Executive Summary

Innovations Center

Future of Orthopedics
Strategic Forecast for a Service Line Under Siege

Service Line Innovation Brief
Fall 2003

Health Care Advisory Board
Washington, D.C.
Executive Summary

Service Line Innovation Brief

Future of Orthopedics
Strategic Forecast for a Service Line Under Siege

- Profits Under Siege
- Vision of the Future
- The New Management Ambition

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### Six Services for Advisory Board Members

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<td><strong>Annual Future Care Briefing</strong></td>
<td>Presentation and facilitated discussion for boards and senior executives on emerging trends of greatest immediate concern to hospitals and health systems.</td>
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<td><strong>Service Line Innovation Briefs</strong></td>
<td>Series of fast-paced briefs—each focusing on a specific service line—highlighting emerging clinical technologies and their impact, payment, and demand projections, as well as the financial outlook for the service line.</td>
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<tr>
<td><strong>Health System Future Facility Reports</strong></td>
<td>Series of reports—each focusing on a particular facility innovation or technology—highlighting the likely investment required, expected payback, implementation hurdles, and likely ROI.</td>
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<tr>
<td><strong>Annual Health Care Innovation Summit</strong></td>
<td>Two-day sessions in which Innovations Center staff present the highlights of that year’s research, focusing on emerging clinical innovations and market trends of greatest immediate concern to members.</td>
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<td><strong>The Center Quarterly</strong></td>
<td>Quarterly briefing across key issue areas—health plan reform, the new consumerism, Medicare and Medicaid, physician relations, technology watch—highlighting top-line insights of immediate relevance to hospitals and health systems.</td>
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<tr>
<td><strong>Service Line Opportunity Assessments</strong></td>
<td>Tools and templates for customizing national patient demand and financial projections to individual member market circumstances, including tools for assessing the business case for future investment.</td>
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</table>
Forecasting the Future for Orthopedics

The Orthopedics Initiative in Brief

Twelve months ago, the Innovations Center set out to assess the future prospects for the most important hospital service lines. The fortunes of orthopedics, among our first areas of inquiry, proved to be a timely topic. Today, orthopedics is a service line under siege, its economics threatened by rising implant costs and unresponsive reimbursement. Looking forward, hospitals have areas of rich opportunity in orthopedics, but also continuing (and new) vulnerabilities. Accordingly, the strategic forecasting initiative for orthopedics maps out principal regions of future growth within the service line, as well as less favored offerings. Further, the initiative identifies the most leveraged areas for management focus, serving as a roadmap for future orthopedics strategy and investment.

Today’s Report

Future of Orthopedics Executive Summary

Executive briefing of critical findings from orthopedic service line initiative. Includes forecasts of future profits, volumes, and resource requirements for orthopedics as a whole, as well as for key offerings—spine surgery, joint replacement, and so on. Assesses orthopedics in context of larger service line portfolio. Identifies leveraged opportunities for management efforts and selective investment.

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Future of Orthopedics Service Line Innovation Brief

200-page report assesses future prospects for orthopedic service line. Includes the material contained in the Executive Summary; in addition, features detailed examination of drivers of change for orthopedic services. Special sections focusing on investment considerations for spine surgery, joint replacement, sports medicine, and fracture care. Also includes in-depth assessments of several dozen potentially disruptive technologies.

Fall 2003

Future of Orthopedics Service Line Opportunity Assessment

Interactive spreadsheets for customizing orthopedics volume, profitability, and bed demand projections to individual member circumstances.

For Further Information

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Future of Orthopedics Executive Summary

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Advisors to Our Work

Across the last twelve months, we have been indebted to a group of leaders in orthopedic surgery, as well as a handful of hospital and health system executives, industry executives, and government officials, who have given generously of their time to guide and inform our Innovations Center efforts. Many of these individuals have participated under the auspices of the American Orthopaedic Association, which has lent its support to our work as well. Whatever immediate value members find in this series of publications, they owe in no small measure to these contributors. Apart from those people and institutions who prefer to remain anonymous, the advisors to this project are listed below.

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Innovations Center Methodology in Brief

The Foundation of Our Model
In developing quantitative forecasts of future orthopedic demand and profitability, the Innovations Center obtained and analyzed data from a variety of sources in both the private and public sectors. These databases of health care utilization, costs, and revenues served as the foundation of our forecasting model. After integrating and reconciling the different sources, the Center developed a comprehensive national picture of current utilization and finances as well as the prevailing trends across the last 25 years. From there, volume, length of stay, and profitability forecasts were constructed, inflecting each of 46 orthopedics DRGs and upward of 1,500 diagnosis and procedure codes by demographic changes, utilization shifts, emerging technological innovations, and health care market dynamics. Innovations Center forecasts represent national, all-payer statistics for short-term, general acute care hospitals unless otherwise stated.

Innovations Center Futures Database Sources

- Agency for Healthcare Research and Quality Health Care Utilization Project
  Hospital inpatient and outpatient utilization
- Center for Medicare and Medicaid Services MEDPAR Database
  Hospital inpatient utilization and finances
- Center for Medicare and Medicaid Services HOPPS Database
  Hospital outpatient utilization and finances
- Center for Medicare and Medicaid Services Standard Analytic Files (5%)
  Hospital inpatient and outpatient, freestanding, and physician office utilization and finances
- Centers for Disease Control and Prevention National Hospital Discharge Survey
  Hospital inpatient utilization
- U.S. Census Bureau International Data Base
  Population estimates and projections
- Solucient LLC All-Payer Inpatient MPIDB
  Hospital inpatient utilization and finances
- Solucient LLC OutpatientView™
  Hospital, freestanding, and physician office outpatient utilization

Predicting Change in Four Layers

Establishing a Baseline Projection by Applying Demographic Trends
Orthopedics Volumes

The Innovations Center projected baseline volumes at the DRG and procedure level by assimilating multiple sources of utilization data, establishing utilization by age cohort, then “aging” and “growing” the population using Census forecasts.

Modifying the Baseline to Reflect Shifts in Utilization
Orthopedics Volumes

Next, the Center selectively adjusted its baseline projection to reflect shifts in per capita utilization, assuming that market forces currently working to increase (or decrease) utilization rates will often continue to affect utilization in the future.

Incorporating Technology’s Impact
Orthopedics Volumes

The Center further inflected future utilization rates—procedure by procedure and diagnosis by diagnosis—to account for the expected impact of new clinical technologies and changes in care delivery; these procedure and diagnosis-level projections were then rolled up to determine aggregate volume projections.

Adding in Payment and Cost

Revenues Costs Profits

Anticipated changes in reimbursement (fee schedule updates, procedures moving from pass-through payment to established APC) were evaluated relative to recent reimbursement trends and projected cost increases, then run against volume predictions to establish revenue and profit forecasts.
# Forecasting the Future of Orthopedics

## Strategy and Operations Implications

### Impact Across the Service Line

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Profits Under Siege

#1 Orthopedics an Increasingly Challenging Market
Orthopedics profitability has been dropping precipitously; even though it remains one of the largest service lines in terms of volumes and revenues, a host of market forces are placing intense pressure on margins.

#2 Skyrocketing Implant Costs Transforming Fortunes
Rapid escalation in the cost of implants is the foremost factor contributing to declining fortunes in orthopedics; nearly half of all orthopedic procedures require implants, a far greater percentage than any other hospital service line.

#3 Outpatient Orthopedics Still Prospering, but Competition Intensifying
The outpatient side of hospital orthopedics still remains a pocket of prosperity; that said, market share for the most profitable outpatient orthopedics procedures has been shifting significantly away from hospitals toward freestanding competitors in recent years.

#4 Service Lines Within a Service Line
Though finances have become increasingly challenged throughout the orthopedics enterprise, orthopedics is best understood as a collection of distinct sub-services, rather than a homogenous whole; revenues and profits differ significantly at the sub-service line level.

#5 Spine, Sports Generating the Lion’s Share of Today’s Profits
Looking at specific areas within orthopedics, spine surgery and sports medicine leap out as disproportionate sources of profits; that said, viewed from the perspective of total contribution profit, joint replacement and spine rank among the top five services in the entire hospital.

Vision of the Future

#6 Threatening Skies Ahead for Orthopedics Profitability
Across the next decade, it will become increasingly difficult for orthopedic programs to maintain even today’s margin levels; strong volumes will keep total profits relatively stable, but per-case profits will drop precipitously.

#7 Robust Demand for Orthopedics Expected
While profits continue their decline, demand for orthopedic care is expected to rise significantly in the coming years; apart from demographics, the emergence of new procedures and greater penetration of existing technologies will further boost overall demand, but specialty competition will moderate both inpatient and outpatient hospital growth.

#8 Admissions Growth to Strain ORs, Not Bed Capacity
Even though volumes for orthopedic procedures will increase, total inpatient days for orthopedic care are actually expected to fall over the next decade; declining length of stay, as well as a modest shift of certain spine and joint procedures to the outpatient setting, will more than balance out demand increases.

#9 Spine Surgery Is Top Investment Choice
Among the major orthopedic sub-service lines, spine surgery will continue to stand out as the best financial performer for most hospitals; healthy reimbursement and strong demand will continue to favor spine procedures into the future.

#10 Spine Surgery the Epicenter of Orthopedic Innovation
The rapid pace of technological change in the spine area makes it a high-risk, though high-return, investment; in the coming years, vertebral compression fracture treatments and minimally invasive surgery could boost volumes significantly, but biological growth factors and artificial disc implants are potential future profits threats.
#11 Sports Medicine a Winner in the Near Term

Sports medicine is also an appealing area for investment; Baby Boomer consumerism and advances in arthroscopic treatment of joint conditions are boosting demand, although competition for volumes from freestanding competitors is intensifying.

#12 Joints Still Volume Mainstay, but Margin Pressures Increasing

The picture for joint replacement surgery is more mixed; demand will grow significantly over the next decade, but further increases in implant costs will continue to place downward pressure on margins.

#13 Joint Replacement Moving Toward a Younger Population

One bright spot for joints is that growth has been disproportionately in the younger, commercial-pay population; more durable implants and less invasive procedures will continue to drive growth in the younger age groups, but most joint replacements will still be performed in Medicare patients at the end of the decade.

#14 Fracture Care—Mission, Not Margins

Fracture care, never a strong financial contributor relative to other areas of orthopedics, will become even less profitable in the coming years as the cost of implants increases; moreover, effective osteoporosis prevention is expected to decrease demand for fracture care across the next decade.

#15 Two Eras in Orthopedics—Timeline of (Potentially) Disruptive Technologies

Today’s state-of-the-art orthopedics care mainly consists of mechanical interventions for musculoskeletal conditions; biological solutions now in development could upend the economics and delivery of orthopedic care, but are unlikely to progress much beyond the concept stage in the next ten years.

#16 Forecasts Not (Necessarily) Destiny

Although every hospital will face daunting pressures to orthopedics profitability moving forward, most institutions have the potential to restore the service line to its position as a leading margin contributor; key levers of profitability include controlling implant costs, optimizing reimbursement, improving product mix, and containing specialty competition.

#17 Ambition #1—Controlling Implant Costs

Hospitals can significantly reduce implant costs through hard-line negotiating for best prices; achieving consensus among surgeons on appropriate use of the most expensive implant models is also critical for controlling spending.

#18 Ambition #2—Optimizing Reimbursement

Institutions can make substantial gains in orthopedic margin by improving reimbursement on the commercial side; the top priority for most hospitals should be negotiating carve-out agreements for implant expenses with insurers.

#19 Ambition #3—Improving Product (and Payer) Mix

Given the striking differences in profitability among the services within orthopedics, hospitals should proactively invest in the procedures (and payers) generating the highest return; avenues for shifting mix include hiring subspecialist orthopedic surgeons, marketing to selected patients through “Center of Excellence”-type branding, and targeting profitable payers or employer groups for outreach efforts.

