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# Cost Awareness and Cost Containment at the Hospital for Special Surgery

## *Strategies and Total Hip Replacement Cost Centers*

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**To help balance the operating budget of The Hospital for Special Surgery, which was encountering an annual major deficit of $4 million in 1989, a program of cost awareness leading to cost containment was instituted in 1990. Costs of supplies, implants, and equipment were identified and reviewed by the hospital staff, including orthopaedic surgeons, orthopaedic residents, health care personnel, and administration, for cost effectiveness. Methods to accomplish the goals included structuring committees for information; workshops organized by different services to affect change; feedback to health care professionals through posters and newsletters; and statistical identification for continued education. Major cost savings resulted from recycling wasted implants, reduction of costly implants, and reduction of unnecessary supplies. As a result, vendors had been challenged, leading to more competitive prices. This program has opened new avenues of cost reduction without sacrificing quality of medical care and has contributed to a breakdown of barriers between medical staff, administration, and finance, leading to a strong hospital-team commitment. The price of health care in the United States in 1993 exceeded $900 billion. Health care expenditures now account for approximately 14% of the gross domestic product. Health care costs have been rising faster than the inflation rate for more than a decade. The result is the current national focus on containment of health care expenditures.**

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In 1989, The Hospital for Special Surgery had a deficit of >$4 million dollars on an operating budget of $78 million. The senior author believed that reduction of the costs of supplies was critical in balancing the budget. A program was initiated based on the simple principle of becoming cost aware of such supplies. Up to this time, the attending orthopaedic staff and health care personnel were not only indifferent to, but also were unaware of, individual supply costs. The time had come for all health care personnel at The Hospital for Special Surgery to become aware of costs to contain such costs in the future. Consequently, a Cost Awareness Cost Containment program was instituted in 1990 to educate the staff about all costs of supplies at the hospital. This paper will review, in part, the first 3 years of this ongoing program.

## MATERIALS AND METHODS

Medical, nursing, and administrative teams were selected to participate at a committee level to identify current costs of supplies and services. Decisions were to be made to reduce some supplies, eliminate others, and challenge vendors on costs. The goals of this program were to introduce cost awareness to obtain cost containment and cost reduction, while maintaining and improving quality of care.

Participating in the first meeting in February 1990 were key members of administration, orthopaedic attending staff, orthopaedic resident staff, materials management, biomechanics, and finance. The first phase of this program analyzed costs and benefits of various supplies (disposable versus nondisposable), implants, instruments, and equipment in the operating room.

Workshops were organized based on various services (sports medicine, spine, total joints). Activation of this program consisted of sharing this information with the entire staff, instituting monthly posters illustrating identification of costs and savings in the operating room, and making appropriate changes based on multidisciplinary medical decisions. Eventually this program was expanded to include a comprehensive analysis of resources dedicated to delivering outpatient and inpatient care.

An agenda for each meeting was developed. A list of all supplies and procedures was compiled and included the items' costs and annual volume consumed. Each item was reviewed, and input from each committee member was encouraged.

## RESULTS

At 1 workshop meeting, the annual cost of purchasing cement mixing bowls (2 bowls were used for each total joint procedure) was estimated at $28,000. A surgical technician made it known that 2 bowls were routinely provided in a total joint pack, but were discarded if there was no stirrer. Subsequently, a stirrer was included in the pack, and the bowls were no longer purchased separately, saving $25,000 annually.

Another item reviewed was the cost of surgical gloves, which was found to vary as much as $2 dollars per pair between different manufacturers. This cost awareness saved $10,000 in the first 8 months of the program.

By September 1990, an awareness of costs leading to additional savings included reusable basin sets ($21,000), reusable light handles ($6000), surgical blades and burrs ($40,000), meniscectomy kits ($40,000), vydrapes ($12,000), and custom packs ($10,000).

## RECYCLING IMPLANTS

It was evident immediately that the highest-cost items were implants. It quickly became known that the costs of wasted implants were as high as $25,000 monthly. Sealed implants were opened and not used. Because the manufacturers imprinted that such implants could not be used or returned after the seal was broken, these items were discarded. The committee addressed this issue.

