bedside; decreased distractions, steps taken, or opportunity for diversion; improved workflow, etc.

Looking to the Future

Because of the serious risks associated with medication errors, patient safety must be the top priority when evaluating methods for increasing efficiency throughout the final 100 feet of the medication administration process. Currently, most facilities have medication administration models that afford security and traceability of medications at the beginning and end of a medication's journey to the bedside, but gaps remain along the way that can be particularly vulnerable to errors.

Technology is necessary to overcome the risks that result from workarounds that persist even in the presence of comprehensive policies and procedures forbidding them. Bar coding at the bedside is an effective last line of defense, but we cannot and should not expect that this technology will catch all errors before they reach the patient. Additional technology is needed to prevent medication errors from ever nearing the finish line.

FACT BOX

The majority of nurses spend one-fourth of their workday on non-patient care activities, meaning tasks that support general patient care but do not require direct patient interaction.

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