#20 Ambition #4—Containing Specialty Competition

While an all-or-nothing phenomenon dependent on local market circumstances, specialty competition represents the single greatest threat to hospital orthopedic volumes and profitability; defending against surgical hospital cherry-picking and addressing ambulatory surgery center threats are equally important.
Future of Orthopedics

Profits Under Siege
Orthopedics an Increasingly Challenging Market

A Service Line Under Siege

The past several years have been difficult for orthopedic finances. Nationally, profitability has been slipping precipitously. Medicare net margins are now barely in the black, falling from a healthy nine percent in 1997 to scarcely one percent in 2001. No institution is immune; hospitals of every size and status across the nation have been experiencing sudden financial flashpoints in orthopedics. Orthopedics profits are genuinely under siege.

Dropping in the Rankings

Once a core contributor to hospital profitability, orthopedics is no longer one of the top profit-generating inpatient service lines (at least on a fully allocated basis). Many hospital executives still perceive orthopedics as one of the principal profit drivers of the institution, next to cardiovascular services and general surgery, but as of 2001 orthopedics barely made the roster of the top ten most-profitable service lines.

Orthopedics Inpatient Profit

<table>
<thead>
<tr>
<th>Year</th>
<th>Medicare Net Margin</th>
<th>Medicare Inpatient Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>9%</td>
<td>$752 M</td>
</tr>
<tr>
<td>1999</td>
<td>3%</td>
<td>$226 M</td>
</tr>
<tr>
<td>2001</td>
<td>1%</td>
<td>$96 M</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.

Top Service Lines

<table>
<thead>
<tr>
<th>Year</th>
<th>Cardiac</th>
<th>General Surgery</th>
<th>Orthopedics</th>
<th>Pulmonology</th>
<th>Vascular Surgery</th>
<th>Oncology</th>
<th>Thoracic Surgery</th>
<th>General Medicine</th>
<th>Neurosurgery</th>
<th>Urology</th>
<th>Neurosurgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>37%</td>
<td>28%</td>
<td>25%</td>
<td>12%</td>
<td>11%</td>
<td>11%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>2001</td>
<td>41%</td>
<td>38%</td>
<td>9%</td>
<td>8%</td>
<td>9%</td>
<td>4%</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
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</tbody>
</table>

Source: Innovations Center Futures Database.
Assailed from Many Quarters
Multiple factors have contributed to the recent difficulties for hospital orthopedics. Growth in implant costs has been the most powerful driver of orthopedics fortunes, but the service line has also been struggling under the burden of specialty competition, new capital demands, and lackluster reimbursement.

Yet Too Important to Ignore
Even as its profits plummet, the orthopedic service line remains a major source of business for the hospital. With respect to both volumes and revenues, orthopedics is still the third largest service line for general acute-care hospitals. Because of its sheer size, as well as its past history of profitability, orthopedics is worthy of concerted management attention.

Forces at Play in Orthopedics

- Rising Implant Prices
- Increasing Utilization of Premium Implants
- Expensive Biological Innovations
- New Capital Demands
- ASC Competition
- Proliferating Surgical Hospitals
- Unfavorable Reimbursement Trend
- Payers Slow to Cover New Technologies

Rising in the Rankings

Inpatient Service Lines, 2001

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Revenues</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cardiac</td>
<td>1. Cardiac</td>
</tr>
<tr>
<td>2. Obstetrics</td>
<td>2. General Surgery</td>
</tr>
<tr>
<td>3. Orthopedics</td>
<td>3. Orthopedics</td>
</tr>
<tr>
<td>5. General Surgery</td>
<td>5. Obstetrics</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.
Skyrocketing Implant Costs Transforming Fortunes

**Implant Burden Growing Unchecked**

The declining fortunes of the orthopedic service line over the past several years can be largely attributed to a single phenomenon—soaring implant costs. After gaining control over implant expenses in the early 1990s, hospitals are finding the costs of orthopedic implants again in the ascendency. Seemingly powerless to control spending with savvy purchasing practices or stringent utilization controls, hospitals around the country have seen implant costs rise at double-digit rates for several years running.

**Reimbursement Not Keeping Pace**

The growth in implant spending would be immaterial if payers were absorbing the increased cost. However, while implant expenses have soared, reimbursement for the majority of orthopedics procedures has remained flat or even declined. Joint replacement is a prime example—even as the cost of hip and knee implants rose at an unprecedented rate, Medicare payments fell four of five years.

---

**Hip and Knee Implant Acquisition Cost**

- **12.1% CAGR since 1998**

**Reimbursement and Implant Cost Changes**

- **Joint Replacement**
  - **Implant Costs**
    - 1998: 1%
    - 1999: (3%)
    - 2000: (2%)
    - 2001: (2%)
    - 2002: (2%)
  - **Medicare Reimbursement**
    - 1998: 1%
    - 1999: 8%
    - 2000: 18%
    - 2001: 14%
    - 2002: 9%

Source: Orthopedic Network News, Ann Arbor, Mich; Innovations Center analysis.
A Particular Issue for Orthopedics

The financial burden of rising implant costs is not unique to orthopedics. The cardiac service line is currently experiencing a similar phenomenon with stents, pacemakers, and defibrillators, while emerging technologies in the neurosciences suggests that implants will become an important issue in neurosurgery economics as well. However, orthopedics is especially at risk for implant cost growth, with a much higher proportion of procedures incorporating implants compared to other service lines.

In addition, implants are an issue throughout orthopedics, not just in one procedure or area. Joint replacement, spine surgery, and fracture care all require increasingly expensive implants.

Common Orthopedic Implants

<table>
<thead>
<tr>
<th>Joint Replacement</th>
<th>Spine</th>
<th>Fracture Care</th>
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</thead>
<tbody>
<tr>
<td>Total hip implant</td>
<td>Fusion cage</td>
<td>Plate</td>
</tr>
<tr>
<td>$2,000–$10,000</td>
<td>$4,800–$11,800</td>
<td>$80–$600</td>
</tr>
<tr>
<td>Partial hip implant</td>
<td>Rod and screw system</td>
<td>Screw</td>
</tr>
<tr>
<td>$750–$2,600</td>
<td>$2,900–$9,000</td>
<td>$500–$1,000</td>
</tr>
<tr>
<td>Total knee implant</td>
<td>Plate</td>
<td>Intramedullary nail</td>
</tr>
<tr>
<td>$3,200–$8,400</td>
<td>$1,300–$1,900</td>
<td>$165–$2,500</td>
</tr>
<tr>
<td>Unicompartmental knee</td>
<td>Electrical stimulators</td>
<td>External fixation</td>
</tr>
<tr>
<td>$2,500–$5,000</td>
<td>$4,100–$4,700</td>
<td>$1,000–$6,900</td>
</tr>
</tbody>
</table>

Source: Orthopedic Network News, Ann Arbor, Mich; Innovations Center analysis.

Percentage of Surgeries Requiring Implants

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<thead>
<tr>
<th>Percentage of Surgeries Requiring Implants 2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Orthopedics</td>
</tr>
<tr>
<td>45%</td>
</tr>
</tbody>
</table>

Source: Innovations Center analysis.
Outpatient Orthopedics Still Prospering, but Competition Intensifying

Leading Outpatient Margin Contributor
Although orthopedics is often thought of as an inpatient-intensive service line, outpatient orthopedics is a significant contributor to profits in its own right. While the inpatient business has suffered recent margin declines, the outpatient side has remained strong, consistently ranking in the top five service lines by profit.

A Profitable Piece of the Pie
Compared to the inpatient side, which suffers from high supply costs and often unfavorable reimbursement, outpatient orthopedic procedures are disproportionately profitable. The absence of expensive implants, commercial-dominated payer mix and high volumes combine for a robust profitability picture—outpatient procedures represent less than one-third of total revenues for the service line, but half of total profits.

Total Hospital Outpatient Profits
National All-Payer, 2001

<table>
<thead>
<tr>
<th>Service Line</th>
<th>Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>$2.67 B</td>
</tr>
<tr>
<td>Digestive</td>
<td>$2.59 B</td>
</tr>
<tr>
<td>Ophthalmology</td>
<td>$1.26 B</td>
</tr>
<tr>
<td>Musculoskeletal</td>
<td>$1.13 B</td>
</tr>
<tr>
<td>Gynecology</td>
<td>$709 M</td>
</tr>
<tr>
<td>ENT</td>
<td>$377 M</td>
</tr>
<tr>
<td>Urology</td>
<td>$319 M</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.

Outpatient Contribution to Orthopedics

Volumes

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Inpatient</th>
<th>Outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>75%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Revenues

<table>
<thead>
<tr>
<th>Revenues</th>
<th>Inpatient</th>
<th>Outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>25%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Profits

<table>
<thead>
<tr>
<th>Profits</th>
<th>Inpatient</th>
<th>Outpatient</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>49%</td>
<td>51%</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.
**Ancillaries Yielding Even More**
Orthopedic patients also contribute to several of the hospital’s other key outpatient services, including radiology, laboratory, and pharmacy. This makes the ancillary and downstream profits of orthopedic patients a critical part of the service line’s overall contribution. Imaging alone—plain film and MRI—contributes almost half of the profits governed by outpatient orthopedics, more than the primary procedure itself.

**Beginning to Slip Away**
Despite the significant contribution of outpatient orthopedics, the hospital share of the market is eroding as ambulatory surgery centers (ASCs) continue to garner a larger share of the business. Nationally, ASC surgery volumes grew 45 percent from 1999 to 2001, compared with seven percent for hospital outpatient volumes; in selected markets the contrast is even starker.

---

**Total Outpatient Orthopedics Profits**
2001

- Imaging $1.39 B (46%)
- Emergency Department $254 M (29%)
- Procedures $884 M (24%)
- Laboratory $219 M (9%)
- Pharmacy $170 M (6%)

**Orthopedics Surgery Volume Growth**
National, 1999–2001

- ASCs: 45%
- Hospital: 7%

Source: Innovations Center Futures Database.
Service Lines Within a Service Line

Diverse Economics

Orthopedics is not a monolithic product. One of the most diverse service lines in the hospital, orthopedics is best thought of as a collection of sub-services, each with its own distinct economics and divergent prospects.

There are four major components of hospital orthopedics—spine surgery, sports medicine, joint replacement, and fracture care. Between them, the four sub-service lines account for 75 percent of orthopedics revenues.

In addition, four smaller areas of orthopedic care merit attention: medical back care, general orthopedics, hand surgery, and foot and ankle care.

Medical back is a particularly interesting sub-service line as it includes many potential spine surgery patients who instead receive more conservative treatment—medical care in the inpatient setting and paravertebral injections for pain management on the outpatient side. As new spine surgery techniques become more widely adopted, future volumes will likely shift from the medical back population to the (currently) more profitable spine surgery sub-service line.

Unbundling the Spine Surgery

Top Procedures
- Lumbar spinal fusion
- Cervical spinal fusion
- Discectomy
- Laminectomy

Average Profit per Case
- Inpatient: $1,690
- Outpatient: $99

Net Margin
- Inpatient: 15%
- Outpatient: 5%

Unbundling the Sports Medicine

Top Procedures
- Knee arthroscopy
- Cruciate ligament repair
- Shoulder stabilization
- Rotator cuff repair

Average Profit per Case
- Inpatient: $544
- Outpatient: $462

Net Margin
- Inpatient: 9%
- Outpatient: 16%

1 National All-Payer 2001.
Orthopedic Service Line

Medical
Back
Average Profit per Case
$450
$18
Inpatient O outpatient
Net Margin 11% 3%
3% of revenues

General
Orthopedics
Average Profit per Case
$1,138
$83
Inpatient O outpatient
Net Margin 11% 14%
12% of revenues

Foot
and Ankle
Average Profit per Case
$654
$353
Inpatient O outpatient
Net Margin 10% 20%
23% of revenues

Joint Replacement

Top Procedures
- Total knee replacement
- Total hip replacement
- Partial hip replacement
- Revision hip replacement

Average Profit per Case

Inpatient
Outpatient

Fracture Care

Top Procedures
- Internal fixation—femur
- Internal fixation—tibia/fibula
- Hip dislocation
- Casting

Average Profit per Case

Inpatient
Outpatient

Source: Innovations Center Futures Database.
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Spine, Sports Generating the Lion’s Share of Today’s Profits

All Sub-Service Lines Not Created Equal

Across all of orthopedics, spine surgery stands out as generating a disproportionate share of total profits for the service line. As seen on the opposing page, in 2001 spine yielded the majority of inpatient orthopedic profits, while composing less than a quarter of volumes. Moreover, spine surgery is offered by only a minority of institutions today, so its impact at the institution level is greater still. Similarly, on the outpatient side, sports medicine generated a majority of total profits, due to its high per-case margins.

