

Payment analysis of total hip replacement

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Purpose of review

Based on current projections, the American Academy of Orthopedic Surgeons estimates that approximately 750 000 joint-replacement procedures will be performed annually. Total-hip-replacement surgery has been shown to be one of the safest and most effective interventions in medicine, decreasing pain and restoring mobility and function in people with long-term hip disease, or injury.

Recent findings

With the reported increases in life expectancy, a large segment of the population will be entering their fifties and sixties over the next decade. Many of these so-called baby-boomers have been physically active through their life and have a strong desire to maintain their current active lifestyles. Demand on these joint-replacement procedures will increase significantly. Between one-third and one-half of all joint-replacement procedures performed in the USA are hip replacements.

Summary

It is estimated that over \$15 billion per year are spent on hip-replacement surgery in the USA alone. These large outlays of dollars have made this procedure the focus of cost-containment efforts by the government and private payers.

Keywords

cost, financial impact, hip replacement, osteoarthritis

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Abbreviation

CMS Centers for Medicare & Medicaid Services

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Introduction

Based on current projections, the American Academy of Orthopedic Surgeons estimates that approximately 750 000 joint-replacement procedures will be performed annually. Total-hip-replacement surgery has been shown to be one of the safest and most effective interventions in medicine, decreasing pain and restoring mobility and function in patients with long-term hip disease, or injury. With the reported increases in life expectancy, a large segment of the population will be entering their fifties and sixties over the next decade. Many of these so-called baby-boomers have been physically active through their life and have a strong desire to maintain their current active lifestyles. The demand for these joint-replacement procedures will increase significantly more the next decade. Between one-third and one-half of all joint-replacement procedures performed in the USA are hip replacements.

In the USA, as well as throughout the world, a large percentage of the costs of these procedures is paid for by the government. In the USA over 60% of all hip replacements are paid for by the Medicare program under the Centers for Medicare & Medicaid Services (CMS). This program, created in 1965, provides medical coverage to most citizens over the age of 65. With the USA currently spending close to 16% of the gross national product on healthcare, these large outlays of dollars have made high-volume procedures the focus of cost-containment efforts by the government and private payers. Some of these strategies will have a significant effect on the patient's access to this procedure and could result in rationing for certain members of society.

The financial benefits that successful hip arthroplasty gives societies have to be factored into this decision-making process. Although little has been written on these benefits, it is clear that a successful total hip replacement will relieve pain and restore mobility. Anti-inflammatory regimes used to decrease pain in individuals with osteoarthritis result in expensive complications such as gastrointestinal bleeds [1–4]. Smailey and colleagues [5] reported that in over 75 000 Medicare/Medicaid enrollees in Tennessee, the use of nonsteroidal anti-inflammatory medication used in people over 65 years of age significantly increased the need for medical care and placed greater financial demand on the Medicare/Medicaid system.

Elderly patients who cannot walk depend on the government for their food and transportation. With surgical

intervention, the cost savings on transport and assisted living can be significant. In addition, the lack of mobility increases heart and pulmonary disease morbidity. In a recent study from India, lack of mobility was reported to increase morbidity due to an increased incidence of urinary-tract infection, high blood pressure, and diabetes [6]. The prevalence of these conditions can increase the cost on the healthcare system by as much as \$3444 per patient per month [6].

The potential costs of new technologies as well as changes in current clinical pathways have to be explored. These new technologies and pathway changes will on occasion improve the outcomes and at other times increase the complications and costs. Having a broad knowledge of the economic issues involved will help clinicians develop appropriate resource-utilization strategies in the future.

Current costs related to hip-replacement surgery

The costs of any surgical intervention can be divided into two main components: hospital and professional. The hospital costs for hip-replacement surgery have been the subject of several publications [7,8]. In total hip-replacement surgery, a large percentage of these costs are taken up by the implant [8,9**] (Figs 1 and 2). Professional costs are usually a fraction of the hospital costs and include the fees of the surgeon, radiologist, anesthesiologist and any other physician consultants that participate in patient care.

