

## **Case Study: Unit-Dose Implementation at the Ross Memorial Hospital “Slow but Sure, Through Small Cycles of Change”**

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### **INTRODUCTION**

The Ross Memorial Hospital (RMH) is a 175-bed community hospital located in Lindsay, Ontario, that provides a variety of services, including emergency services, diagnostics, surgery, medicine, intensive care, palliative care, obstetrics, mental health services, rehabilitation, complex continuing care, dialysis, ambulatory services, and chronic disease management. Over the past 5 years, pharmacy services have expanded to meet increasing demands for quality and improvements in medication safety, as well as demands related to the addition of new patient care programs.

This case study describes the implementation of a low-cost, hybrid unit-dose system over a period of several years, by making stepwise changes to the medication distribution system.

### **BACKGROUND**

Until 2007, the RMH had a traditional drug distribution system. There was a large supply of ward stock on each nursing unit. Drugs that were not available as ward stock were dispensed as 1-week supplies in individually labeled patient vials, except in the case of continuing care and rehabilitation patients, who received 2-week supplies. Nurses were responsible for ordering ward stock and replenishing the medication carts. Orders were entered by pharmacy technicians and were manually checked by pharmacists. However, the pharmacy department was understaffed to provide modern services. With only 2.5 full-time equivalent (FTE) pharmacists and 4.5 FTE technicians, service was limited to 0830 to 1630, Monday to Saturday.

Starting in mid-2007, a series of strategies were used to build the case for enhanced control of ward stock by the pharmacy department and for unit-dose distribution:

1. Submitting a business case to add a pharmacy technician with responsibility to manage ward stock, which reduced the volume of inventory and the number of expired products on hand.
2. Submitting a business case to add a pharmacy technician for purchasing and inventory management in the pharmacy, which reduced drug costs, decreased inventory levels, increased inventory turnover, and increased refunds for returns.

3. Discarding all medications that had been dispensed and returned to the pharmacy, as per standards of the Ontario College of Pharmacists and the Canadian Society of Hospital Pharmacists

These strategies proved successful: drug costs began to fall and the pharmacy department's reputation for sound medication management began to grow.

In 2007, nursing management requested an automated dispensing cabinet (ADC) for the emergency department, which launched our unit-dose program. We began with a tabletop packager and a manual ledger for recording lot numbers and expiry dates. Labeling standards were established, and eventually the pharmacy technicians were certified for "tech-check-tech" for packaging. Later that year, the medications stored in the night cupboard were also changed to unit-dose packaging.

A subsequent request from nursing management for the pharmacy department to prepare all epidural solutions provided the leverage needed to establish a centralized intravenous additive service (CIVA), which is essentially a unit-dose program for parenteral products. Two syringe pumps were purchased, one for CIVA and one for unit-dose oral liquids. Launched in March 2009, the CIVA program paved the way for registered practical nurses to administer IV drugs and demonstrated to all inpatient nurses the value of having medications in a ready-to-administer format. When the hospital's dialysis program began in spring 2008, the unit-dose cart-exchange system for ward stock was introduced; it was well received.

The budget forecast for 2010/2011 looked grim, but rather than cut pharmacy positions, a business case was developed that included sufficient drug cost savings to recover the cost of implementing a full unit-dose system and computerized medication administration records (cMARs) in less than 2 years.

Anecdotal evidence from other hospitals has demonstrated that prior implementation of cMARs is critical to the success of a unit-dose system. In a traditional system with nursing-generated medication administration records (MARs), less precise communication with pharmacy is required, since doses are readily available in ward stock. However, poor communication in a unit-dose environment could lead to missing doses, with rework and frustration for both nursing and pharmacy. Therefore, extending the use of cMARs from complex continuing care to the acute care areas was considered a prerequisite to implementation of unit-dose distribution.

## **BUSINESS CASE FOR UNIT-DOSE SYSTEM**

### **One-Time Costs**

Equipment: \$30 000 (cassettes, carts)

Renovations in the pharmacy: \$48 000

Consulting fees for implementation of cMARs: \$60 000

Nursing education: \$18 000 (does not include time for nursing participation on the Steering Committee)  
Additional pharmacy technician time: \$40 000  
TOTAL: \$196 000

### **Drug Cost Savings**

**Misappropriation and Pilferage** – The literature suggests that 10%–15% of medications are lost through misappropriate or pilferage in traditional drug distribution systems.<sup>1</sup> With an annual drug budget of about \$2 million, the potential cost avoidance at RMH was estimated at \$200 000.

**Wastage and Recycling of Medications** – According to separate audits, in 2007 and 2008, the RMH disposed of about \$110 000 to \$150 000 worth of drugs that were returned from the patient care units each year. This waste would be avoided with a unit-dose system.

