
Factors to consider for the implementation of Automated Pharmacy Distribution Systems in Hospitals and Health Services

HOSPITAL PHARMACY PRACTICE UPDATE



SHPA Dispensing and Distribution Leadership Committee

Introduction

Several Australian hospitals are implementing a range of automated pharmacy distribution systems to gain safety and efficiency benefits in the preparation, distribution and supply of medicines for inpatients and on discharge. Automated pharmacy distribution systems are pivotal in the movement towards closed loop medication management systems.¹ In Australia, the use of in-pharmacy robotics and automated dispensing cabinets are most commonly considered when evaluating the use of automated technology. However, the implementation of optimal automated pharmacy systems will be dependent on the circumstances and service requirements of each individual hospital pharmacy department.

The aim of this practice update is to share the learning that has been gained through the implementation of automated technology across some Australian Hospital Pharmacy Departments. The lessons learned from the implementation experience may help to guide decision making for other Australian hospitals looking to implement automated pharmacy distribution systems.

Background

Automated pharmacy solutions comprise of various individual pieces of technology which can automate a variety of steps in the process of preparation, distribution and supply of medications. These can include but are not limited to:

1. *In-pharmacy robotics*

In the Australian context, original pack dispensing robots are most commonly used in the hospital setting. Original pack dispensing robots are located within pharmacies and "...automate the storing and picking of products and some the labelling stage of the dispensing process and require the supply of original packs to support effective use..."¹

2. *Automated Dispensing Cabinets (ADCs) and Anaesthetic ADCs*

"...ADCs are computerised drug storage devices or cabinets that allow medications to be stored and dispensed near the point of care, while controlling and tracking drug distribution..."². ADCs also allow the generation of an electronic controlled substances register. ADCs can be used in 'profiled mode' which is a feature that "...directs practitioners to a patient-specific medication profile and limits access to medications which have been reviewed and verified by a pharmacist as appropriate for the patient. Use of non-profiled ADCs allows practitioner access to all medications contained within [the ADC] ..." ²

3. Unit dose packaging equipment

“...Unit dose is a system of packaging whereby each dosage unit is separately packed in a protectively sealed unit and labelled with the name of the medicine, strength, dose contained within the pack, batch number and expiry date. The presentation should minimise or eliminate the preparation required for the medicine to be administered...”³. To facilitate closed loop medication management, these unit dosed packaged medications should also have a barcode.

4. Controlled substances cabinets

A controlled substances cabinet is a computerised drug storage device that is located in the pharmacy and tracks individual access to the cabinet and the distribution of controlled medications from the device. This automates the generation of an electronic controlled substances register.

Benefits and Limitations of Automated Pharmacy Distribution Systems

Often automated pharmacy solutions are implemented as part of larger-scale projects including electronic medicines management systems. Therefore, assessing the level of benefit of each individual item of technology can be difficult in isolation. When reviewing the published evidence for automation it is important to reflect on the methodology of each paper as well as the pre and post automation factors in each case. Varying hospital processes, resourcing, models of supply, data capture and measurement often result in a large variety of studies and conflicting evidence. Broadly however, the rationale for implementing a spectrum of automated pharmacy distribution systems can be categorised into three key areas.

1. Financial benefits

There is evidence to suggest that automated pharmacy distribution systems can provide financial benefits through greater accountability of medications.^{1,2,4-6} There are several features in the various automated pharmacy distribution solutions which can impact on the accountability of medications. These include traceable expiry date management;^{1,2} greater accountability for medications through data capture, access restrictions and security features;¹ a reduction in required storage space^{1,4,5} and a one-off financial benefit of reduced stock holdings.^{1,4,6} Additionally the electronic record of issue of impressed medication doses to an individual patient level can support more accurate drug usage information and hospital costings.

Reduction in costs associated with medication-related errors has been demonstrated in barcode enabled systems.^{2,7} However there are a number of systems which potentially are contributing to the error reduction, including electronic prescribing systems which are outside the scope of this document. Therefore, isolation of cost benefits associated with reduced medication-related harm is difficult to quantify at the level of an individual piece of automated technology.

