

STATISTICAL BRIEF #34

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Hospital Stays Involving Musculoskeletal Procedures, 1997–2005

Chaya Merrill, M.P.H. and Anne Elixhauser, Ph.D.

Introduction

The musculoskeletal system is comprised of the muscles, bones, and cartilage that are collectively responsible for movement and maintaining posture. Individuals faced with musculoskeletal conditions often experience difficulty engaging in activities of daily living. Procedures, such as knee arthroplasty, hip replacement, and spinal fusion, help mitigate the debilitating nature of musculoskeletal problems. The magnitude, cost, and burden of musculoskeletal procedures are significant. As many of these procedures are performed on elderly individuals, the demand for musculoskeletal procedures is expected to grow as the American population continues to age.

This Statistical Brief presents data from the Healthcare Cost and Utilization Project (HCUP) on hospital stays that include musculoskeletal procedures from 1997 to 2005 and provides details on musculoskeletal procedures for 2004. Characteristics of these hospital stays are compared with hospitalizations for all procedures. Additionally, the three most common musculoskeletal procedures (knee arthroplasty, hip replacement, and spinal fusion) are described, and variations in utilization are illustrated by gender, age, and payer. The trend in the number of musculoskeletal procedures performed from 1997 to 2005 is also discussed. All differences between estimates noted in the text are statistically significant at the 0.05 level or better.

Findings

In 2005, musculoskeletal procedures were performed in over 3.4 million hospitalizations (about 9 percent of all stays) (data not shown). For the 2.5 million hospital stays (data not shown) in which a musculoskeletal procedure was the principal procedure performed (i.e., for definitive treatment rather than diagnostic or exploratory purposes), stays for musculoskeletal procedures were longer and more expensive relative to all hospitalizations.

Table 1 describes the general characteristics of hospitalizations involving musculoskeletal procedures compared with all hospital stays in 2004. These stays were about a half-day longer (5.0 days versus 4.6 days) and, on average, over \$5,500 more expensive

Highlights

- In 2005, musculoskeletal procedures were performed in over 3.4 million hospital stays (about 9 percent of all hospitalizations)
- Aggregate costs for musculoskeletal procedures totaled \$31.5 billion—accounting for over 10 percent of all hospital care in the U.S.
- These stays were about a half-day longer (5.0 days versus 4.6 days) and, on average, over \$5,500 more expensive than all hospital stays—costing \$13,200 per stay versus \$7,600 per stay.
- The volume of musculoskeletal procedures overall increased by about 24 percent from 1997 to 2005. Spinal fusions experienced the greatest increase, about 73 percent, from 202,100 procedures performed in 1997 to 349,400 procedures in 2005. Knee arthroplasties and hip replacements increased by about 69 percent and 32 percent, respectively, over the same time period.
- Musculoskeletal procedures tend to be performed more frequently on females and older patients (mean patient age of 60 years).
- Knee arthroplasty, hip replacement, and spinal fusion are the most common musculoskeletal procedures, accounting for about 1.2 million hospital stays.
- Spinal fusion and hip replacement are among the most expensive musculoskeletal procedures, with average hospital costs of \$19,600 and \$14,500 per stay, respectively.
- Medicare bore a large burden of hospital costs for stays involving knee arthroplasty (57.9 percent) and hip replacement (63.4), while private insurance was billed for over half (52.2 percent) of spinal fusion stays.

than all stays—costing \$13,200 per stay versus \$7,600 per stay. The aggregate hospital costs for musculoskeletal procedures in 2004 were \$31.5 billion—representing over 10 percent of the total cost of hospital care in the U.S. Patients hospitalized for musculoskeletal procedures were about 13 years older than the typical hospitalized patient (60 years old versus 47 years old), but died in the hospital less frequently (0.8 percent versus 2.1 percent). Fewer stays involving musculoskeletal procedures originated in the emergency department compared to all stays: 31.6 percent versus 43.1 percent, indicating that most of these procedures were planned.

