The Scarborough Hospital: Journey to an Automated Unit-Dose System

Introduction

The Scarborough Hospital is a 600-bed acute care hospital across 2 acute care hospital campuses and 6 satellite sites. Since the Birchmount campus (a 250-bed facility) was opened in November 1985, it has had a unit-dose medication distribution system. In contrast, the General campus (a 350-bed facility) continued to use the traditional distribution model through the 1990s, before implementing a robotic unit-dose system in 2003. The following case study describes the journey to unit-dose distribution at the General campus, including specific hurdles and how they were overcome.

Background

Under the traditional distribution model at the General campus, a 350 bed facility, a multiple-day supply of medications for each patient was sent to the patient care units in plastic containers and/or in resealable plastic bags (for purchased unit-dose medications). Commonly used drugs were also available as ward stock. The new robotic unit-dose system provides a 24-hour supply of drugs for each patient, which is replenished daily. Ward stock is greatly reduced, although some commonly used drugs, such as antinauseants, oral liquid drugs, and narcotics are stocked this way.

Challenges to implementation of the robotic unit-dose system at the General campus included the small physical space housing the pharmacy department, a general lack of space throughout the entire facility, and the need for fundraising to support the new system. The pharmacy department is still located in the same space it had when the hospital opened over 50 years ago, when there were just 4 staff members and only a few hundred drugs on the market. Today, the department employs 44.7 unit-producing personnel FTE staff and houses an average inventory of $ 632,472 in drugs. The department has about 2 000 ft^2 (about 186 m^2), very much smaller than the 10 000 ft^2 (929 m^2) now recommended for a typical pharmacy in a hospital of this bed capacity. Capital approval for unit-dose distribution was initially obtained around 1996, but new space could not be found, the building of a planned new wing was delayed, and the existing space was too small for the traditional unit-dose model using exchange carts.

However, the increasing availability of automation and robotics for medication distribution systems provided an opportunity for the Scarborough Hospital to consider new distribution models that used space more effectively than the traditional unit-dose systems. The hospital first conducted research on available technologies, including visiting vendors at exhibit booths during conferences, making site visits to other locations where such systems had already been installed, and having vendors come to view the available space. The known challenges were emphasized when most of the invited vendors reported that “it [unit-dose distribution] cannot

be accomplished in this space." Nonetheless, the team persevered in the search for a way to implement unit-dose distribution; eventually an automated unit-dose drug distribution system was found to fit in the small space.

The team undertook due diligence in a number of ways: by making site visits, reviewing available equipment, conducting literature searches, and reviewing requests for proposal (RFPs) provided by other organizations upon request for automated unit-dose systems, and communicating with key stakeholders to learn what they wanted from the new system. The team responded to requests for a safe medication system, one which supported the moved to bar-coding for medications, and met the recommendations of the Canadian Society of Hospital Pharmacists (CSHP), the American Society of Health-System Pharmacists (ASHP), Accreditation Canada and the Joint Commission on the Accreditation of Healthcare Organizations (JCAHO; now known as the Joint Commission) to implement a unit-dose system as the standard for medication distribution. With this information, the Scarborough Hospital developed its own comprehensive RFP, which was posted in January 2003.

An amended request for capital funding was presented to hospital administrators, including information about the anticipated return on investment, which was based largely on avoidance of additional hiring that would be needed with the traditional unit-dose system and realization of safety benefits. Funding was approved, with the condition that no new human resource requests accompany the request for an automated system. Meeting this condition proved challenging, because the vendors did not have enough technical staff to implement the new system and pharmacy did not have pharmacy technicians available for the tasks associated with the automated system. (This problem arose because the hospital was no longer using a cart-filling process and did not have any technicians assigned to a cart-filling rotation. The old process of bringing medication carts to the pharmacy for refill by pharmacy technicians had been discarded in favour of using the Meditech system to incorporate the average length of stay for each patient care unit into the initial fill. As a result, only patients who stayed longer than the average length of stay required refills. Because the General campus had a pneumatic tube system servicing all patient care units, the refill process and turnaround time were already efficient, but the new automated process would require technician resources for unit-dose packaging and daily 24-hour filling.) To meet this need, order entry and clinical roles for technicians were discontinued, and the technician rotations were reorganized.

