BIOWORLD® & MEDICAL DEVICE DAILY™

ARTHRITIS REPORT: DRUG AND MED-TECH INNOVATION AND ECONOMICS

2009

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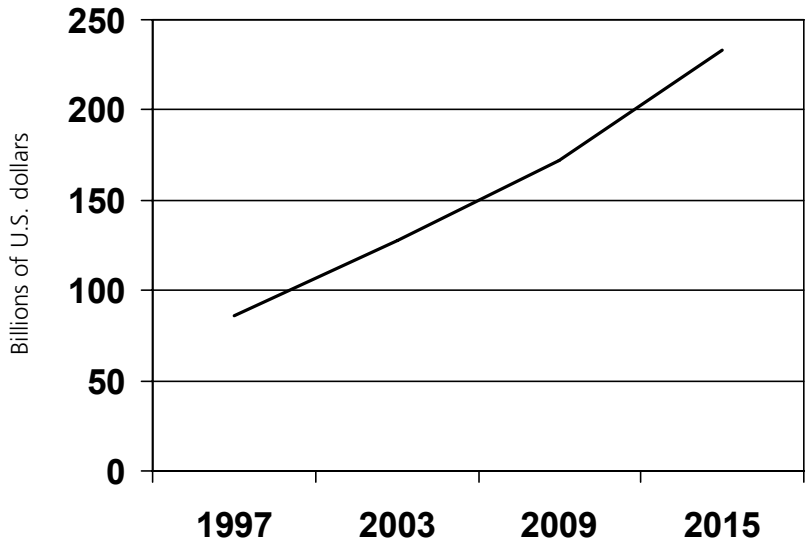
INDUSTRY DATA

Annual Arthritis Burden in the U.S.

46 million adults with self-reported, doctor-diagnosed arthritis
Nearly 20 million people with activity limitations
More than $130 billion in total costs
More than $80 billion in medical costs
36 million outpatient visits
750,000 hospitalizations
9,500 deaths

SOURCE: Centers for Disease Control and Prevention and BioWorld research.

Cost to Treat Arthritis in the U.S.

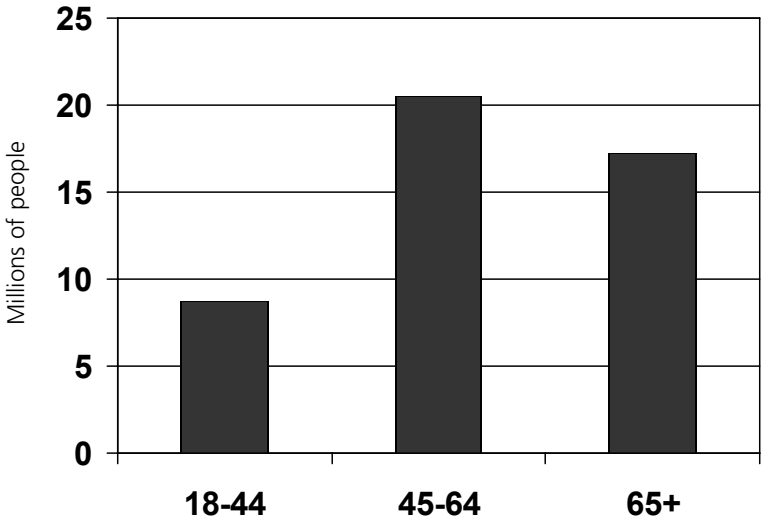


SOURCE: Centers for Disease Control and Prevention.

