Canadian Society of Hospital Pharmacists
Société canadienne des pharmaciens d'hôpitaux

Medication Safety and Drug Use Management Enhanced by Drug Distribution

Background Paper

June 2008

- CSHP Vision 2010 –

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Summary

Patients and health care workers deserve a safe, efficient medication system. A safe system prevents, identifies and corrects errors before a patient is administered a drug, or reduces the effects of an error which has occurred. An efficient system facilitates the optimal allocation and use of resources within the health care system. Ideally, this system includes a work environment that enhances job satisfaction for personnel involved in the medication system.

Healthcare organizations are evaluated in terms of its strategies to improve patient safety. These strategies include methods to reduce harm by ensuring compliance with standards, creating a 'just' culture, and embracing opportunities to improve the organization's overall performance. The systems used to prescribe, dispense and administer drugs are subject to that same type of assessment.

How safely and efficiently a medication system performs is influenced by many factors, including the method used to prepare and provide the drug for administration. The unit-dose drug distribution system is the method of choice because it provides improvements in:

- medication safety,
- overall system efficiency, and
- job satisfaction and effective use of human resources.

Background

"Drug use management" refers to the "system of knowledge, understanding, judgments, procedures, skills, controls, and ethics that ensures optimal safety in the distribution and use of drugs" (1). The aim of this system is to ensure that drugs are available in the quality and amounts required and used safely. A publicly funded health care system benefits from the optimal allocation and efficient use of resources. Efficiencies in the drug use management processes contribute to the optimization of resources.

The process to administer a drug safely to a patient is complex and involves many health care disciplines working towards the common goal of high quality, safe, efficient drug administration. This process typically consists of these main phases: prescribe, transcribe, dispense, administer, and monitor. The integrity of each phase affects the overall process performance. System-related deficiencies in any phase can reduce medication safety. Examples of medication errors include: drug prescribed to the wrong patient, misinterpreted prescription, drug mistakenly selected because its packaging resembles the correct drug, failure to store the drug as required, administration of a drug to which the patient is allergic, and drug not taken or administered as directed. Each phase of the process should identify and correct a weakness present in the system, and not introduce new errors or weaknesses in the process. This background paper focuses on the dispensing phase.

There are many inter-related steps in the dispensing phase. These include the review of the prescription, identification and resolution of drug-related problems, verification of the computer-entry of the prescription, and the distribution of the drug (2). Each step contributes to the quality of the medication use process.

The drug distribution system refers to the method used to physically prepare and provide a drug for administration. The system's impact on safety, accuracy, and efficiency will usually determine the method used by a hospital. No drug distribution system will provide an absolute error-or risk-free environment. The system's overall performance is influenced by how it is used, how it supports and complements the other components of a safe medication system, and the organizational culture and commitment towards medication safety.

On an international scale, hospitals favour and use the unit-dose drug distribution system (3, 4, 5). A unit-dose system includes the preparation and provision of patient-specific oral and injectable drugs in a quantity and

formulation that is ready-to-administer to the patient, in accordance with the prescription requirements. Usually a 24-hour supply of drug is provided to the patient-care area; but that time period may vary among patient-care areas, usually ranging from 12 to 72 hours. A centralized intravenous admixture (CIVA) program operated by the hospital pharmacy to make sterile preparations for injection is part of the unit-dose drug distribution system.

A unit-dose drug distribution system can help to redirect the pharmacist's efforts from a distribution focus to more clinical and direct patient care activities. This serves to improve the overall medication use process (6,7, 8, 9, 10). Increasingly, a unit-dose drug distribution system is coupled with automated dispensing cabinets, with results of more timely access to drug, additional clinical support, increased accountability of drug usage, and a more efficient use of human resources (11, 12). It is for these reasons that unit-dose systems and technologies are implemented in areas such as the emergency room, the operating room and critical areas to decrease medication errors with highly susceptible patients.

Given the strengths of a unit-dose drug distribution system, many hospital-related organizations support its use. The Canadian Society of Hospital Pharmacists (CSHP) has endorsed the unit-dose drug distribution system as the choice for healthcare settings in several of its statement papers (13, 14, 15). Automated unit-dose/CIVA distribution is also strongly endorsed by the American Society of Health System Pharmacists (ASHP) (16, 17) and by the Audit Commission of the National Institute of Health in the United Kingdom (18).

What does the unit-dose distribution system have to offer?