Notably, on a contribution profit basis (looking only at direct costs), joint replacement also rises to the fore—joints, as well as spine, are ranked among the top five hospital services in terms of average contribution profit per patient day.
Golden Age of Spine and Sports

Much of the recent growth in spine surgery and sports medicine is attributable to favorable population trends. Largely serving patients in middle age, spine and sports have been bolstered by the Baby Boom population. As the Baby Boomers grow older, joint replacement volumes will accelerate—the first Boomer will turn 65 in 2011—but for the next five years spine and sports will continue to receive the greatest boost from demographics.

Spine Surgery Relative Contribution
National All-Payer, 2001

Inpatient Volumes
- Spine: 21%

Inpatient Revenues
- Spine: 25%

Inpatient Profits
- Spine: 53%

Source: Innovations Center Futures Database.

Procedure Utilization by Age

Untapped Market Opportunity
Percentage of Hospitals Offering Sub-Service Lines
By Bed Size, 2001

Percentage of Hospitals Offering Sub-Service Lines
- Spine: 15%
- Joints: 27%
- Sports: 46%

Source: Innovations Center Futures Database.
Future of Orthopedics

Vision of the Future
Threatening Skies Ahead for Orthopedics Profitability

Total Profit Stable, but Profit per Case Falling
Bolstered by robust volume growth, total profits for orthopedics are expected to be relatively stable into the future. Profit per case, however, will fall sharply—some procedures, such as joint replacement, crossing into the red.

Reimbursement the Critical Uncertainty
Beyond cost challenges, orthopedics finances are at the mercy of third-party reimbursement decisions. At present course and speed for cost and reimbursement trends, the orthopedics service line could approach break-even by 2010 (at the national level). On the other hand, if insurers were to increase payments in line with expected cost increases, total profits for orthopedics could nearly double across the decade. The Innovations Center consensus estimate takes a middle course, assuming that the gap between reimbursement and cost growth will narrow but not close in the coming years.

Challenged by Implants, Biologicals, Competition
Across the next decade, it will become increasingly difficult for orthopedic programs to maintain even today’s margins. The threats massed against orthopedic profitability suggest that the financial gap between strong performers and the typical institution is set to widen significantly. Rising implant expenses will continue to pose the greatest challenge to procedure profits. Other notable threats include expensive new biological materials, selective poaching by specialty competitors, and the shift (albeit modest) to the outpatient setting.

Profit per Procedure Forecasts

1 Assumes reimbursement changes at the same rate as costs, keeping percentage profit margins constant but increasing profits in dollars.
2 Assumes gap between reimbursement and cost growth seen over past five years persists into the future.

Total Orthopedics Profits Forecast

Profit per Procedure Forecasts

Source: Innovations Center Futures Database.
### Drivers of Future Profitability

<table>
<thead>
<tr>
<th>Driver</th>
<th>Current Impact</th>
<th>Five-Year Impact</th>
<th>Ten-Year Impact</th>
<th>Innovations Center Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implant Pricing</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>Implant pricing to continue playing major role in pushing down profits, supported by ongoing industry consolidation; over long term, price increases expected to moderate but not disappear</td>
</tr>
<tr>
<td>New Implant Technologies</td>
<td>←</td>
<td>→</td>
<td>↓</td>
<td>Additional driver of implant costs is shift to new premium designs; while unicompartamental knee replacement and other innovations may actually lower costs in near term, shift to other, more expensive implants will accelerate across next several years</td>
</tr>
<tr>
<td>Growth Factors</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>For now, impact of high-priced biological growth factors for orthopedic procedures muted by incremental reimbursement; over time, ever-broader applications will overwhelm any decreases in growth factor pricing</td>
</tr>
<tr>
<td>Minimally Invasive Techniques</td>
<td>←</td>
<td>←</td>
<td>↓</td>
<td>Need for specialized instruments and equipment to increase costs of procedures; slow adoption of techniques will limit impact</td>
</tr>
<tr>
<td>Outpatient Migration</td>
<td>←</td>
<td>←</td>
<td>↓</td>
<td>Vast majority of today's inpatient procedures will remain within hospital setting; ten years hence, minority of joint replacement and spine surgeries could become ambulatory surgeries, likely yielding smaller financial contribution</td>
</tr>
<tr>
<td>Non-Hospital Competition</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td>Ambulatory surgery centers currently targeting profitable outpatient sports medicine procedures; long-term, threat to inpatient profits will intensify, with for-profit specialty hospitals increasingly skimming most desirable patients</td>
</tr>
<tr>
<td>Medicare Reimbursement</td>
<td>←</td>
<td>←</td>
<td>↓</td>
<td>Although past two years have seen absolute increases in Medicare payments for some orthopedics procedures, almost guaranteed that government reimbursement will not keep pace with cost increases; macro trend is for declining DRG case weights for orthopedics</td>
</tr>
<tr>
<td>Commercial Reimbursement</td>
<td>↑</td>
<td>↓</td>
<td>↓</td>
<td>Short-term opportunity for implementing pass-through arrangements for implants; over long run, loss of hospital leverage relative to payers a virtual certainty</td>
</tr>
<tr>
<td>Payer Mix</td>
<td>←</td>
<td>←</td>
<td>←</td>
<td>Large industrywide shifts in payer mix unlikely; that said, aging of population and demographic profile of orthopedic procedures will tilt scales somewhat in favor of Medicare patients</td>
</tr>
<tr>
<td>Product Mix</td>
<td>←</td>
<td>←</td>
<td>↓</td>
<td>Innovations in (higher-margin) spine and (lower-margin) joint replacement will grow volumes in both specialties, resulting in little net change; small decline in proportion of fracture care cases could be a modest financial boon</td>
</tr>
<tr>
<td>Length of Stay Declines</td>
<td>↑</td>
<td>↑</td>
<td>↑</td>
<td>Expected LOS declines made possible by emerging minimally invasive techniques will present hospitals opportunity to profit from cost reductions until reimbursement levels catch up; slow adoption of relevant techniques make this a ten-year phenomenon seen mainly in later years</td>
</tr>
</tbody>
</table>

**Legend:**
- **Strongly Positive Effect (>30%)**
- **Moderately Positive Effect (5%–30%)**
- **No Effect**
- **Moderately Negative Effect (5%–30%)**
- **Strongly Negative Effect (>30%)**
Robust Demand for Orthopedics Expected

No Shortage of Patients

Over the next ten years, demand of orthopedic care will rise significantly, with relatively balanced growth between hospital inpatient and outpatient settings. Aging and growing of the population supports an optimistic volume forecast—a 17 percent increase for inpatient admissions and 13 percent growth for outpatient procedures. While the emergence of new procedures and greater penetration of existing technologies will further boost overall demand, specialty competition will moderate both inpatient and outpatient hospital volume growth. Hospital outpatient volumes will be particularly affected by loss of share to non-hospital care settings; the total outpatient market (hospital and non-hospital) is actually expected to grow 46 percent over the next decade. Inpatient utilization rates will also decrease as a result of new technology spurring shifts to the outpatient setting.

Competition the Wildcard

Competition from ASCs and surgical hospitals is the greatest wildcard in forecasting future orthopedics demand. While it is a virtual certainty that orthopedics care will (continue to) migrate to non-hospital settings, this is very much a local market phenomenon. Although some will successfully fend off the competitive threat, institutions confronted with specialty competitors in their local market are at risk for devastating volume declines in key orthopedic procedures.
# Drivers of Future Volumes

<table>
<thead>
<tr>
<th>Driver</th>
<th>Current Impact</th>
<th>Five-Year Impact</th>
<th>Ten-Year Impact</th>
<th>Innovations Center Commentary</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td>Population growth and aging driving moderate, gradual increase in inpatient and outpatient volumes; spine surgery and sports medicine to benefit most in next five years, joint replacement and fracture care thereafter</td>
</tr>
<tr>
<td><strong>Lifestyle Factors</strong></td>
<td></td>
<td></td>
<td></td>
<td>Changes in lifestyle factors to accelerate volume growth further; growing obesity rates across the population and rising activity levels among Baby Boomers expected to increase need for musculoskeletal care beyond demographics</td>
</tr>
<tr>
<td><strong>Penetration of Existing Technologies</strong></td>
<td></td>
<td></td>
<td></td>
<td>Long-term trend of broadening applications for core orthopedic procedures (joint replacements, spine surgeries) to new populations of patients; technology the principal driver of past volume growth, with no reason to expect procedures have reached saturation point</td>
</tr>
<tr>
<td><strong>Medical Prevention</strong></td>
<td></td>
<td></td>
<td></td>
<td>Drugs preventing osteoporosis are effective at reducing fracture risk, but limited diagnosis and poor patient compliance will radically restrict impact; medical solutions for osteoarthritis and degenerative disk disease are years if not decades away</td>
</tr>
<tr>
<td><strong>Biological Treatments</strong></td>
<td></td>
<td></td>
<td></td>
<td>Biological techniques for treating musculoskeletal diseases hold great potential to radically transform service line; that said, broad applications of stem cells, gene therapy, and tissue engineering unlikely to reach the clinic in next five or even ten years</td>
</tr>
<tr>
<td><strong>New Procedures</strong></td>
<td></td>
<td></td>
<td></td>
<td>Over long term, potential for emerging procedures to expand volumes significantly, reaching previously untreated patients; key examples are kyphoplasty and vertebroplasty, first successful interventions for osteoporotic vertebral compression fractures</td>
</tr>
<tr>
<td><strong>Outpatient Shift</strong></td>
<td></td>
<td></td>
<td></td>
<td>Vast majority of today’s inpatient procedures will remain within hospital setting; ten years hence, minority of joint replacement and spine surgeries could become ambulatory surgeries, increasing vulnerability to competition</td>
</tr>
<tr>
<td><strong>Non-Hospital Competition</strong></td>
<td></td>
<td></td>
<td></td>
<td>Ambulatory surgery centers currently targeting outpatient sports medicine procedures; over time, intensifying threat to inpatient profits from surgical hospital poaching best inpatient payers and procedures</td>
</tr>
</tbody>
</table>

**Effect Categories:**
- **Strongly Positive Effect (>30%)**
- **Moderately Positive Effect (5%–30%)**
- **No Effect**
- **Moderately Negative Effect (5%–30%)**
- **Strongly Negative Effect (>30%)**
Admissions Growth To Strain ORs, Not Bed Capacity

Flat Forecast for Inpatient Days
In the next decade, more orthopedics patients will not necessarily require more inpatient beds. The total number of orthopedic procedures performed is certain to rise significantly, placing heavy demands on current operating room capacity. By contrast, bed needs related to orthopedics are expected to be relatively unchanged.

Compared to the 14 percent growth forecast for inpatient orthopedics admissions in the next ten years, orthopedic inpatient days will actually trend downward—a 0.6 percent average annual decrease across the next decade. Declining length of stay is primarily responsible, although the shift of procedures to the outpatient setting will also play a role, especially in later years.

Continued Length of Stay Declines Expected
Consistent with the trends observed across the past decades in orthopedics, length of stay is expected to decline significantly in the coming years. The adoption of more efficient inpatient management protocols and better rehabilitation techniques will continue to drive LOS declines. In addition, minimally invasive approaches to common orthopedic procedures will enable a radically shorter inpatient stay for certain patients.

Orthopedics Inpatient Days

<table>
<thead>
<tr>
<th>Year</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>11.27 M</td>
</tr>
<tr>
<td>2008</td>
<td>11.17 M</td>
</tr>
<tr>
<td>2013</td>
<td>10.56 M</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.