Major Types of Arthritis

Adult Onset Still's Disease
Ankylosing Spondylitis
Arthritis In Children
Arthritis in Pets
Arthritis Joint Pain
Arthritis Pain
Aseptic Necrosis
Avascular Necrosis
Basal Joint Arthritis
Behcet's Disease
Bursitis
Carpal Tunnel Syndrome
Celiac Disease
Charcot's Joints
CMC Arthritis
Complex Regional Pain
Costochondritis
CPPD
Crohn's Disease
Degenerative Joint Disease
Dermatomyositis
Diffuse Idiopathic Skeletal
Discoid Lupus Erythematosus
Ehlers-Danlos Syndrome
Eosinophilic Fasciitis
Familial Mediterranean Fever
Felty Syndrome
Fibromyalgia
Fifth Disease
Forestier Disease
Fungal Arthritis
Gaucher Disease
Giant Cell Arteritis
Gonococcal Arthritis
Gout
Henoch-Schonlein Purpura
Infectious Arthritis
Inflammatory Bowel Disease
Joint Hypermobility
Juvenile Arthritis
Kawasaki Disease
Legg-Calve-Perthes Disease
Lupus
Lyme Disease
Marfan Syndrome
MCTD / UCTD
Mycotic Arthritis
Myositis
Osgood-Schlatter Disease
Osteitis Deformans
Osteoarthritis
Osteonecrosis
Osteoporosis
Paget's Disease of Bone
Palindromic Rheumatism
Polyarteritis Nodosa
Polymyalgia Rheumatica
Polymyositis
Pseudogout
Psoriatic Arthritis
Raynaud's Phenomenon
Reactive Arthritis
Reflex Sympathetic
Reiter's Syndrome
Restless Legs Syndrome
Rheumatic Fever
Rheumatoid Arthritis
Scleroderma
Septic Arthritis
Sjogren's Syndrome
Somatotroph Adenoma
Spinal Stenosis
Takayasu Arteritis
Temporal Arteritis
Tendinitis / Tendonitis
Tietze's Syndrome
TMJ / TMD
Tuberculous Arthritis
Ulcerative Colitis
Vasculitis
Viral Arthritis
Wegener's Granulomatosis
Other Related Conditions

Prevalence of Arthritis by Age



SOURCE: Centers for Disease Control and Prevention.

Denosumab: A Future Standard-Bearer for Rheumatoid Arthritis and Osteoporosis

Amgen Inc.'s Denosumab is a monoclonal antibody designed to inhibit osteoclast formation by binding to the RANK ligand. The RANK ligand is an essential regulator of osteoclasts — the cells that break down bone.

In addition to four Phase III and two Phase II trials in postmenopausal osteoporosis, Amgen has evaluated denosumab's effects on bone erosions in rheumatoid arthritis (RA) in a Phase II study. Amgen recently pulled together all the requisite data and filed with the FDA for a biologics license application in December 2008 in the indications for treatment and prevention of postmenopausal osteoporosis (PMO) in women, and treatment and prevention of bone loss in patients undergoing hormone ablation for either prostate or breast cancer.

Thousand Oaks, Calif.-based Amgen had said a new drug application for denosumab was expected in early 2009, which could put the drug on the market as early as the latter half of the year. But the company will have to figure out how to get the drug to patients, since Amgen does not have its own primary care sales force. The company has not yet outlined its marketing plans for the drug, but definitely is seeking a marketing partner.

The potential for denosumab in the $7 billion osteoporosis market also will depend on how it stacks up to bisphosphonates like Fosamax (alendronate, Merck & Co. Inc.).

In addition to osteoporosis and RA, Amgen also is pursuing denosumab in late-stage trials in oncology indications, such as the prevention of cancer-related bone loss and the prevention of bone metastases.

Denosumab Pipeline

Prevention of bone metastases	Phase III
Postmenopausal osteoporosis	Phase III
Bone loss induced by hormone ablation therapy in breast cancer or prostate cancer	Phase III
Prevention of cancer-related bone damage in breast cancer, prostate cancer and solid tumors and multiple myeloma	Phase III
Rheumatoid arthritis	Phase II

SOURCE: www.amgen.com.

Amgen's Denosumab Meets High Expectations in FREEDOM Study

The much-anticipated September 2008 data from Amgen's pivotal fracture study of denosumab in postmenopausal women demonstrated a significant reduction in vertebral fracture rate and relatively clean safety profile, ending a month and a

half of speculation among investors since top-line data were released in late July.