Improvements in Medication Safety

1. Contributes to safer provision of medications to the patient.

    a. The likelihood that an error will occur due to drug selection or preparation processes is expected to be lower than with other systems. Ready-to-administer drug packaging, provided by pharmacy services, maintains the drug identity to the point of administration and removes the steps traditionally undertaken by nursing staff to remove the required number of tablets or capsules or measure the required amount of liquid from packages that contain more than one dose. The unit-dose system also eliminates the need to transfer the drug to a medication cup or create medication tickets, steps that are commonly known to be prone to errors in drug selection or transcription. The shared responsibility between nursing and pharmacy services should result in fewer medication errors reaching the patient and enhance the safety of the drug administration processes.

    b. A drug cannot be wrongly administered if it is not available for use. Unit-dose systems usually do not make a drug available for use until a pharmacist has approved the prescription for the drug and updated the patient's medication profile.

    c. A CIVA program is accepted as an effective method to reduce the opportunity for medication errors, despite the lack of randomized controlled trials of this program (19). According the Institute for Safe Medication Practices (ISMP), studies indicate that the incidence of errors associated with injectable drugs is higher than with other routes of administration (20). And, most of the drugs listed on *ISMP's List of High-Alert Medications* are given via injection (21). Incorrect preparation and administration of these high alert medications (e.g., potassium chloride, narcotics) can result in serious consequences. (22) ISMP promotes the use of commercially available products dispensed by pharmacy departments for specific patients (20) and the centralized preparation of drugs for specific patients by pharmacy staff when commercially-made products are not available (23, 24). Preparation of these products in a specially designed and controlled environment, by persons who are specially skilled and trained in the process should result in fewer medication errors.

d. The quantity of drug supplied significantly reduces the potential for medication administration errors to re-occur. An error should be detected more readily, for example, when the next dose of the drug is due to be administered or dispensed.

2. Provides critical indirect benefits to patient safety.

a. Unit-dose drug distribution systems facilitate efficient use of pharmacy personnel by the delegation of drug preparation and distribution of tasks to pharmacy technicians. This enables the pharmacist to participate directly with the patient care team and enhance the safety of the medication use process.

b. Patient morbidity and mortality are reduced when the pharmacist participates in specific patient care activities, which is facilitated in a unit-dose system. When the pharmacist is relieved of extensive involvement in drug distribution tasks, there is more opportunity to participate in specific patient care activities. Pharmacists provide a structured systematic method to identify, resolve and *prevent* adverse drug events (25). A strong correlation has been observed between pharmacist participation in activities such as patient care rounds and a reduction in patient morbidity and mortality (26, 27).

c. Nursing staff spend less time and effort to safely select and prepare drug doses prior to administration, especially when injectable preparations are involved. This frees up time for nursing staff to use for other responsibilities.

d. A unit-dose drug distribution system is more adaptable to automated procedures, such as bar-coding technology, than other distribution systems. This allows adoption of a "closed loop" medication administration system, when combined with computerized prescriber order entry and electronic medication administration record. As a result, medications can be compared with patient medication profiles at the bedside prior to administration of the drug to the patient, which serves as another check in the process to reduce medication errors.

Improvements in Overall System Efficiency

1. Promptly provides drugs in patient care areas where drugs are needed urgently (e.g., critical care and emergency departments).

a. Unit-dose packaged drugs that are provided in a ready-to-use form require less manipulation from nursing staff and can be quickly identified and administered in urgent or emergent situations. (In critical care and emergency departments, the drugs are selected and administered in critical situations, often prior to, or without pharmacist review.)

b. Automated unit-dose drug distribution systems enhance the security and accountability of drugs that are promptly needed and would otherwise be selected from a common drug stock provided for non-specific patients and held in the patient-care area (a method also known as ward-stock distribution).

2. Significantly reduces cost due to wastage and drug diversion.

    a. Unused unit-dose packaged drugs that are returned to pharmacy are likely to be returned to inventory, and re-cycled, unless the integrity and identity of the drug is not assured. (Typically, when bulk issued drugs are returned to pharmacy, they would be destroyed.)

    b. The quantity of drug, stored in a patient-care area, is limited to hours or a few days. As a result, it is easier to detect a dose that is missing due to drug diversion and decreases the likelihood that a drug will be diverted The likelihood of diversion further decreases when an automated drug storage or distribution device tracks removal of the drug from the device.

3. Increases accountability for each drug administered.

    a. Patient-specific drug costing is facilitated when the drugs are dispensed on a patient-specific basis. The accuracy of the drug costing increases if the recording of the drug administration is electronically interfaced with the drug-costing program.

Improvements in Job Satisfaction and Effective Use of Human Resource

1. Improves job satisfaction for health care professionals.

    a. Reduction in nursing staff stress occurs, with the assurance that the administration system they are using is safer and should detect potential errors more easily prior to administration to the patient. Exposure to occupational risks associated with the handling of biohazardous drugs or antibiotics is reduced.

    b. Delegation of drug distribution activities to pharmacy technicians shifts more pharmacist time to participate in patient care teams, thereby increasing job satisfaction for pharmacists.

    c. Job satisfaction improves for pharmacy technicians who can now assume a measure of "ownership" of drug distribution activities.