Characteristics of the three most common musculoskeletal procedures

Table 2 provides a focused look at the three most common musculoskeletal procedures performed in U.S. hospitals in 2004: knee arthroplasty (surgical reconstruction or replacement of knee), hip replacement, and spinal fusion (correction of an unstable part of the spine by joining two or more vertebrae). Collectively, there were about 1.2 million hospital stays that included these procedures, accounting for nearly half of all stays during which a musculoskeletal procedure was the principal procedure performed. Spinal fusion, hip replacement, and knee arthroplasty were also among the most expensive musculoskeletal procedures, with average hospital costs of \$19,600, \$14,500, and \$13,200, respectively. The national bill for these three procedures totaled over \$17.5 billion in 2004, and the average length of stay ranged from about four to five days per stay.

Trends in the volume of the most common musculoskeletal procedures, 1997–2005

From 1997 to 2005, the volume of musculoskeletal procedures performed grew by about 24 percent from 2.7 million to 3.5 million procedures (data not shown). Figure 1 depicts the even larger increase in the percentage of knee arthroplasty, hip replacement, and spinal fusion procedures over this nine-year period, despite significant shifts in performing the procedure on an outpatient basis.¹ Spinal fusions experienced the greatest rise, about 73 percent, from 202,100 procedures performed in 1997 to 349,400 procedures in 2005. While the volume of spinal fusions performed at the hospital continues to increase, recent data indicate that these procedures are shifting from the inpatient to outpatient setting.²

Increases in knee and hip replacement procedures witnessed during the 1990s continued from 1997 to 2005.³ Over this time period, the volume of knee arthroplasties and hip replacements rose by about 69 percent (from 328,800 procedures to 555,800 procedures) and about 32 percent (from 290,700 procedures to 383,500 procedures), respectively. The demand for these procedures is projected to double in the next two decades.⁴

Most common musculoskeletal procedures, by age and gender

Figure 2 illustrates that females underwent musculoskeletal procedures more often than males—especially for knee arthroplasty and hip replacement. The rate of knee arthroplasty in females was over 70 percent higher than in males: 20.5 procedures per 10,000 females versus 12.0 procedures per 10,000 males. For hip replacements, women had this procedure 60 percent more frequently, with a rate of 15.2 procedures per 10,000 females versus 9.5 procedures per 10,000 males. Spinal fusions were more equitably spread across both genders, with females having slightly more than males: 10.9 procedures per 10,000 females and 9.7 procedures per 10,000 males.

Most musculoskeletal procedures tend to be performed on older patients. This pattern holds true for knee arthroplasty and hip replacement patients who were typically in their upper 60s; spinal fusions, however, were performed on younger patients (mean age of 52 years) (table 2).

Figure 3 shows that the rate of knee arthroplasty and hip replacement procedures increased with age. The rate of knee arthroplasty was much greater for the elderly—79.1 procedures per 10,000 people 65 years of age and older compared with 24.6 procedures per 10,000 people 45 to 64 years of age. Similarly

¹Russo, C. A., Owens, P., Steiner, C., Josephsen, J. *Ambulatory Surgery in U.S. Hospitals, 2003—HCUP Fact Book No. 9*. AHRQ Publication No. 07-0007, January 2007. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.ahrq.gov/data/hcup/factbk9/>

²Deyo, R. A. and Mirza, S. K. (2006). Trends and variations in the use of spine surgery. *Clinical Orthopaedics and Related Research*, 443:139-46.

³Kurtz, S., Mowat, F., Ong, K., Chan, N., Lau, E., and Halpern, M. (2005). Prevalence of primary and revision total hip and knee arthroplasty in the United States from 1990 through 2002. *The Journal of Bone and Joint Surgery*, 87(7):1487-97.

⁴Kurtz, S., Ong, K., Lau, E., Mowat, F., and Halpern, M. (2007). Projections of primary and revision hip and knee arthroplasty in the United States from 2005 to 2030. *The Journal of Bone and Joint Surgery*, 89(4):780-5.

for hip replacement, there were 67.6 procedures per 10,000 elderly compared with 14.2 procedures per 10,000 people 45 to 64 years of age. In contrast, spinal fusions were more equally distributed across age groups, being performed at significant rates even for 18 to 44 year olds—7.5 procedures per 10,000 compared with 20.1 procedures per 10,000 people 45 to 64 years of age and 18.4 procedures per 10,000 people 65 and older.