The CMS program in the USA pays for over 60% of the hip replacements and, as a result of this, they have become an important force in dictating reimbursement for this procedure. Whereas the hospital reimbursement by CMS for primary joint replacement has increased at a

Figure 1 Breakdown in percentage costs of a total hip arthroplasty in which the patient is discharged to a clinical rehabilitation unit

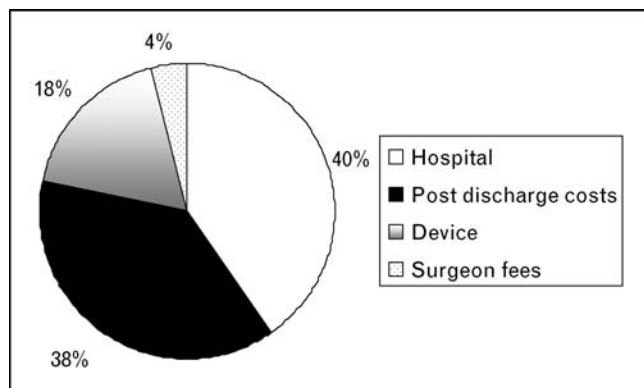
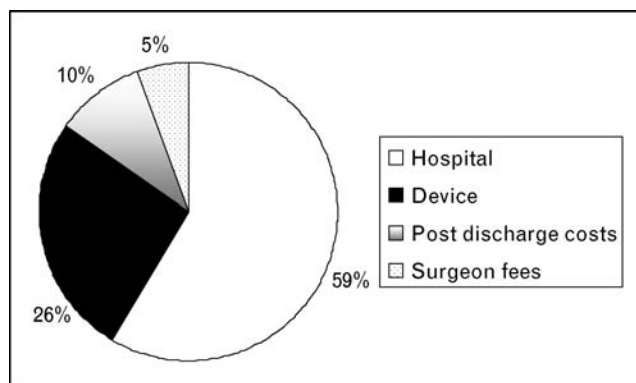


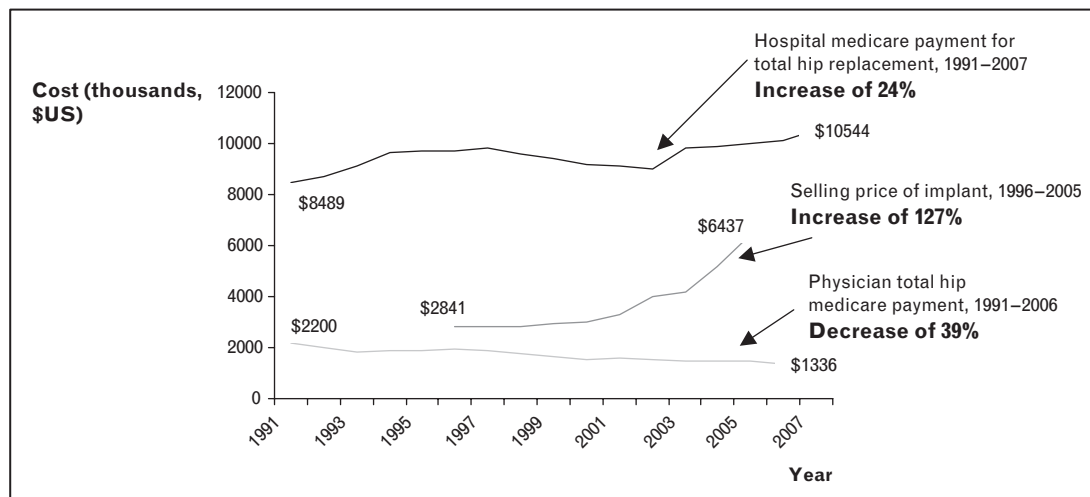
Figure 2 Breakdown in percentage costs of a total hip arthroplasty in which the patient is discharged to home



relatively small rate, implant costs continue to rise substantially. In the USA in 2005, the hip-implant market was worth approximately \$2.1 billion [10]. From 1996 to 2004 the selling price for total hip implants had increased by 117% [11*]. The median cost of an implant in 2001 was approximately \$3200 and by 2005 the median cost had risen to over \$6400 [12] (Fig. 3).

