

Integrating information flows in orthopaedics at Leeds Teaching Hospitals NHS Trust

ABSTRACT

The Leeds Teaching Hospitals NHS Trust's demand management project has produced significant efficiency savings in the orthopaedics supply chain. The project highlighted the need for global synchronisation of product codes for automatic identification and data capture, including RFID within healthcare.



Article by **Graham Medwell**

Background

Leeds Teaching Hospitals NHS Trust started to roll out materials management in 1999 and now has over 270 materially-managed stocking points. It has derived significant benefits from controlling stock levels in major areas like Cardiology, where stock usage is updated live on the system through barcode scanning at the point of use.

The Chapel Allerton Orthopaedic Centre (CHOC) was an area identified in 2006 as a priority for increased stock management and as a stand-alone service for elective surgery (orthopaedic trauma carried out at the Leeds General Infirmary) which had a problem with high stock levels and system integrity problems arising from consignment stock and vendor-managed inventory. The system became known as "CHOC Stock" and is now linked to the main patient systems enabling product costing and track and trace of product.

The wider healthcare vision

Patient safety was at the forefront of the DH paper 'Coding for Success' which featured 'islands of application within the NHS' of Automatic Identification and Data Capture including the bar coding system implemented in the Leeds Teaching Hospitals' Catheter Labs. The report highlighted that around 10% of NHS inpatient episodes result in errors of some kind – of which 50% are preventable. Of 8 million admissions each year, about 850,000 result in patient safety incidents that cost the NHS £2billion in extra hospital days.

With the advent of payment by results, it is important that consumables are recorded by each procedure for which

they are used, to ensure that the true cost of that procedure is recorded accurately. In orthopaedics there is an additional requirement to record any implanted products and update the National Joint Registry (NJR) for track-and-trace.

The vision at Leeds is that the patient administration system and the stock systems are integrated to update stock records and patient data automatically in order to improve accuracy and provide live data to suppliers and the trust budget holders. The data recorded would be invaluable in supporting activity-based costing.

Data flows – the challenge

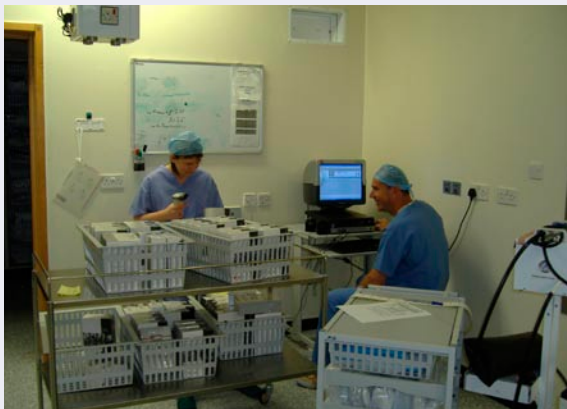
Within healthcare, unlike other sectors, there is a lack of consistency in the identification of product within the supply chain. It is for this reason that Leeds Teaching Hospitals has been a major supporter of the DH in the implementation of GS1 standards. From our experience in linking manufacturers' bar codes to product within cardiology and radiology, we understood the scope of the problem in mapping thousands of codes within our systems. The suppliers of the products had no means of providing the data, so we were left with the following alternatives:

- Map the codes ourselves
- Use our own bar codes

We decided to map the codes ourselves, but work with the suppliers through GHX, the healthcare e-commerce exchange provider, to enrich the data used throughout the supply chain. In September last year GHX announced that it was to become a GDSN-certified data pool to accelerate use of GS1 standards in healthcare.

Data Management

The resources required to enable the introduction of an inventory control system should not be underestimated. The need to find, identify and record stock for over 2,500 product lines required a full team from the supplies department working over a public holiday in the elective area. (A later trauma theatres project did not have the benefit of a shutdown as they work 24/7.)



Labour Intensive – Supplies staff checks stock and allocates bar codes to products in orthopaedic theatres – May 2007. The CHOC Stock project highlighted the need for global synchronisation of product codes for automatic identification and data capture within healthcare.