Implementation of the new system

The new system included a robot for dispensing, which contained over 95% of required medications, mostly drugs for oral administration, as well as some injectable agents and patches. Because the "fast packager" was not yet available from the vendor selected, the hospital purchased a computerized manual-feed packager, which has proven very efficient. An automated carousel, integrated with the vendor's software and the Meditech information system, completed the suite of equipment within the department. Unit-dose packaging for

liquids was not included in the system, because of a lack of space to house the equipment; these drugs are distributed in multidose packaging using traditional ward stock. Automated dispensing cabinets in areas with high ward stock were also part of the automation plan. However, because of financial limitations, it was possible to implement such cabinets only in the emergency department of the Birchmount campus at the outset, and not at the General campus. However, over the next few years, staged implementation occurred in the critical care units, the operating rooms, the recovery rooms, and the emergency department of the General campus.

Electrical renovations, removal of existing storage shelving, and installation of equipment in the pharmacy occurred over the course of 5 to 6 weeks, during which time regular operations continued in the same space. Pharmacists provided in-service educational sessions in each patient care unit, explaining the impending changes and answering questions. Specifically, they explained that medications would be dispensed into patient-specific bar-coded "envelopes". Only a few of the current medication carts could be modified to accept the filing drawer for these envelopes, so the nurses would have to transfer each patient's medications from the envelope to the "bin" on the traditional medication cart. Roll-out of the unit-dose system occurred over a 2-month period, with one patient care unit being added to the system each week, after a 2-week period for the initial pilot unit. The pilot unit was, by choice, the busy nephrology unit.

To enhance efficiency and reduce the number of changes associated with new orders, the timing of dispensing and delivery was selected with care. Because most of prescriber activity occurs during the day, it was decided to perform the filling function during the day. More specifically, medications are distributed to the medical units in the afternoon, since most prescriber activity occurs in the morning. The reverse occurs for surgical units. New doses are dispensed as required, and the robot prioritizes these doses among patients whose medication needs are filled from the cart. Envelope labels identify each item as "new", "stat", or "refill", which allows the technician to prioritize new and stat items for immediate delivery by pneumatic tube. Any remaining doses that are needed are delivered by the porter, according to scheduled delivery times.

A typical problem of unit-dose systems is missing doses. The Scarborough Hospital decided to address this potential problem immediately as the robotic software allows easy verification of whether a medication has been dispensed and the time of dispensing; as such, pharmacy staff can easily determine if the medication has been sent to the patient care unit. The need to properly place and find medications was clearly communicated to pharmacy staff both initially and upon each request for a missing medication.

The implementation of this robotic unit-dose system has had several benefits:

1. Efficiencies:
    a. Little space is required.
    b. The robot provides efficient unit-dose dispensing.
    c. The carousel provides extremely efficient storage and retrieval, through use of bar codes and a "pick-to-light" system.
2. Inventory management:
    a. Inventory turnover has increased. At the time of implementation, the inventory turnover was already high at this campus, at 22 times per year (more than twice the national average of 10.2, according to the Hospital Pharmacy in Canada Report for 2009/2010[1]). With implementation of the robot, the turnover rate rose to more than 30 times per year in the first year, thereby effectively creating a just-in-time inventory system.
    b. The number of line item held in unit-based ward stock dropped by about 25%.
    c. Wastage of medications was reduced. Unit-dose medications that are not used can be safely recycled for delivery to another patient, as long as the packaging is intact and the medications have been stored on the medication carts.
3. Safety:
    a. Bar-coding of all medications dispensed by the robot has reduced the likelihood of stocking and retrieval errors. The carousel uses bar codes for both stocking and retrieval of medications, including patient-specific retrieval of drugs. Each envelope dispensed by the robot contains a bar-coded patient label. For manual picks from the carousel, the technician scans the patient label. The carousel software connects with the Meditech patient profile to identify the medications required and automatically rotates to the desired locations. The technician then removes the drug using bar-code scanning and verifies that the medication is correct by scanning the patient label.
    b. Bar-coding of medications has prepared the hospital for future verification of medications at the bedside.

The transition to a unit-dose system raised some issues for nursing staff. In particular, the nurses were concerned about the amount of garbage created from the unit dose packaging and were initially unhappy with the requirement to transfer medications from the envelope to the bins on the medication cart. Overall, however, the transition process was efficient and well accepted and did not lead to an increase in the number of errors. The new bar-code unit-dose system enabled the Scarborough Hospital to move to a safer, more effective model of medication distribution. In addition, it created the foundation from which the hospital will move to verification of medications at the bedside to further enhance the effectiveness and safety of patient care at the bedside.

1. Harding, J. Drug Distribution Systems. In: Babich M, Bussières JF, Hall KW, Harding J, Johnson N, Macgregor, P, et al., editors. Hospital pharmacy in Canada 2009/2010 report. Eli Lilly; 2011 [cited 2012 Mar 2]. P 21-35. Available from: http://www.lillyhospitalsurvey.ca/hpc2/content/2010_report/2009_2010_full_E.pdf