Orthopedics Length of Stay

Days

<table>
<thead>
<tr>
<th>Year</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>4.46</td>
</tr>
<tr>
<td>2008</td>
<td>4.01</td>
</tr>
<tr>
<td>2013</td>
<td>3.56</td>
</tr>
</tbody>
</table>

10% decline 20% decline

Source: Innovations Center Futures Database.
Spotlight on Minimally Invasive Techniques

The major technological driver of declining length of stay over the next ten years will be adoption of minimally invasive techniques for joint replacement and spine surgery. Although results for minimally invasive spine and joint techniques are still preliminary, and adoption is expected to be slow and gradual, minimally invasive approaches have the potential to reduce inpatient stays radically or even move procedures to the ambulatory setting. Early studies of minimally invasive hip replacement, discectomy, and spinal fusion report dramatic reductions in LOS relative to conventional techniques.

Outpatient Shift to Be Limited

As minimally invasive techniques become more broadly used, several major inpatient orthopedic procedures will begin to be performed as ambulatory surgeries. In theory, hip replacement, knee replacement, discectomy, and spinal fusion can all be performed as outpatient procedures. However, the impact of the outpatient shift will be limited throughout the next decade: slow adoption is predicted for minimally invasive orthopedic procedures, and outpatient migration is expected to be even slower as surgeons become comfortable with the new techniques.

Median Length of Stay

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Standard Procedure</th>
<th>Minimally Invasive</th>
<th>Percentage Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Replacement</td>
<td>2</td>
<td>5</td>
<td>60%</td>
</tr>
<tr>
<td>Knee Replacement</td>
<td>2</td>
<td>4</td>
<td>50%</td>
</tr>
<tr>
<td>Discectomy</td>
<td>1</td>
<td>3</td>
<td>66%</td>
</tr>
<tr>
<td>Spinal Fusion</td>
<td>3</td>
<td>5</td>
<td>40%</td>
</tr>
</tbody>
</table>

Source: Innovations Center interviews and analysis.

Percentage of Procedures Performed Outpatient

<table>
<thead>
<tr>
<th>Procedure</th>
<th>2003</th>
<th>2008</th>
<th>2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip Replacement</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>Knee Replacement</td>
<td>0%</td>
<td>1%</td>
<td>4%</td>
</tr>
<tr>
<td>Discectomy</td>
<td>2%</td>
<td>15%</td>
<td>30%</td>
</tr>
<tr>
<td>Spinal Fusion</td>
<td>0%</td>
<td>3%</td>
<td>10%</td>
</tr>
</tbody>
</table>

Source: Innovations Center interviews and analysis.
Spine Surgery Is Top Investment Choice

**Significant Upside Opportunity**

On average, spine surgery is, and will continue to be, the most profitable service within orthopedics. Spine has a number of elements in its favor—high-dollar procedures, a payer mix weighted toward commercial patients, periodic favorable reimbursement updates from Medicare, and a long-term trend of increasing per capita utilization. In addition, novel techniques (notably, new procedures for treating vertebral compression fractures) could be an engine for further growth over the next several years.

**High Return, High Risk**

Spine is also the most volatile orthopedic sub-service line, with significant potential for technological disruption. Programs have already begun to confront the cost of the new biological growth factors, although payers seem to be defusing the impact for now. Another key technology expected within the next few years—artificial discs—could replace many spinal fusions, with the threat of higher costs without commensurate payment. Over the long term, given ongoing debates over the appropriateness of surgical spine intervention, medical consensus could shift and use rates could stabilize or even plummet. With this risk profile, spine may not be for everyone—indeed, fewer than half of hospitals have programs today—but those who invest may be rewarded handsomely.

---

**Spine Surgery Sub-Service Line Forecast**

<table>
<thead>
<tr>
<th>Average Profit per Case, Inpatient</th>
<th>Total Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003: $1,683</td>
<td>$895 M</td>
</tr>
<tr>
<td>2008: $1,892</td>
<td>$1.21 B</td>
</tr>
<tr>
<td>2013: $1,728</td>
<td>$1.28 B</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Average Profit per Case, Outpatient</th>
<th>Total Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003: $105</td>
<td>531 K</td>
</tr>
<tr>
<td>2008: $75</td>
<td>571 K</td>
</tr>
<tr>
<td>2013: $(3)</td>
<td>586 K</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.
A Discipline on the Ascent

Spine surgery’s optimistic outlook is consistent with its history. For more than two decades, spine surgery has been the epicenter of technological innovation in orthopedics—reflected in the steep rise in the utilization of spinal fusion surgery over time.

One factor that may contribute to spine surgery’s fast pace of growth is its multidisciplinary nature—spine surgeries are performed by neurosurgeons as well as orthopedic spine specialists. National numbers suggest that, on average, orthopedists perform 42 percent of inpatient spine procedures and 62 percent of outpatient spine surgeries. In addition, some of the new minimally invasive spine procedures in the outpatient setting—most notably, vertebroplasty and kyphoplasty—can also be performed by interventional radiologists and general orthopedic surgeons.

Spine Surgery Forecast Drivers

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increasing penetration of spine surgery technology</td>
<td>Add-on reimbursement for growth factors yielding profits at two times cost of the technology</td>
</tr>
<tr>
<td>Kyphoplasty and vertebroplasty creating new market for treating vertebral compression fractures</td>
<td>Higher procedure costs due to increasing use of growth factors and other biological products, adding procedure costs</td>
</tr>
<tr>
<td>Higher procedure costs due to increasing use of growth factors and other biological products, adding procedure costs</td>
<td>Rising implant costs pressuring procedure margins</td>
</tr>
<tr>
<td>Rising implant costs pressuring procedure margins</td>
<td>Competition from specialists siphoning off most profitable cases</td>
</tr>
<tr>
<td>Vertebral compression fracture market continuing to expand</td>
<td>Minimally invasive techniques enabling shift of minority of discectomies and spinal fusions outpatient</td>
</tr>
<tr>
<td>Minimally invasive techniques expanding spinal fusion market</td>
<td>Artificial discs substituting for spinal fusion surgeries, dramatically increasing implant costs while potentially lowering reimbursement</td>
</tr>
<tr>
<td>Potential for change in clinical practice lowers rate of spine surgery overall</td>
<td>Source: Innovations Center Futures Database.</td>
</tr>
</tbody>
</table>
Spine Surgery the Epicenter of Orthopedic Innovation

Key Disruptive Technologies Expected in the Coming Decade

Vertebral Fracture Treatments

Two procedures for treating compression fractures in the spine are emerging as the greatest drivers of spine surgery volume growth across the next several years. While the profitability picture is still uncertain—many payers are still deciding at what level to reimburse for the procedures—the potential market is huge. Currently, vertebroplasty is profitable as an outpatient procedure, while kyphoplasty, which requires an additional component, is usually only profitable if performed inpatient.

**Kyphoplasty**
- Treats vertebral fractures with bone cement delivered through catheter
- Reduces pain, restores height
- Inpatient or outpatient procedure, usually under general anesthesia
- Performed in OR with fluoroscopy or in angio suite
- Requires $2,000 disposable balloon and instruments
- Reimbursement at $1,000 to $4,000 and above

**Vertebroplasty**
- Treats vertebral fractures with bone cement delivered through catheter
- Reduces pain
- Outpatient procedure, usually under local anesthesia
- Performed in OR with fluoroscopy or in angio suite
- Direct procedure costs approximately $300
- Reimbursement near $1,000

Minimally Invasive Surgery

Techniques for performing disc excision and spinal fusion procedures through smaller incisions, while sparking considerable interest among patients and physicians, will see slow adoption over the next few years, limiting their impact. Over the long term, minimally invasive spine techniques could significantly reduce length of stay and even enable a shift to the outpatient setting.

**Endoscopic Discectomy**
- Removes portion of degenerated disc through portal
- Uses fiber-optic endoscopes and/or fluoroscopic imaging
- Can be performed as 23-hour outpatient procedure
- Requires $1,000 to $2,000 in additional instrumentation

**Endoscopic Spinal Fusion**
- Fuses spinal segments, introducing implant through portal
- Uses fiber-optic endoscopes and/or fluoroscopic imaging
- Reduces LOS by 1+ days
- Requires $1,000 to $2,000 in additional instrumentation

Endoscopic Spine Surgery Adoption Rate

Source: Innovations Center interviews and analysis.

Market Potential

Vertebral Compression Fractures Annual Incidence

Resolve Independently 500K
Cause Chronic Pain 250K

Source: Innovations Center interviews and analysis.

Endoscopic Spine Surgery Adoption Rate

Source: Innovations Center interviews and analysis.
Artificial Disc Replacement

Potentially a significant disruption to spinal fusion volumes, artificial discs treat spinal disc degeneration by replacing the damaged disc, rather than fusing adjacent spine segments together. Many expect artificial discs to take substantial market share away from spinal fusion surgery after their introduction in 2005. The main concern for hospitals is the cost of the implants—estimated at $8,000 per level—and their provisional classification into lower-paying back and neck procedure DRGs rather than more remunerative spinal fusion codes. By 2007 or 2008, insurers are expected to resolve gross reimbursement inequities related to artificial discs, but in the worst case artificial discs could be a serious blow to spine profits for several years.

DePuy Charite III Artificial Disc
- Replaces degenerated disc with artificial device
- Unlike fusion, retains mobility and shock absorption of spine
- Inpatient or outpatient procedure, usually under general anesthesia

Growth Factors

Biological bone growth factors represent a major threat to spine procedure economics. The first growth factor on the market, Medtronic’s INFUSE product (BMP-2), costs $3,500–$4,900 per fusion level—representing a significant additional expense. Following its 2002 launch, INFUSE has captured a sizeable portion of the spine market—the product is now used in around 10 percent of fusion surgeries. However, CMS and some private insurers have defused the threat for now, providing ample reimbursement for the added costs. For Medicare patients, CMS actually approved a $8,900 DRG pass-through payment, which would result in a $4,000–$5,000 net gain for single-level fusion cases with INFUSE. Over the long term, broader adoption of INFUSE, new growth factors, and other biological products for use in spine may pose additional challenges, depending on insurer response.

DePuy Charite III Artificial Disc

Medtronic INFUSE Growth Factor
- Biological product for use in stimulating bone growth
- Approved for use in anterior lumbar fusion surgeries in July 2002
- Intended to substitute for bone graft harvested from iliac crest
- Approval pending for broader spinal fusion indications

Comparative Economics, Spinal Fusion Versus Artificial Discs

<table>
<thead>
<tr>
<th></th>
<th>Spinal Fusion Surgery</th>
<th>Artificial Disc Replacement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implant Costs (Estimated)</td>
<td>$11,623</td>
<td>$5,649</td>
</tr>
<tr>
<td>Expected Medicare Reimbursement</td>
<td>$5,000</td>
<td>$8,000</td>
</tr>
</tbody>
</table>

Impact of Growth Factor Pass-Through on Medicare Spinal Fusion Reimbursement

<table>
<thead>
<tr>
<th></th>
<th>Without Growth Factors</th>
<th>With Growth Factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Implant Costs (Estimated)</td>
<td>$11,623</td>
<td>$20,523</td>
</tr>
<tr>
<td>Expected Medicare Reimbursement</td>
<td>$5,000</td>
<td>$9,000</td>
</tr>
</tbody>
</table>

1 Based on 2001 national reimbursement levels for spinal fusion without complications

Source: Innovations Center interviews and analysis.
Attractive Profit Margins

On the whole, orthopedic sports medicine is—and will remain for some time—an attractive business. Although sports medicine procedures are largely outpatient and therefore lower-dollar than other offerings within hospital orthopedics, most sports medicine procedures generate a healthy profit. Moreover, a critical advantage of sports medicine procedures is that they generally do not require implants, reducing exposure to cost increases. Future prospects for the sports medicine market are if anything brighter as active Baby Boomers continue to suffer from activity-related injuries. The most tangible threat to profits is the long-term potential for commercial insurers to shift to an APC-like prospective payment methodology, which could dramatically reduce commercial outpatient reimbursement levels.