Most common musculoskeletal procedures, by payer

Figure 4 illustrates the distribution of hospital stays billed to each payer for knee arthroplasty, hip replacement, and spinal fusion procedures. Medicare bore a large burden of hospital costs for stays involving knee arthroplasty and hip replacement, 57.9 percent and 63.4 percent, respectively. This is expected given the older mean age of patients having these procedures. In contrast, for spinal fusion procedures, which are performed on a younger patient population, private insurance was billed for over half (52.2 percent) of hospital stays. Medicaid's share of stays ranged from about 6 percent to 8 percent for these three procedures. Uninsured hospital stays for musculoskeletal procedures were very uncommon—less than 1 percent for knee arthroplasty and hip replacement procedures and less than 2 percent for spinal fusions.

Data Source

The estimates in this Statistical Brief are based upon data from the HCUP 2004 and 2005 Nationwide Inpatient Sample (NIS). Historical data were drawn from the 1997–2003 NIS. Supplemental sources included data on age group and gender population estimates from Table 2: Annual Estimates of the Population by Selected Age Groups and Sex for the United States: April 1, 2000 to July 1, 2006 (NST-EST2006-02) (<http://www.census.gov/popest/estimates.php>).

Definitions

Types of hospitals included in HCUP

HCUP is based on data from community hospitals, defined as short-term, non-Federal, general and other hospitals, excluding hospital units of other institutions (e.g., prisons). HCUP data include OB-GYN, ENT, orthopedic, cancer, pediatric, public, and academic medical hospitals. They exclude long-term care, rehabilitation, psychiatric, and alcoholism and chemical dependency hospitals, but these types of discharges are included if they are from community hospitals.

Unit of analysis

The unit of analysis is the hospital discharge (i.e., the hospital stay), not a person or patient. This means that a person who is admitted to the hospital multiple times in one year will be counted each time as a separate "discharge" from the hospital.

Costs and charges

Total hospital charges were converted to costs using HCUP Cost-to-Charge Ratios based on hospital accounting reports from the Centers for Medicare and Medicaid Services (CMS).⁵ Costs will tend to reflect the actual costs of production, while charges represent what the hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used because detailed charges are not available across all HCUP States. Hospital charges reflect the amount the hospital charged for the entire hospital stay and does not include professional (physician) fees. For the purposes of this Statistical Brief, costs are reported to the nearest hundreds.

Payer

Up to two payers can be coded for a hospital stay in HCUP data. When this occurs, the following hierarchy is used:

- If either payer is listed as Medicaid, the payer is "Medicaid."
- For non-Medicaid stays, if either payer is listed as Medicare, the payer is "Medicare."
- For stays that are neither Medicaid nor Medicare, if either payer is listed as private insurance, the payer is "private insurance."

⁵HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2003. U.S. Agency for Healthcare Research and Quality, Rockville, MD. www.hcup-us.ahrq.gov/db/state/costtocharge.jsp

- For stays that are not Medicaid, Medicare or private insurance, if either payer is some other third-party payer, the payer is "other," which consists of Worker's Compensation, TRICARE/CHAMPUS, CHAMPVA, Title V, and other government programs.
- For stays that have no third-party payer and the payer is listed as "self-pay" or "no charge," the payer is "uninsured."

Procedures, ICD-9-CM, and Clinical Classifications Software (CCS)

The principal procedure is the procedure that was performed for definitive treatment rather than one performed for diagnostic or exploratory purposes (i.e., the procedure that was necessary to take care of a complication). If two procedures appear to meet this definition, the procedure most related to the principal diagnosis was selected as the principal procedure. All-listed procedures include all procedures performed during the hospital stay.

ICD-9-CM is the International Classification of Diseases, Ninth Revision, Clinical Modification, which assigns numeric codes to diagnoses. There are about 12,000 ICD-9-CM diagnosis codes and 3,500 procedure codes.

CCS categorizes procedure codes into clinically meaningful categories.⁶ This "clinical grouper" makes it easier to quickly understand patterns of procedure use.

