

## Device Costs, Total Costs, and Other Characteristics of Knee Replacement Surgery in California Hospitals, 2008

The Berkeley Center for Health Technology (BCHT) has been working with the Integrated Healthcare Association (IHA) in the collection and analysis of hospital and patient data on seven high-cost orthopedic, cardiac, and spine procedures. From these efforts, BCHT is creating a series of Issue Briefs detailing specific findings by procedure.

This Issue Brief reports findings on device costs, total costs, surgical complications, and length of stay for total knee replacement. Subsequent reports will present findings for six other procedures: hip replacement, lumbar spine fusion, cervical spine fusion, cardiac valve replacement, cardiac rhythm management, and coronary angioplasty with drug-eluting stents.

This data collection and analysis is part of the larger Value-Based Purchasing of Medical Devices (VBP) Project, which also includes roundtables for hospital leaders and the development of a bundled payment pilot project. A major goal of the VBP project has been to help physicians and hospitals align their incentives, since cooperation on clinical quality and supply purchasing are important for the efficiency of surgical service lines, especially when it comes to the adoption and diffusion of new medical technology.

Forty-five hospitals in California participated in the full collection initiative, with another seventeen providing device costs but not data on total costs, length of stay, complications,

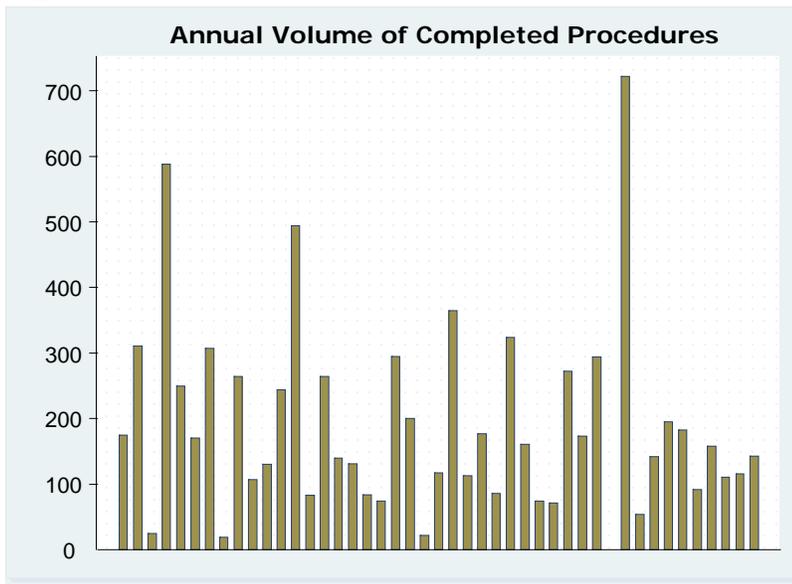
reimbursements, and patient characteristics. The participating hospitals are diverse in terms of bed size, urban versus rural location, teaching status, profit or non-profit status, and whether they are part of a larger hospital system. Individualized hospital reports were distributed to the participants, and benchmarks of best performance were generated and distributed without hospital identifiers. BCHT obtained patient data from non-California hospitals to provide a national comparison; results using those data are not presented here. All data are from 2008.

