

Automation at ward level

— installing a Medi 365 system

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The use of ward-based automated storage is in its infancy in the UK. This article describes the experiences of one trust in installing such a system, explaining some of the benefits and challenges



Fingerprint scanners prevent unauthorised access to medicines stored in a ward-based Medi 365 automated dispensing unit

Considerable amounts of money have been spent in recent years on installing automated dispensing equipment in UK hospital pharmacy departments. The potential benefits of such systems have been well-documented and include freeing staff time, improving the working environment and reducing stock wastage and picking errors.¹

However, ward-based storage facilities at most UK hospitals have not received quite such attention. As far as we are aware, ward-based automation has been implemented at just a few UK hospitals (as well as ours) — the Cromwell Hospital, London^{2,3} and BMI Ross Hall, Glasgow, use the Pyxis Med2000 system, Charing Cross Hospital, London, uses the ServeRx system,^{4,5} and the Hinchingsbrooke Hospital, Cambridgeshire, uses the MedLocker system. Other hospitals are in the process of trialling systems.

In other countries, such as the US, ward-based automation (albeit using unit-dose administration) is much more commonplace

and has been shown to reduce medication errors, particularly with regard to drug availability and the timing of doses.⁶

With this in mind, pharmacy managers at the Countess of Chester NHS Foundation Trust leased the Medi 365, a ward-based automated storage system. Units have been installed in the surgical admissions unit (in December 2004) and the accident and emergency “minors” (in June 2005) and “majors” (in July 2005) units. We have just finished developing the units to host the out-of-hours medicines cupboard.

System design and function

The Medi 365 is a secure storage unit that has computer-controlled drawers. It consists of a number of frames (in our experience, between two and five), each of which contains a number of drawers, with a storage cupboard at the top and at the bottom of the unit. The unit is approximately 2m in height, and each frame is just over 0.5m in width and depth. Drawers come in a number of shapes and sizes and can be subdivided.

Staff access the software's graphic user interface using a touch-screen at the front of the unit. Allocated system administrators have full access to the Windows-based personal computer which controls the unit via a secure keyboard and a wider range of options on the touch-screen interface. System administrators can also adjust all drawers and compartments into the required configuration by changing the drawer shape and

size using a “plug and play” concept. In addition to this, refrigerated and bulk fluid storage units may be added as annexes.

Staff log on to the unit using a four-digit personal identification number and a fingerprint scanner. Individuals are restricted to certain products according to their staff group. Staff can search for products on the computer screen in three ways. First, they can type in a number of characters, which will bring up all products with those letters. For example, “par” would bring up paracetamol and danaparoid. Secondly, staff can select products by groups or subgroups, for example, a group might be “fluids” and subgroups might be “plasma expanders”. Thirdly, where staff have physical possession of an item, such as a box of paracetamol, they can request more of the same item using the barcode scanner.

Staff select the product they require, the computer then releases a solenoid (ie, an electromagnetic lock), allowing the drawer to be opened. To aid the user to identify quickly which drawer to open, a signalling light comes on at the top of the individual frame, and then on the relevant drawer. The drawer only opens as far as the rear of the required product, minimising the likelihood of selecting the wrong product.

Currently, nursing staff select products without linking the selected item to a patient and the system is used for stock items only — items that have been dispensed for discharge or under a one-stop dispensing scheme are stored in the patient's bedside

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locker. An image of the product being requested is displayed on the monitor as a visual safety check.

The software can also display or print any relevant policies and procedures. For example, selecting dobutamine results in an option to print or display a dobutamine-dosing table.

Where more than one unit is in operation, they can communicate using the hospital's computer network. Thus, if one unit is out of stock of an item, the user can be directed to another unit that contains the item. This feature can be linked to the pharmacy department's stock control system.

In terms of restocking, Medi 365 creates a report, which it e-mails direct to the pharmacy stores as a picking list. Where items are required urgently, or are about to reach their expiry date, it can send an urgent or high priority order. Restocking is essentially the reverse of withdrawal — the machine is set into restock mode and the products are scanned in. Again, frames and drawers are illuminated and drawer access is limited.

