Robots and automation: a UK perspective

1 March, 2002 01:00 AM | By Chris Cairns

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Automation in hospital pharmacy is not completely novel. The use of automated dispensing systems has been described in the USA for both outpatient dispensing and unit dose systems for hospital inpatients. A number of European countries, including Spain and Sweden, have used automated systems to support unit dose dispensing. In Germany, automated dispensing systems have been used in both hospital and community pharmacy.

In the UK until recently, experience was limited and trials were not overwhelmingly successful. The systems were limited in scope, often requiring major changes to working practices, were not compatible with the UK healthcare system's methods as they centred more around unit dose principles, had reliability issues and were expensive. This latter issue was further complicated as there was little or no economic benefit that could be derived from their introduction.
However, in the past 12 months three major hospitals have purchased, installed and brought into use a robotic picking system. This article looks at why this has happened and how the systems are working.

Reasons for change

Two main driving forces can be identified. There are now significant shortages in the hospital pharmacy workforce. Pharmacist shortages are a consequence of expanding roles for pharmacists, variation in pay between the hospital and community, and possible underproduction of pharmacists. Nationally 16% of hospital pharmacist posts are vacant, but there are local "hotspots". Similar problems are now emerging in the pharmacy technician workforce, and similar reasons apply. Most of the functions of a hospital pharmacy are cognitive: they require thought and analysis of a wide range of factors. Therefore people with the appropriate skills are needed. Some of this work can be supported by computers, but most of it cannot be replaced. However, the technical functions of selecting, picking and delivering to the correct location a pack of medicine need relatively low levels of cognitive intelligence and are possible using technology. Systems are in common use in many other industries, albeit up to recently on a relatively large scale. Thus it is possible to make up some of the shortfall in workforce by employing technology.
The second factor is that, although dispensing error rates are low, the majority of errors involve a human element. With pressures on pharmacy staff increasing, due to increased workload and staff shortages, the likelihood of error is increased. Automation can reduce these errors to almost zero as machines do not get tired, do not have their attention distracted, do not get sick and once programmed will select the correct medication time after time.

Robotic dispensing

Two UK hospitals have operational robotic picking machines installed and a third is almost operational. Each of them uses the Rowa Speedcase, which is imported from Germany. In each case the robot is used primarily for supporting dispensing, although they can be used for distribution of stock drugs for inpatients.
At St Thomas' Hospital in London, the robot is a twin installation of two identical automated machines, side by side, working together. Between them the machines have four sides of 3m-high floor-to-ceiling shelves. Stock is more densely packed than conventional shelving as there is no need for human hands to access the stock. Equally the robots can stock medicines much higher than would be possible for humans to reach. Once entered onto the pharmacy computer system, robotic arms inside the machines automatically "pick" the medication and deliver it to the appropriate destination via conveyor belts and spiral chutes.
The majority of products can be stored and picked in this way, although there are some limitations. Items requiring specialised storage, such as those needing refrigeration and controlled drugs, are not suitable for automated dispensing. Similarly there are certain limitations with very heavy or large items. On top of this the system depends on having units of issue packs and is not compatible with the conventional British system of dispensing from bulk packs. However, patient packs are rapidly being introduced throughout the UK, which will facilitate the introduction of this type of technology. The system copes with injections, topical medication, inhalers and eye drops, as well as patient packs of tablets and capsules. The maximum capacity of the twin installation is around 20,000 packs.

The robot is dependent on barcode technology. Items are scanned using a laser barcode reader to identify the drug, strength, pack size, and so on. It is then placed on a conveyor belt at one of two input points; the pack's dimensions are measured electronically before it is picked by the robotic arm and randomly allocated to a suitable space on a shelf. The pack is placed in that space, and the system remembers exactly where it placed the item. Several products can be put into the machine at the same time. During quiet times, such as during the night, the robot can reorganise the contents to place frequently used items near the front of the machine, thus speeding up picking times.
Linking the robot to the pharmacy computer system means that initiating the dispensing process at any of the dispensary computer terminals brings the robot into action. From the dispensing details entered the robot identifies which product to pick and, from its memory, determines the location on the shelf. The robot's memory also identifies which products have the shortest expiry dates and picks them first. A robotic arm selects the appropriate product and puts it on a conveyor belt destined for the specified dispensing area.
Introducing such technology is not inexpensive, and there is a need to invest considerable staff time and expertise in the setting-up process and for validation. To account for this there must be major benefits

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realised. At St Thomas' a number of benefits have been seen. As predicted, errors arising from incorrect putting away and picking of stock have been eliminated. Additionally the need for skilled staff to be involved with these processes has been dramatically reduced. Initially about 20% of time involved with putting stock away and picking items was taken over by the machine. As the pharmacy increasingly moves over to patient packs this figure will rise to about 80%. As the machine stores items very efficiently there has been a reduction in the amount of space required to store medicines, with a corresponding increase in working space.
Similar results have been achieved at Arrowe Park Hospital near Liverpool, using the same basic system. The robotic system was installed in January 2001 with the aims of reducing dispensing error rates and releasing pharmacy staff to manage medicines at ward level. Remote terminals are used to input information into the robot, and the system covers 77% of medicine items. The Arrowe Park system currently dispenses between 900 and 1,200 items each day.

A whole range of benefits have been seen in a relatively short time. In addition to a reduction in reported dispensing errors from 19 per 100,000 to seven per 100,000, 70% less shelving is required and the equivalent of three pharmacy technicians have been released to support direct patient care. The complete range of benefits are outlined in Table 1. In combination with electronic prescribing the robot has reduced dramatically the time that pharmacists are involved with supply of medicines and increased their clinical activities to almost 70% of their time.
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A recent government report into medicines management in hospitals in England and Wales recognised that hospital pharmacy faces many challenges and advocates the use of robotic dispensing as one method of meeting some of these challenges and improving the quality of medicines use for the benefits of patients.(1)

Reference

1. Audit Commission. A Spoonful of Sugar: medicines management in NHS hospitals. London: Audit Commission; 2001.

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