2. Creates the opportunity for more efficient use of pharmacist and pharmacy technician and supply resources within a healthcare region, where practical considerations allow.

    a. Unit-dose distribution within a healthcare region can include centralized activities, such as CIVA and repackaging of drugs into units-of-use packages. This allows for efficiencies within the region and staff to be freed to perform other tasks.

    b. Centralised unit-dose packaging allows hospital sites within a region to maintain stock levels of drugs in a unit-dose package that are more suitable to the use of the drug in the site and thereby decrease over-stocking of bulk quantities of drug.

Conclusion

The unit-dose drug distribution system, which includes a CIVA program, is the method of choice to provide drugs for administration to patients. It offers improvements to the medication system, not only in the way the drugs are supplied, but also through opportunities to improve the overall efficiencies in the system, and job satisfaction of health care professionals.

Glossary of Terms

Automated Dispensing Cabinets (ADCs): ADCs refer to "storage devices or cabinets that electronically dispense medications in a controlled fashion and track medication use. Their principle advantage lies in permitting nurses to obtain medications for inpatients at the point of use" in a timely fashion. "Most systems require user identifiers and passwords, and internal electronic devices track nurses accessing the system, track the patients for whom medications are administered, and provide usage data" to the pharmacy department for costs and inventory management purposes (28 p. 111).

Bar Coding: Bar coding incorporated as part of a safe medication system. Bar codes can be added to unit-dose packaging and CIVA prepared doses in pharmacy. These bar codes can then be used at the patient's bedside to automate bedside medication administration and increase patient safety. By scanning bar codes on unit-dose medications, patient wristbands, and staff I.D. badges, staff can automate cognitive checks of right patient, right drug, right dose, right route, and right time before administering medications, and also sign off the administration of the drug. This eliminates a number of manual steps and reduces the chance of error.

Centralized Intravenous Admixture (CIVA): Specially trained pharmacy personnel prepare drugs to be administered by injection, using aseptic technique in a clean air environment. CIVA centers remove the need for nurses to mix doses at the bedside, reduce the risk of errors and contamination, improve the safety of the healthcare worker, as well as reduce wastage. These doses are then delivered to the floors for a 24-hour supply in a way similar to the unit-dose system described above.

Computerized Provider Order Entry (CPOE): "*CPOE* refers to a variety of computer-based systems of ordering medications, which share the common features of automating the medication ordering process. Basic CPOE ensures standardized, legible, complete orders by only accepting typed orders in a standard and complete format… Basic clinical decision support may include suggestions or default values for drug doses, routes, and frequencies. More sophisticated systems can perform drug allergy checks, drug-laboratory value checks, and drug-drug interaction checks, in addition to providing reminders about collateral orders" (e. g., reminders to order glucose checks when insulin is ordered). In addition, medication protocols can be incorporated into these systems to further promote standardized evidence-based prescribing (29 p. 59).

Drug Distribution: Refers to the way provider medication orders are received, processed, dispensed, delivered and administered within a hospital.

Electronic Medication Administration Record (eMAR): The eMAR replaces traditional methods of manually transcribing physician's orders into a Medication Administration Record, which the nurses then check off when they administer a drug. eMARs are generated from either CPOE, as described above, or from a pharmacy medication management system. eMARS eliminate the risk of transcription errors, problems with illegibility of transcription and help to standardize interpretation of physician orders.

Unit-Dose (UD): "In unit-dose dispensing, medication is dispensed in a unit of use package that is ready to administer to the patient. It can be used for medications administered by any route, but oral, parenteral, and respiratory routes are especially common." In the early days of unit-dose distribution, hospital pharmacies purchased machines that packaged and labeled tablets and capsules, one tablet or capsule per package. Equipment was also purchased to package liquids in unit-doses. Recently, many hospitals have adopted new technology that packages and dispenses patient-specific medication on a daily basis. Today, in addition to in-house unit-dose packaging, some medications can be purchased in a unit-dose format from the manufacturer. *(Continues on next page.)*

"There are many variations of unit dose dispensing. As just one example, when physicians write orders for inpatients, these orders are sent to the central pharmacy….Pharmacists verify these orders and technicians place drugs in unit

dose carts. The carts have drawers in which each patient's medications are placed by pharmacy technicians—one drawer for each patient. The drawers are labeled with the patient's name, ward, room, and bed number." Before the carts are transported to the wards, each drawer's medications are checked for accuracy. "Sections of each cart containing all medication drawers for an entire nursing unit often slide out and can be inserted into wheeled medication carts used by nurses during their medication administration cycles. A medication administration recording form sits on top of the cart and is used by the nurse to check-off and initial the time of each administration of each medication. The next day, the carts are retrieved from the wards and replaced by a fresh and updated medication supply. Medications that have been returned to the central pharmacy can be credited to the patient's account" (30 pp. 101-102).

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