The Supplier Performance and Communications Enablement project (SPaCE)

Leeds was an early adopter of GHX's e-commerce Exchange and has been at the forefront of the search for even greater accuracy and improvements in efficiency. In addition to the use of PowerGate Inventory in theatres and PowerGate Web Requisitioning, the Trust has embarked on a programme to improve catalogue management, for which it is using GHX's Nexus cataloguing solution. Nexus is a web-hosted

catalogue management system that incorporates an online data repository containing catalogue information with secure shared access for both providers and suppliers. It features approved lists of centrally-managed product information grouped by supplier, with customer specific pricing. Both customers and suppliers can maintain the catalogue data.

SPaCE has involved Leeds and the suppliers Johnson & Johnson and Covidien and even though the suppliers ordinarily compete, SPaCE is bringing about an unprecedented level of co-operation as all parties involved – including members from the National e-Enablement Group and GS1 User Group – see the potential benefits in which they could all share. SPaCE aims to move dispute management from end-of-process (invoicing) to the beginning (demand management). As part of this process, Leeds is involved in the synchronisation of contracts through the GHX Nexus web-based interface. The GHX Exchange is also being enhanced to handle more documents, including the remittance advice and proof-of-delivery and to share internal workflow with the supplier for invoice reconciliation.

Although currently at the 'proof of concept' stage, the resulting GHX Nexus project has already proved invaluable in understanding the data flows within healthcare purchasing and supply.

The challenge for orthopaedics

The orthopaedic supply model, where stock is held on consignment at the hospital, was hugely inefficient, and manufacturers are typically applying a 15-20% on-cost as a result. At Leeds, where the annual orthopaedic spend exceeds £3 million, the long-term reduction in consignment stocks has cut £500,000 from that figure.

Although joint replacement procedures have become routine and are subject to long waiting lists, it remains difficult to forecast product demand accurately. The complex nature of many procedures means that a vast range of sizes of prosthetic and ancillary products required (instrumentation, screws etc) is held on consignment in theatres.

Clinical preference also meant that a number of suppliers were represented, with the result that costs and wastage rose. A team comprising the leading surgeons and procurement staff agreed to standardise the range and as a result new contracts were agreed with the suppliers. Data

from the contracts was then enriched (classified, coded and priced) and fed from the GHX Nexus catalogue system to the inventory system.

Stock management

The Leeds IT team worked hard to engineer the data process so as to provide live and accurate updates to both stock and patient systems. The solution is simple, as it mirrors the award winning processes successfully implemented in cardiology and radiology at Leeds General Infirmary. The inventory management system chosen was GHX PowerGate, which was integrated into the Trust's Oracle e-Business system alongside GHX Exchange for the electronic transmission of order and invoice data and the GHX Nexus catalogue management system. The area is connected to the Trust-wide Patient Administration system (PAS) and the theatre management system, Galaxy.

All the stock that might be required for a procedure is taken to the theatre from the stock room by the clinician, but the stock record is not updated. Once the stock is in theatre, the patient arrives and their ID is entered onto the patient administration system. From that point all scanned consumables used in the procedure are allocated to that patient and procedure type through PowerGate. It is only when the next patient ID is entered that the scanner will record product against the next ID.

Any unused stock is returned to the store (as it remains on the stock record) and from only scanning the stock that was