It should be noted that there are some important differences between the Medi 365 and the ServeRx system. As far as we are aware, the latter is a "closed-loop" system that uses electronic identification software to match the patient, the prescription and the medicine. At present, the use of Medi 365 is restricted to stock management, although there is potential for other developments, which are described later.

— Benefits

Safety Formal evaluation of the system has not yet been completed. However, it seems a reasonable assumption that the use of barcode technology to stock the machine and withdraw products has the potential to reduce the risk of human picking errors.

Stock management Traditionally, restocking has taken place on a pre-programmed basis and at time intervals that are determined by departmental capacity and turnover of items. The pharmacy "top-up" system was introduced in the 1960s and has changed little since. It does not necessarily prevent stock running out and is often criticised by nursing staff because of this. It requires products to be counted and expiry dates to be checked manually. At our trust, it took nine hours on a weekly basis to top-up our accident and emergency units, with an additional daily top-up taking about an hour (excluding the time nursing staff take to put away the items delivered).

Now Medi 365 is in place, the emphasis of the pharmacy assistant technical officer's work has changed — the time previously taken counting stock for top-up is now spent putting stock into the unit, thereby releasing nursing staff time. The weekly top-up has been replaced by an order (usually

daily) that is calculated and triggered using minimum and maximum quantities set for each individual item, resulting in stock being ordered when needed, and not just because it is a certain day of the week. There is anecdotal evidence that further nursing time is saved, by reducing the likelihood of wards running out of stock.

Less stock is also likely to be wasted. When Medi 365 was installed at our accident and emergency majors department, several thousand pounds worth of excess, duplicate or expired stock was found, including items that were never stock for the unit, officially at least. This situation is less likely to build up again, now the Medi 365 is in place, because, for example, there are no cupboards in which to hoard stock. In addition, the installation process has provided the impetus to review and adjust stock lists, allowing a more efficient management of items that are actually required.

Automated stock management also means that there is likely to be less chance of missed doses. Nursing staff can find medicines easily and access them without the need for keys, which can be taken home by mistake, or without the need to visit other wards or the pharmacy department.

If batch numbers are added during the "barcoding in" process (which we have currently decided not to do at our trust) product recall is made considerably easier.

Entry of expiry dates (which we do) allows the software to monitor when products are near to expiry and alert the appropriate staff. Software modifications prevent the staff from accessing an out-of-date product.

The Home Office has granted approval to store Controlled Drugs in the unit, and the technology has the potential to act as a CD register. However, in the event of downtime, and a lock release process, the security of the CDs cannot be guaranteed. This option needs further consideration and redesign.

Security Many hospital wards stock medicines that should be stored under locked conditions but are not. Furthermore, it is usually impossible to identify accurately who has withdrawn medicines from storage areas, should an incident that requires further investigation occur. There is evidence, mostly anecdotal, that there may be theft from UK hospitals, with staff self-medicating or removing hospital stock. Certain classes of medicines may be at a higher risk of abuse, for example, benzodiazepines or opiates. Automating access should prevent this situation and provides robust audit trails.

— Challenges

Some potential problems when using the Medi 365 system and their solutions are set out in Panel 1.

Panel 1: Potential problems and their solutions

- **What if the power goes off?**
The machine has an uninterrupted power supply and can operate for up to 25 minutes on an independent backup power supply. In the event of a complete power outage, the machine can be put into manual override. This allows staff to unlock all the drawers, which can then be accessed as if they were standard storage drawers. Staff are asked to manually record what they have removed from the machine and this facilitates inventory adjustment after the event. Clearly, this system relies on staff completing a written record, which may not happen, resulting in stock errors. To help staff find items, a map of the unit is available, with the medicines listed in alphabetical order, and drawer numbers annotated accordingly. Although this approach has not been formally tested, it is probably similar in efficiency to more traditional methods of medicines storage. However, the likelihood of this being required is minimal.
- **What if the computer crashes?**
In a similar manner to during a power failure, the system can be manually overridden and products withdrawn as appropriate.
- **What if the hospital computer network fails?**
Network problems have resulted in some downtime and we have developed solutions to minimise the impact of these. However, if the hospital network fails completely, the unit can operate independently but cannot be accessed remotely and cannot e-mail stock reports. Medi 365 is programmed to backup data routinely via the hospital network, but during downtime, it can backup to a USB flash drive or memory stick.
- **What if the drawers jam?**
If the drawers jam while the machine is in electronic mode the system can be manually overridden. The drawers in each frame within the unit are then released and can be freely accessed.
- **What if a number of staff require a number of medicines at the same time in an emergency?**
Experience does show some element of "queuing". However, staff would still have to queue to some extent with traditional cupboards. The time saved by not having to search cupboards for stock or look for keys should be taken into consideration.