**Reduction in Ward Stock** – Industry estimates indicate that ward stock generally accounts for approximately one inventory turnover per year, which is \$200 000 at RMH. Inventory levels had already been reduced in the emergency department, and we estimated that implementation of the unit-dose system would reduce ward stock inventory elsewhere in the hospital by \$75 000, as well as avoiding the associated carrying charges (5% of this amount or \$3 750 per year).

**Expired or Unusable Drugs** – At the time the business case was prepared, the pharmacy department's monthly "sweep" of carts to check expiry dates typically yielded in excess of \$1 000 worth of outdated drugs. By reducing quantities in ward stock and by monitoring usage daily through the unit-dose system, the loss of \$15 000 worth of drugs annually was expected to be avoided.

**Packaging Costs** – The change from traditional packaging (vials, resealable bags) to unit-dose packaging was assumed to be cost neutral.

The above estimates indicated that implementation of the unit-dose system would save \$200 000 to \$250,000 per year in drug costs.

### **Effects on Human Resources**

**Pharmacy** – Because of the inefficiencies inherent in traditional drug distribution systems, which have a large ward stock component, the initial business plan did not call for changes to the number of pharmacy FTEs (at the time a total of 7.0). However, an additional 0.5 FTE pharmacy technician was requested for the increased order entry volumes related to use of cMARs. In addition, 1 FTE pharmacy technician position

was converted to 1.5 FTE pharmacy assistants to accommodate the functions of prepackaging, cart fills, and cart exchanges.

The new CIVA program and the implementation of the dispensing cabinet in the emergency department resulted in additional positions. With the new staffing pattern, which included 10-hour shifts, the hours of operation in the pharmacy were increased to 11 h per day, 7 days per week, with closure only on statutory holidays.

**Nursing**– Traditional medication systems require nurses to gather and pour each medication, which typically takes 4.5 min per dose for most oral solids and liquids. In a unit-dose system, the number of procedural steps is reduced, resulting in a saving of 3 min per dose. The need for nurses to refill medication carts from stock in the medication rooms would also be reduced. Overall, a 6% decrease in medication-related activities with the unit-dose system was anticipated.<sup>2</sup>

### **Other benefits**

**Medication Safety** –Unit-dose systems have been shown to reduce the potential for human error at both the dispensing and the administration steps. Various studies, as cited by David and Cohen in *Medication errors. Causes and prevention*, have demonstrated that the rate of medication errors is 5.3% to 20.6% with traditional systems but only 0.6% to 3.5% with unit-dose systems.<sup>3</sup>

**Accreditation Standards** – By implementing a unit-dose system, we will meet the Accreditation Canada's Managing Medications<sup>4</sup> Standards 7.4 and 13.4 before our next accreditation survey.

### **IMPLEMENTATION**

Our project plan included hiring a consultant with experience using the Meditech cMAR system and creating a cMAR Steering Committee, with representation from every nursing area and a cross-section of managers, team leaders, educators, registered nurses, and registered practical nurses, as well as pharmacy staff. The health records, information technology (IT), and professional practice departments were consulted as required. A nurse who had worked in several areas of the hospital, and who had many years of experience with cMARs, was selected as co-chair to develop buy-in with nurses and to be the lead Nursing trainer. The projects were rolled out as follows:

Approval + 1 month: Select consulting company

Approval + 2 months: Launch cMAR Steering Committee and identification of gaps

Approval + 3 months: Develop cMAR formats and menus

Approval + 4 months: Conduct pilot on Mental Health Inpatient Unit

Approval + 6 months: Start renovations

Approval + 8 months: Implement cMARS on remaining units  
Approval + 9 months: Start packaging; switch of all dispensing to unit-dose system  
Approval + 10 months: Order capital equipment; Begin Meditech dictionary changes  
Approval + 11 months: Communicate with management and nursing staff  
Approval + 12 months: Implement unit-dose cart exchange

## **DESCRIPTION OF SERVICE**

Our unit-dose model is based on a combination of dispensing cabinets for areas with frequent changes to medication orders (e.g. emergency department, night cupboard, intensive care unit [ICU]) and manual cart exchange using existing medication carts. Because of the relatively small size of RMH, the purchase of computerized dispensing equipment was neither financially feasible nor practical.

In the new system, a duplicate set of the cassettes for each medication cart is kept in the pharmacy. Each patient is assigned 1 or 2 drawers in the top cassette, and the bottom cassettes are used for ward stock. Regularly scheduled medications are located in the front section of the drawer, and medications for prn administration are in the back section. Each day, the pharmacy assistant refills the drawers, providing a 1- to 3-day supply, depending on the acuity of each patient's condition and the frequency of order changes. The refilled cassettes are checked by a pharmacy technician before being exchanged for the used cassettes.