Sports Medicine Sub-Service Line Forecast

Vulnerable to Competition

The sunny outlook for hospital-based sports medicine is tempered by intensifying competition. The attractive fundamentals of sports medicine has not gone unnoticed by non-hospital players. In many markets, sports medicine is currently “ground zero” for competition from ASCs and physician offices. Already, more than a third of all knee arthroscopies are done outside the hospital, and ambulatory surgery centers are actively seeking to capture a larger share of the outpatient market. Thus, even though the sports medicine market has the potential to grow rapidly, hospitals may not capture the lion’s share of that growth.
**Volume Boost from New Procedures**

Sports medicine programs will benefit from the adoption of new, less-invasive procedures to treat common activity-related injuries. These new procedures, largely outpatient, have been used to date mainly in the commercial-pay population, which has translated to positive economics. Moreover, at least anecdotally, these procedures have generated considerable interest among active consumers by offering dramatically quicker recovery.

### New Sports Medicine Procedures

- **Arthroscopic Rotator Cuff Repair**: Cuts less tissue than open procedure, dramatically reducing recovery time.
- **Tommy John Surgery**: Provides an alternative to life-long pain and poor performance from shredded elbow tendon.
- **Unspacer Knee Implant**: Provides relief for young, active patients who want to delay knee replacement.
- **Minimally Invasive Wrist Fixation**: Allows surgeons to secure small wrist bones without a large scar.
- **Arthroscopic Ankle Reconstruction**: Alleviates chronic pain with half the recovery time of open procedure.
- **Arthroscopic ACL Reconstruction**: Re-grafts tendon onto bone using a combination of endoscopic and mini-open techniques.

### Sports Medicine Forecast Drivers

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expensive tissue-engineered autologous cartilage transplants potentially a substantial net loss per case</td>
<td>Increasing physical activity levels among middle-aged and elderly leading to rising rates of chronic and acute sports injuries</td>
</tr>
<tr>
<td>Expensive tissue-engineered autologous cartilage transplants potentially a substantial net loss per case</td>
<td>Consumer comfort with “lifestyle procedures” increasing likelihood that patients seek surgical intervention for chronic conditions</td>
</tr>
<tr>
<td>Expensive tissue-engineered autologous cartilage transplants potentially a substantial net loss per case</td>
<td>Competition from ASCs capturing outpatient surgeries</td>
</tr>
<tr>
<td>Expensive tissue-engineered autologous cartilage transplants potentially a substantial net loss per case</td>
<td>Questions about efficacy of knee arthroscopy in arthritis patients limiting growth</td>
</tr>
<tr>
<td>Increasing physical activity levels among middle-aged and elderly leading to rising rates of chronic and acute sports injuries</td>
<td>Potential shift away from charge-based to prospective payment methodology for commercial outpatient business reducing payment levels</td>
</tr>
<tr>
<td>Consumer comfort with “lifestyle procedures” increasing likelihood that patients seek surgical intervention for chronic conditions</td>
<td>Biological approaches for repairing damaged cartilage expanding market</td>
</tr>
<tr>
<td>Competition from ASCs capturing outpatient surgeries</td>
<td>Competition from ASCs capturing outpatient surgeries</td>
</tr>
</tbody>
</table>

**Positive Impact**

**Negative Impact**
No Respite from Implant Challenge
As in the past, the future fortunes of joint replacement procedures will turn on trends in implant costs. Driven by continued increases in implant expenses without commensurate increases in reimbursement, the Innovations Center anticipates that the average joint replacement case—commercial cases included—will be a break-even proposition within the next ten years. At the same time, volumes for joint replacement will be robust, presenting an opportunity for hospitals who manage to moderate implant costs to net attractive returns.

Considerable Volume Growth Ahead
Demand for joint replacements will escalate sharply across the next ten years. Toward the end of the decade, demographics-fueled growth in joint replacements will spike, as Baby Boomers begin to wear out their joints. The greater effect will be from increases in utilization rates, which have risen steeply across the past several decades and will continue to climb. New procedures, new techniques, and changes in consumer behavior will contribute to higher utilization in the future.

Source: Innovations Center Futures Database.
A Disruptive (but Distant) Future for Biologics

The potential for biologics to have a truly disruptive impact on joint replacement demand and profitability warrants awe— and caution. Ultimately, the most remarkable innovations will likely come in the fields of gene therapy and stem cell therapy— reversing the effects of aging and preventing osteoarthritis, the underlying disease that necessitates joint replacement in the first place. However, progress here is measured not in years, but decades.

In the intervening years, joint replacement surgeries will begin to incorporate human tissue-engineered implants rather than today’s metal and synthetic implants. The first tissue-engineered application to market— autologous cartilage transplantation— has experienced limited success to date, due to high costs (exceeding $12,000), inconsistent reimbursement, and narrow indications.

Biological Solutions for Joint Degeneration

<table>
<thead>
<tr>
<th>Biological Solutions for Joint Degeneration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tissue-Engineered Cartilage</td>
</tr>
<tr>
<td>Tissue-Engineered Bone</td>
</tr>
<tr>
<td>Tissue-Engineered Tendon</td>
</tr>
<tr>
<td>Tissue-Engineered Total Knee</td>
</tr>
<tr>
<td>Gene Therapy</td>
</tr>
<tr>
<td>Stem Cell Therapy</td>
</tr>
</tbody>
</table>

Joint Replacement Forecast Drivers

<table>
<thead>
<tr>
<th>Volumes</th>
<th>Profitability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>More durable implants expanding market to younger patients</td>
</tr>
<tr>
<td></td>
<td>Unicompartmental knee replacement expanding market to younger patients</td>
</tr>
<tr>
<td></td>
<td>Increased activity levels among the middle-aged and elderly leading to more chronic joint wear</td>
</tr>
<tr>
<td></td>
<td>Implant prices continuing to rise</td>
</tr>
<tr>
<td></td>
<td>Shift to more durable (and more expensive) implants</td>
</tr>
<tr>
<td></td>
<td>Competition from specialists siphoning off most profitable cases</td>
</tr>
<tr>
<td></td>
<td>Growth in under-65 market shifting payer mix toward commercial insurers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Current</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Hip joint resurfacing procedure expanding market</td>
</tr>
<tr>
<td></td>
<td>Minimally invasive hip and knee replacement expanding market, particularly to younger patients</td>
</tr>
<tr>
<td></td>
<td>Biological approaches for repairing damaged cartilage expanding market</td>
</tr>
<tr>
<td></td>
<td>(Modest) shift of hip and knee replacements to outpatient setting</td>
</tr>
<tr>
<td></td>
<td>Competition from specialists siphoning off most profitable cases</td>
</tr>
</tbody>
</table>

Positive Impact                      | Negative Impact
Joint Replacement Moving Toward a Younger Population

A “Booming” Market Niche?
Over the past five years growth in hip and knee replacement surgeries was predominantly in the commercial-age population. Volumes grew faster in patients between 45 and 54 years old than in any other age group. Driven by new less-invasive procedures and more durable implants (as well as a healthy dose of Baby Boomer consumerism), this trend toward joint-replacement interventions will continue across the next decade.

Growth in the under-65 joint replacement population means profitable growth, given that current commercial contracts yield over 10 percent net margin on average, whereas Medicare cases represent a break-even proposition for most. Moderating this effect is the reality that younger patients are the ones most likely to get the most expensive implants—potentially limiting the gains from more lucrative reimbursement.

Driver #1—More Durable Implants
The primary driver of recent growth in joint replacement procedures for younger patients has been the use of more durable implants. In the past, surgeons have been reluctant to operate on patients in their forties and fifties who could reasonably be expected to outlive the 10- to 20-year life span of a joint replacement implant. Today, new implant materials, including modified polyurethanes, ceramics, and metal alloys, are expected to increase implant life significantly, leading surgeons to operate more often on younger patients.

Driver #2—New Procedures
Two new joint replacement procedures are expected to be major drivers of joint replacement volumes across the next ten years: unicompartmental knee replacement and hip joint resurfacing. Both are less destructive to bone than standard joint replacements, making them particularly attractive to younger patients.

Joint Replacement Volume Growth
1996–2001

<table>
<thead>
<tr>
<th>Commercial Population</th>
<th>Medicare Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>35–44</td>
<td>12%</td>
</tr>
<tr>
<td>45–54</td>
<td>66%</td>
</tr>
<tr>
<td>55–64</td>
<td>51%</td>
</tr>
<tr>
<td>65–74</td>
<td>17%</td>
</tr>
<tr>
<td>75–84</td>
<td>58%</td>
</tr>
<tr>
<td>≥85</td>
<td>41%</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.

Percentage of Joint Replacements Using Premium Implants

<table>
<thead>
<tr>
<th>2003</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hip</td>
<td>Knee</td>
</tr>
<tr>
<td>56%</td>
<td>12%</td>
</tr>
</tbody>
</table>


Unicompartmental Knee Replacement
- Replaces just one osteoarthritic knee compartment
- Causes less trauma to muscle and tendons than a total knee replacement, making the implant easier to revise later

Hip Joint Resurfacing
- Coats ball and socket of hip joint with metal lining
- Approved in Europe; clinical trials ongoing in The United States
**Minor Driver #3—Minimally Invasive Hip**

The joint replacement procedure attracting the most attention of late has been minimally invasive hip replacement. The potential of minimally invasive hip is appealing: dramatic reductions in inpatient stays, radically faster recovery, and substantially reduced post-operative pain. Over the long term, the benefits of minimally invasive hip (as well as knee) replacement procedures will expand volumes, especially in younger patients. However, adoption of the new joint replacement techniques is likely to be modest for a number of years to come.

**Steep Learning Curve**

Although manufacturers are investing heavily in product development and physician education, minimally invasive hip replacement has a steep learning curve. Even joint replacement specialists face a substantial challenge in mastering the new procedures; general orthopedists who perform only a few joint replacements each month will be reluctant to spend the considerable effort required to learn the new techniques.

**Limited Eligibility**

Based on current clinical guidelines, only a fraction of hip replacement patients would be eligible for minimally invasive hip surgery. Over time, patient eligibility will probably expand significantly, but for now adoption of the procedure will be slowed by its limited applicability—at best, approximately one-third of patients.

---

**Bottom Line: Still Mainly Serving the Elderly**

Across the next decade, demand for joint replacement will continue to be dominated by senior-age Medicare patients. Despite rapid growth in joint replacements in the younger population, hip and knee replacement will continue to be a procedure primarily performed on the elderly. Even with the recent growth in under-65 patients undergoing joint replacements, only 31 percent of patients getting hip and knee replacements are under age 65 today.
Fracture Care—Mission, Not Margins

Modest (and Diminishing) Contribution
Never a leading profit center, fracture care margins will decline slightly as the cost of implants continues to rise and reimbursement remains steady. Over the long term, the use of growth factors and other biological products to accelerate bone healing could significantly increase costs, but widespread adoption is a number of years away.

Growth Sluggish at Best
Unlike other areas of orthopedics, hospital-based fracture care—surgical and medical treatment for fractures, sprains, and dislocations—is not poised for significant growth. As osteoporosis prevention becomes more widespread, the incidence of severe fractures will decline—an effect already observed over the past several years. That said, fracture care will continue to account for a significant portion of overall orthopedics volumes.

Fracture Care Sub-Service Line Forecast

### Average Profit per Case, Inpatient

<table>
<thead>
<tr>
<th>Year</th>
<th>Medical</th>
<th>Surgical</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>($78)</td>
<td>($69)</td>
</tr>
<tr>
<td>2008</td>
<td>($152)</td>
<td>($252)</td>
</tr>
<tr>
<td>2013</td>
<td>($263)</td>
<td>($580)</td>
</tr>
</tbody>
</table>

### Average Profit per Case, Outpatient

<table>
<thead>
<tr>
<th>Year</th>
<th>Medical</th>
<th>Surgical</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>$13</td>
<td>$6</td>
</tr>
<tr>
<td>2008</td>
<td>$266</td>
<td>$277</td>
</tr>
<tr>
<td>2013</td>
<td>$268</td>
<td>($10)</td>
</tr>
</tbody>
</table>

### Total Profits

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Volumes</th>
<th>Total Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>$22 M</td>
<td>($25 M)</td>
</tr>
<tr>
<td>2008</td>
<td>$16 M</td>
<td>($147 M)</td>
</tr>
<tr>
<td>2013</td>
<td>($1 M)</td>
<td>($372 M)</td>
</tr>
</tbody>
</table>

### Total Volumes

- Inpatient
- Outpatient
- Medical
- Surgical

2003 2008 2013
- Inpatient: 1.05 M, 1.12 M, 1.16 M
- Outpatient: 477 K, 489 K, 501 K
- Medical: 477 K, 489 K, 501 K
- Surgical: 176 K, 185 K, 190 K

Source: Innovations Center Futures Database.
Osteoporosis Prevention Having an Effect

Efforts to reduce osteoporosis are beginning to have an effect; per capita utilization for fracture procedures has (slowly) declined over the past several years. Still, today fewer than a quarter of the patients at high risk for osteoporosis are adhering to a preventative regimen—diet, exercise, and bone-strengthening drugs—even though the current arsenal of pharmaceuticals is highly effective at preventing fractures. Across the next ten years, the trend toward declining fracture care utilization may accelerate as the result of better diagnosis of osteoporosis and more consistent prescribing of preventative drugs.