In 1990, 7000 orthopaedic surgical procedures were performed at The Hospital for Special Surgery, including 1300 total hip arthroplasties and 900 total knee arthroplasties.

The committee tracked 4500 implant procedures, discovering that 400 implants had been opened and not used, at a cost of $425,000. One half the implants were plastic and, therefore, not recyclable (at this time). The other $\frac{1}{2}$ were metallic components, costing $360,000, which were potentially recyclable. Whether an implant could be recycled depended on its composition, degree of contamination, and alteration of structure.

The unused implants were divided into 3 categories: absolutely recyclable (nonporous metal), absolutely nonrecyclable (tissue and plastic), and potentially recyclable (porous metal). A program was established and procedures written to recycle such implants through the biomechanics department. All nonporous metallic components were recycled in a safe and efficacious man-

**TABLE 1. Results of Opened–Unused Implants**

| Year | Opened Unused | Recycled | Wasted |
|---|---|---|---|
| 1992 | $208,229 | $91,648 | $116,580 |
| 1993 | $124,400 | $56,600 | $67,800 |

ner. Structurally altered implants were not recycled. A monthly wasted implant report was generated, including the wasted item, identification number, course of recycling (or not recycling), and attending surgeon's name. Awareness by surgeon was immediate and eventually cost effective (Table 1).

Although there was no safe method for recycling contaminated porous implants, the committee realized that such a process would be possible in the future, and all opened and unused porous implants were stored in the biomechanics department for potential recycling when such a process becomes available.

## POROUS IMPLANTS

In 1994, at The Hospital for Special Surgery the list prices for the total hip implants most commonly used ranged between $4000 and $4500. Porous implants were the highest priced of all implants that were being opened and unused. Until this time, there has been no acceptable method of safely decontaminating porous implants.

An investigative study was begun in the biomechanics department to clean such implants (patent pending). The study subjected sample porous coupons to repeated ultrasonic and Clorox (Oakland, CA) washes. Percentage of reduction of contaminated tissue by ultrasonic wash was determined by weight measurements on repeated washings. Additional decontamination with detergents, nitric acid, and Clorox was performed. All specimens were inspected by light microscopy (magnification, ×31) by the metallurgist. A definition of "clean" was obtained by contacting the American Association of Medical Instrumentation. Specimens were finally subjected to repeated immune assay analysis. This process is presently being concluded, and final results will be reported in the near future.[4]

## IMPLANT ACCOUNTABILITY

At the onset of the program, there was very little accountability of the implants that were stored in the operating central supply. Realizing a total implant inventory (all implants) of >$5 million (owned or on consignment), a security implant room was constructed. Control of implant distribution was administered by the operating room materials management staff. Before this time, no inventory of implants in the operating room suite was maintained. It was not possible to account for implant reduction by waste or by loss. With the new system of maintaining implants in a secured area, administered by materials management personnel, it is now possible to control distribution of implants, realize waste or loss in a more systematic manner, and account for missing implants.

## CEMENT LOSS

Packages of polymethylmethacrylate (monomer) were opened and not used, at an average cost of $1500 monthly. Once this item was stored and distributed in the newly created implant room, the loss was reduced to an average of <$200 monthly. This method was arrived at only after having a conference with the manufacturer's representatives who acknowledged that the monomer was recyclable, but the process would not be cost effective.

## DISCUSSION

### Total Hip Replacement Critical Pathways

As part of the cost-containment efforts, different methods were used to monitor trends occurring in the hospital. The most common

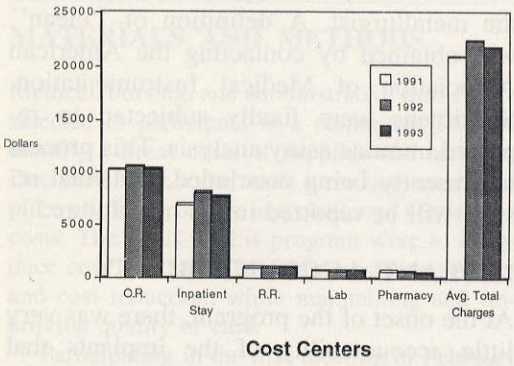


**Fig 1.** The 5 highest cost centers based on hospital charges (1991–1993) were identified in the critical path analysis. The highest cost centers were the operating room and the length of stay (room and board). (O.R. = operating room; R.R. = recovery room.)

