

Prosthetic inventory management

PETER BRINKMAN, CHRISTINE SEIPEL, AND ALISON JUERS

Peter Brinkman is Assistant Director of Nursing, Logan Hospital. Christine Seipel is Clinical Resource Co-ordinator, Critical Care Areas, Division of Surgery, Princess Alexandra Hospital, Brisbane. Alison Juers is Nurse Educator at the Intensive Care Unit, Princess Alexandra Hospital, Brisbane.

Abstract

An improved approach to inventory management in the Operating Theatre has been initiated at Princess Alexandra Hospital. A Clinical Resource Co-ordinator (CRC) position was created to provide access to expertise in purchasing and materials management at the clinical level. A review of existing inventory management practices conducted by the CRC revealed reporting inadequacies, lack of product specialisation and inadequate control over pricing, stock levels and product usage. Through liaison with key stakeholders, a competitive tendering process was introduced which resulted in a standing offer arrangement being installed for three specialty orthopaedic areas. Outcomes of this arrangement are discussed. The importance of raising the area of prosthetic inventory management for debate in the Australian literature is also highlighted.

Introduction

Over the past two decades Australian Hospitals have been required to respond to changes occurring within health care. These changes have reduced the number of acute care hospital beds, increased the number of patients receiving hospital treatment and reduced average hospital length of stay (Braithwaite, 1993). Models of funding that rewarded improved performance and productivity were introduced (Commonwealth Department of Health & Aged Care, 1999; Queensland Department of Health, 1999). With the trend towards increasing efficiency, it is imperative that areas of high cost are managed effectively to gain maximum value for the health care dollar.

Mathias (1996), the National Demonstrated Hospitals Program (1997) and Tubbe (1998) have identified that the inventory held within the operating theatre (OT) is associated with high cost. One area of OT inventory that has been subject to scrutiny due to rapidly increasing costs is Prosthetics (Healy & Finn 1994; Healy 1995; Healy et al 1998; Iorio et al 1998; Patterson 1994). A budget overrun in the area of clinical consumables and prosthetics at the Princess Alexandra Hospital (PAH) in Queensland provided the impetus for a review of inventory management in the OT. This paper will outline the strategies implemented at PAH to improve the efficiency of orthopaedic prosthetic management, the outcomes thus far, and the application of these strategies to other areas of surgical implants.

Literature Review

Prosthetic inventory control within the operating theatre environment has been highlighted in the American literature since the early 1990s. Process changes that result in easily identifiable savings is the focus of much of the literature. These changes include reducing the number of vendors and standardising implants (National Demonstrated Hospitals Program 1997, Petrucelli & Karpovich 1993, Patterson 1994, Tubbe 1998), implementing contractual arrangements that stipulate price capping (Patterson 1994), increasing the use of purchasing on consignment (Patterson 1994; Tubbe 1998) improving inventory turnover (Tubbe 1998), and recycling implants (Levine, Cole and Rodeo 1995). Negotiating volume and timely settlement discounts (Iorio

et al 1998), loan equipment, repacking, resterilisation and freight charges (Patterson 1994), and greater vendor responsibility for inventory maintenance (Patterson 1994) are cost saving initiatives identified in the literature.

The importance of a multidisciplinary approach to cost-benefit analyses of prosthetic implants was identified as essential in generating commitment to initiatives, particularly in the area of implant standardisation (Johnson-Bailey 1994; Levine et al 1995; Zuckerman, Kummer & Frankel 1994). Methods used to achieve implant standardisation include researching physician prosthetic usage (Rennecker 1996; Zuckernam et al 1994), improving cost awareness (Levine et al 1995; Sabatino 1992; Tubbe 1998; Zuckernam et al 1994), and locating materials management personnel in the OT environment to enable them to effectively track compliance (Rennecker 1996; Sabatino 1992). A prostheses utilisation committee is another mechanism to track standardisation compliance and review requests for non-standard items (Zuckernam et al 1994).