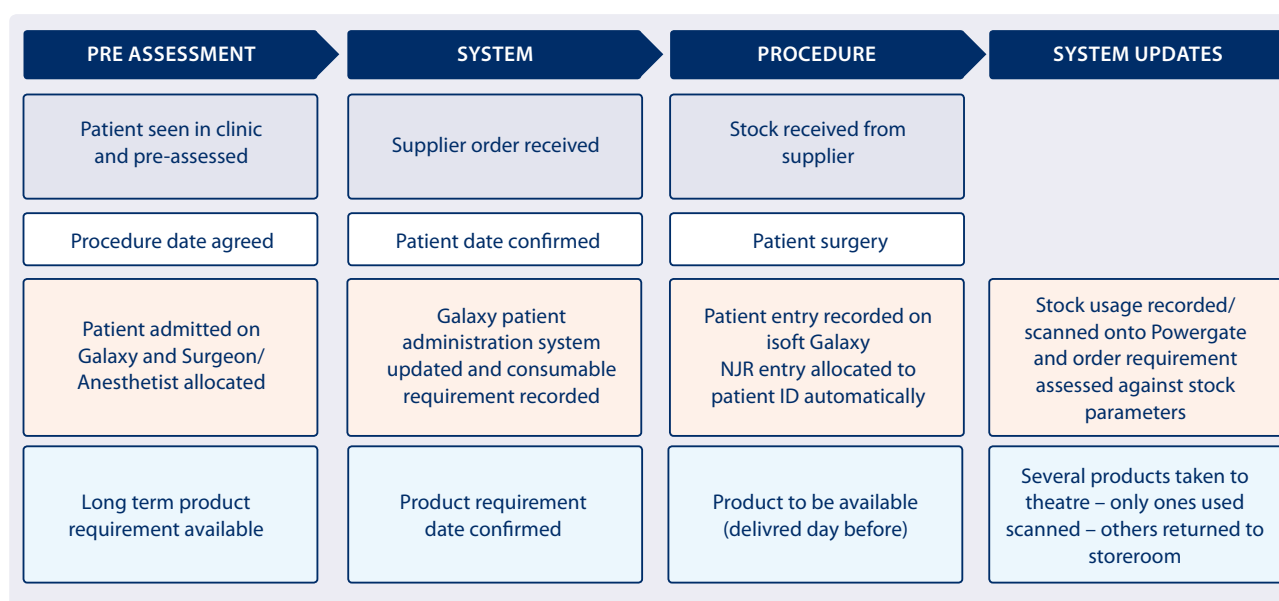
actually used, the information on costs by procedure and implant data for the National Joint Registry can be recorded in real time.

Data capture

1. Before the day of surgery patient records are sent from PAS to CIS (demographics and patient history)
2. At reception PAS admission is entered and time of arrival; Galaxy time into department update; patient then gets changed and enters anaesthetic room; time in anaesthetic room; time induced; Anaesthetic given; ASA score all entered on Galaxy by theatre staff.
3. Patient enters theatre – time recorded then time recorded knife-to-skin by theatre staff – also recorded is people in theatre and roles performed.
4. On completion closure time recorded; surgical outcome recorded; time into recovery; time out of department recorded.
 - Knife-to-skin
 - Closure
 - Out of department

These three updates trigger a message to CIS (clinical information system) which will now update PowerGate.

5. On CIS the information has created a theatre list, from which the surgeon can select patient and input operation notes. (surgeon and anaesthetist information) including procedure details and implants used. Alongside CIS updates the consumables used are recorded by theatre staff on to 'CHOC stock' – the Trust's nick-name for GHX's PowerGate.



Actual or projected benefits of the new system

Financial benefits

- Stock to the value of £400,000 was found over and above the consignment levels. This eased the pressure on the clinical area (in the year of introduction), which had been seen as a failing area in terms of finance. Ongoing revenue benefits are being achieved by using quality inventory information to rationalise-down stock holding levels without the risk of stock outages.
- If the Trust could invest in reducing the consignment stock, both the supplier and the Trust would reduce process and write-off costs. As a result, contract prices could be reduced to share savings.
- If consignment stock was only used for slow moving products (extremes of ranges) and new products with no demand patterns, then efficiencies would be maximised.

Clinical benefits

- Stock turnover increased, so any new products can be used quickly (no residual stocks to exhaust)
- System stock integrity improved thereby improving stock availability
- All supplier relationships formalised, eliminating invoice queries with clinicians
- Supplier training, product development and new product introduction still facilitated
- National Joint Registry updated accurately and immediately
- Kit availability greater as a result of better forward planning
- Increased training quality as procedures and product requirements planned in advance.