Fracture Care Forecast Drivers

**Volumes**

- Increasing physical activity levels among middle-aged and elderly leading to rising rates of chronic and acute sports injuries
- Lengthening life spans resulting in more fractures in the elderly

**Profitability**

- Rising cost of implants
- Medical prevention decreasing incidence of osteoporosis-related fractures
- Potential for biological growth factors to be used in fracture healing, increasing procedure costs

Fracture Care Utilization Rates

Per Thousand, Inpatient

9% decline, 1996-2001

Source: Innovations Center Futures Database.
Two Eras in Orthopedics

Timeline of (Potentially) Disruptive Technologies

Era of Mechanical Interventions

- 2003: Osteoporosis Prevention and Screening
- 2004: Unicompartmental Knee Replacement
- 2005: Endoscopic Spinal Fusion
- 2006: Vertebroplasty
- 2007: Minimally Invasive Discectomy
- 2008: Mobile-Bearing Knee Implant
- 2009: Minimally Invasive Knee Replacement
- 2010: Next-Generation Implants
- 2011: "Ship-in-a-Bottle" Implants

Future of Orthopedics

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## Minimally Invasive Surgical Procedures

<table>
<thead>
<tr>
<th>Application</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
<th>Current Adoption</th>
<th>Potential Impact on Profitability</th>
<th>Potential Impact on Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unicompartmental Knee Replacement</td>
<td>Knee replacement technique treats single-compartment knee osteoarthritis; easier to revise than standard procedure</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Minimally Invasive Total Knee Replacement</td>
<td>Knee replacement technique with shorter incision, less trauma to bone and soft tissues; significantly faster recovery promised</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/down.png" alt="Down" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Minimally Invasive Total Hip Replacement</td>
<td>Hip replacement technique with shorter incision, less trauma to tissues, shorter inpatient stays than conventional hip replacement; eligibility currently limited</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/down.png" alt="Down" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Endoscopic Discectomy</td>
<td>Portal-based disc excision offer faster recovery; small numbers currently performed outpatient</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/down.png" alt="Down" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Endoscopic Spinal Fusion</td>
<td>Minimally invasive fusions promise shorter inpatient stays, faster recovery</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/down.png" alt="Down" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Hip Resurfacing</td>
<td>Bone-preserving technique covers osteoarthritis-affected hip joint surfaces with metal implants; easier to revise than hip replacement procedure</td>
<td>Late-stage clinical trials; available internationally</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/equal.png" alt="Equal" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Kyphoplasty</td>
<td>Percutaneous catheter-based procedure treats vertebral compression fractures with cement; restores height using balloon</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/equal.png" alt="Equal" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Vertebroplasty</td>
<td>Percutaneous catheter-based procedure treats vertebral compression fractures with cement</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Spinal Directed-Energy Therapies</td>
<td>Radio-frequency or thermal energy treat lumbar disc pain caused by degenerative disc disease</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/equal.png" alt="Equal" /></td>
<td><img src="images/up.png" alt="Up" /></td>
<td></td>
</tr>
<tr>
<td>Arthroscopic Rotator Cuff Repair</td>
<td>For subset of patients, minimally invasive shoulder procedure offers quicker recovery; can be performed in ambulatory setting</td>
<td>Currently available</td>
<td><img src="images/circle.png" alt="Circle" /></td>
<td><img src="images/down.png" alt="Down" /></td>
<td><img src="images/up.png" alt="Up" /></td>
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</tr>
</tbody>
</table>
## Implants

<table>
<thead>
<tr>
<th>Application</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
<th>Current Adoption</th>
<th>Potential Impact on Profitability</th>
<th>Potential Impact on Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal-on-Metal Surfaces</td>
<td>Joint replacement implant design with two metal surfaces; expected to provide better long-term wear than standard implants</td>
<td>Currently available</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Ceramic Surfaces</td>
<td>Joint replacement implant design with two ceramic surfaces; expected to provide better long-term wear than standard implants</td>
<td>Currently available</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Modified Ceramic Surfaces</td>
<td>Joint replacement implant design with one modified ceramic and one polyurethane surface; expected to provide better long-term wear than standard implants</td>
<td>Currently available</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Cross-Linked Polyethylene Surfaces</td>
<td>Joint replacement implant material with polyethylene modified to improve durability; expected to provide better long-term wear than standard implants</td>
<td>Currently available</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Mobile-Bearing Knee</td>
<td>Total knee replacement implant design replicates natural motion of the knee; appropriate for heavier or more active patients</td>
<td>Currently available</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Artificial Discs</td>
<td>Metal and polymer implant replaces lumbar disc affected by degenerative disc disease; supplants spinal fusion procedures</td>
<td>Late-stage clinical trials</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>Artificial Nuclei</td>
<td>Metal and polymer implant replaces lumbar disc nuclei affected by degenerative disc disease; supplants spinal fusion procedures</td>
<td>Preclinical studies</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>“Ship-in-a-Bottle” Implants</td>
<td>Joint replacement and spinal implants are assembled inside the body, allowing for smaller incisions and less trauma to the surgery site</td>
<td>Concept phase</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
<tr>
<td>“Smart” Implants</td>
<td>Nanotechnology and advanced polymers permit real-time implant adjustments, reducing wear and lengthening implant life</td>
<td>Concept phase</td>
<td></td>
<td></td>
<td><img src="impact.png" alt="Impact" /></td>
<td><img src="volumes.png" alt="Volumes" /></td>
</tr>
</tbody>
</table>

### Application

- **Knee**
- **Hip**
- **Spine**
- **Long Bone**
- **Shoulder**
## Biologics

<table>
<thead>
<tr>
<th>Application</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
<th>Current Adoption</th>
<th>Potential Impact on Profitability</th>
<th>Potential Impact on Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autologous Growth Factors</td>
<td></td>
<td>Patient's own blood or bone marrow is concentrated to harness body's natural healing compounds</td>
<td>Currently available</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Recombinant Growth Factors</td>
<td>(Spine)</td>
<td>Bone morphogenic proteins, used in conjunction with a cage implant, speed healing after spinal fusion procedures</td>
<td>Currently available</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Recombinant Growth Factors</td>
<td>(Long Bone)</td>
<td>Bone morphogenic proteins accelerate the healing process for poorly healing long-bone fractures usually associated with open fixation</td>
<td>Late-stage clinical trials; available under compassionate use program</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Recombinant Growth Factors</td>
<td>(Cartilage)</td>
<td>Growth agents stimulate cartilage healing after injury; delays or prevents the onset of osteoarthritis</td>
<td>Animal trials</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Autologous Cartilage</td>
<td>Transplants</td>
<td>A sample of the patient's knee cartilage is taken, grown in vitro, and then arthroscopically implanted; now used only in single-area cartilage injuries but hope is for use in osteoarthritis</td>
<td>Currently available</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Tissue-Engineered Materials</td>
<td></td>
<td>Tissues—cartilage, ligaments, tendon, or even bone—grown in vitro, then surgically implanted at the affected site</td>
<td>In vitro studies</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Embryonic Stem Cells</td>
<td></td>
<td>Stem cells are differentiated to form various musculoskeletal tissue inside the body</td>
<td>Animal trials</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
<tr>
<td>Gene Therapy</td>
<td></td>
<td>Genes delivered locally to spur healing of musculoskeletal injuries, regeneration of chronic tissue damage</td>
<td>Animal trials</td>
<td></td>
<td>![image]</td>
<td>![image]</td>
</tr>
</tbody>
</table>

### Adoption

<table>
<thead>
<tr>
<th>Adoption</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>![image]</td>
<td>0%</td>
</tr>
<tr>
<td>![image]</td>
<td>12.5%</td>
</tr>
<tr>
<td>![image]</td>
<td>25%</td>
</tr>
<tr>
<td>![image]</td>
<td>50%</td>
</tr>
<tr>
<td>![image]</td>
<td>75%</td>
</tr>
</tbody>
</table>
# Computer-Assisted Surgery

<table>
<thead>
<tr>
<th>Application</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
<th>Current Adoption</th>
<th>Potential Impact on Profitability</th>
<th>Potential Impact on Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Image-Free Navigation Systems</td>
<td></td>
<td>Computer-powered infrared motion detectors allow surgeons to track implants and patient’s anatomy during joint replacements and spinal surgery; anatomical markers provide calibration</td>
<td>Currently available</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Red" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Image-Guided Navigation Systems</td>
<td></td>
<td>Preoperative or intra-operative images linked to infrared-monitored implants give surgeons a “virtual” image of the patient’s anatomy during surgery</td>
<td>Currently available</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Red" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Active Systems (Robotics)</td>
<td></td>
<td>Robots use preoperative protocols established by surgeons to perform task during surgery</td>
<td>Clinical trials; available internationally</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Red" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
</tbody>
</table>

## Medical Solutions

<table>
<thead>
<tr>
<th>Application</th>
<th>Technology</th>
<th>Description</th>
<th>Status</th>
<th>Current Adoption</th>
<th>Potential Impact on Profitability</th>
<th>Potential Impact on Volumes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosupplementation</td>
<td></td>
<td>Hyaluronic acid injected into the knee lubricates joint to treat pain caused by osteoarthritis or injury; delays knee replacement</td>
<td>Currently available</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Green" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Osteoporosis Prevention</td>
<td></td>
<td>Oral drug regimen prevents or delay the onset of osteoporosis; results in significantly fewer fractures</td>
<td>Currently available</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Green" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Next-Generation Pain Killers</td>
<td></td>
<td>Advanced pain medication allows for better palliation of osteoarthritis symptoms without adverse side effects</td>
<td>Early-stage clinical trials</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Green" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Osteoarthritis Prevention</td>
<td></td>
<td>Oral pharmaceuticals systemically prevent or delay the onset of osteoarthritis; avoids need for joint replacement surgeries</td>
<td>Concept phase</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Green" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
<tr>
<td>Degenerative Disc Disease Prevention</td>
<td></td>
<td>Oral pharmaceuticals systemically prevent or delay the onset of degenerative disc disease; results in fewer spinal fusion procedures</td>
<td>Concept phase</td>
<td></td>
<td><img src="#" alt="Green" /> <img src="#" alt="Green" /> <img src="#" alt="Green" /></td>
<td></td>
</tr>
</tbody>
</table>

## Potential Impact

- **Strongly Positive Effect (>).**
- **Moderately Positive Effect (8%-30%).**
- **No Effect.**
- **Moderately Negative Effect (5%-30%).**
- **Strongly Negative Effect (>30%).**
Future of Orthopedics

The New Management Ambition
Overcoming Profit Pressures

Although every hospital will face daunting pressures to orthopedics profitability moving forward, most individual institutions have the real potential to reverse the national trend, restoring orthopedics to its position as a major profit contributor. Across orthopedics, the Innovations Center found a substantial opportunity to improve margins by focusing attention on the most-leveraged areas for improvement.

Key Drivers: Commercial Rates, Implant Costs

The sensitivity analysis below illustrates the relative return on investment for five different management initiatives—reducing implant costs, reducing premium implant use, reducing LOS, improving payer mix, and negotiating for more favorable commercial contracts. The bars reveal the impact on total profit by changing each profit driver by 10 percent. For example, either improving commercial contracts or implant acquisition costs by just 10 percent would nearly double total profit for the joint replacement sub-service line.