CMS reimbursement for primary total hip arthroplasty for hospitals and manufacturers has steadily risen over the past decade. Surgeon reimbursement in the other hand has declined significantly. Over the 15 years from 1991 to 2006, physician reimbursement has decreased 39% [11*] (Fig. 3). This reduction in physician reimbursement by the CMS is usually adopted by most private payers. In Miami Dade County, where the senior author of this article (C.J.L.) practices, all the managed-care companies base their contracts and pay on a percentage of the CMS reimbursement, with most paying the surgeons less than 100% of CMS rates. These declines in reimbursement have occurred in spite of large increases in practice expenses. Although most orthopedic surgeons still participate in the CMS program a significant number of so-called expert or master surgeons have abandoned the program.

One of the first papers in which costs related to hip replacement were described was published over 10 years ago by the senior author (C.J.L.). In this work, a small cohort of patients was analyzed documenting the charges for 25 individuals having a primary total hip replacement [8]. The total charges for the procedure were more than \$19 000, which included over \$15 000 in hospital charges [13**]. This included surgical fee, implant cost, and total hospital charges. Although this paper had a small number of patients it started a formal examination by practicing clinicians of the costs associated with arthroplasty.

Figure 3 The current costs and payments in total hip arthroplasty

Sources: adapted from [10,11*,12].

Examining financial data from 290 primary hip-replacement surgeries in a teaching hospital from 1993 to 1995, Iorio *et al.* [14] reported that the average hospital cost was slightly more than \$11 000. An important finding was that the average length of stay was approximately 5 days. This paper highlighted the importance of implant costs as well as length of stay. In addition it illustrated the significant decrease in length of stay that occurred in a period of 6 years.

March and colleagues [15] investigated the preoperative health status of the individual and how that related to event cost issue in the mid-1990s. They reported that people who perceived worse physical function and pain before surgery spent more 'out of pocket' in the first year after surgery.

Shah and colleagues [16] reported on the relationship of hospital cost with severity of illness following primary hip-replacement surgery. Their data showed how hospital costs increased with severity of illness. From 2000 to 2002, Bozic and colleagues [17*] reported similar results. They also reported that preoperative health was a predictor of higher resource utilization.

Vincent *et al.* [18*] noted that regardless of age, average inpatient hospital charges were almost \$2000 more for females than males. Furthermore, for both men and women, those individuals who incurred the greatest hospital cost were those of 85 years or older. These data, as well as the prior studies, clearly demonstrate the increase in costs associated with an increase in the patient's age as well as the medical severity of illness.

Hip-replacement surgery outside the USA

Countries outside the USA have different methods for delivery and paying for healthcare. For example, Martineau and colleagues [19**] reported that from three Canadian hospitals with high patient volume, there were much lower overhead, direct, and total costs for performing a total hip procedure when compared to hospitals with low patient volume. The total cost of performing total hip arthroplasty in low-volume hospitals was approximately \$2900 more than if the surgery was performed in a high-volume hospital.

Antoniou and colleagues [20] compared the hospital cost of hip-replacement surgery done in Canada with those in the USA (three hospitals). In Canada, the average total cost for the procedure was \$6766; this included both direct and overhead costs [20]. The total cost in the USA was over \$13 000. One interesting point was that the average length of stay in the USA was 4 days whereas the average length of hospital stay in Canada was 7 days.

O'Shea and colleagues [21] reported that the average implant cost in Ireland was only 8.2% of the total cost for the procedure. The implant cost in one Canadian hospital was 25% of the total cost (\$1695), whereas in US hospitals the cost of the implant ranges from 45 to 60% of the total cost (\$8017) [20].