### Introduction

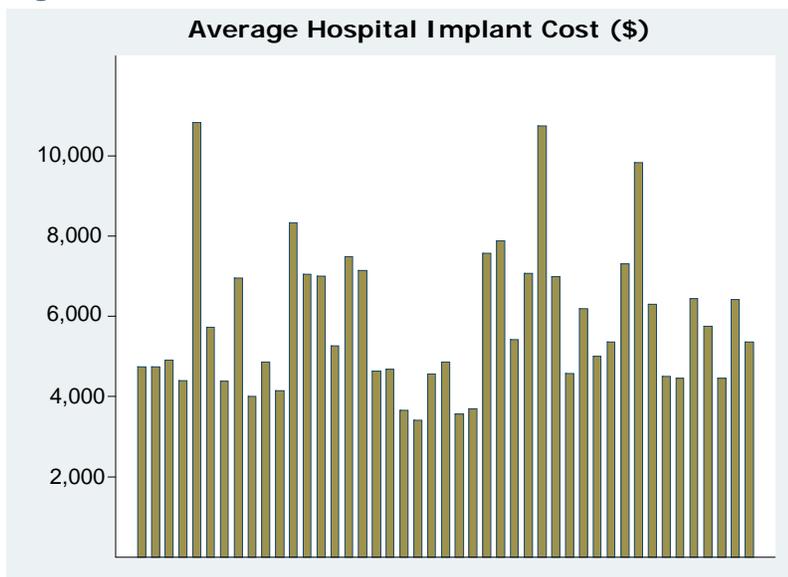
There are 581,000 knee replacements in the United States every year, according to the American Academy of Orthopaedic Surgeons, which makes it one of the highest volume surgical procedures in the country. This number is projected to continue to rise over coming years as the population ages, the rate of obesity continues to rise, and the population expresses increasing demands for full knee function, even for older and very overweight individuals.

Knee replacement surgery involves the implantation of an artificial joint, comprised of various components in metal, ceramic, or plastic. Knee implants are “physician preference items” (PPI) in the sense that surgeons are traditionally responsible for choosing which device to implant,

**Figure One**



**Figure Two**



which can lead to the development of individual preferences for particular brands and functional levels.

This contrasts with many other supplies used in the hospital, where physicians are not loyal to particular brands and the hospital can aggregate purchases and achieve volume-based discounts. Historically, PPI devices have been a point of contention between hospitals and surgeons, as they are very expensive and are often chosen without regard for a hospital’s desire to contain costs.

**Wide Variation in the Annual Volume of Surgical Procedures**

Figure One highlights the variation in the annual volume of knee replacement procedures across participating hospitals. In 2008, the lowest volume hospital had a total of two procedures, whereas the highest volume hospital had 722. The average number of procedures was 189.

**The Costs of Knee Replacement Implants Vary by a Factor of Three**

The data’s most striking feature is the wide variation in the cost of knee implants, both across and within hospitals, controlling for patient disease severity. Figure Two shows variation in average implant cost per case across the 45 California hospitals for which full data were collected.

The average device cost faced by Californian hospitals in 2008 was \$5,840. Across hospitals, the minimum average cost was \$3,408, whereas the maximum was \$10,830, for a range of \$7,422. This represents only half of the total variation across patients in device costs, as there was also wide variation within each hospital. Within-hospital variation in device use and cost is due partly to patient differences in case-mix severity, but the statistical analysis found that the vast majority of within-hospital device-cost variation remained after adjusting for patient characteristics such as

age, principal diagnosis, co-morbidities, complications, and discharge destination (e.g., to home or a nursing home). This residual within-hospital variation reflects differences among surgeons in their preferences concerning device brand and functional level.

### Hospital Efforts to Manage Device Costs

Two factors are often invoked to explain variation in device costs across hospitals. The first of these is the number of procedures that take place in a hospital over a given period. Large numbers of procedures, and corresponding device purchases, could lead to volume-related price discounts on implants.

Despite the intuitive appeal of volume discounts, it cannot be assumed that volume purchasing from a vendor is easily aggregated into bulk purchasing by a hospital, as a high total volume of device purchases could be the result of a number of decentralized decisions by individual surgeons.

The second factor that could explain variation in device costs across hospitals is whether a hospital contracts with a small number of device vendors for the purpose of leverage. If a hospital restricts its purchases to the products of just two of six possible vendors, for example, vendors could offer price discounts to be selected as one of the two authorized vendors. However, while consolidation may have first year effects that reduce device costs, hospitals may be left with a lock-in dilemma that is not beneficial in the long run.