For this report, musculoskeletal procedures were defined as CCS procedure categories (italicized procedures are discussed in more depth in this brief):

- 142: Partial excision of bone
- 143: Repair of toe deformities
- 144: Treatment of facial fracture or dislocation
- 145: Treatment of fracture or dislocation of radius and ulna (lower arm)
- 146: Treatment of fracture or dislocation of hip and femur
- 147: Treatment of fracture or dislocation of leg (other than hip or femur)
- 148: Other fracture and dislocation procedure
- 149: Arthroscopy (procedure to view the inside of a joint through a lighted tube and to diagnose and treat problems)
- 150: Division of joint capsule, ligament or cartilage
- 151: Excision of semilunar cartilage of knee
- 152: *Arthroplasty of knee (surgical reconstruction or replacement of knee)*
- 153: *Hip replacement, total and partial*
- 154: Arthroplasty other than hip or knee (surgical reconstruction or replacement of other joints)
- 155: Arthrocentesis (procedure that involves introducing a needle into a joint to remove joint fluid)
- 156: Injections and aspirations of muscles, tendons, bursa, joints and soft tissue
- 157 Amputation of leg, foot, or toe
- 158: *Spinal fusion (correction of an unstable part of the spine by joining two or more vertebrae)*
- 159: Other diagnostic procedures on musculoskeletal system
- 160: Other therapeutic procedures on muscles and tendons
- 161: Other operating room therapeutic procedures on bone
- 162: Other operating room therapeutic procedures on joints
- 163: Other non-operating room therapeutic procedures on musculoskeletal system
- 164: Other operating room therapeutic procedures on musculoskeletal system

Admission source

Admission source indicates where the patient was located prior to admission to the hospital. Emergency admission indicates the patient was admitted to the hospital through the emergency department.

⁴HCUP Clinical Classifications Software (CCS). Healthcare Cost and Utilization Project (HCUP). August 2006. U.S. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>

Discharge status

Discharge status indicates the disposition of the patient at discharge from the hospital, and includes the following six categories: routine (to home), transfer to another short-term hospital, other transfers (including skilled nursing facility, intermediate care, and another type of facility such as a nursing home), home health care, against medical advice (AMA), or died in the hospital.

About the NIS

The HCUP Nationwide Inpatient Sample (NIS) is a nationwide database of hospital inpatient stays. The NIS is nationally representative of all community hospitals (i.e., short-term, non-Federal, non-rehabilitation hospitals). The NIS is a sample of hospitals and includes all patients from each hospital, regardless of payer. It is drawn from a sampling frame that contains hospitals comprising 90 percent of all discharges in the United States. The vast size of the NIS allows the study of topics at both the national and regional levels for specific subgroups of patients. In addition, NIS data are standardized across years to facilitate ease of use.

About HCUP

HCUP is a family of powerful health care databases, software tools, and products for advancing research. Sponsored by the Agency for Healthcare Research and Quality (AHRQ), HCUP includes the largest all-payer encounter-level collection of longitudinal health care data (inpatient, ambulatory surgery, and emergency department) in the United States, beginning in 1988. HCUP is a Federal-State-Industry Partnership that brings together the data collection efforts of many organizations—such as State data organizations, hospital associations, private data organizations, and the Federal government—to create a national information resource.

For more information about HCUP, visit <http://www.hcup-us.ahrq.gov/>.

HCUP would not be possible without the contributions of the following data collection Partners from across the United States:

Arizona Department of Health Services
Arkansas Department of Health & Human Services
California Office of Statewide Health Planning & Development
Colorado Health & Hospital Association
Connecticut Integrated Health Information (Chime, Inc.)
Florida Agency for Health Care Administration
Georgia GHA: An Association of Hospitals & Health Systems
Hawaii Health Information Corporation
Illinois Health Care Cost Containment Council and Department of Public Health
Indiana Hospital & Health Association
Iowa Hospital Association
Kansas Hospital Association
Kentucky Cabinet for Health and Family Services
Maryland Health Services Cost Review Commission
Massachusetts Division of Health Care Finance and Policy
Michigan Health & Hospital Association
Minnesota Hospital Association
Missouri Hospital Industry Data Institute
Nebraska Hospital Association
Nevada Division of Health Care Financing and Policy, Department of Human Resources
New Hampshire Department of Health & Human Services
New Jersey Department of Health & Senior Services
New York State Department of Health
North Carolina Department of Health and Human Services
Ohio Hospital Association
Oregon Office for Oregon Health Policy and Research and Oregon Association of Hospitals and Health Systems
Rhode Island Department of Health
South Carolina State Budget & Control Board
South Dakota Association of Healthcare Organizations