While the firm reported previously that the Phase III FREEDOM (Fracture REduction Evaluation of Denosumab in Osteoporosis Every Six Months) trial met its primary endpoint of reducing the incidence of new vertebral fractures compared to placebo, analysts urged caution pending the release of more detailed data for the overall benefit and risk picture, specifically waiting for the actual fracture reduction rate and the incidence of adverse events such as infections. (See "Amgen's Denosumab Meets All Endpoints in Long Awaited Trial," below.)

"Expectations were very high," analyst Michael Aberman, of Credit Suisse Securities LLC, wrote in a research note, "but we believe the data have lived up to those expectations."

Results from the FREEDOM study, presented in a poster session during the American Society of Bone and Mineral Research (ASBMR) meeting in Montreal, showed that denosumab statistically significantly reduced vertebral fractures by 68 percent. While the company advised against direct comparisons to other drug trials, that figure appears to put denosumab on par with Novartis AG's Reclast (zoledronic acid), a once-yearly injectable bisphosphonate, which has shown about a 70 percent fracture reduction in studies.

Denosumab also significantly reduced hip fractures by 40 percent and other nonvertebral fractures by 20 percent. Importantly, the safety data also were clean, "with no notable imbalances that would hinder denosumab's chances at the FDA or commercially," Aberman wrote.

Analysts had been concerned particularly with the rate of infection, especially after results from the 332-patient DEFEND study showed twice as many infections requiring hospitalization — including pneumonia and sepsis — in the denosumab-treated group vs. placebo. But safety data from the 7,868-patient FREEDOM study showed no similar trends.

The overall rate of infection in the denosumab group was 52.9 percent vs. 54.4 percent in the placebo group. Infections classified as serious adverse events occurred in 4.1 percent (159 patients) receiving denosumab and in 3.4 percent (133 patients) on placebo.

Adverse events leading to discontinuation of the study drug involved 4.9 percent of denosumab patients and 5.2 percent in the placebo arm, and patient deaths in the study were at a rate of 1.8 percent (70 deaths) in the denosumab group vs. 2.3 percent (90 deaths) for placebo.

Those efficacy and safety data "place denosumab on roughly equal footing with bisphosphonates," analyst Eric Schmidt, of Cowen and Co., wrote in a research note.

The task for Amgen will be to differentiate its drug from bisphosphonates such as Reclast and Fosamax (alendronate), which is sold as a branded product by Whitehouse Station, N.J.-based Merck & Co. Inc. or in generic form. In a separate study presented at the ASBMR meeting, data showed that more than 75 percent of patients preferred denosumab's twice-yearly injections over a weekly oral pill (Fosamax or generic alendronate).

Clinician Ethel Siris, of Columbia University, who co-authored the study, said during an analyst briefing that she would consider denosumab, if approved, as a first-line treatment option for patients. "I think there are a number of options, and I think [denosumab] is right there with the others," she said.

Some, however, still remained cautious. Cowen and Co. analysts warned that denosumab would have to go up against the 10-year safety record of bisphosphonates, though the drug's clean safety profile, efficacy and convenience should make it the "drug of choice in the 20 percent of patients who don't tolerate oral bisphosphonates."

Analyst Christopher Raymond, of Robert W. Baird & Co., said discussions with physicians at ASBMR indicated that they "seemed positively inclined to the data, but somewhat noncommittal as to whether they will actually stock and use the drug."

Arthritis, Osteoporosis and Inflammation Deals: 2007-2008

Bionomics Signs Merck Serono in MS, Autoimmune Partnership

Australian firm Bionomics Ltd. landed a collaboration with Merck Serono in June 2008 aimed at developing an oral treatment for multiple sclerosis and other autoimmune diseases based on compounds from Bionomics' Kv1.3 program. Under the terms, Bionomics gets an up-front payment of $2 million, in addition to committed research funding, from Merck Serono, a division of Darmstadt, Germany-based Merck KGaA. In addition, Merck Serono will support all development activities, including clinical work, and will pay Bionomics development and commercial milestones of up to $47 million for each compound selected. Beyond that, Adelaide, Australia-based Bionomics will be eligible to receive undisclosed royalties on net sales of any products resulting from the collaboration.