There are two forms of switching costs for implantable devices. First, if a surgeon has been working with the same type of device for a long period of time, switching to another product can be difficult in terms of the time needed to adapt to the new implant type and its related instruments. Second, there may be substantial administrative time and staff time needed for the hospital to

Figure Three

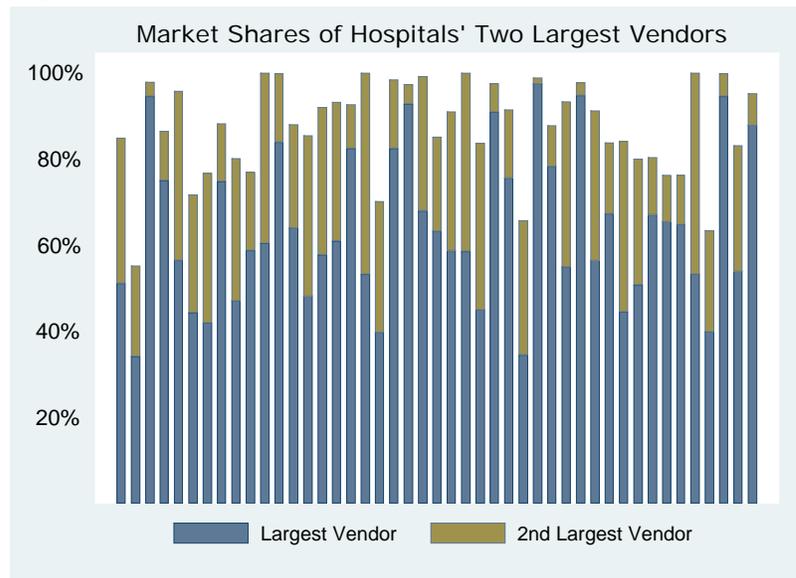
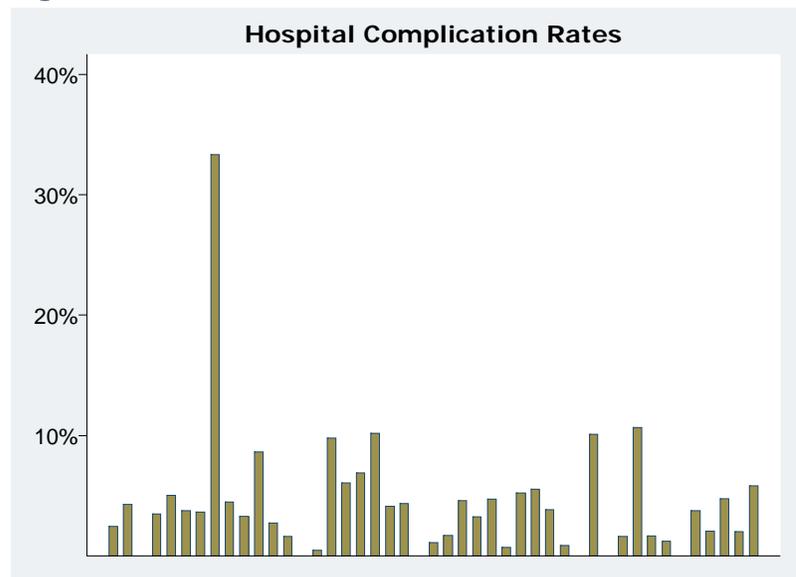
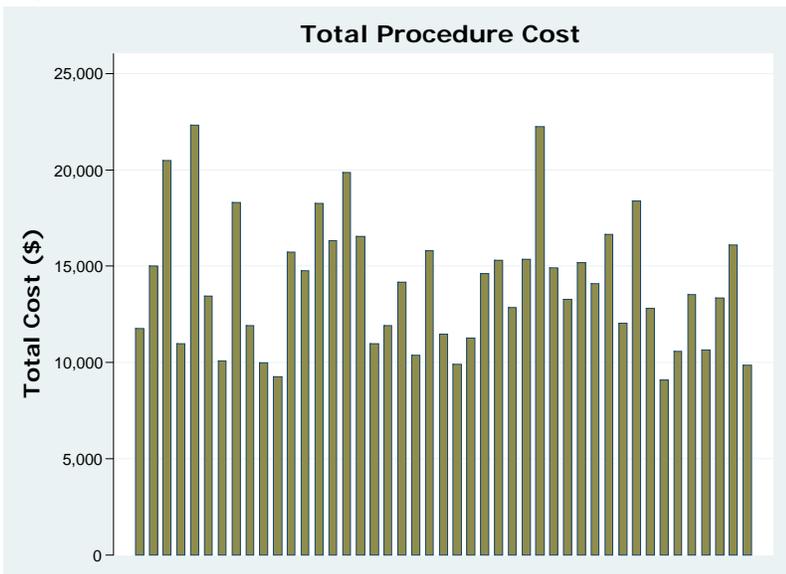