A Host of Controllable Factors

Failure to control implant costs and optimize reimbursement are the most common reasons for profit shortfalls in orthopedics, although not the only ones. Suboptimal distribution of procedure cases, unfavorable payer mix, and losing profitable patients to specialty competition can also be major contributors to disappointing margins. Accordingly, the Innovations Center identified four key management ambitions in orthopedics that executives should take as a starting place for margin improvement efforts.

#1 Controlling Implant Costs
#2 Optimizing Reimbursement
#3 Improving Product (and Payer) Mix
#4 Containing Specialty Competition

Change in Total Profit by Management Initiative

Joint Replacement

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Change in Total Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Reimbursement Improvement by 10%</td>
<td>98%</td>
</tr>
<tr>
<td>Implant Price Reduction by 10%</td>
<td>92%</td>
</tr>
<tr>
<td>Premium Implant Use Reduction by 10%</td>
<td>35%</td>
</tr>
<tr>
<td>Payer Mix Improvement by 10%</td>
<td>31%</td>
</tr>
<tr>
<td>LOS Reduction by 10%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Source: Innovations Center interviews and analysis.
Low Revenues

- Poor Commercial Payments (12%)
  - Failure to Negotiate Appropriate Contract Terms
  - Insufficient Revenue Capture
  - Coders Poorly Trained
  - Collectors Too Passive
- Medicare-Heavy Payer Mix (8%)
  - High Proportion of Elderly in Population
- Low Medicare Wage Index (5%)
  - Failure to Cultivate Commercial Business
- Implant Costs Above Norm (37%)
  - Ineffective Vendor Negotiation
  - Inability to Control Utilization
- Inpatient LOS Longer Than Average (5%)
  - Sicker Patient Population
  - Inefficient Care Patterns
  - No "Center of Excellence" Initiative
- High Local Labor Costs (8%)
  - Failure to Manage Mix Actively
- Competitors Skimming Best Patients (12%)
- High Proportion of Elderly in Population (8%)
- Lack of Surgeon Support (5%)
  - Volumes Too Low
  - No Surgeon Involvement
  - No Dedicated Hospital Resources

High Costs

- Implant Costs Above Norm (37%)
  - Ineffective Vendor Negotiation
  - Inability to Control Utilization
- Inpatient LOS Longer Than Average (5%)
  - Sicker Patient Population
  - Inefficient Care Patterns
  - No "Center of Excellence" Initiative
- High Local Labor Costs (8%)
  - Failure to Manage Mix Actively
- Competitors Skimming Best Patients (12%)
- High Proportion of Elderly in Population (8%)

Suboptimal Product Mix

- Competitors Skimming Best Patients (12%)
- High Proportion of Elderly in Population (8%)
- High Medicare Wage Index (5%)
  - Failure to Negotiate Appropriate Contract Terms
- Patients Prefer Competitor (5%)
  - Insufficient Negotiating Leverage
  - Hospital Negotiators Outmatched
  - Lack of Surgeon Support
- Clinical Results Favorable for Premium Implants (12%)
  - Inefficient Operations
  - Lack of Revenue Sharing Opportunity
- Surgeons Dissatisfied (8%)
- No Dedicated Hospital Resources (8%)
- No "Center of Excellence" Initiative (5%)
  - Inefficient Operations
  - Lack of Revenue Sharing Opportunity
- Facility Unattractive (5%)

Special Note

Tactics for managing the impact of new clinical technologies, including orthopedic implants and biologics, are compiled in the recent Health Care Advisory Board study Profiting from Innovation: Managing the Impact of New Clinical Technologies. Members can order copies at no charge by calling 202-266-5920 or visiting our website at http://advisory.com.
Ambition #1—Controlling Implant Costs

Negotiating Discounts Is First Step

The first step in managing orthopedic implant costs is to attempt to reduce the price paid for each implant. Although manufacturers publish list prices annually, most hospitals pay a lower price; negotiating for price discounts in exchange for volume or market share guarantees is an accepted industry practice. Still, a surprisingly large group of institutions simply pay list prices for implants. The reasons for this failure to negotiate are varied, but seldom insurmountable. If nothing else, hospitals currently paying list price or receiving a token reduction through a group purchasing program should investigate the possibility of negotiating discounts directly with manufacturers.

Limiting Vendors a Powerful Lever

Vendors are often more willing to give price discounts in exchange for guarantees of volumes or market share. In practice, this often requires hospitals to limit the number of manufacturers from which they purchase implants. This type of standardization appears to get results at the negotiating table: a survey of 61 hospital orthopedics programs showed a strong correlation between the number of vendors used and the magnitude (and direction) of implant cost changes.

Sizable Reductions Possible

Hospitals have the potential to reduce their costs significantly by pursuing preferred pricing from vendors. Based on manufacturers’ 2002 implant list prices and the average selling prices paid in a survey of hospitals the same year, hospitals can reasonably expect to receive a discount of 20 to 25 percent off the manufacturers’ list. Actual discounts received depend upon a multitude of factors; individual institutions may achieve discount levels much lower or higher than the average.
Also Important — Reducing Use of Premium Models

In the future, regulating what types of implants should be used, not just which manufacturers to buy from, will be necessary to stem the tide of implant expenses. Premium-level orthopedic implants can cost thousands of dollars more than standard models, while their benefits may not be appropriate for every patient. On the whole, doctors—and patients—are reluctant to use implants that may not offer the absolute best clinical outcomes. That said, many institutions have made substantial progress toward reducing implant costs by getting orthopedists to decide on appropriate use of premium implants. Even some prominent academic orthopedic departments, where early adoption of advanced technologies is encouraged, have acted to limit the use of premium-level implants to the most appropriate patients.

Participation of Surgeons Is Critical

Without surgeon involvement and agreement, efforts to standardize implants are doomed to failure—or else to alienate the surgeons on staff. Moreover, at the negotiating table, the presence of high-volume surgeons signals hospital commitment to standardization efforts and increases the likelihood that vendors will provide some relief.

Surgeons can also be a nearly insurmountable obstacle to implant cost control efforts. A major cause of surgeons’ recalcitrance is the strong ties they have with manufacturers, and in particular with sales representatives. It is routine practice for orthopedic salespeople to be present in the operating room for surgical procedures, for instance. Several leading institutions have addressed manufacturer-surgeon entanglements head-on by instituting policies that restrict vendor access to hospital facilities.

Premium Implants in Orthopedics

<table>
<thead>
<tr>
<th>Technology</th>
<th>Clinical Benefits</th>
<th>Additional Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metal-on-metal hips</td>
<td>Increased durability</td>
<td>$2,500</td>
</tr>
<tr>
<td>Ceramic hips</td>
<td>Increased durability</td>
<td>$2,500</td>
</tr>
<tr>
<td>Oxinium knees</td>
<td>Increased durability and strength</td>
<td>$2,000</td>
</tr>
<tr>
<td>Mobile-bearing knees</td>
<td>Increased durability, better range of motion</td>
<td>$700</td>
</tr>
<tr>
<td>Growth factors</td>
<td>Faster healing</td>
<td>$3,000–$6,000</td>
</tr>
<tr>
<td>(spine)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth factors</td>
<td>Faster healing</td>
<td>$3,000–$6,000</td>
</tr>
<tr>
<td>(fracture)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An Intimate Relationship

“[Sales representatives] see the physician as their customer, not the hospital. They look at the hospital just as a place to conduct business. The rep has a better relationship with the surgeon than the hospital does.”

Scott Crandall
Senior Product Manager
Novation
Cost Increases Largely Uncompensated

Over the past several years, payers have not been keeping pace with cost increases in orthopedics. On the commercial side, ideally insurers would reflect actual hospital costs by paying on a percent of charges basis. A commercial contract based on percent of charges is the most preferable option. However, most commercial contracts offer substantial room for improvement: nationally about two-thirds of commercial reimbursement is not paid as percent of charges, with 29 percent paid as case rate and another 34 percent as per diem.

Most Not Taking Advantage of Carve-Outs

Increasingly, hospitals are pursuing—and achieving—contracts with commercial payers that carve implants and prosthetics out of case rate and per diem reimbursement. In that effort no better time than the present, when the hospital industry has strong negotiating leverage; if (or when) hospital leverage declines, insurers may be less willing to take on the risk of implant costs.

One caveat—the impact of implant carve-outs is limited by the payment mix of the orthopedic service line. In areas such as joint replacement, with a high percentage of fee-for-service Medicare payments, contracting for implant carve-outs on the commercial side may not have a major impact on profits. For commercial-dominated services such as spine surgery, on the other hand, carving out implant costs can be a boon to profitability.
Carve-Outs Improving Commercial Revenues
Under the terms of implant carve-out contracts, orthopedic implants are paid for on a “pass-through” basis, typically at approximately sixty percent of charges. These pass-through payments usually result in a substantial net gain in procedure profitability. Moreover, pass-through arrangements mitigate hospitals’ risk for future implant price increases; as long as the agreement remains in place, insurers, not hospitals, will be at financial risk for rising implant costs. (The same effect can be achieved by carving out the entire reimbursement for an orthopedic procedure, not just the implant costs alone, on a percent-of-charges basis.)

Projected Impact of Implant Carve-Outs
Typical Hip Replacement Case, Commercial Payer

<table>
<thead>
<tr>
<th></th>
<th>Before Carve-Outs</th>
<th>After Carve-Outs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Per Diem</td>
<td>Per Diem</td>
</tr>
<tr>
<td></td>
<td>(5 days at $1,500 per day)</td>
<td>(5 days at $1,500 per day)</td>
</tr>
<tr>
<td></td>
<td>$7,500</td>
<td>$7,500</td>
</tr>
<tr>
<td></td>
<td>$10,500</td>
<td>$11,500</td>
</tr>
<tr>
<td>implants</td>
<td>$4,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>other costs</td>
<td>$6,500</td>
<td>$6,500</td>
</tr>
<tr>
<td></td>
<td>$3,000 net loss</td>
<td>$1,000 net profit</td>
</tr>
</tbody>
</table>

Expanding Stop-Loss for Short-Stay Procedures
New, less-invasive techniques and innovations in implant design are simultaneously lowering length of stay and increasing costs. As a result, many procedures incur costs that far exceed per diem reimbursement levels. In per diem contracts, leading hospitals are instituting provisions triggering stop-loss terms for short-stay, high-cost procedures invasive surgery.

New Contractual Language
“If stay is three days or less and charges exceed an average of $4,000 per day, reimbursement for that stay only will be at a 40 percent discount from charges in lieu of the per diem rate.”
Ambition #3—Improving Product and Payer Mix

Not All Breadwinners the Same

One lever hospitals have for improving margins is shifting the composition of their orthopedic staff. The financial contribution of some sub-specialists is considerably better than others—spine surgeons, for example, earn three times more in contribution profit for the hospital than orthopedists who heavily focus on medical cases.

Some Payers (Much) Better Than Others

The imperative to manage payer mix derives from a simple truth—some payers reimburse at better rates than others. As a result, orthopedic programs with a favorable payer mix often report significantly better financial performance than those with less desirable payers. Specifics vary from market to market, but frequently workers’ compensation and commercial insurers pay the highest rates, followed by Medicare, with Medicaid (and of course uncompensated care) trailing behind. Data from one academic medical center in the Midwest illustrates the striking disparities between payers, with workers’ compensation paying nearly three times what Medicaid provides.

<table>
<thead>
<tr>
<th>Contribution Profits per Day</th>
<th>National Inpatient Medicare, 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spine</td>
<td>$1,045</td>
</tr>
<tr>
<td>Joint</td>
<td>$862</td>
</tr>
<tr>
<td>General Ortho (Surgical)</td>
<td>$725</td>
</tr>
<tr>
<td>Hand</td>
<td>$624</td>
</tr>
<tr>
<td>Fracture Care (Surgical)</td>
<td>$515</td>
</tr>
<tr>
<td>Foot</td>
<td>$478</td>
</tr>
<tr>
<td>General Ortho (Medical)</td>
<td>$419</td>
</tr>
<tr>
<td>Fracture Care (Medical)</td>
<td>$274</td>
</tr>
</tbody>
</table>

Source: Innovations Center Futures Database.