surgical procedure, total hip arthroplasty, was examined, and a method of critical pathways was analyzed. Critical pathways are clinical management tools that organize, sequence, and time the major interventions of nursing staff, physicians, and other departments for a particular case management program, such as for total joint arthroplasty. The development of such critical pathways helps to identify resource dedication, cost centers, and their respective variances.

This method was applied to all patients >60 years of age with a diagnosis of degenerative joint disease of the hip who were undergoing unilateral uncomplicated primary total hip arthroplasty from 1991 to 1993. By reviewing charts and billing records of this group of patients, the principal cost centers comprising the overall charge, length of stay, and sequence and intensity of resources used were identified and recorded.

Five hundred twenty-seven admissions in 1991, 603 admissions in 1992, and 608 admissions in 1993 met these criteria. The top cost centers in decreasing order were room and board (length of stay), operating room costs (including implant cost of >50% in most cases), recovery room, laboratory, and radiology (Fig 1). The total charges remained constant without significant differences, despite increases in New York State-approved cost-to-charge ratios routinely used to allocate costs. This accompanied an annual reduction in the length of stay (1991, 9.88 days; 1992, 9.43 days; 1993, 8.67 days).

Analysis by individual cost centers has been beneficial. Recently, based on the high costs and variances of laboratory tests and pharmacy costs, guidelines for physician-generated tests and perioperative medication orders were instituted. For example, all surgical procedures were divided into "big" and "small," and patients into "old" and "young," to streamline preoperative testing. New York State requirements were successfully upheld, and the numbers of unnecessary tests were simultaneously reduced without compromising patient care. Furthermore, these guidelines have significantly reduced the number of missing laboratory values that previously delayed operating-room start times.

These results indicate that the major elements contributing to the cost of total hip arthroplasty are implant costs, length of stay, and operating room time. Similar findings have been reported by Barber and Healy[1] in an analysis of total hip arthroplasty at The Lahey Clinic. These authors reported that the cost of total hip arthroplasty increased by only 1.9% in inflation-adjusted dollars between 1981 and 1990 because of reductions in length of stay and in volume of services used (such as radiology and laboratory services). The most notable finding in this study is the rapid rise in the cost of the implant: Although the implant cost represented 11% of the total hospital costs in 1981, this figure rose to 24% of the cost in 1990.[1] The actual dollar cost of the implant increased by 212% during this period. The cost of the implant rose faster than the consumer price index. It is evident that attention must be focused on controlling the cost of hip implants.

The annual orthopaedic implant market

is now in excess of $1 billion. The 1992 list prices of commonly used hip implants ranges from $2060 to $3205 for cemented implants and from $3899 to $4332 for uncemented implants.[9] Profits of the pharmaceutical industry (most implant manufacturers are owned by pharmaceutical companies) as a percentage of net sales were the highest of any industry in the last quarter of 1991. The rise in implant costs is in part attributable to the wider variety of implants now on the market, with modular designs and uncemented fixation now available. These additions have expanded the indications for total hip arthroplasty and the options available to the surgeon. It is not clear if these changes have resulted in improved clinical results to justify the increased expense. Prospective outcome studies are needed to address these important questions.

## INCREASE IN COST AWARENESS

During the 3 years of this cost awareness program, surgeons became informed of the hospital costs of implants. Realization of an increasing surgeon–hospital cooperative team approach to cost control became more evident when health care staff were laid off in 1990 and 1991. This affected the quality of patient care. The potentially serious implications were quickly recognized by all health care professionals. Surgeons challenged vendors regarding costs. Major discounts from suppliers were obtained by the materials management staff, which was a first with some vendors. Critical concerns of high-cost, low-volume implants have emerged. Surgeon responsibility for introducing new costly implants has led to procedures that critically evaluate the need for such systems. It is believed that judicial limitation is now self-imposed by the surgical staff, and not mandated. This still will allow for introduction of innovative, state-of-the-art, and investigative orthopaedic surgical procedures to continue.

