

# Automating medication storage in theatres

Major savings in medicines expenditure have been reported by a hospital in North Wales, following the installation of an automated medication cabinet within the operating theatre. The automated system is also improving the accountability of medication use and helping to improve safety.

Many NHS Trusts and health organisations have implemented or considered installing automated medication cabinets into accident and emergency departments and other hospital admission areas and wards. Very few, however, have considered implementation into operating theatres due to concerns regarding gaining rapid access to high-risk critical medicines during anaesthesia.

This paper describes the early experience of implementation into a hospital operating theatre within Betsi Cadwaladr University Health Board (BCUHB) in North Wales. BCUHB had previously taken an organisational approach to significantly improve the security of medicines storage and accountability of medication use by the wide-scale implementation of automated medication cabinets. Subsequently, it was felt that BCUHB had gained significant experience to consider a trial of such a system within an operating theatre.

BCUHB formed in 2009, merging the existing three NHS Trusts and six local health boards in North Wales. BCUHB is the largest health organisation in Wales, providing a full range of primary, community, mental health and acute hospital services across the six counties of North Wales (Anglesey, Gwynedd, Conwy, Denbighshire, Flintshire, and Wrexham).

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Fig 1. 5 frame unit at the intensive care unit, Glan Clwyd Hospital

One of the key medicines management development strategies identified within the new organisation was to expand and develop ward-based automation of medicines across the acute and community sector, building upon the expertise and benefits gained from

a pilot installation in Glan Clwyd Hospital.

The case for investment was based on potential reductions on inventory and more importantly on the nursing staff, highlighted by research from a UK accident and emergency department.<sup>1</sup> In mid-2011, there was wide-spread media coverage of the patient fatalities due to contaminated saline solutions at Stepping Hill hospital.<sup>2</sup> The pharmacy management team utilised this media coverage to highlight to the Health Board the need to vastly improve and modernise storage facilities of medicines in all clinical areas of the organisation.

An initial strategic plan was presented to the Board, including the need for better security, accountability and supported access to medicines in clinical areas. The plan also noted the problem of medicine administration errors and omission of ►

critically required medicines as an increasing problem in the NHS.

While numerous factors may have contributed to this increasing problem, it was suggested that a significant issue was the largely manual systems for supply and storage of medicines, which had not changed substantially since the 1970s. Medicines were stored in standard medicines cupboards of various ages, with normal key access and security was, at best, modest. The advent of storage systems with secure biometric access, stock accountability and automated ordering were felt to be far superior and was unanimously supported by the Health Board.

Following a full European tendering process, BCUHB agreed to a contract with TouchPoint Medical (formerly Mediwell Supplies) in 2012 for the supply and implementation of automated medication cabinets. To date, 76 cabinets have been successfully installed across most acute wards, hospital admission areas and critical care units within the organisation. Vast experience has been gained by nursing and pharmacy staff in the use of these robust, highly secure and simple to use systems.

They provide full audit trails of medication usage, thereby dramatically improving the accountability of medication use within BCUHB. In recognition of old, inadequate and insecure existing manual systems in the theatre suites at the Wrexham Maelor Hospital, the head of nursing for the Surgical Directorate recommended consideration of automated storage systems within one of the two main theatres as a pilot project.

### Product description

The TouchPoint Medical automated dispensing systems are custom built to a required size depending on the identified stock holding needs within the specific clinical areas.

The systems run off normal power supplies with hard-wired access to the hospital network. Commonly, cabinets consist of two to five metal frameworks within an integral touch screen PC. (Fig. 1)

The software permits regulation of users and user groups on a variety of levels ranging from nursing/pharmacy staff to external suppliers using controlled elements and features of the software. The operating systems provide controlled access to the inventory, with automated ordering to the central pharmacy stores.

Access to particular medicines within the inventory can be restricted to certain user groups or individual users, under the control of departmental managers and senior clinicians. This functionality can aid superior control of product use and legal requirements in comparison to manual storage cupboards.