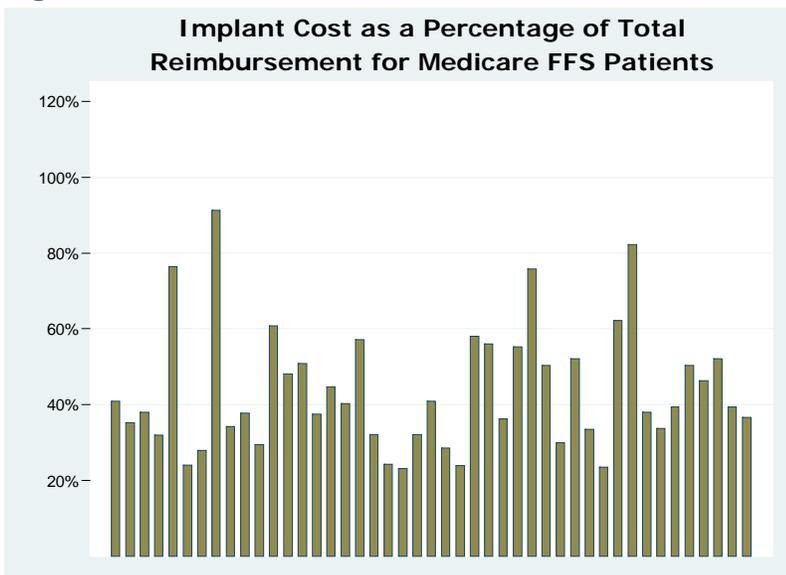
Figure Four



**Figure Five**



**Figure Six**



establish a new contractual relationship with a particular vendor.

A number of California hospitals have embraced the volume discount perspective, and limit their business to two vendors, although these vendors are different across hospitals. Figure Three shows the percent of total knee devices purchased from the largest and second largest vendors for each institution, respectively. Four hospitals get 100% of their knee devices from just two vendors, and the vast majority obtain over two thirds of their devices from their two largest suppliers. This illustrates that consolidation of purchasing does not eliminate variation, and that any gains from consolidation may already have been realized.

**Significant Variation in Surgical Complications and Patient Length of Stay**

Hospital variation extends to complication rates, average length of stay (LOS), and total costs for knee procedures in California. These three components are related: complications are defined as events that are severe enough to prolong length of stay by one day, and longer lengths of stay necessarily entail more resources, leading to higher costs. Figure Four shows complication rates across California hospitals, which range from 0% to 33%. Since the introduction of total knee replacements in 1968, average length of stay has gone down by at least half, although discharge to an inpatient rehabilitation facility has gone up.<sup>1</sup> In the 45 Californian hospitals surveyed, the average LOS is 3.5 days, ranging from 2.4 days to 6 days.

**Total Surgical Costs Vary by a Factor of Three**

Figure Five shows total surgical costs across hospitals for knee replacement. Average costs for the surgery range from a low of \$9,089 to a high of \$22,311, with an average of \$14,036. Device costs are

a major driver of these costs for all hospitals, but complications and length of stay also have an impact, which suggests that hospitals can look both internally—to reduce errors and find cost-savings—and externally—to secure better prices from device manufacturers—to lower total costs.