Procurement benefits

- Increased notice for kits – opportunity to schedule procedures requiring same kit in sequence
- All products to be part of a contract negotiation process, thereby ensuring best price
- Reduced supplier costs reflected in reduction of prices to the Trust.

Supplier benefits

- Reduced consignment stock
- Reduced need to manage stock levels
- Reduced write-off of expired consignment stocks
- Increased information for forward demand planning.

Supply chain benefits

- Reduced stockholding for system stock
- Consignment stock on system, so order screens reflect true position when determining replenishment requirement
- Reduced obsolescence through stock visibility, stock rotation and stock levels that ensure usage within expiry
- Reduced emergencies thanks to improvements in forward demand/stock planning
- Reduced cost of carriage as stock delivered on efficient lead times and using scheduled deliveries.

The vision for the orthopaedic centre

The vision for the orthopaedic centre is to automate all information flows through the patient administration system, PowerGate stock control system and updates to the national joint registry database. To enable this, Leeds Teaching Hospitals has data capture points (barcode scanners) in the storeroom and in each orthopaedic theatre suite. The next stages are:

1. orthopaedic kit RFID tagging proof-of-concept project and
2. early demand capture.

Orthopaedic kit RFID - Proof of Concept

Orthopaedic kits or modules, which contain hip and knee joints in a variety of sizes, are commonly utilised in the Trust. Although these kits simplify the sourcing of components for a surgical procedure, they also complicate the administration process that supports it.

Each kit is loaned to the Trust on a consignment basis and only the elements that are utilised or not returned to the supplier are invoiced. This produces a manually-intensive checking exercise at each point in the lifecycle of the kit. Before delivery, the supplier checks that all components are present in the kit. The variety of kit complexity can mean that this is anything from a ten minute to a two hour process. This checking is then repeated by the Trust on receipt of the kit from the supplier, as the absence of any component can mean a cancelled operation. The checking is carried out again after the surgical procedure, to ascertain which components have been used and to record them manually for the creation of a purchase order that will match the supplier's invoice. One more check takes place on the return of any kit components to the Supplier as a final reconciliation.



Orthopaedic kits or modules, which contain hip and knee joints in a variety of sizes, are commonly utilised by the Trust.

What is a module?

An inventory code with a bill of materials below. e.g 5421

Each module has a build/lot number. E.g 5421/6

Each item in the build has product and lot number.

Johnson & Johnson are committed world-wide to implementing GS1 standards and these will form the basis of future RFID projects within Leeds. The timescales for the J&J adoption of GS1 standards will vary by J&J business unit.

Radio Frequency Identification (RFID) is potentially a perfect remedy to all of these manual checks. Leeds Teaching Hospitals, in conjunction with GS1, Depuy, Sybase and GHX, have piloted a test case of RFID-tagging a kit to simplify ad-hoc checking, receipting, issuing and final return of orthopaedic kits.

The solution has been built around Sybase's RFID Anywhere software. The advantage of this three-tier solution is that it translates inputs from a variety of sources into an homogenous message type which is then filtered for relevance. Filtered messages may then pass onto the business layer. This approach means that a number of input sources can easily sit alongside each other and should the initial RFID tags / readers change then the effects are insulated from the rest of the solution. The variety of built-in adaptors to communicate to ERP systems also means that the business layer is easily portable should their corporate solution(s) change and the solution can again be easily ported to other organisations with entirely different ERP solutions.

Leeds Teaching Hospitals integrated the solution into GHX's PowerGate inventory management system, which is in turn deeply integrated with Oracle Applications Purchasing, the Trust's corporate ERP system.

PowerGate allows the Trust to create a shopping list for each kit so orders can be generated by simple drag-and-drop-style requisitioning.

These requisitions are then matched with Oracle Purchasing, where they produce purchase orders which are then transmitted via GHX's e-trading exchange and routed via GHX to the supplier.