The compounds at the center of the deal were discovered by Bionomics and target the potassium ion channel Kv1.3, a known modulator of the immune system. Kv1.3 is a target found on immune cells that are associated with nerve cell damage in patients with MS, and by inhibiting the proliferation of those cells, Bionomics and Merck Serono might be able to treat MS, as well as other autoimmune conditions such as arthritis. Bionomics CEO Deborah Rathjen called the deal "an important milestone" for the company that validates its discovery approach.

The partnership also puts the firm's work in autoimmune diseases into the hands of a company with a successful track record in MS. Merck Serono markets Rebif (interferon beta-1a), a disease-modifying drug approved to treat the relapsing forms of MS, as well as Novantrone (mitoxantrone), which is targeted for worsening forms of MS. For Bionomics, the deal bolsters its growing pipeline of drugs for cancer and central nervous system disorders.

Debiopharm and Airmid Sign Agreement for Peptide for Autoimmune Diseases

Debiopharm Group, of Lausanne, Switzerland, in April 2008 signed an option and license agreement with Airmid Inc., of Redwood City, Calif., to develop a ShK peptide called Debio 0824, a highly specific Kv1.3 potassium channel blocker, currently in early preclinical development for the treatment of autoimmune diseases.

Under the terms of the agreement, Debiopharm will pay Airmid an option fee for signature of the contract. If Debiopharm exercises its exclusive option to license in the product for further development and worldwide commercialization, it will pay Airmid an up-front fee and milestones, as well as

running royalties for the license. In vitro data showed that ShK peptides discovered by Airmid's founders are potent and selective Kv1.3 inhibitors with a strong potential to treat autoimmune diseases.

Preclinical data showed that ShK peptides suppress the activation and inhibit the proliferation of auto-reactive human and rat T effector memory cells at concentrations 20 to 80 times lower than the proliferation of naive and central memory T cells. In addition, ShK peptides significantly improved disease symptoms in animal models of several autoimmune disorders. ShK peptides could prove useful in treating autoimmune disorders such as psoriasis, multiple sclerosis and rheumatoid arthritis, without significant impairment of the immune response.

Pacific Biometrics Signs Contracts for RA Immunological Markers

Pacific Biometrics Inc., of Seattle, said in April 2008 it signed a series of long-term contracts worth a combined $3 million with an unnamed major multinational sponsor to test for improvements in immunological markers in patients with rheumatoid arthritis. The contracts relate to a series of clinical trials, part of a global Phase II and Phase III program, investigating a potential follow-on biological approach for the treatment of rheumatoid arthritis.

Assuming the scope of the studies remains unchanged, the contracts will contribute to revenues over more than five years, starting in fiscal 2008. Pacific Biometrics will provide the sponsor with arthritis biomarker testing on samples collected to support the sponsor's clinical development program, eventually expected to result in a new drug application filing with the FDA and equivalent filings with regulatory agencies in other jurisdictions.

The initial phase of testing for this program commenced in the first quarter of 2008 and testing is anticipated to continue through the third quarter of 2015, although several of the studies will be completed by 2012.

Karo Bio and Zylus Cadila Collaboration for Inflammatory Diseases

In February 2008 Karo Bio, of Stockholm, Sweden, and Zylus Cadila, of Ahmedabad, India, entered into a three-year collaboration to develop new drugs for the treatment of inflammatory diseases.

The goal is selective glucocorticoid receptor modulators for conditions such as rheumatoid arthritis, bowel disorders, psoriasis and asthma. Zylus Cadila will carry out preclinical work, filing of the investigational new drug application and preclinical studies and human clinical trials. Karo will use its expertise in nuclear receptor drug discovery including structural biology, drug design and compound characterization. Financial terms were not disclosed.

