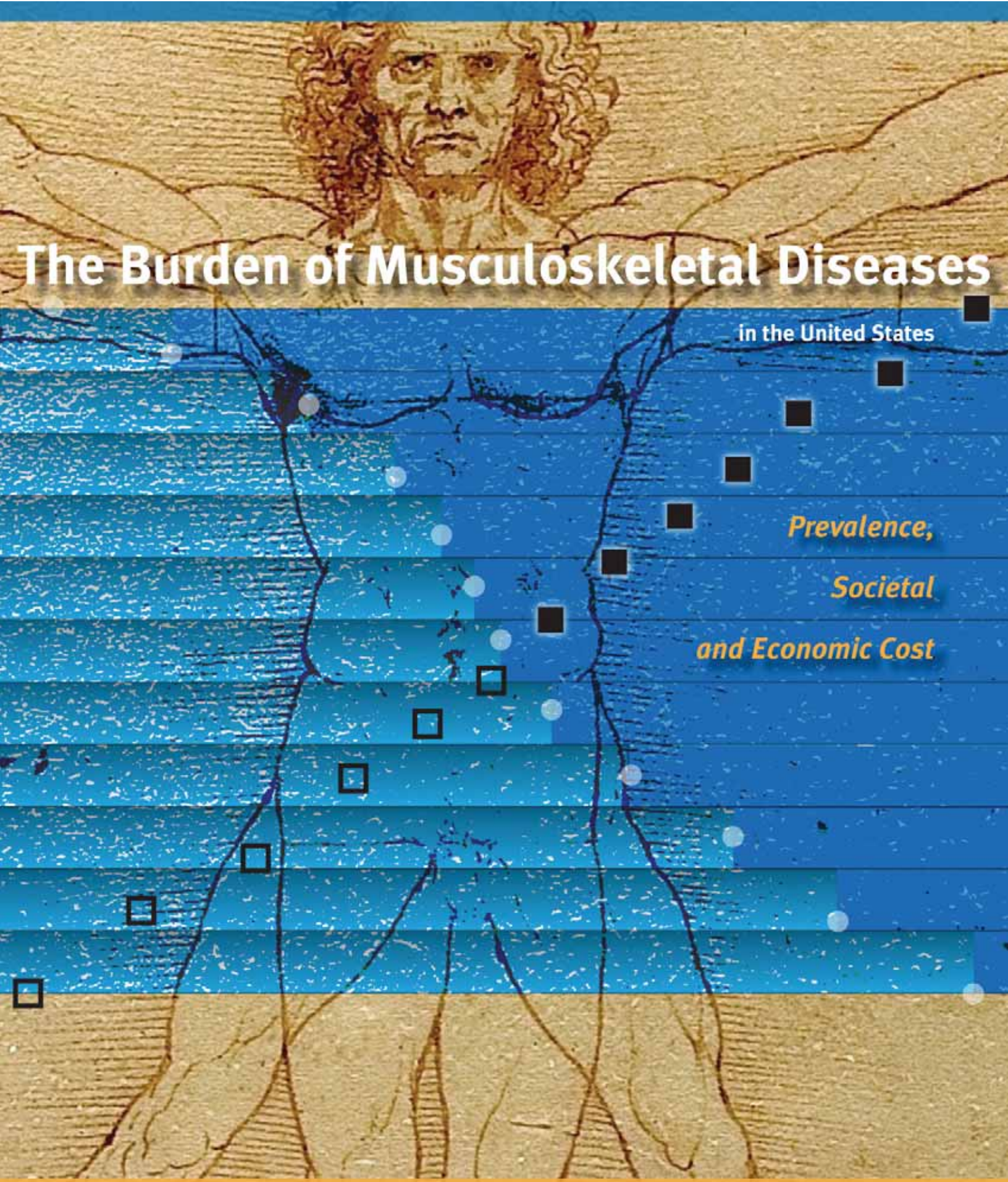

The Burden of Musculoskeletal Diseases

in the United States

Prevalence, Societal and Economic Cost

Bone and Joint DECADE
2002 - USA - 2011

The Burden of Musculoskeletal Diseases

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Second Edition

Prevalence,
Societal,
and Economic Cost

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THE BONE AND JOINT DECADE 2000 - 2010 JOINT MOTION

The Burden of Musculoskeletal Diseases in the United States, Second Edition, is a joint project of the **American Academy of Orthopaedic Surgeons, American Academy of Physical Medicine and Rehabilitation, American College of Rheumatology, American Society for Bone and Mineral Research, Arthritis Foundation, National University of Health Sciences, Orthopaedic Research Society, Scoliosis Research Society, and the United States Bone and Joint Decade**.