The benefits of a more scientific approach to implant standardisation have been emphasised in a number of studies. Healy (1995) developed a scoring system to match projected patient demand on the most appropriate prosthetic device, to ensure that costly, high-tech prosthetics were utilised only when clinically indicated. Similar short-term studies (Healy et al 1998, Lorio et al 1998) appear to support implant standardisation as a valid cost saving measure.

Long term patient outcomes of decision-making tools have not been established. Maliff and Swan (1996) highlight the lack of long-term, randomised trials assessing innovations in total hip replacement and total knee arthroplasty in relation to patient outcomes. Consequently, it is difficult to justify the increasing costs of implants when improved patient outcomes have not been determined.

Although prosthetic management issues have been widely addressed in American literature, there is a lack of similar Australian studies. Prosthetic inventory management needs to be raised as an agenda item for debate in the Australian literature, so that successful approaches can be shared, monitored and refined.

Inventory management

Historically, control of the OT inventory at PAH was delegated to junior nursing staff. Ordering practices were supervised by Clinical Nurse Consultants and remotely located purchasing officers. Demand and supply in the area of prostheses was influenced primarily by individual surgeon preference, with minimal liaison among colleagues.

In 1998 a review of the nursing workforce at PAH was initiated. One of the outcomes of this review was the implementation of single-point accountability for cost centre management within clinical units. Nursing management responsibilities previously undertaken by Nurse Managers, including the co-ordination and negotiation of consumable purchasing were incorporated into Clinical Nurse Consultant positions. The amalgamation of these positions resulted in the development of a new role, the Nurse Practice Co-ordinator, and meant that an alternative approach to inventory management was required.

It was proposed to create a position to be known as the Clinical Resource Co-ordinator (CRC) to assume control of the ordering, purchasing and inventory management practices within the operating suite. The CRC would provide the technical purchasing and inventory management skills to supplement the clinical knowledge of senior registered nurses within OT. To maximise the efficiency of the role the position was created within the Division of Surgery, with professional accountability to the PAH Materials Manager. The position was physically located within the surgical division to ensure proximity to the clinical areas which enabled the CRC to become part of the clinical team and to focus on providing a high quality service to the Surgical Division.

As OT activity also influences consumable usage within the Intensive Care Unit (ICU), the CRC role was broadened to provide a specialised service to both areas. Purchasing practices between OT and ICU were previously managed independently, with little consistency in purchasing practice, resulting in product wastage and increased costs. With the CRC working across both areas, it was anticipated that streamlining of purchasing practice would occur.

Inventory management review

In early 1999, the CRC conducted an investigation into an apparent expenditure overrun on clinical consumables and prosthetics in OT. Findings included limited expenditure breakdown due to information system coding inadequacies, lack of product standardisation and inadequate control over pricing, stock levels and product usage.

The newly implemented Queensland Health Corporate SAP R/3 financial and materials management information system (FAMMIS) had been structured with only one broad product group code and general ledger expenditure code for prosthetics. This meant that prosthetics could not be grouped into the different specialties (eg. orthopaedics, ophthalmic and vascular). Consequently, purchasing and financial reports lacked the specific detail required by the specialty areas. Further, inconsistencies in processing orders by OT staff and incomplete product knowledge on the part of supply purchasing staff resulted in incorrect coding of consumables as prosthetics and vice versa, subsequently consumable and prosthetic reports were often unreliable and inaccurate.

Despite considerable increases in the price of prostheses (up to 30%) over the previous 12 months, there were no firm pricing arrangements in place. Traditionally prosthetics were a product line where limited price negotiation occurred. Suppliers would generally advise the price when the Supply Department placed the purchase order. In the case of major items such as hip and knee components, the purchase order was usually placed after the surgical procedure had occurred. Surcharges were applied for provision of loan sets and on consignment stock. Suppliers' "list" prices were normally charged and paid for all products with no advantage being taken of potential volume discounting. Invoiced prices were paid regardless of minor variations between the order and invoice.