2. Efficiency benefits

Automating dispensing and medication supply processes can improve the timeliness of medication supply and administration. Australian studies have highlighted that automated pharmacy distribution systems support greater access to medications for the nursing staff by reducing stock-outs and improving the timeliness of administration of some medications.^{8,9}

Automation has also demonstrated a reduction in time for pharmacy staff to undertake imprest resupply functions.⁸ There are conflicting reports around the efficiency benefits for nursing staff, however some studies have demonstrated efficiency gains in nursing time.^{2,4,10} The amount of efficiency benefit is likely to be impacted by the workflows prior to implementation of the automated pharmacy distribution systems.

3. Safety benefits

In pharmacy, automation has been demonstrated to improve the accuracy of the dispensing process by reducing selection errors in the dispensary.^{1,6} Automation can also support management of expiry date and batch information to support medication recall processes. Ward based automation such as ADCs have also demonstrated patient safety benefits. These benefits can include reduced selection error through interfaced ADCs with electronic medical records, barcode scanning verification of medications for administration, reduction in omissions of medications and reduced delays for medication administration^{4,9,11}.

Automation does not provide a failsafe for all medication errors and should be used in accordance with safe use guidelines such as the Institute for Safe Medication Practices (ISMP) Guidance on the Interdisciplinary Safe Use of Automated Dispensing Cabinets.²

The table breaks down some of the benefits and limitations experienced by Australian Hospitals for each aspect of automated technology.

Benefits	Limitations
Opportunity for varied career paths for pharmacists and pharmacy assistants.	Requires additional training, support models and maintenance of the equipment.
<i>In pharmacy robotics (original pack)</i>	
Efficiency gains for picking imprest orders. ⁸	Cost of implementation
Space saving ^{1,4,6}	Original pack management only
Automated stock take process ¹	Not all medications can be managed through by the robotics
May reduce selection errors through barcode scanning ^{1,6,11}	
May facilitate reduced stock holdings and improved inventory control ^{1,6}	
Change management limited to pharmacy	
<i>Automated Dispensing Cabinets</i>	
Facilitates medication availability at the ward level	Cost of implementation
May reduce inventory holdings at the ward level and reduce waste or diversion	
A reduction in medication errors with ADCs ^{4,9,11}	Limited storage capacity
Time efficiency gains for nursing and/or pharmacy staff. ⁴	Changes to nursing, some medical and pharmacy workflows required
Security of medications	
Data analysis capabilities to inform KPIs and drug usage evaluation, clinical costing.	
Increased efficiency of stock replenishment process.	
Allows for electronic controlled drug register at ward level	

Unit dose packaging equipment	
Allows supply of barcoded medications to facilitate closed loop medication management	Cost – International evidence suggests it is costly to unit dose pack at hospital level ¹¹
Closed loop medication management facilitates HIMSS level 6 accreditation ¹²	Human resources required to run packing machines
Safety benefits demonstrated with the ability to barcode the medication at the level of patient administration ¹¹	Similarity of packaging for medications
	Space – for the equipment and storage of packaged medication
Controlled substances cabinets	
May interface with other automated technology	May need to seek specific exemptions to meet local legislative requirements
Allows the generation of an electronic controlled substances register	Interoperability of these systems with other technology
Auditable security access	

Assessment: are automated pharmacy distribution systems suitable for your organisation?

Prior to the implementation of pharmacy automation, a needs assessment should be conducted to identify the goals for the hospital by the implementation of varying levels of automation. Assessment of the current and future situation should be considered prior to such a large investment. This checklist covers a number of areas considered by some Australian Hospitals who have previously implemented varying levels of automated pharmacy distribution systems.

Questions to consider	
Financial	Capital costs <ul style="list-style-type: none"> • Will the location for the automation be in a new building or retrofitted into a department? • Are data points and essential power readily available in this area or easily installed? • Will new equipment be required?
	Information Technology <ul style="list-style-type: none"> • What costs are associated with the development of interfaces, servers and ongoing support and maintenance?
	Human Resources <ul style="list-style-type: none"> • What sort of a project team might be required to support implementation? This will be impacted by the size of the project and may include ICT resources to support integration of systems. • Have overtime costs associated with training and implementation been factored in? • What level of human resource is required to support ongoing 'back end' server activities? • What are the costs for supporting ongoing training of new staff? • What are the costs of supporting ongoing maintenance and troubleshooting?
	Is data on the cost of medications to a patient level valuable for your organisation?