Tennessee Hospital Association
Texas Department of State Health Services
Utah Department of Health
Vermont Association of Hospitals and Health Systems
Virginia Health Information
Washington State Department of Health
West Virginia Health Care Authority
Wisconsin Department of Health & Family Services

For additional HCUP statistics, visit HCUPnet, our interactive query system at www.hcup.ahrq.gov.

For More Information

For a detailed description of HCUP and more information on the design of the NIS and methods to calculate estimates, please refer to the following publications:

Steiner, C., Elixhauser, A., Schnaier, J. The Healthcare Cost and Utilization Project: An Overview. *Effective Clinical Practice* 5(3):143–51, 2002.

Design of the HCUP Nationwide Inpatient Sample, 2004. Online. August 8, 2006. U.S. Agency for Healthcare Research and Quality. http://www.hcup-us.ahrq.gov/db/nation/nis/reports/NIS_2004_Design_Report.pdf

Houchens, R., Elixhauser, A. *Final Report on Calculating Nationwide Inpatient Sample (NIS) Variances, 2001*. HCUP Methods Series Report #2003-2. Online. June 2005 (revised June 6, 2005). U.S. Agency for Healthcare Research and Quality. <http://www.hcup-us.ahrq.gov/reports/CalculatingNISVariances200106092005.pdf>

Houchens R. L., Elixhauser, A. *Using the HCUP Nationwide Inpatient Sample to Estimate Trends*. (Updated for 1988-2004). HCUP Methods Series Report #2006-05 Online. August 18, 2006. U.S. Agency for Healthcare Research and Quality. http://www.hcup-us.ahrq.gov/reports/2006_05_NISTrendsReport_1988-2004.pdf

Suggested Citation

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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other HCUP data and tools, and to share suggestions on how HCUP products might be enhanced to further meet your needs. Please e-mail us at hcp@ahrq.gov or send a letter to the address below:

Irene Fraser, Ph.D., Director
Center for Delivery, Organization, and Markets
Agency for Healthcare Research and Quality
540 Gaither Road
Rockville, MD 20850

Table 1. Hospitalizations that included musculoskeletal procedures compared to hospitalizations for all conditions, 2004

	Hospital stays that included musculoskeletal procedures*	All hospital stays
Number of hospital stays (percentage of all hospital stays)	3,312,690 (8.6%)	38,661,800 (100%)
Mean length of stay, days	5.0 days	4.6 days
Mean hospital cost	\$13,200	\$7,600
Aggregate costs (percentage of total national cost)	\$31.5 billion (10.7%)	\$294.8 billion (100.0%)
Mean age	60 years	47 years
Percentage of stays for females	56.0%	59.2%
Percentage admitted through the emergency department	31.6%	43.1%
Percentage died in hospital	0.8%	2.1%

*Number of hospital stays is based on all-listed procedures; all other characteristics are based on the principal procedure.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.

Table 2. Most common musculoskeletal procedures in U.S. hospitals, 2004[‡]

Procedure	Number of hospital stays	Mean length of stay	Mean cost	Aggregate costs	Mean age	Percentage of stays for females	Percentage admitted from the emergency department	Percentage died in hospital
Arthroplasty of knee (surgical reconstruction or replacement of knee)	488,000	3.9	\$13,200	\$6.3 billion	66	63.8%	*	0.1%
Hip replacement, total and partial	368,000	5.0	\$14,500	\$5.3 billion	70	62.3%	24.8%	1.0%
Spinal fusion (correction of an unstable part of the spine by joining two or more vertebrae)	325,100	4.1	\$19,600	\$6.0 billion	52	53.9%	6.0%	0.3%