There was considerable overstocking and obsolete stock retained in OT. This situation was not isolated to orthopaedic stock but also occurred in other specialties. Comparatively little stock was held on consignment — being restricted to cardiac prostheses, vascular grafts, intraocular lenses and some knee and spinal implants. Orthopaedic implants on consignment accounted for at most 5% of the prosthetic range used.

Product usage was largely based on individual surgeon preference on a case by case basis. In the area of orthopaedic prosthetics, ten suppliers were used across the areas of trauma, microplating and spinal surgery. Various nursing staff members, without the benefit of historical information, usage forecasting or accurate pricing knowledge, made decisions regarding stock levels. Changes to product usage or trialing of new products occurred on an ad hoc basis. Variation existed between instrumentation that affected staff training requirements and the efficiency of reordering instrumentation.

Due to the wide variety of prosthetics and associated instrumentation the system lacked efficiency, potential savings were not maximised and staff training requirements were increased.

Formal Pricing Arrangements

A recommendation was made to the Orthopaedic Department that formal pricing arrangements be initiated by tender for all prosthetics. A critical element in this recommendation was that product usage would still be based on clinical decisions but that these decisions would now be made pre-operatively using a collaborative departmental approach. Tender arrangements would include the flexibility to allow purchase outside the contract based on specific clinical requirements or supply deficiencies.

Given the identified budget overrun, it was evident that a competitive tender was most likely to provide the outcomes required by the organisation. The Orthopaedic Department was concerned that any savings generated by competitive tender would be absorbed into general prosthetic expenditure and not directly benefit the department. It was decided to identify orthopaedic expenditure and create a separate orthopaedic prosthetic budget. As a result of this decision the entire prosthetic budget was removed from the general OT cost centre and divided up into the relevant specialties. A competitive tender was developed for spinal, microplating and trauma prosthetics. Joint prosthetics were excluded from these original tenders, however, at the time of writing, tenders for joint prosthetics were under evaluation.

Devolution of financial responsibility and budget was beneficial in gaining a commitment to achieve cost-effective control over prosthetic usage. The importance of clinician involvement from the start of the process cannot be over-estimated. Clinician input is important in determining clinical suitability and the level of support and training required.

Additionally it is important to minimise the impact on the clinicians' time during the evaluation process. The use of comparison charts and grouping prostheses by sample case assisted in streamlining the selection process.

The CRC initiated strategies to address system-reporting inadequacies. A database (spreadsheet format) was developed and maintained to include details of current products, part numbers, current prices, desired product group classifications, government rebate numbers and rebate amounts for charging private cases. This data was then loaded into the Operating Room Management Information System (ORMIS). ORMIS generates reports that are used for identifying stock replenishment requirements, loan usage and private case charging by the Finance Department. Data was also electronically loaded into FAMMIS to enhance the catalogue database and facilitate requisitioning and purchase order processing.

The database allowed the CRC to control purchase order pricing and provide comparative data to surgical staff relating to product groupings and prices. The database was also used to update FAMMIS and ORMIS. The centralised purchasing service utilised the database to verify pricing of all purchase orders, eliminating incorrect pricing and payments, and suppliers were no longer able to introduce price increases without prior notification to OT.

An approach was made to the Queensland Health (QH) FAMMIS support team with a proposal to breakdown coding of prosthetics into a comprehensive range of product groups (see Table 1). The CRC, in consultation with the support team, re-coded the existing FAMMIS catalogue database into meaningful product groups allowing detailed materials management reporting across a range of specialties and product types.