Postoperative complications

Complications in primary total hip replacement can include, among other things, death, dislocation, infection, and pulmonary embolus. In over 58 000 primary hip replacements performed in Medicare beneficiaries over a 1-year period (1995-1996), about 3% of the surgeries

had dislocation within the first 90 days after the procedure [22]. Although these complications involve only a small percentage of the cases, they can place an increased financial burden on the hospital, the patient, and society.

Bozic and Ries [23^{*}] noted that the cost of revision secondary to infection was over \$96 000. Other complications, such as deep-vein thrombosis and postthrombotic syndrome, can have a significant financial impact on the total cost of primary hip replacement [18^{*},24].

Although complications are infrequent in primary hip replacement, when considered over the large number of surgeries done in the USA they become a significant economic factor.

New technologies

Total-hip-replacement surgery is a safe and effective intervention, yet clinicians and researchers continue to develop new devices, procedures, and protocols that can improve the outcome. Minimally invasive surgery is one area that has gained recent popularity. In a small, recent pilot study, cost comparisons were made between a group of individuals having total hip replacement using a traditional inpatient model with those having total hip replacement at an outpatient facility (minimally invasive surgery) [25^{*}]. In this study, inpatient hospital charges were \$4000 more than the procedure completed on an outpatient basis. When comparing inpatient and outpatient procedures, studies have shown that there were more perioperative complications with the outpatient procedure. [26–28,29^{**}].

Bozic *et al.* [30^{*}] recently evaluated the cost effectiveness of alternative bearing surfaces in hip-replacement surgery. The authors reported that bearing surfaces may have a positive cost/utility ratio only in certain age groups [30^{*}]. Moreover, the authors suggest that further evidence is needed to determine whether, over the long run, these surfaces provide better wear profiles [30^{*}]. Alternative bearing surfaces can double the implant costs in primary surgery and the evidence for improved outcomes in the long run remains controversial.

Postdischarge costs

Although an important factor in hip-replacement surgery, rehabilitation costs have not been well documented. Recently, Brunenberg *et al.* [31^{**}] investigated the cost of an intense joint-recovery program which included physiotherapy during and immediately following hip-replacement surgery. Compared with individuals receiving usual care, the people who participated in the advanced joint-recovery program had higher functional outcomes. In this study, individuals participating in the joint-recovery program had lower admission (\$4281 compared with \$5104) and discharge (\$4281 compared with

\$5063) costs. Furthermore, the length of hospital stay was approximately 4 days shorter for those patients completing the joint-recovery program.

Postdischarge or rehabilitation strategy costs have also received some attention in the literature. Rehabilitation hospital costs were reported in a study by Walker and investigators [32]. The authors reported the rehabilitation hospital cost to be slightly more than \$10 000 in 39 individuals having primary hip replacement from 1994 to 1998.

We recently reported an analysis of postdischarge costs in a cohort of patients treated in Miami [9^{**}]. Although this report was limited to a geographic area, it clearly showed that rehabilitation costs are significant and that some strategies are significantly more expensive than others. We reported that postdischarge costs were five times greater in those patients who were discharged to a comprehensive rehabilitation unit compared to those who went home with home care services [9^{**}] (Figs 1 and 2). More importantly, functional outcomes were similar between individuals staying home with home-care services and those going to a comprehensive rehabilitation unit [9^{**}]. Using our data, and an algorithm to estimate postdischarge costs, we estimated that the national average total postdischarge expenditures exceeded \$3.4 billion. Clearly, attention should be directed at defining more appropriate interventions in rehabilitation in an effort to maximize functional outcomes and minimize postdischarge costs.

Conclusion

Overall, it is clear from this review that significant work needs to be done under the guidance of practicing clinicians to optimize the economic factors surrounding total hip replacement while improving the outcome. Researchers in orthopedics need to clearly document the economic impact that a hip arthroplasty can have for society.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 83).