An extensive and customisable reporting functionality is provided. Clinical managers

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can routinely review the usage of all products, which individual users or analysis groups have withdrawn and when. In the event of any stock discrepancy or query, access data for individual users can be easily produced to aid identification of error or any potential misuse.

### Consideration for use in operating theatres

There are subtle but significant differences in how the manual storage cabinets are utilised and accessed in the theatre environment in comparison to all other clinical areas of the hospitals in the NHS. In keeping with Guidelines published by the Royal College of Anaesthetists (RCoA) and Association of Anaesthetists of Great Britain and Ireland (AAGBI),<sup>3</sup> immediate access to a variety of medicines is routinely essential.

The guidelines recognise and endorse the need for medicines to be available in unlocked storage in certain situations. The design of automated storage systems had to be cognisant of these factors to ensure that these processes and features are either mimicked or enhanced to allow unhindered access to rapidly required medicines.

While automated systems have the

potential to improve efficiency and safety, they also have the potential to delay administration of medicines if access is not easy, simple and fit for purpose. Access must not be significantly hindered in the event of technical glitches. Anecdotally, trials of similar automated systems in operating theatres in the UK have been abandoned due to concerns and problems with slow access to critical medicines in operating suites.

Cognisant of these needs, a project team took a cautious clinically led approach. The team was headed up by a lead anaesthetist with members including the theatre manager, nursing team leaders from anaesthetics and from the recovery area, senior pharmacists and pharmacy technicians, and design engineers from TouchPoint Medical.

The team reviewed existing storage facilities and processes for ordering and accessing medicines, noting that in the two main theatres suites in Wrexham Maelor hospital, these were similar to many NHS hospitals. Each theatre suite had a central main medicine store within each of the recovery areas that were manually replenished by pharmacy staff on a regular basis, two to three times a week with agreed lists and quantities. The medicines store in the recovery area provided medicines for patients from five separate theatres that used the same recovery suite.

There were separate storage facilities in each of the five anaesthetic rooms adjacent to each theatre. Each had an agreed list of the relatively few medicinal products required for anaesthetic and emergency care use. Unlike all other medicine storage points in the hospital, these were managed by nursing staff who worked directly within them and not by pharmacy staff. The nursing staff replenished the stocks in the anaesthetic rooms after the end of surgery each day or as necessary for individual agents from the recovery central stores. No records of any transactions that took place were made.

The systems for storage of medicines within the Maelor theatre suites had been in place for many years, and the storage furniture within the main central stores



Fig 2. Previous medicines store



Fig 3. Main Recovery System

within each recovery area was recognised as being antiquated (Fig 2). It had also become customary practice that the cupboards were fully open during surgical sessions for ease of access to products. Security was known to be compromised but was accepted as a necessary risk so that medicines could be easily accessed without any delay caused by closed and locked systems.

The storage furniture within each anaesthetic room complied with current standards but was lacking in overall security.

### Project plan

The project team considered direct implementation of a system into an anaesthetic room adjacent to an operating room with direct access from anaesthetists and direct ordering from pharmacy stores. This strategy was ultimately considered too high risk until nursing and medical staff had gained sufficient experience with the automated systems in a lower risk environment and were fully comfortable with them.

Nursing staff worked closely with TouchPoint Medical engineers to ensure that the front-end developments were clinically designed and met their needs. The project team recognised that the nursing staff who were to access these automated systems were commonly highly experienced staff, the majority of whom were only used to using manual systems.

While the systems are intuitive and relatively easy to use, the team anticipated some resistance to change from some staff as they were switching from many years of using a simple manual system to one that required biometric access and live stock control.

Experienced pharmacy staff presented the concept and design, which was well received, to most of the nursing staff prior to the technical training provided by TouchPoint Medical.