Table 1 Prosthetic groupings

Cardiothoracic	Ortho-Knee
ENT	Ortho-Other
Microplating	Ortho-Shoulder
Miscellaneous	Ortho-Trauma
Neurosurgical	Spinal
Ophthalmic	Urogenital
Ortho-Hip	Vascular

The Tender Process

Consultation between the CRC, OT nursing management, surgical directors and divisional chairpersons, resulted in a decision to invite separate offers for spinal fixation devices, internal and external fixation devices and microplating. In line with QH long-standing plans to implement statewide (i.e. whole of health) corporate purchasing arrangements, approval was first obtained from QH Purchasing and Logistics Group to proceed with these offers.

Offer Evaluation Committees were formed for each product group. Active participation, with members being involved in the entire invitation to offer process, was the key concept underpinning the formulation of these committees. The process included preparation of offer documents, evaluation of offers, preparation of reports and submission of final recommendations to the appropriate procurement delegate (PAH Materials Manager). Committee membership included representation from key stakeholders such as specialty related medical representatives, senior theatre nursing staff and the CRC.

The invitation to offer was publicly advertised and required offers to address the following:

- provision of consignment stock
- provision of loan instrumentation
- alternative technical and innovative solutions to supply and inventory management
- alternative offers or part offers
- any complete package proposals.

Offers were requested for an initial period of 12 months, with an option to extend for a further 12-month period. It was stipulated that any resultant arrangement could be utilised by other hospitals under the same prices, terms and conditions as those contained in the offers. Evaluation criteria used for assessment of offers were also contained in the invitation to offer document (Table 2).

Table 2 Evaluation Criteria

- | |
|--|
| <ul style="list-style-type: none">• the offeror’s technical and commercial compliance with the specification• the quality of the offeror’s product• clinical suitability of products offered• alternative technical and innovative solutions to supply• the offeror’s Quality Assurance system• the provision of equipment and instrumentation• the sponsorship of local education courses for relevant surgeons and theatre nurses on the use of implants supplied by the manufacturer• the ability of the offeror to provide delivery, warranty, after sales service, spare parts and training support on a long term basis• the past performance of the supplier as assessed by information obtained from internal and external sources• the comparative cost of the offers• delivery times |
|--|

Evaluation process

The evaluation of offers for orthopaedic devices was by far the most complex. Offers were received from 14 different suppliers. Ten were current hospital suppliers. Offers were separated into the sub-groups listed in the offer specifications (Table 3). Products were assessed against identified clinical criteria and shortlisted for further evaluation. Pricing and cost comparison was then undertaken considering current inventory holdings, the value thereof and the costs of changing product ranges.

Table 3 Orthopaedic (Trauma) sub-groups

- | |
|---|
| Basic Bone Plates and Screws |
| Intramedullary Nailing Systems |
| Hemi-arthroplasty prostheses |
| Cannulated Hip Screws |
| Neck of Femur Fracture (Compression Hip Screws) |
| Cabling Systems |
| External Fixation |
| Miscellaneous Wires and Pins |

Detailed evaluation reports and recommendations were prepared incorporating a weighted matrix analysis of offers against the evaluation criteria. The PAH Materials Manager gave final approval to install each arrangement on the basis of the recommendations within the reports.

Outcomes

The initial standing offer arrangement was installed with one supplier for spinal fixation devices. This arrangement allowed for price reductions, fixed pricing arrangements, the elimination of surcharges for loan sets and provision of consignment stock. Another arrangement was also installed with one other supplier for a smaller range of spinal products to meet specific clinical requirements.

After reviewing the remaining orthopaedic tenders the decision was made to choose the same supplier for spinal fixation devices, orthopaedic fixation devices and microplating, excluding orthopaedic cabling systems (not available from that offeror). Further price reductions, fixed pricing, upgrading of existing stock, consignment of all products and loan instrumentation (as required) were included in the arrangement. A separate arrangement was installed with another supplier for a cabling system that included the provision for consignment stock.

The microplating tender achieved standardisation of products and equipment across four specialities (Maxillofacial, Neurosurgery, Hand surgery and Plastic surgery). Other benefits evolved as a result of one major supplier securing all three arrangements. These included the opportunity to streamline ordering with a blanket order process following the setting up of consignment stocks by the vendor. Agreement with the vendor resulted in a process (Table 4) which did not compromise total control over contract pricing and usage history reporting.