## **FUTURE DIRECTIONS: APPLICATION OF TECHNOLOGY**

ADCs are ideal for storing controlled substances and products that must be kept on hand but are rarely used, as this equipment maintains a continuous inventory count (which saves nurses' time spent counting controlled drugs) and tracks expiry dates. ADCs enhance medication safety by reducing the risk of errors related to selection of an incorrect product, such as may occur with look-alike or sound-alike drugs. ADCs also provide nurses with inventory for urgent orders and when the pharmacy is closed, thereby reducing the need for a centralized night pharmacy. At RMH, the next priorities for this technology will be areas where orders change quickly and where there is a high volume of stat and prn orders, namely the ICU, the mental health inpatient unit, and the dialysis unit. ADCs will be added over time as capital funding permits, and as ADCs are introduced, the need for new medication carts will be reassessed.

For several reasons, the implementation of bar-code technology was deferred. First and foremost, there was a desire to not have the added cost and complexity of bar-coding delay or prevent the implementation of the unit-dose system. Also, while it would have been feasible to enhance the safety of the drug distribution system with bar-code checking, our current IT systems will not support bedside verification of bar codes. Our Local Health Integrated Network (LHIN) plans to implement a network-wide

system for electronic medical records, so we were hesitant to develop our own codes in the absence of a local or national standard. Once a standard is established, this added safety feature will be implemented, since the pharmacy's equipment and systems support the use of bar codes.

## **SUMMARY & LESSONS LEARNED**

Over September and October 2010, cMARs were implemented across the hospital. By the end of 2010, minor changes to format were still being made, but overall the project has been a success. Nurses and pharmacy staff have adapted well, and medication incidents are being prevented and detected more readily.

The cMAR project had an important spinoff for medication reconciliation: Once there was confidence in the cMAR processes, medication reconciliation documents, discharge prescriptions, and patient medication schedules were provided through the Meditech system.

Numerous changes to the Meditech system were required to implement the unit-dose system. Not only did the refill system have to be changed from "traditional" to "unit dose", the system now supplied doses in half tablets and standard liquid sizes. To ensure that the appropriate medications were on the unit-dose fill list, new standards for order entry were developed.

As of May 1, 2011, the unit-dose system had been implemented across the hospital. At first, a 2- to 3-day supply was provided for medical patients and a 7-day supply provided for patients receiving complex continuing care or rehabilitation, but the nurses were not happy with this arrangement. They noted that the bins were too full and they were unsure which section to use for specific days. Therefore, once the technicians became adept at filling and checking the unit-dose cart, the duration of fill was reduced to 1 day for medicine and 2 or 3 days for complex continuing care and rehabilitation. The biggest challenge has been the need for all connected processes to run smoothly, to ensure coordination with the very precise and transparent operation of the unit-dose system. For example, in the old drug distribution system, it did not matter if the admitting department was delayed in entering admissions or made errors with transfers and discharges, but now such problems do make a difference. Nurses often do not understand these complexities and tend to blame the pharmacy when doses are missing. Efforts continue to improve the provision of service, however there are limits on what is negotiable. For instance pharmacy will not send extra doses in case one is dropped or revert to vials.

## **Lessons Learned**

Each hospital has its own unique set of circumstances and priorities that will contribute to its success and lessons learned.

- Engage both pharmacy staff and nursing staff early on. By actively seeking their input and by communicating changes and decisions by a variety of methods they seem to accept the change and adapt to it more readily. For example, the presence of a flip chart in the pharmacy has proven more effective than e-mail as a means of keeping everyone up to date when we are making drastic changes. During implementation of the unit-dose system, the dispensary supervisor conducted a 15-minute daily huddle in the dispensary. For nurses, the daily presence of pharmacy staff working in patient care areas has been particularly effective for answering questions, solving problems, and improving interprofessional relations on the care unit. When key nursing staff members were hesitant or too busy to become involved, they were actively sought out so they could provide their input.
- Build relationships with other stakeholders
- Watch for opportunities to improve services.
- Focus on the potential safety benefits for the patient.
- Hire a dedicated project manager. To minimize costs and maximize the return on investment, these projects were managed by the director of pharmacy and the dispensary supervisor. However, management of complex projects like these ones is time consuming, and the department did not have a contingency plan for sick leave or staff resignations. The next time a project of similar magnitude is undertaken, the business plan will include a request for funds for a dedicated project manager.
- Perform more research regarding availability of equipment. Only a few months after the original implementation, the replacement parts for the models of exchange cassettes used in the exchange carts had been discontinued and no longer available. Fortunately, in the case of RMC, some cassettes could be acquired from a hospital that had switched entirely to ADCs.

## **REFERENCES**

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