**Device Costs Make Up a Large Portion of Insurance Reimbursement**

For Medicare patients, who comprise the majority of knee implant recipients, hospitals are paid a fixed amount by DRG (Diagnosis Related Group) for knee replacement and other procedures. From this sum, they must pay for the implanted device, regardless of the functional level or brand selected by the surgeon. In recent years, manufacturers have introduced a steady stream of incremental device modifications, many of which are accompanied by higher prices. The cost of knee implants has been rising faster than the growth in DRG payments over the past several years, causing the implant to eat up more and more of a hospital’s reimbursement for a surgical procedure. **Figure Six** presents implant cost as a percent of Medicare reimbursement across Californian hospitals, which ranges from a low of 23% to a high of 91%, with an average across the 45 hospitals of 44%.

Commercial insurance payments for knee replacements are substantially higher than Medicare payments, and implant costs as a percent of these payments are lower. **Figure Seven** shows implant cost as a percent of reimbursement for commercial patients, which ranges from 8% to 55%, with an average of 30%.

Consolidation in the hospital market has given these organizations greater bargaining power in their negotiations with health plans, which has allowed them to charge higher rates and ‘carve out’ the price of a device from payments received for surgical procedures. These carve-outs shield

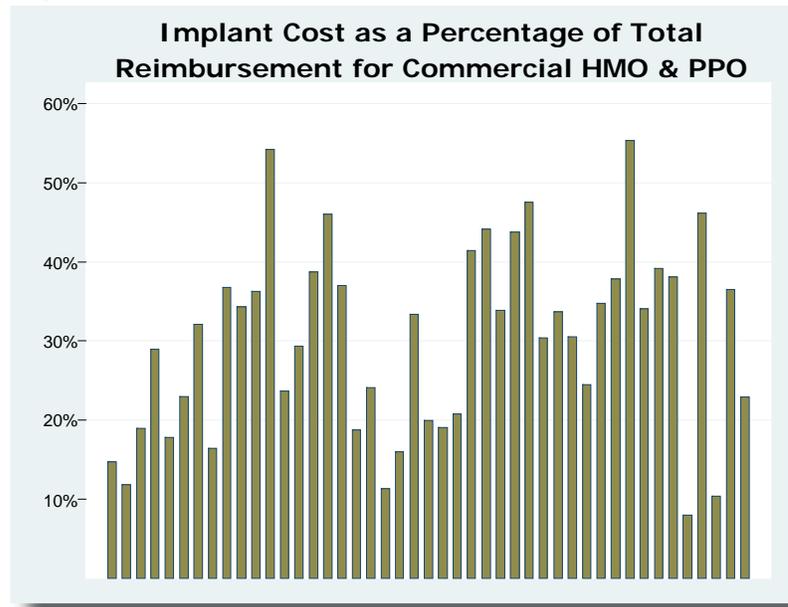
hospitals from increases in device cost, and attenuate their incentive to reduce device costs. However, given the large fraction of total cases covered by Medicare, hospitals retain a strong incentive to work more effectively with their surgeons in managing these costs.

**Conclusion**

Implantable devices constitute a major factor in both cost and reimbursement for knee replacement surgery in California hospitals. The variation in device costs across hospitals is difficult to justify, and suggests that substantial savings are potentially available if those facilities currently at the high end of the cost spectrum can work with their affiliated surgeons to bring themselves closer to the low end. Comparison of device costs, total costs, and other performance indicators across hospitals is only a first step towards improving the performance of the device-intensive surgical service lines.

The Pacific Business Group on Health is spearheading an effort to establish a statewide orthopedic joint registry, which should yield

**Figure Seven**



important insights on device quality and patient outcomes. The Integrated Healthcare Association is coordinating a pilot project involving major health plans and hospitals in the Los Angeles area to shift from fee-for-service to bundled 'episode of care' payment for knee replacement and other major procedures. A single payment for the hospital, the surgeon and other participating physicians, and elements of post-discharge care will help create a culture of shared financial and clinical responsibility for the care of each patient.

<sup>1</sup>Jain NB, Higgins LD, Ozumba D, et al. Trends in epidemiology of knee arthroplasty in the United States, 1990-2000. *Arthritis Rheum* 2008;52(12):3928-3933.

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