## LEGAL STANDARDS

During the past 3 years, many have questioned the legality of recycling opened and unused implants that have been designated for single use only. Now it is becoming a standard in the hospital industry to recycle any supplies that may be safely reused despite designation by the vendors as single use only.

Invention of the steam autoclave in 1880 created in hospitals a cottage industry. Surgical instruments, glassware, rubber gloves, and needles were resterilized and reused. With the rapid widespread introduction of plastics in the 1950s, the disposable era of single use became the standard in the health care system. At the time, it was cost effective and safe. Costs of single-use items escalated until this decade, where revisitation of increasing costs of supplies and environmental concern have led to a return of recycling. However, concern regarding legal and ethical implications has arisen.

Regulatory agencies have addressed these issues of reuse of all types of disposable items. In 1985, the Centers for Disease Control removed its recommendation against reusing single-use devices, leaving the responsibility up to the health care facility to ensure that the reprocessing procedure is safe and efficacious. The Joint Commission on Accreditation of Health Care Organizations changed its standards in 1986 regarding reuse of disposable medical devices. It deleted the statement, ''disposable items should not be reused.'' In its 1976 medical device amendments to the Food Drug and Cosmetics Act, the Food and Drug Administration established its policy regarding reuse of disposable medical devices. This amendment provided public protection against unsafe and ineffective devices. It also implies that it is a medical practice decision to ensure that such devices be safe and effective. When a disposable medical device is reused in a hospital, the institution or practitioner must demonstrate

that the device can be adequately cleaned and sterilized and that the physical characteristics of the device will not be adversely affected.[12]

As a health care provider, a physician's liability for negligence falls into 3 categories: (1) failure to meet the accepted standard of care; (2) failure to obtain informed consent; and (3) vicarious liability for the negligence of persons working under the physicians' control. Informed consent must include the physician's disclosure of information; ability of a patient to understand to make a competent decision; and the statement that such patient decisions should be voluntary.

The institution that reuses disposable medical devices must have established policies and procedures for ensuring safety and effectiveness. These policies should be reviewed by the institution's governing bodies and ethics committees, where applicable. In many respects, the legal status of reuse is still not well defined.

## ETHICAL STANDARDS

In 1992, the Joint Commission for Accreditation of Health Organizations required principles of ethics in determining accreditation.[8] Ethics in medicine date back to the code of C. Hammurabi[5] (2000 BC) that dealt with the concerns of the patient's welfare and appropriate behavior of physicians. The Board of Directors of the American Academy of Orthopaedic Surgeons adopted its first code of ethics in 1988. It was derived from the ''Current Opinion of the Council on Ethical and Judicial Affairs''[5] of the American Medical Association. In 1990, the American Academy of Orthopaedic Surgeons published the book entitled, ''A Guide to the Ethical Practice of Orthopaedic Surgery.'' In 1992, it published the second guide.[6]

The interdisciplinary field of biomedical ethics has been in existence in the United States for >20 years. The basic principles of biomedical ethics are autonomy, nonmaleficence, beneficence, and justice. Autonomy implies the patient's right to direct his or her care. Nonmalificence concerns balancing what the patient wants with what the patient needs. Beneficence implies doing the patient good. Justice requires fair treatment for all, regardless of background, ethnicity, and education.[10] In regard to reuse of devices, risk benefits and patient-informed consent are basic. This applies to all invasive devices, instruments, and supplies used in surgical management, not just recycled implants. The final answers in this field are still evolving.