Aastrom Raises $13.5M for Regenerative Products

With a Phase III trial under way using regenerative stem cell products to treat osteonecrosis of the

femoral head, in October 2007 Aastrom Biosciences Inc. entered agreements to raise $13.5 million through a registered direct offering of stock and warrants. The Ann Arbor, Mich.-based company said it will sell approximately 11.8 million units at a price of $1.14 per unit. Each unit will consist of one share of common stock and one five-year warrant to purchase an additional half-share of common stock for $1.5875 per share. If all warrants are exercised, Aastrom stands to get another $9.4 million.

The funds raised will supplement the $28.3 million in cash, equivalents and short-term investments Aastrom reported as of June 30, the end of its 2007 fiscal year. At the time, the company had projected a burn rate of $1.7 million per month in the coming year. At that rate, the combination of existing cash and new money should give the company about a two-year runway. In its prospectus, Aastrom said proceeds from the offering will be used for clinical trials, research and development, manufacturing, working capital and general corporate purposes, including the possible acquisition or development of complementary business activities.

Clinical trials alone are keeping the company fairly busy. In addition to the ongoing Phase III trial in osteonecrosis of the femoral head, Aastrom is conducting an open-label study in Spain for the same indication. Positive data from both trials could be used to support a biologics license application for Aastrom's Bone Repair Cell (BRC) product, a mixture of stem and progenitor cells derived from a patient's own bone marrow.

Aastrom also expects data this month from a Phase I/II fracture trial and is conducting a Phase IIb trial in critical limb ischemia. Preclinical programs also are under way for cardiac regeneration in chronic heart disease and neural regeneration in spinal cord injury.

Procedures with Medical Devices

Introduction to Procedures with Medical Devices

Responsible for body support, posture, and movement, the musculoskeletal system is made of muscles, bones, and cartilage. This system is often greatly debilitated or worn away by arthritis. The number of arthritic diseases is more than matched by the many ways to try to cure them. Besides drugs and other remedies, problems can be mitigated by musculoskeletal procedures.

The number of people suffering from arthritis is quite astounding, considering it is a disease that as yet has no perfect cure. Arthritic disease affected about 46 million people in the United States in 2007. Osteoarthritis is just one form of arthritis that involves a wearing down of the cartilage that cushions the bones of the knee or other joints, as they move against each other. When this cushioning is harmed, there will eventually be reduced mobility and pain involved. Osteoarthritis will mainly affect weight-bearing joints such as the lower back, the hips and the knees. But it can also affect the neck, the big toe, the base of the thumb and the many finger joints. It is estimated that one in ten Americans over the age of 64 have osteoarthritis of the knee, the most common ailment associated with arthritis. Arthritis should concern us all. We are not only surrounded with people trying to alleviate arthritis symptoms, but there is a good chance that we either suffer from it in the present, or will in the future.

According to a review of existing studies that was funded by the Centers for Disease Control and Prevention, the Agency for Healthcare Research and Quality concluded that there is no convincing evidence that the common methods of treatment of osteoarthritis of the knee actually produce any benefit. The Agency retrospectively reviewed all existing studies and also performed meta-analyses of the combined evidence, on the following approaches: Dietary supplementation with over-the-counter glucosamine and chondroitin that are supposed to improve physical function and knee pain; injections of hyaluronan to improve lubrication to achieve the same purpose; or arthroscopic surgeries to clean up the area of the knee joint, with or without removal of debris and loose cartilage. This review found they were all comparable to placebo. The review authors also pointed out that better quality randomized clinical trials are needed to fully clarify whether any of these approaches provides some slight benefit.