A decision was made to install a main repository system within the existing storage room adjacent to an eight bedded theatre recovery area. The main system was to be primarily designed to provide full product packs for replenishment of medicines for each of the five anaesthetic rooms (Fig 3). In addition, a smaller unit was installed directly in the bedded area to provide access to individual medicines during patients' post-operative recovery (Fig 4).

The systems were installed during October 2018. During configuration, alerts were added to aid safer administration of medicines. Visual warnings were included for any penicillin-containing products and any with the potential for cross sensitivity to penicillin, to alert nursing staff to check patient penicillin allergy status immediately before administration. Information and reference to the NHS Patient Safety Alert relating to dosing of naloxone<sup>4</sup> was also included in the cabinets. These safety



Fig 4. Single frame unit for unit doses

alerts were designed by senior pharmacists and were subjected to clinical governance approval processes within the Health Board.

### Review

The *in-situ* systems in the theatre recovery area have been in continual use for about 12 months to date. The systems have been well received by the users on the nursing and theatre management staff. Notwithstanding the cultural changes required when altering deeply embedded manual processes within the NHS, most nursing staff enjoyed working with the systems, noted their ease of use and recommended them over previous manual storage facilities. More than 90% of staff reported that biometric access to the storage systems provides them with "more secure" or "much more secure" access to medicines according to a survey.

Although the systems were clinically designed to aid in the simple and effective withdrawal of medicines, staffing in operating theatres, like any clinical environment, is dynamic and ever-changing and picking errors do occur. Karen Pritchard, patient safety pharmacist for the Maelor Hospital, commented: "A pre-requisite to the continued effective use of these systems is the quality assurance provided by pharmacy staff."

Designated pharmacy staff routinely review and correct stock discrepancies and picking reports are reviewed and reported to nursing ►