- 1 Hochberg MC, Dougados M. Pharmacological therapy of osteoarthritis. *Best Pract Res Clin Rheumatol* 2001; 15:583–593.
- 2 Tannenbaum H, Bombardier C, Davis P, *et al.* An evidence-based approach to prescribing nonsteroidal anti-inflammatory drugs. Third Canadian consensus conference. *J Rheumatol* 2006; 33:140–157.
- 3 Chan FK, Graham DY. Review article: prevention of nonsteroidal anti-inflammatory drug gastrointestinal complications—review and recommendations based on risk assessment. *Allment Pharmacol Ther* 2004; 19:1051–1061.
- 4 Ehrlich GE. A benefit/risk assessment of existing therapeutic alternatives for the treatment of painful inflammatory conditions. *Int J Clin Pract Suppl* 2004; 144:20–26.

- 5 Smailey WE, Griffin MR, Fought RL. Excess costs from gastrointestinal disease associated with nonsteroidal anti-inflammatory drugs. *J Gen Intern Med* 1996; 11:461–469.
- 6 Tarundeep S, Amarjeet S, Ajit A. Pattern and quality of long term care for the bedridden patients in Chandigarh, North India. *Internet J Geriatrics Gerontol* 2005; 2:1–17.
- 7 Healy WL, Iorio R, Richards JA, *et al.* Opportunities for control of hospital costs for total joint arthroplasty after initial cost containment. *J Arthroplasty* 1998; 13:504–507.
- 8 Lavernia CJ, Drakeford MK, Tsao AK, *et al.* Revision and primary hip and knee arthroplasty. *Clin Orthop Rel Res* 1995; 311:136–141.
- 9 Lavernia CJ, D'Apuzzo MR, Hernandez VH, *et al.* Postdischarge costs in arthroplasty surgery. *J Arthroplasty* 2006; 21 (suppl 2):144–150. This is a recent study documenting postdischarge costs after replacement surgery examining cost after surgery and the relationship with discharge placement. The study reported that compared to individuals discharged to home, postdischarge costs were higher in those individuals going to a rehabilitation unit, yet functional outcomes were similar.
- 10 Mendenhall Associates. The 2005 U.S. hip & knee implant market. *Orthopedic Network News* 2006; 17:6.
- 11 Mendenhall Associates. Hip and knee implant prices rise 6.3%. *Orthopedic Network News* 2006; 17:1. This article presents good data and a graph of the average implant selling price over an 8-year period.
- 12 Mendenhall Associates. Hospital resources and implant cost management – a 2005 update. *Orthopedic Network News* 2006; 17:9.
- 13 Fielden JM, Cumming JM, Horne JG, *et al.* Waiting for hip arthroplasty: economic costs and health outcomes. *J Arthroplasty* 2005; 20:990–997. This is an interesting study from New Zealand which reports that the timing of when to have surgery may have an impact on the overall cost of total hip arthroplasty. Those individuals who waited less than 6 months to have total hip arthroplasty saved almost \$1500 in total costs compared with those who waited longer than 6 months.
- 14 Iorio R, Healy WL, Richards JA. Healthcare delivery: comparison of the hospital cost of primary and revision total hip arthroplasty after cost containment. *Orthopedics* 1999; 22:185–189.
- 15 March L, Cross M, Tribe K, *et al.* Cost of joint replacement surgery for osteoarthritis: the patient's perspective. *J Rheumatol* 2002; 29:1006–1014.
- 16 Shah AN, Vail TP, Taylor D, *et al.* Comorbid illness affects hospital costs related to hip arthroplasty: quantification of health status and implications for fair reimbursement and surgeon comparisons. *J Arthroplasty* 2004; 19:700–705.
- 17 Bozic KJ, Katz P, Cisternas M, *et al.* Hospital resource utilization for primary and revision total hip arthroplasty. *J Bone Joint Surg Inc* 2005; 87-A:570–576. This study showed in primary total hip arthroplasty that preoperative health was a predictor of higher resource utilization.
- 18 Vincent HK, Alfano AP, Lee L, *et al.* Sex and age effects on outcomes of total hip arthroplasty after inpatient rehabilitation. *Arch Phys Med Rehabil* 2006; 87:461–467. This was an investigation which evaluated the cost of total hip arthroplasty in men and women. The authors found that women had higher total charges and men were more often discharged to home.