Despite the gloomy government facts, pretty much every person in industry and the public believes that there are therapies that can change arthritis that are present, emerging, and still to come. Surely such optimism is borne of more than the placebo effect. In any case, these therapies include the use of medical devices. As the American population ages, it is expected that demand for procedures will go up. Procedures encompass diagnostic or exploratory interventions as well as principal procedures such as knee replacements. So instead of taking a dim view of devices, the forecast for future involvement of medical devices in the treatment of arthritis is quite rosy, to the tune of billions of dollars, by almost everyone's reckoning.

Not all procedures are related to arthritis, but many are. A summary of common musculoskeletal procedures is provided below:

Musculoskeletal Procedures

- Therapeutic procedures on muscle or tendon
- Treatment for dislocation of the shoulder, lower arm, hip, femur, leg
- Treatment of fractures in lower arm, hip, femur, leg, etc.
- Facial repair
- Toe repair
- Injections into muscle, tendon, bursa, joint
- Arthrocentesis, or removal of joint fluid by needle
- Arthroscopy, or viewing a joint for diagnostic and treatment purposes
- Operating room procedures on bones and joints of the musculoskeletal system
- Division or excision of ligament or cartilage, including semilunar knee cartilage
- Excision of bone
- Arthroplasty of knee, or knee reconstruction or replacement
- Hip replacements, total or partial
- Arthroplasty of the shoulder, including shoulder replacement
- Arthroplasty of other joints
- Spinal fusion, where vertebrae are joined
- Other spinal approaches and implants
- Amputation of leg, foot, toe, etc.

Operations on the Musculoskeletal System and Size of the U.S. Market

Musculoskeletal Procedures Are a Multi-Billion Dollar Market

Although available data on musculoskeletal procedures in the U.S. is lagging several years behind the current year, the basic anatomy of the clinical situation with respect to these procedures can be seen by looking at the available data. According to the U.S. government's Agency for Healthcare Research Quality (AHRQ) of the Department of Health and Human Services (HHS), newly released information for 2006 is as follows: Equaling 6.3 percent of all hospital discharges in the U.S., there were 2,491,880 hospital discharges relating to procedures performed on the musculoskeletal system. The mean length of stay was 5 days and the average patient age was 60. The mean cost of a procedure was $14,933 and the associated hospital charge, excluding doctor, was $41,956. The total for costs of all these procedures in the U.S. for 2006 was $37.2 billion and the total for associated charges was

$104.5 billion. We definitely are not talking about small potatoes.
By comparison, in 2004 the aggregate hospital costs for musculoskeletal procedures were $31.5 billion, or about 10 percent of the total cost for healthcare. Although the average patient age was 60 instead of the 47 years for all procedures, patients died in the hospital less frequently (0.8 percent vs. 2.1 percent), mostly because about two-thirds of musculoskeletal-related visits are planned.

For the purposes of easy statistical collection by the government, the normal unit for procedures has to do with hospital discharges and not patients, so if a patient has two related or unrelated procedures in one year, it would be show up as two discharges, not one patient. So one must bear in mind that the number of discharges/procedures could exceed the number of actual patients undergoing procedures. Another detail to do with government data collection has to do with costs. Cost reflects a cost of production, while charge refers to what the hospital billed for the case, not including physician fees.

Market for Musculoskeletal Procedures in 2006

Selected Procedures	Rank	# Procedures	Aggregate Cost
Knee replacement	#12	547,300	$7.9B
Hip replacement	#16	369,400	$5.8B
Spinal fusion, all types	#19	343,300	$7.7B
Fracture or dislocation of hip/femur	#24	267,036	$3.7B
Laminectomy and excision of disc	#30	231,201	$2.0B
Fracture or dislocation other than hip/femur	#35	182,755	$2.0B
Other OR procedure on joints	#70	75,688	$0.9B
Other OR procedure on bone	#79	66,414	$0.8B
Fracture or dislocation of radius and ulna	#88	56,888	$0.5B
Arthroplasty other than hip or knee, includes shoulder replacements	#89	55,600	$0.7B
Total of operations on musculoskeletal system		**2,491,880** (Represents 6.3% of all hospital discharges)	Procedure cost: **$37.2B** (But aggregate charges or hospital fees is $104.5B)

SOURCE: Rank is for status in all hospital procedures for 2006, all as per AHRQ.