Table 4 Blanket order process

FAMMIS blanket order assigned on a monthly basis, separated into reportable categories for product group and cost area Daily faxing to vendor of the ORMIS usage report

Overnight replenishment of consignment stock generated with direct delivery to OT

Blanket monthly invoice and spreadsheet emailed from vendor to CRC to facilitate:

- quick reconciliation with daily delivery dockets;
- electronic reconciliation with contract pricing;
- electronic sorting into required reportable categories and totalling thereof;
- processing bulk receipt and payment through FAMMIS

The standing offer arrangements were installed over the period June to September 1999. The estimated direct savings achieved to date (April 2000) are \$120,000. This does not take into account the avoidance of price increases likely to occur during the life of the offer arrangement nor the costs for purchasing new or replacement instrumentation had loan instrumentation not been provided. Available storage space in OT also increased due to the reduction of inventory holdings.

An indirect outcome of streamlined processing practices has been a reduced labour requirement across OT, Purchasing and Accounts Payable Departments. The provision of a supplier representative dedicated to the hospital (24-hour and 7 days a week coverage), has improved communication, problem resolution and restocking of prosthetics.

The success of the competitive tendering process described has resulted in the implementation of similar arrangements for other prosthetics and specialty consumable product groups. Negotiations have been undertaken for:

- orthopaedic hip and knee prostheses
- urology prosthetics and specialty products
- neurosurgical prosthetics and specialty products
- intraocular lenses
- vascular grafts and specialty products.

From these initial offers, methods of improving offer documentation have been identified which will result in evaluations becoming easier and less labour intensive. For example, the offeror could separate products into required sub-groups and provide total procedure costs where applicable as opposed to individual item pricing.

Discussion

The value of any practice remodelling or process re-engineering is commonly based on the cost involved and benefits achieved. Inventory management strategies, including the competitive tendering process introduced, have provided the organisation with a good return on investment.

It could be argued that strategies presented in this paper are merely those expected of any well-managed department. However, with the lack of published studies in the Australian literature and the high interest shown by other health care organisations in the PAH initiatives, it seems highly likely that less than efficient inventory management practices are widespread in the Australian health care system. This observation is supported by the report of the Austin and Repatriation Medical Centre when surgical consumable inventory management was reviewed at that facility (National Demonstration Hospitals Program, 1997).

Furthermore, with the advent of e-commerce within the private and public sectors, it is imperative that inventory management practices are introduced as an agenda item for discussion and debate in the local literature.

Conclusion

The CRC role introduced at the PAH in 1999 has been successful. Inventory management in OT and ICU has improved. It is anticipated that the expenditure overrun in clinical consumables and prosthetics in OT will be substantially reduced. Correspondingly, the limited expenditure reporting due to coding inadequacies, lack of product standardisation and inadequate control over pricing, stock levels and product usage will also be eliminated.

At the PAH, the critical factor for the successful implementation of an inventory management system was the introduction of strategies to improve system reporting and control mechanisms for the ordering and supply of prostheses.

Processes were developed to initiate formal pricing arrangements for all prosthetics, with competitive tendering processes introduced in the specialty orthopaedic areas of spinal, microplating and trauma. Through liaison with key stakeholders and detailed evaluation, a standing offer arrangement was installed with one major supplier for prosthetic supply in the three orthopaedic specialty areas.

Outcomes of this arrangement included price reductions, fixed pricing arrangements, elimination of surcharges for loan sets, greater provision of consignment stock, blanket order arrangements and standardisation of prostheses and associated equipment. In addition to the directly measurable cost savings, benefits have also been realised via reduced labour requirements for the hospital and an improvement in the available OT storage space. The success of these initiatives has led to the extension of similar standing offer arrangements being pursued in other areas of prosthetics and clinical consumables.