Efficiency	<p>Current workflows should be carefully examined to identify how automation may support your practice. Whilst workflows can be changed to support the technology implementation this may also impact on efficiency.</p> <ul style="list-style-type: none">• What are the current wholesaler supply models e.g. delivery direct to imprest?• What are the processes for after-hours access to urgent medications?• What is the current imprest model?• How are medication rounds managed by nurses currently? E.g. bedside lockers, medication trolleys• Is the proposed location for the technology suitable to use it effectively and safely?• What are current processes for controlled drug management and documentation?• What would new workflows look like and how will they be implemented?• If time savings are expected from implementation, what additional tasks will your staff be able to do?• Are there new value-add processes that will be implemented that are not performed currently (due to no automation). E.g. barcode guided restocks, KPIs available from data generated? <p>Capacity and Space</p> <p>Automated technology can reduce storage space requirements^{1,4} however some items may not be suitable for storage in particular automated devices. There will still need to be space for storage of items not managed within the automation.</p> <p>Consideration should also be given to the profile of medications commonly used in the location and whether what configuration of device is needed to meet these needs. Some aspects for consideration are the:</p> <ul style="list-style-type: none">• amount of controlled drugs used and relevant state or territory storage requirements;• how patient's own controlled drugs will be stored;• amount of bulk fluids and IV preparations;• storage for cytotoxic preparations;• the amount of refrigerated storage required;• will additional medications be able to be stored in imprest locations due to greater traceability of the medications. <p>Stakeholder engagement – automation is not just limited to the pharmacy department.</p> <ul style="list-style-type: none">• Are there champions from other departments who will use the technology to help drive the change?• Are their training leads that can support ongoing training on this technology?• Are there current support and maintenance processes you could link in with for troubleshooting and repairs? And what local support models are offered by vendors for optimisation, repair and maintenance?
Safety	<p>Security</p> <ul style="list-style-type: none">• Is security and accountability of medications a current focus for your hospital? <p>The physical environment the technology is placed in can have an impact on medication errors.²</p> <p>Medication errors</p> <ul style="list-style-type: none">• What kinds of medication errors are more likely in your hospital?• How will the automation address those errors?• How will medication errors associated with automation be monitored?• Where will the technology be located and is this a suitable environment for the preparation of medications?

	<p>ISMP recommends the use of ADCs in profile mode²</p> <p>Does your organisation have an electronic prescribing system?</p> <ul style="list-style-type: none"> • What ability do the software products in use in your hospital have to interface with an automated system? • Does your organisation have the capability to ensure medications can be reviewed and verified by a pharmacist prior to dose administration?
Governance activities	<ul style="list-style-type: none"> • Automated pharmacy systems implementation requires a well-established governance process to ensure safe and optimal use of the technology and efficient implementation². • A multidisciplinary steering group is recommended in areas where multiple items of automated technology are implemented: <ul style="list-style-type: none"> ◦ Identify, assess and manage implementation risks ◦ Ensure implementation tasks are running to schedule ◦ Consider decisions around alerts ◦ Display changes ◦ Review of protocols and policies ◦ Standardisation of drug catalogues across the hospital or health service ◦ Decisions regarding level of interface with eMM ◦ Decisions on workflow recommendations ◦ Decisions to be made on what requires verification in profile mode and how this would work out of pharmacy hours
Other considerations	<ul style="list-style-type: none"> • Do the solutions meet legislative and procedural requirements for the storage of medications in your hospital and are there any additional permits or reporting requirements as a result? • Will alternate record keeping requirements be required? • To what extent are barcoded unit dose medication available? • Can you collaborate with other hospitals or organisations who have already implemented automated technology? • Can you utilise or consult with industry (vendor) resources and use their expertise and experience to ensure the final solution meets your hospital's needs?

Following this scoping exercise, the benefits and limitations of each item can then be assessed to determine how they align best with the needs of your department.

Summary

A number of Australian hospitals have recently implemented automated technology to support the cost-effective, efficient and safe dispensing and distribution of medications and their experiences can guide other organisations considering automated technologies. There is limited literature on the benefits of automated pharmacy distribution systems in the Australian context, however as more hospitals implement the technology this can help to inform the literature of the outcomes achieved. For hospitals with an opportunity to consider automation in future, there are several factors to assess prior to deciding which technology is best for your organisation.

VERSION

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