Most Common Musculoskeletal Procedures Are on the Rise

Some of the most common musculoskeletal procedures are replacement of knee parts, the hip, and spinal procedures such as fusions. A report by the AHRQ stated that from 1997 to 2005, there was a 24 percent overall increase in musculoskeletal procedures, with spinal fusions increasing about 73 percent, knee arthroplasties increasing about 69 percent, and hip replacements increasing about 32 percent. The report stated that by 2025, the number of procedures may double the amount done in 2005.

For the most common musculoskeletal procedures, age is a factor. In particular, the rate of knee arthroplasty and hip replacements increases with age, so for knees, 24.6 procedures per 10,000 people are performed on 45-64 year olds, while 79.1 procedures per 10,000 people are performed on those over 65. For hips, 14.2 procedures per 10,000 people are performed on 45-64 year olds, while 67.6 per 10,000 are performed on those over 65. In contrast for spinal fusions, some procedures are already performed on 18-44 year olds (7.5 procedures per 10,000), and the other age groups have comparable rates (20.1 and 18.4 per 10,000). A table relating to age at procedure and revision is added

Most Common Musculoskeletal Procedures: Large Joint Replacements and Spinal Fusions

Location procedure	**Knee**		**Hip**		**Spine**		**Shoulder**
Year	**2004**	**2006**	**2004**	**2006**	**2004**	**2006**	**2006**
Common proc. rank		#12		#16		#19	
Total number procedures (thousands)	488	547	368	369	325	343	18 (27, all shoulder)
Length of Stay (days)	3.9	3.8 (3.5/2008)	5.0	4.9 (3.5/2008)	4.1	4.0	(1.75/2008)
Age (mean yrs)	66	66	70	70	52	53	About 60
Hosp Death (%)	0.1	0.1	1.0	0.9	0.3	0.3	<<0.1
Procedure Cost (mean in $)	13,200	14,470	14,500	15,794	19,600	22,342	
Hospital Charge, excl. doctor (mean in $)		39,525 (43K in 2008)		43,472 (48K in 2008)		64,229	(33-38K in 2008)
Total cost ($/yr, all)	6.3B	7.9B	5.3B	5.8B	6.0B	7.7B	

SOURCES: AHRQ and PearlDiver.

later in this text. The take-home message here is that knee procedures are the most common, the need for knee and hip replacements increases somewhat with age, and the spine can deteriorate early on.

Below is a table comparing the most common musculoskeletal procedures. The next largest joint replacement, the shoulder, is included as well. The rank in terms of the most common procedures list is included, for 2006. The table compares the numbers from 2004 with 2006, for the three main procedures. Available data for length of hospital stay and charges for 2008 were included, where available. As can be seen, the number of knee procedures per year increased, the mean patient age is remaining about the same for all operations, the total length for a hospital stay is decreasing, the least risky operation is the shoulder replacement and the most risky by far in terms of the risk of death, are the hip replacements. The spinal procedures are tremendously expensive, and the cost of all procedures is rising. Hospital charges are just incredibly high, per procedure. The total cost of each of the top three procedures is in the billions of dollars a year, a cost that must be absorbed by someone. In the U.S., most people are covered by either their insurance plans at work or the government. As can be seen, most people would not be able to afford these operations on their own.

Knee Replacement, the Most Common Musculoskeletal Procedure

Osteoarthritis of the knee is the most common reason for knee replacement surgery. As can be seen in the chart below, the need for interventions and operations on the knees increases with age, because osteoarthritis increases with age. Mobility and freedom from pain are what those with arthritis of the knee are seeking. As mobility is such an essential thing, it is less likely that people will delay interventions. At first, canes and walkers, over-the-counter remedies, pain medications, arthritis medications, injections in the joints, and minor surgical interventions may be tried. Eventually, the knee might need to be replaced. There is usually a gradual buildup of symptoms after diagnosis that leads to the decision to operate.