<table>
<thead>
<tr>
<th>Inpatient Surgery Reimbursement as Percentage of Charges</th>
<th>Academic Medical Center</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicaid</td>
<td>26%</td>
</tr>
<tr>
<td>Medicare</td>
<td>33%</td>
</tr>
<tr>
<td>HMO “A”</td>
<td>45%</td>
</tr>
<tr>
<td>Blue Cross</td>
<td>53%</td>
</tr>
<tr>
<td>Workers' Comp</td>
<td>76%</td>
</tr>
</tbody>
</table>

Source: Innovations Center interviews.
Fine-Tuning Payer Mix
Executives often see payer mix as an attribute of the local market, rather than a controllable factor. At worst, the idea of managing payer mix can carry the connotation of failing to serve the most vulnerable members of the community—a course none could recommend in good conscience. However, individual institutions have the real potential to inflect payer mix without compromising mission or values by actively growing volumes associated with the most profitable payers. This effort could take the form of emphasizing service offerings that strongly favors a commercial-age population, such as spine surgery; alternatively, institutions could actively reach out to patient populations— or employers—associated with more profitable reimbursement.

Representative Tactics for Shifting Payer Mix

Workers’ Compensation Liaison
Orthopedics program hires dedicated staff member to manage relationships with state workers’ compensation program and local employers; goal is to grow volumes of workers’ comp patients

Active Employer Outreach
Orthopedics program markets “Return to Work Program”—quick recovery protocols and advanced rehab capabilities for joint and spine surgeries—to local employers; goal is to capture disproportionate share of commercial-insured patients

Boomer-Focused Marketing
Hospital highlights innovative technologies, surgeons, and facilities, and aggressively markets to active Baby Boomers—featuring minimally invasive joint and back surgery, for example; goal is to maximize market share of the growing commercial-insured population

Marketing Services to Select Patients
Beyond surgeon recruitment, a number of leading institutions have been successful at selectively growing volumes within orthopedic subspecialties through marketing initiatives. Some have had success with consumer advertising campaigns alone, but the centerpiece of targeted marketing approaches is frequently the establishment of specialized centers—joint centers, spine centers, or sports medicine centers being some of the most popular options. Specialized subspecialty programs offer clear brand definition for consumers, as well as providing a single point of entry for patients. Moreover, creating dedicated centers for particular procedures often spurs operational improvements, motivating surgeons and staff to streamline care protocols and redouble cost control efforts.

Common Orthopedic Specialty Centers

Spine Center
- Multidisciplinary program for treating back and spine condition
- Spinal fusion
- Discectomy
- Outpatient rehabilitation
- Pain management

Joint Replacement Center
- Patient-focused joint program includes pre- and post-operative therapy as well as inpatient component
- Knee replacement
- Hip replacement
- Outpatient rehabilitation
- Post-surgical evaluation

Sports Medicine Center
- Comprehensive provider of sports medicine services; targets professional, high school, and weekend athletes
- Knee arthroscopy
- Outpatient rehabilitation
- Bracing and orthotics
- Gait analysis
Outsized ASC Risk for Orthopedics

While non-hospital competition for outpatient business is a familiar story for most hospitals, orthopedics has risen to the forefront of outpatient competition issues in recent years. Offerings such as ophthalmology and chemotherapy have almost entirely moved from hospital outpatient facilities to ASCs and physician offices. While this first exodus from the hospital outpatient setting is largely over, a second wave of businesses has begun to shift out of the hospital and into ASCs, in which orthopedics is on the vanguard of this new generation of hospital outpatient émigrés.

New Technologies, Codes Are Boons for ASCs

The same innovations that originally spurred the outpatient revolution in orthopedics—minimally invasive techniques featuring endoscopes and laparoscopes—are now being refined for applications other than the knee, including other joints, spinal fusion, and discectomies. Many of these new applications are short-stay inpatient procedures; however, as more procedures migrate outpatient the target for competition grows ever larger. Exacerbating the situation, more CPT codes are being added to the Medicare ASC fee schedule for orthopedics than any other service line, allowing ASCs to compete for even more procedures that were once secure in the hospital outpatient setting.

New Outpatient Orthopedic Procedures

- Vertebroplasty/Kyphoplasty
- Arthroscopic Rotator Cuff Repair
- Arthroscopic Ligament Reconstruction
- Unispacer Knee Implant

New ASC Codes, 2003

- Dermatology
- Ophthalmology
- Neurosurgery
- Cardiovascular
- GI
- Gynecology
- ENT
- Plastic Surgery
- General Surgery
- Urology
- Orthopedics

Note: Bubble size corresponds to total volumes. Source: Innovations Center Futures Database.

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Surgical Hospitals Eyeing Inpatient Volumes
The past several years have seen the rise of a new breed of inpatient orthopedic competitor: the specialty surgical hospital. Hospitals around the country are finding new investor-owned or surgeon-financed competitors springing up, with several others in the planning stages. Perhaps most threatening is the establishment of national chains, Charlotte, N.C.-based OrthoNeuro, for example.

Cherry-Picking the Most Profitable Cases
Even more concerning than the loss of total volumes to surgical hospitals is the potential to lose the most profitable cases. Revision joint replacements, multi-level spinal fusions, and other unprofitable cases are unlikely targets for for-profit surgical hospitals. Instead, competitors will focus on the youngest, healthiest, and most profitable patients, leaving hospitals a greater percentage of unprofitable cases. If surgical hospitals selectively take just 10 percent of commercial patients and no Medicare patients, the effects can be severe.

OrthoNeuro in Brief
- Started by Stephen Puckett, founder of MedCath
- First for-profit specialty hospital chain opened in Austin; company plans to open three to four new facilities annually
- Specializes in orthopedic and spine surgery and pain management

Addressing Specialty Competition
Hospitals have embraced a range of tactics in response to specialty competition, ranging from the most combative to the most conciliatory. Although by no means comprehensive, the list below is a survey of best practices for containing specialty competition, depending on local market circumstances.

Discount-Based Exclusive Contracts
Discounts on outpatient/inpatient cases given to managed care companies in return for exclusive contracts

Increased OR Efficiency
OR gets an overhaul with patient tracking system to speed throughput

Suite Block Lease
Hospitals lease interventional radiology or endoscopy suites to physicians in discrete, four-hour blocks

JV-Driven Recruiting
Hospitals use equity joint ventures to attract new physician talent

Restricted ORs
Hospital carves out ORs for high-volume surgeons

Hospitals lease interventional radiology or endoscopy suites to physicians in discrete, four-hour blocks

Participating Bond Transaction
Specialty facility is financed in part by selling participating bonds to physicians

JV-Enabled Outreach
Hospital establishes outreach program with participating physicians to exploit underserved market

Appropriately hiring specialists to replace specialists defecting to ASCs

More Efficient Use of Capital Equipment
Capital equipment is shared by several facilities

Before Competition
10% of Commercial Patients Poached

Profit Impact of Surgical Hospital Competition
Typical Hospital

<table>
<thead>
<tr>
<th>Spine Surgeries</th>
<th>Joint Replacements</th>
</tr>
</thead>
<tbody>
<tr>
<td>$422,494</td>
<td>$380,244 (10%)</td>
</tr>
<tr>
<td>$90,514</td>
<td>$63,360 (30%)</td>
</tr>
</tbody>
</table>

1 Assumes 250 spine surgeries and 300 joint replacements. Source: Innovations Center analysis.
### Key Considerations for Orthopedics Strategy in the Decade Ahead

#### In Search of Drivers of Differentiation

Orthopedics is regarded by many hospitals as a “bread-and-butter” service—robust volumes with patients (and referring physicians) perceiving little difference from hospital to hospital, or surgeon to surgeon. As a result, shifting market share often rests upon the ability to successfully brand and market oneself as a “center of excellence,” either as an entire service line or as key profitable niches (spine centers, sports centers, Baby Boomer joint camps). The key question here for hospital executives to ask: “What represents an orthopedics center of excellence—not just today, but five and ten years from now?” Summarized below are some key attributes for consideration.

#### Defining an Orthopedics Center of Excellence

<table>
<thead>
<tr>
<th>Key Attributes</th>
<th>Key Considerations</th>
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| **Patient Volumes**  | • Market share paramount: #1 or #2 in local market share key to contracting, branding leverage  
|                      | • Market movers: New technology, dedicated specialty centers, physician renown, service excellence  
|                      | • No volume threshold: No definitive evidence of volume-outcomes or volume-profit relationships  |
| **Key Lines of Business** | • Top profit drivers: Spine and sports  
|                      | • Secondary keys to success: Joint replacement, hand surgery, foot and ankle surgery, pain management  |
| **Technology Investment** | • Mission critical: Minimally invasive surgery  
|                      | • Physician recruiting/retention tool: Computer-aided surgery  
|                      | • New market makers: Kyphoplasty, vertebroplasty, unicompartmental knee replacement, hip resurfacing  |
| **Facility Investment** | • Inpatient: Dedicated space and staff, ranging from dedicated ORs to standalone specialty hospitals  
|                      | • Outpatient: Freestanding ortho ambulatory centers, with ORs, imaging, rehab, sports complex, physician offices  |
| **Academic Research** | • Top distinction: Becoming innovator in new era of biologicals—Growth factors, gene-based therapies, tissue engineering, stem cell research  |
| **Clinical Research** | • Clinical outcomes in minimally invasive surgery—Hip and knee replacement, non-traditional arthroscopy  
|                      | • Clinical outcomes in new spine procedures—Kyphoplasty, vertebroplasty, artificial discs  
|                      | • Future prospects: Application of biologics to clinical practice  |
Managing the Service Line for Profitable Growth

While determining what constitutes a center of excellence may be challenging in and of itself, the next set of immediate questions—"How do we get there? How do we ensure a profitable course?"—is where the real work begins. Provided below is a summary of the key management ambitions discussed in this brief, accompanied by core competencies necessary to successfully manage the orthopedics service line in the future. In the full-length Future of Orthopedics service line report, additional diagnostic worksheets, benchmarking tools, and technology adoption report cards will help member institutions further assess their market circumstances and chart an optimal course for future orthopedics strategy.

Core Competencies for Future Success

<table>
<thead>
<tr>
<th>Management Ambitions</th>
<th>Core Competencies</th>
<th>Key Questions</th>
</tr>
</thead>
</table>
| Controlling Implant Costs | • Negotiating with vendors  
   • Standardizing physician choice  
   • Managing premium mix | • Do we pay below list price for the majority of implants? Who at our institution has responsibility for price negotiation and utilization review?  
   • Have we established guidelines for standardizing physician choice for commonly used implants?  
   • Do we limit the involvement of manufacturer sales representatives in real-time implant purchasing decisions (e.g., in the operating room)? |
| Optimizing Reimbursement | • Contracting with insurers  
   • Creating carve-outs, stop-loss provisions  
   • Perfecting revenue capture | • Have we conducted a profitability-by-payer analysis?  
   • Have we maximized our contract revenues with commercial insurers for orthopedic services?  
   • Do we have agreements with commercial insurers to pay for implant costs on a pass-through or percent-of-charges basis? |
| Marketing the Program | • Attracting Baby Boomer share  
   • Leveraging patient consumerism with new technology  
   • Branding destination center through service excellence | • Do we have a market opportunity to brand our orthopedics services as a "center of excellence"?  
   • Have we considered dedicating (additional) resources to specialty programs (e.g., spine center, sports center, Baby Boomer joint camp) — and what is the expected return on investment?  
   • Are our orthopedic surgeons more academic (favoring research-oriented, high-acuity musculoskeletal institutes) or more entrepreneurial (favoring high-volume, high-efficiency specialty surgery centers)? |
| Managing Physician Relations | • Understanding relative drivers of physician (dis)satisfaction— income, autonomy, operational efficiency, dedicated space and staff, technology investment, conducive research environment | • What is the current state of our relationship with our orthopedic surgeons? Do we understand the drivers of physician (dis)satisfaction?  
   • Do our orthopedic surgeons participate in, or are they planning, a freestanding ambulatory surgery center? Have we considered joint venturing with, or employing, orthopedic surgeons?  
   • Is our market vulnerable to the entry of a specialty orthopedics hospital— is one already planned? |