The outcome of implementing these technologies is that:-

1. Orthopaedic kits become their own receipts, while issues and returns are recorded in the inventory solution without the need for manual intervention
2. Consumed components create receipts against the purchase order which then act as a complete three-way match control for invoicing
3. Clinical staff are able to check the contents of a kit instantly, without the need for manual counts at each step in the administrative and clinical process
4. The Trust can meet legislative prompt payment requirements for invoices which otherwise would be delayed, due to the reconciliations required
5. Supplier stock-to-cash cycle is improved.

The technology is scalable and the concept has been proven but we now need a full pilot to prove the concept within the wider healthcare orthopaedic arena.

Early demand capture

This area is in the next phase of development at Leeds. The patient is assessed several weeks before the procedure takes place (normally 6 weeks). At this point the surgeon, given demographic characteristics and procedure type, can predict with a degree of accuracy the product requirement (through a lookup template). The early demand information should help suppliers to optimise production, resulting in improved service efficiency and performance. The forward demand could also help the trust to ensure that any kits required are used for sequential procedures and so reduce rental costs.

The first phase of the implementation has been successful and Leeds now automatically updates patient records and joint registry information in the theatre environment through scanning equipment.

NEW PROCESS FLOW

The day prior to surgery patient records are sent from PAS to CIS <i>Patient history and demographics recorded</i>	Patient arrives in orthopaedic centre	Patient ID entered onto PAS (isoft Galaxy)	Procedure takes place <i>Time of theatre entry, knife-to-skin and people present recorded on CIS</i>	Patient leaves theatre <i>Surgical outcome recorded, patient recorded out-of-theatre</i>	Once a new patient ID is entered the scanning is completed for the previous procedure
	All products potentially to be used are issued to theatre	<i>Type of procedure, arrival time and 'into-department' time</i>	All consumables used are scanned in theatre into PowerGate and allocated to the procedure code for costing and to the patient ID for the NJR	Unused products not scanned and returned to stock	

NOTE

PowerGate Locally known as CHOCSTOCK – is the stock control and forecasting system
CIS Clinical Information system
PAS Patient Administration System (isoft Galaxy)

Output from PAS to CIS and PowerGate
*Knife-to-skin time
Closure time
Out-of-department time*

POSSIBLE FUTURE PROCESS FLOW

The day prior to surgery patient records are sent from PAS to CIS <i>Patient history and demographics recorded Information shared with suppliers for production planning</i>	Patient arrives in orthopaedic centre	Patient ID entered onto PAS (isoft Galaxy)	Procedure takes place <i>Time of theatre entry, knife to skin and people present recorded on CIS</i>	Patient leaves theatre <i>Surgical outcome recorded, patient recorded out-of-theatre</i>	Once a new patient ID is entered the scanning is completed for the previous procedure
	All products potentially to be used are issued to theatre	<i>Type of procedure, arrival time and 'into-department' time</i>	All consumables used are scanned into the Galaxy 'equipment module' – implants used recorded and consumable usage updated to PowerGate	Unused products not scanned and returned to stock	

Output from PAS to CIS and PowerGate
*Knife-to-skin time
Closure time
Out-of-department time
NJR data
Implants and consumables used*

MANAGING THE TRANSITION

- STEP 1 – Agree stock levels**
Clinical and supplies staff agree practical minimum stock levels, reorder levels and consignment levels
- > **STEP 2 – Training**
All staff taken to see the barcode recording system working in other departments (cardiology) and at other trusts.
- > **STEP 3 – Procedures**
To ensure the new system is as efficient as possible and benefits are maximised, the processes are recorded and monitored
- > **STEP 4 – Stakeholder engagement**
All stakeholders engaged in stock level review and the importance/benefits of recording all products used communicated. Cross-functional group set up to review quarterly and agree new product lines
- > **STEP 5 – System transition**
After 6 months the order history is on the system and the ordering function is transferred to predictive ordering – significant service improvement.

AUTHOR

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as working on health event linkage for the local health authority. He is a member of the GS1 UK HUG and the NHS National e-Enablement Programme.