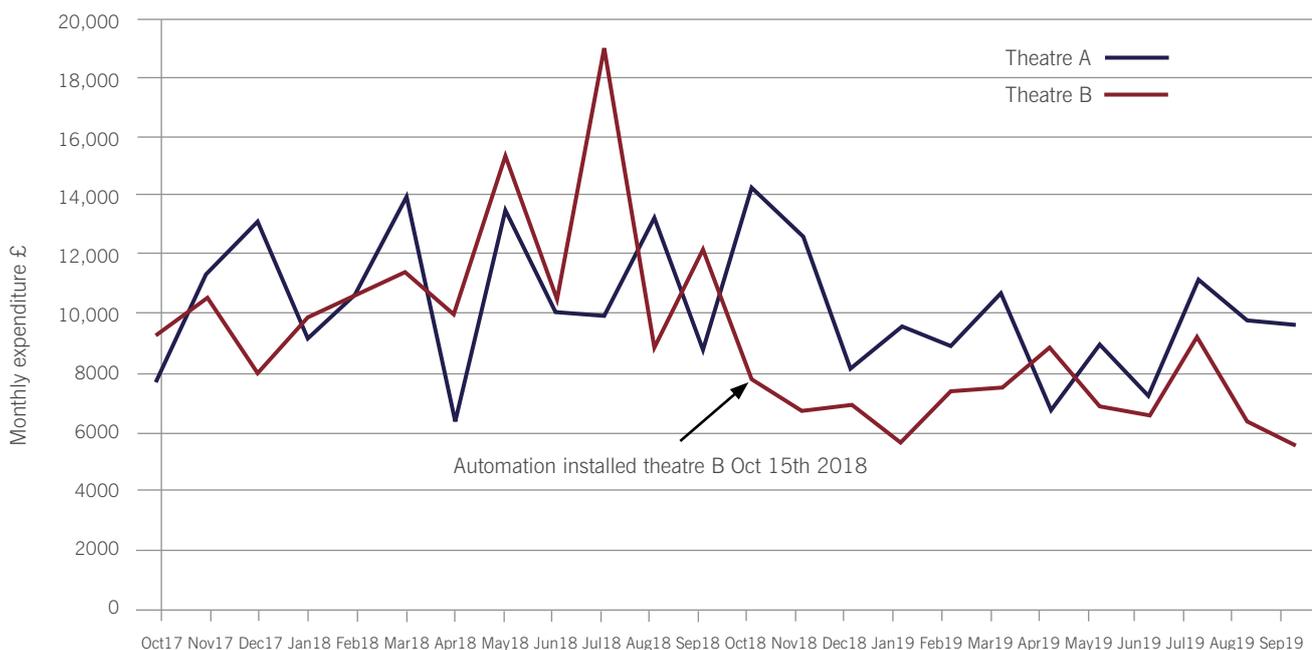


Fig. 5 Monthly theatre drug expenditure

management. Those staff who make picking errors are subject to further training and support.

The project team was unable to identify a UK reference site with similar experience in a full literature search. The key objective of the team was to prove that automation could be safely applied to the theatre environment. This clinically-led industry and NHS collaborative project took a cautious approach and while the use of automation directly in theatre suites has yet to be trialled, the use of automation in theatre recovery providing a central repository for theatre suites has significantly improved the security and accountability of medication use in the operating theatre environment.

David Bevan, the theatre manager, commented: “We had no benchmark in the UK, so we needed to prove the concept of automation in a theatre department would work. Our expectations have been met in that we have a system, which has been shown to be both safe and improves the security of medicines.”

Nursing staff from each of the five anaesthetic rooms now access replenishment medicines from the central store system. Full inventory control is currently in place, a function that was impossible with the manual system. Medicines are automatically ordered from the pharmacy store, which has resulted in a significant reduction in the number of additional emergency orders in between scheduled orders.

Pharmacy and theatre managers are easily able to review turnover of any products used for each theatre room and see who has ordered and accessed medicines. The project

team has reviewed total theatre medication usage pre- and post-implementation. Monthly expenditure for both main theatres was calculated (Fig 5). The system was installed in Theatre B in mid-October 2018 with Theatre A acting as comparator.

**Results**

An immediate and sustained reduction in monthly turnover of products and total monthly costs were noted. Expenditure on medicines for Theatre B in the 12 months following implementation totalled £85,395. In the 12 months prior to installation it was £135,224 a reduction of £49,829 or 36.8%. The monthly average expenditure for Theatre B reduced from £11,268 to £7116. By comparison for Theatre A, the expenditure in the 12 months from implementation in theatre B was £117,937. In the previous 12 months, it was £127,872, a reduction of £9,939 or 7.8%. There have been no notable changes in patient throughput or significant changes in case-mix or operative procedures across the two main theatres within the two-year time period. David Bevan observed: “It was useful to compare both Theatres A and B. The slight reduction in Theatre A you would expect to translate to the same order of reduction in Theatre B without the system. Taking that into account, it still appears that there is a decent reduction in costs which suggests introducing the system is having very good financial benefits.”

No effects of any changes in contracted individual product costs over this period have been considered but, given the highly similar perioperative medicines stock lists between

the two main theatres, any impact would likely be minimal.

This pilot project has demonstrated the applicability, safety and effectiveness of automating the storage of medicines in those NHS hospitals that currently utilise theatre recovery storage as the main storage repository for a theatre suite. **CSJ**

**References**

- 1 Joanne Ardern-Jones *et al.* The impact of the introduction of a ward-based automated medicines vending unit on nursing tasks and time in the Emergency Department. *IJPP* 2009, 17: 1–5
- 2 *BMJ* 2011;343:d4707
- 3 Storage of Drugs in Anaesthetic Rooms Guidance on best practice from the RCoA and AAGB <https://www.rcoa.ac.uk/system/files/STORAGE-DRUGS-2016.pdf>
- 4 Patient Safety Alert – risk of distress and death from inappropriate doses of naloxone in patients on long-term opioid or opiate treatment; 20th November 2014; NHS England. <https://www.england.nhs.uk/2015/10/psa-naloxone-2/>

**About the author**

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