## TOTAL HIP REPLACEMENT COST AWARENESS

In 1982, 65,000 total hip arthroplasties were performed in the United States. By 1985, this number had risen to 195,000.[7] Among Medicare beneficiaries (age 65 years and older), 56,204 total hip arthoplasties were performed in 1988.[11]

The economic impact of total hip arthroplasty is difficult to quantify. Cushner and Friedman[7] estimated the total direct and indirect cost of hip arthroplasty to be $4.9 billion annually (in 1980 dollars), mostly caused by lost work time and hospital costs. The economic benefit, resulting from the ability to return to the work force and decreased use of support services, was estimated to be $1.85 billion. These authors concluded that although total hip arthroplasty is expensive, the excellent clinical results justify the expense. Another study compared the cost of total hip arthroplasty in patients >80 years of age with that of maintaining a nonindependent person in a nursing home. In this study of 42 patients, the estimated difference in costs between total hip arthroplasty for these patients compared with 1 year of nursing home care was $745,000. After 5 years, the estimated savings were $3,896,000. These estimations assume that total hip arthroplasty

allows maintenance of the patient's independence and the ability to continue to live in their previous surroundings.[3]

Total hip arthroplasty is reimbursed under Diagnostic-Related Group 209, which is currently the eighth most common diagnostic-related group nationwide.[14] Review of primary unilateral total hip arthroplasties performed at the authors' institution in 1992 showed an average hospital cost of $14,551 for patients <65 years of age, $16,060 for patients between ages 65 and 80 years old, and $19,300 for patients >80 years of age. The increased cost in older patients is attributable to longer lengths of stay necessitated by slower rehabilitation and a higher prevalence of complications and associated comorbidities.[2]The average length of stay after a total hip arthroplasty among Medicare beneficiaries was 12.2 ± 7.7 days in 1988. The average total hospital reimbursement was $7218 ± $2591 during the same period.[11] Reimbursement under DRG 209 often is insufficient to cover hospital costs, especially for older patients, and thus the adverse consequences for hospital finances may become critical. In this setting, it is mandatory for hospitals to develop means for cost containment and cost-effective care.

These experiences demonstrate that physicians can effectively provide the impetus, leadership, and cost control in the hospital setting. These efforts have resulted in no increase in total hospital costs for total hip arthroplasty, despite rapidly rising health care costs. Costs were calculated on a variable formula based on hospital charges. A similar program for cost containment has been successful at other institutions. Surgeons at The Lahey Clinic achieved cost containment by progressively decreasing the length of stay and the volume of services delivered with no adverse effects on the quality of care provided.[1] Sommers et al[14] at Stanford University reported that orthopaedic surgeons and nurses were able to reduce costs by addressing length of stay, use of laboratory tests, and operating-room time. The result of these changes was a mean total hospital charge decrease of $2045 per patient undergoing total hip arthroplasty.

Other areas addressed in this cost-containment program included use of laboratory tests and other preadmission testing. In collaboration with the medical staff, those laboratory tests that do not routinely contribute to the patient's perioperative management were identified. This allows a more selective and cost-effective preoperative evaluation with no adverse effects on quality of care. Similar analysis and changes in preoperative laboratory assessment have been reported from Massachusetts General Hospital for patients undergoing total hip arthroplasty.[13] Also, in cooperation with the biomechanics department, a system for recycling opened unused implants has been developed.

The authors' experience has taught us that cost indifference, the traditional prevailing attitude among most physicians, is cost ineffective. By using a critical pathways approach, the authors have identified and monitored areas of high costs regarding their total hip arthroplasties. It has been demonstrated that significant cost changes can be made by physicians and nurses working with administration. Perhaps more important than the dollar amounts saved has been the impact of the staff becoming cost conscious. In this way, it will be possible to improve cost-containment efforts regarding total hip arthroplasty, as well as in other areas of delivery of health care.

The author's Cost Awareness-Cost Containment program is ongoing. It is highly contagious among orthopaedic attendings and residents, and nursing, administration, and supporting services (anesthesia, radiology, medicine, pediatrics, and pathology). It has led to innovative changes in preadmission testing, medical records, length of stay, orthotics, physical therapy, engineering, and materials management. It encourages cost reduction by intelligent decision-making resulting in improved quality of patient care.

It also has produced a challenged, informed, market, thus reducing price abuse in the health care industrial complex. Cost awareness has led to cost containment now and cost reduction tomorrow. The bottom line will be cost effective improved quality of care. It is health care reform and physician reform at the grass roots level.

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