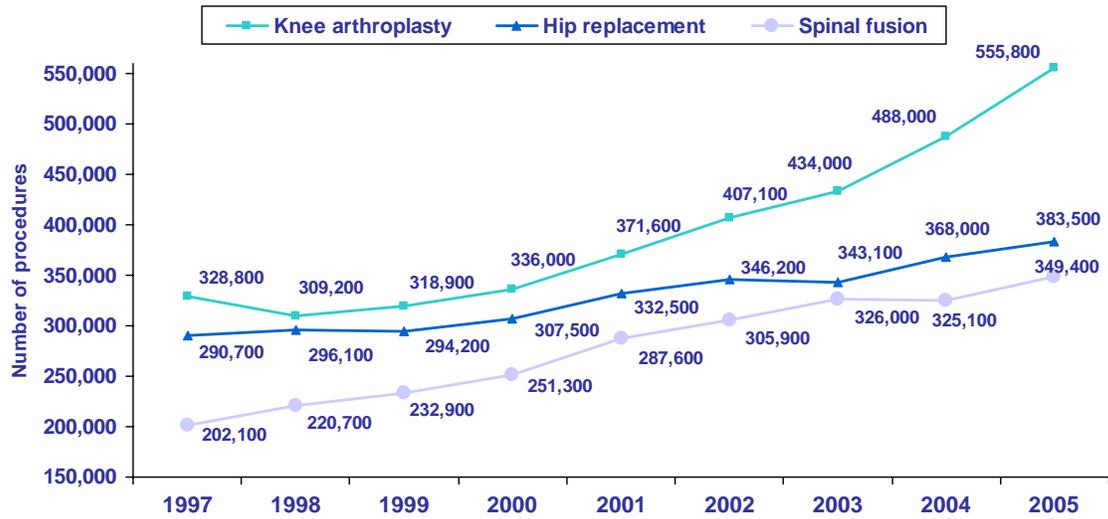
*Number of hospital stays is based on all-listed procedures; all other characteristics are based on the principal procedure.

*Too few cases to report with statistical reliability.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.



Figure 1. Trends in knee arthroplasty, hip replacement, and spinal fusion procedures, 1997–2005*

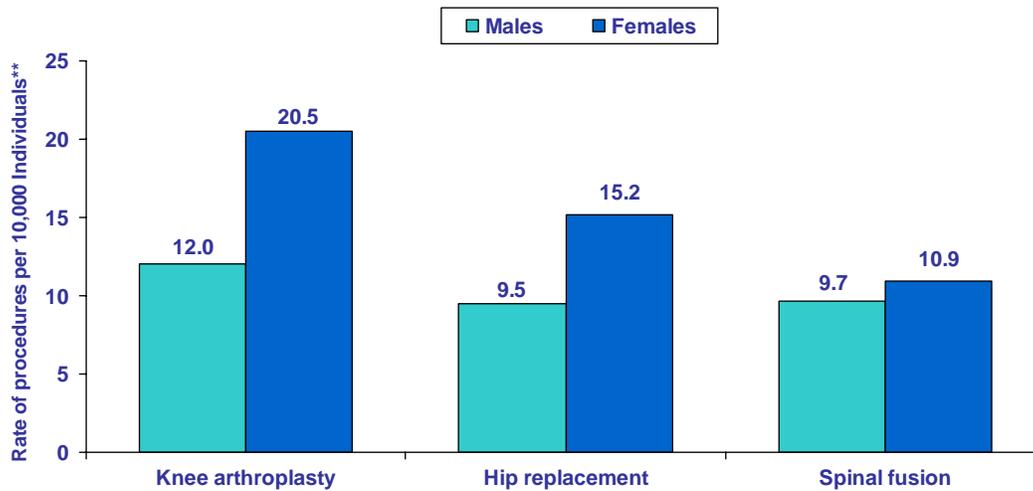


*Based on all-listed procedures.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1997-2005.