- 19 Martineau P, Filion KB, Huk OL, *et al.* Primary hip arthroplasty costs are greater in low-volume than in high-volume Canadian hospitals. *Clin Orthop Rel Res* 2005; 437:152–156. This article reports on a cross-sectional study of 940 patients following total hip arthroplasty, comparing the cost of surgery between high and low-volume centers in Canada. The results indicated that overhead, direct, and total costs were greater in hospitals with low volume.
- 20 Antoniou J, Martineau PA, Filion KB, *et al.* In-hospital cost of total hip arthroplasty in Canada and the United States. *J Bone Joint Surg Inc* 2004; 86-A:2435–2439.
- 21 O'Shea K, Bale E, Murray P. Cost analysis of primary total hip replacement. *Official J Irish Med Org* 2002; 95:177–180.
- 22 Katz JN, Losina E, Barrett J, *et al.* Association between hospital and surgeon procedure volume and outcomes of total hip replacement in the United States Medicare population. *J Bone Joint Surg Inc* 2001; 83-A:1622–1629.
- 23 Bozic KJ, Ries MD. The impact of infection after total hip arthroplasty on hospital and surgeon resource utilization. *J Bone Joint Surg Inc* 2005; 87-A:1746–1751. This was a small study indicating that infection following total hip arthroplasty which requires revision is extremely costly.
- 24 Caprini JA, Botteman MF, Stephens JM, *et al.* Economic burden of long-term complications of deep vein thrombosis after total hip replacement surgery in the United States. *Value Health* 2003; 6:59–74.
- 25 Bertin KC. Minimally invasive outpatient total hip arthroplasty: a financial analysis. *Clin Orthop Rel Res* 2005; 435:154–163. This was a small pilot study which showed that minimally invasive surgery was cost-effective compared to a traditional inpatient protocol.
- 26 Lawlor M, Humphreys P, Morrow E, *et al.* Comparison of early postoperative functional levels following total hip replacement using minimally invasive versus standard incisions. A prospective randomized blinded trial. *Clin Rehabil* 2005; 19:465–474.
- 27 Woolson ST, Mow CS, Syquia JF, *et al.* Comparison of primary total hip replacements performed with a standard incision or mini-incision. *J Bone Joint Surg Inc* 2004; 86:1353–1358.
- 28 Ciminiello M, Parvizi J, Sharkey P, *et al.* Total hip arthroplasty – is small incision better? *J Arthroplasty* 2006; 21:484–488.
- 29 Huo MH, Gilbert NF. Specialty update: what's new in hip arthroplasty. *J Bone Joint Surg Inc* 2005; 87-A:2133–2146. A recent review article on total hip arthroplasty covering recent topics such as fixation with and without cement, types of implant device, primary total hip arthroplasty, revision, minimally invasive surgery, and cost analysis.
- 30 Bozic KJ, Morshed S, Silverstein MD, *et al.* Use of cost-effectiveness analysis to evaluate new technologies in orthopaedics: the case of alternative bearing surfaces in total hip arthroplasty. *J Bone Joint Surg Inc* 2006; 88-A:706–714. A recent study noting the cost-effectiveness of alternative bearing surfaces. The authors report that cost savings depend on implant cost and patient age.
- 31 Brunenberg DE, Steyn MJV, Sluimer JC, *et al.* Joint recovery programme versus usual care: an economic evaluation of a clinical pathway for joint replacement surgery. *Med Care* 2005; 43:1018–1026. This study compared the cost-effectiveness of a specific joint-recovery protocol with standard care. The results showed that when compared with people having the standard care, those individuals who had a specific goal-directed protocol following surgery had higher function levels and quality of life many weeks and up to 1 year after the procedure.
- 32 Walker WC, Keyser-Marcus LA, Cifu DX, *et al.* Inpatient interdisciplinary rehabilitation after total hip arthroplasty surgery: a comparison of revision and primary total hip arthroplasty. *Arch Phys Med Rehabil* 2002; 82:129–133.