In addition, contract changes mean that the barcodes and pack sizes for medicines can change frequently. The use of more than one supplier to provide the same product also caused problems, although a software modification can now create a "many-to-one" relationship. This itself can cause frustration because products sometimes have to be put into different drawers because of their size. Compartments could be altered so that all packs of a particular drug, regardless of brand, fit into the chosen location, provided pack sizes do not vary dramatically.

A significant amount of time was involved in setting up the system, but the expertise generated as a result means that we expect to be able to manage the process of moving from cupboards to Medi 365 in other wards and departments much more quickly because, for example, aspects such as drawer sizing become more intuitive. When we moved our out-of-hours medicines cupboard, the process took two to three days. Allocating passwords to all existing staff, and the capture of their thumb and finger print data, also took a considerable amount of time. However, adding new staff member's details only takes a few minutes. Staff time to help maintain the units, train system administrators and "super-users" is also a factor.

Overall, the project has been well received, although initially one or two of the more technophobic staff were less positive. A suggestion box, the contents of which are frequently reviewed, has been attached to the machine. Staff sometimes have unrealistic expectations about the technology used in Medi 365, although most changes suggested by our end-users have been adopted.

— Future developments

Although the Countess of Chester Hospital does not currently have automation in the dispensary, we hope to install this in the next year or so. The intention is for the Medi 365 unit to link directly to this and to instruct it as to what to dispense into ward boxes, removing manual activity from ward-based medicines management, other than putting away stock. The units could also be used for items that are unsuitable for placement within an automated dispensary-based system.

Another development opportunity is to install sound files. For example, withdrawal of linezolid might trigger a verbal suggestion to check whether the prescription has been approved by a microbiologist. The system has potential for self-medication, with patients obtaining their medicines through fingerprint access. However, in its current size and layout, a patient would have to be able to leave his or her bed to do so. Day-case surgery is another possible use, with barcoded prescription forms allowing access to over-labelled packs (linked to individual patients) by staff, or possibly patients.

In a different format, the system could be placed on a trolley and be used during medicine rounds. If linked to electronic prescribing, a combination of the use of bar codes and EAN numbers could restrict access to medicines that are currently prescribed for a particular patient. Work on a similar concept has shown a reduction or elimination in medication errors.⁵ The Countess of Chester Hospital uses the Meditech system for most of its electronic patient information system requirements and there is no reason why Medi 365 could not be interfaced with this.

There are a number of potential non medicines-related applications of the Medi 365. These include the storage and release of high-cost items such as ophthalmoscopes or tympanic thermometers. Devices such as syringe drivers and blood pressure monitors could be recharged, as well as stored, and a prompt could be set up to alert staff when devices need servicing or damaged devices that need repairing are being stored.

We are also investigating the potential of using the Medi 365 unit to improve blood product management, by installing a unit with a refrigeration facility. Keys that allow access to other storage areas could also be stored. Adding technology to photograph or video users might also be worth considering, particularly when a CD is accessed.

— References

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Emphasis on automation

Two original papers from the Freeman Hospital, Newcastle, are set to continue the theme of automation into the next issue of *Hospital Pharmacist*. In them, the authors validate and evaluate aspects of the dispensary-based ROWA Speedcase system. Making the most out of advances in technology is also one of the aspects of the Healthcare Commission's recent medicines management review (see the **Comment**, p306).