Patients with Osteoarthritis of the Knee

Age Range	Number of Patients	Percent of Total
0-44	364,075	5.6%
45-65	2,054,864	31.4%
65+	4,118,840	63.0%
Total	6,537,841	100%

SOURCE: PearlDiver and BioWorld research.

In reviewing knee replacement and repair for 2004, it was found that the average age was 66, and women and girls constituted 63.8 percent of the knee recipients. It was calculated that 2/1000 women and 1.2/1000 men had knee arthroplasty, despite the common mental association of this type of surgery with male athletes. Those 45-64 years of age had knee replacements at a rate of 2.46/1000, while those over 65 had knee replacements at a rate of 7.91 per 1000. Having a total knee replacement or TKR has been the norm, but now the market is beginning to see alternatives such as smaller implants that can be placed in the knee with less damage, bone loss, and faster recuperation times. More on these implants and prosthetic knees will be found later in the chapter, under the list of devices.

Hip Replacement Is Still Making Strides To Improve Mobility

In a brochure on hip replacement issued by the NIH in mid-2006, this arthroplasty is described as the removal of diseased parts and replacement with artificial parts, for the purpose of regaining function of the hip joint and mobility, and as relief from the pain. Osteoarthritis is most often responsible for the hip damage, but osteonecrosis due to insufficient blood supply or avascular necrosis, rheumatoid arthritis, bone tumors and injury can also be the causes of damage. The report states that as per recent studies, early intervention before joints deteriorate may aid recovery and improve outcomes.

Not all people do equally well with a hip replacement. People with certain health problems such as being at a high risk of infection, or having poor health from chronic diseases such as Parkinson's disease, or even conditions involving muscle weakness, tend to have poorer outcomes. Alternatives to hip replacement are the use of canes and walkers, exercise programs to strengthen muscles around the hip joint, and pain medications. Acetaminophen is usually recommended for hip pain without inflammation, while nonsteroidal inflammatory drugs (NSAIDS) such as aspirin or ibuprophen are recommended for hip pain with inflammation. Occasionally both are recommended, or stronger analgesics or narcotics such as tramadol or codeine, or even corticosteroids are given for rheumatoid arthritis. Corticosteroids or a joint lubricant can be injected into the hip. Topical analgesic products such as capsaicin may help, and some people find that supplements such as glucosamine and chondroitin ease the pain. Once medication or exercise no longer relieve pain or improve joint function, a less complex corrective surgery may be done, such as joint resurfacing or osteotomy, a procedure to realign the bone and shift weight to a healthier surface. It takes about half to a full year to recuperate, with no guarantees.

In reviewing the total and partial hip replacements for 2004, it was found that about 25 percent of these patients were admitted through the ER. The average age was 70, and women and girls constituted 62 percent of the hip recipients. It was calculated that 1.52/1000 women and .95/1000 men were having hip replacements. Those 45-64 years of age had hip replacements at a rate of 1.42/1000, while those over 65 had hip replacements at a rate of 6.76 per 1000. Older and less active people used to be the main hip recipients, but doctors are finding that hip replacement surgery can be very successful in younger people, as per the NIH.

Hip implant materials used to be weaker and not last too long. The newest trends in hip replacement involve improvements in materials that increase hip durability. Lamentably, for a small percentage of people, hips made with ceramics have led to squeaking. More will be written on this in the following sections to do with the implants and with government. Regardless of being of ceramic, plastic, or metal materials, the traditional design for a hip prosthesis involves parts that imitate the ball and cup design of the femoral head and pelvic acetabulum. The 1-2 hour traditional operation removes diseased bone and tissue and replaces the main parts with artificial ones. There is a minimally invasive replacement procedure that can be used on younger, healthier subjects.