The process was also able to demonstrate that clinicians, unit managers and purchasing personnel were able to work together to achieve an outcome for the hospital which met the clinical needs of patients at a reduced cost.

Further improvements in inventory management are always possible. However, the attainment of improved practices requires inventory management initiatives to be raised for debate in the Australian literature. This will promote the discussion and exchange of ideas about short and long term benefits and the applicability of such initiatives throughout the health care sector.

The authors would like to thank all the staff members involved in the tender process. The authors would like to particularly thank Dr Peter Steadman, Dr John Morris, for their support of the process and Michael Seow for his support in the preparation of this paper. The views expressed in this paper are those of the authors and may not reflect the views of the Princess Alexandra Hospital.

References

- Braithwaite J 1993, 'Identifying the elements in the Australian health service management revolution', *Australian Journal of Public Administration*, vol 52, no 4, pp 417-430.
- Commonwealth Department of Health & Aged Care 1999, 'State and Territory casemix developments', Acute & Co-ordinated Care Branch, URL: <http://www.health.gov.au/casemix/statedev.htm> (accessed 27/3/2000).
- Healy W & Finn D 1994, 'The hospital cost and the cost of the implant for total knee arthroplasty', *The Journal of Bone and Joint Surgery*, vol 76-A, no 6, pp 801-806.
- Healy W 1995, 'Economic considerations in total hip arthroplasty and implant standardisation', *Clinical Orthopaedics and Related Research*, vol 311, pp 102-108.
- Healy WH, Ayers ME, Iorio R, Patch DA, Appleby D & Pfeifer BA 1998, 'Impact of a clinical pathway and implant standardisation on total hip arthroplasty', *The Journal of Arthroplasty*, vol 13, no 3, pp 266-276.
- Iorio R, Healy WL, Kirven FM, Patch DA & Pfeifer BA 1998, 'Knee implant standardization: an implant selection and cost reduction program', *The American Journal of Knee Surgery*, vol 11, no 2, pp 73-79.
- Johnson-Bailey MP 1994, 'We cannot manage the cost until we can manage the system', *AORN Journal*, vol 60, no 6, pp 1002, 1004-7.
- Levine DB, Cole BJ & Rodeo SA 1995, 'Cost awareness and cost containment at the hospital for special surgery: strategies and total hip replacement cost centers', *Clinical Orthopaedics and Related Research*, vol 311, pp 117-124.
- Maliff RP & Swan M 1996, 'Orthopedic implants: clinical factors related to purchasing decisions', *Surgical Services Management*, vol 2, no 12, pp 26-31.
- Mathias JM 1996, 'Pushing costs down with inventory control', *OR Manager*, vol 12, no 2, pp 15-6.
- National Demonstration Hospitals Program 1997, 'Management of surgical consumables inventory', Australian Resource Centre for Hospital Innovations, URL: <http://www.archi.net.au/phase1/consumab.htm> (accessed 23/3/2000).
- Patterson P 1994, 'Orthopedic implants: contracts with vendors cut costs sharply', *OR Manager*, vol 10, no 6, pp 14.
- Petrucelli MH & Karpovich G 1993, 'Standardization and management of orthopedic implants', *Seminars in Perioperative Nursing*, vol 2, no 2, pp 98-102.
- Rennecker JA 1996, 'An outcomes approach to designating an orthopedics prosthetics inventory management process', *Seminars in Perioperative Nursing*, vol 5, no 1, pp 36-9.
- Sabatino F 1992, 'Standardizing implants: how to break the barrier', *Materials Management*, April, pp 24-28.
- Tubbe R 1998, 'Inventory control in the OR', *Surgical Services Management*, vol 4, no 6, pp 35-6.
- Zuckerman JD, Kummer FJ & Frankel VH 1994, 'The effectiveness of a hospital-based strategy to reduce the cost of total joint implants', *The Journal of Bone and Joint Surgery*, vol 76-A, no 6, pp 807-811.