Figure 2. Rate of knee arthroplasty, hip replacement, and spinal fusion procedures, by gender, 2004*



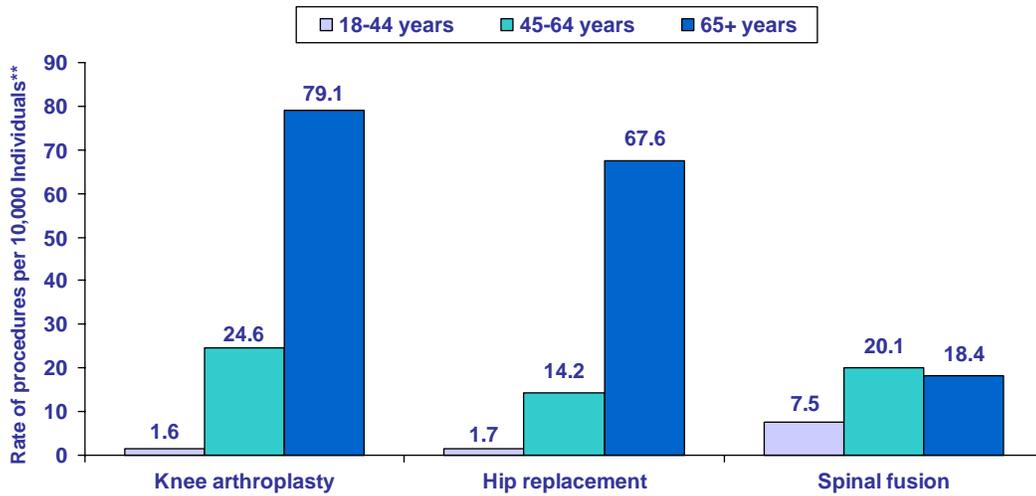
*Based on principal procedure.

**The denominator for each bar is gender-specific. U.S. Census Bureau. Population Division, Census 2004.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.



Figure 3. Rate of knee arthroplasty, hip replacement, and spinal fusion procedures, by age, 2004*



*Based on principal procedure.

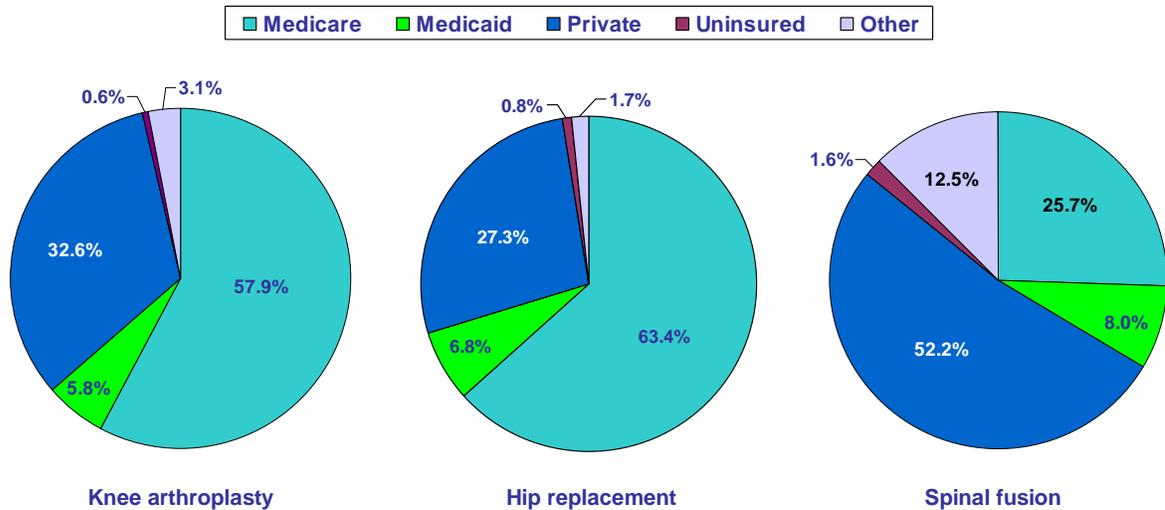
**The denominator for each bar is age-specific. U.S. Census Bureau. Population Division, Census 2004.

Note: A very small number of these procedures are for patients less than 18 years of age (data not shown).

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.



Figure 4. Percentage of knee arthroplasty, hip replacement, and spinal fusion procedures, by payer, 2004*



*Based on principal procedure.

Source: AHRQ, Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004.