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Bone and Joint Decade

The Bone and Joint Decade is an international collaborative movement sanctioned by the United Nations/ World Health Organization and working to improve the quality of life for people with musculoskeletal conditions and to advance the understanding, prevention and treatment of these conditions.

Officially proclaimed by the U.S. President, the United States Bone and Joint Decade (USBJD) 2002-2011 has been endorsed by all 50 States and more than one hundred national health care professional, patient and public organizations, all 125 U.S. medical schools and many colleges of medicine.

The goal of the United States Bone and Joint Decade is to improve bone and joint health by enhancing collaborative efforts among individuals and organizations in order to raise awareness of the growing burden of musculoskeletal disorders on society, to promote wellness and prevent musculoskeletal disease, and to advance research that will lead to improvements in prevention, diagnosis and treatment.

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Bone and Joint DECADE 2002 - USA - 2011

THE BONE AND JOINT DECADE 2000 • JOINT MOTION • 2010

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Preface

It is with pleasure that I introduce you to this publication of the *Burden of Musculoskeletal Diseases in the United States*, the timely result of a partnership between the American Academy of Orthopaedic Surgeons and a number of other organizations supporting the U.S. Bone and Joint Decade (2002-2011). The level of disease recognition that the Decade has provided has done much to push the state of the science forward, and this new publication presents a snapshot of how far we have come since its predecessor, the 1999 *Musculoskeletal Conditions in the United States*, was released.

Although many advances have been made, musculoskeletal conditions remain common, chronic, and costly—and potentially disabling—to an increasingly graying population with high expectations of the health system. With the National Center for Health Statistics' 2008 National Health Interview Survey as a solid base, this publication examines such issues as spinal problems, arthritis and joint pain, osteoporosis, injuries, congenital conditions, neoplasms, and health care utilization and costs. The biomedically inclined reader will find within these pages both food for thought and a call to action.

The plight of millions of Americans whose lives are affected by the physical, financial, and emotional demands of musculoskeletal conditions make the findings of *Burden* difficult to ignore. I encourage you to read and digest its contents, and to appropriate for yourself those parts within your specific areas of interest or expertise.

Stephen I. Katz, MD, PhD
Director
National Institute of Arthritis and Musculoskeletal and Skin Diseases
National Institutes of Health
Bethesda, Maryland
January 10, 2008

Foreword

Musculoskeletal disorders and diseases are the leading cause of disability in the United States and account for more that one-half of all chronic conditions in people over 50 years of age in developed countries. The economic impact of these conditions is also staggering: in 2004 the sum of the direct expenditures in health care costs and the indirect expenditures in lost wages has been estimated to be $950 billion dollars, or 7.4% of the 2006 GDP (national gross domestic product.)

Beyond these statistics, the human toll in terms of the diminished quality of life is immeasurable. This situation is unlikely to improve in the foreseeable future and will likely be intensified by current demographic trends, including the graying of the baby boomer population, the epidemic of morbid obesity, and the higher recreational activity levels of our elderly population.

Despite these compelling facts, the investment in musculoskeletal research in the United States lags behind other chronic conditions. While musculoskeletal diseases are common, disabling and costly, they remain under-appreciated, under-recognized and under-resourced by our national policy makers.

In March 2002, President George W. Bush declared the years 2002–2011 the National Bone and Joint Decade. The mission of the U.S. Bone and Joint Decade is to "promote and facilitate collaboration among organizations committed to improving bone and joint health through education and research."

This volume serves the mission of the decade in that several professional organizations concerned with musculoskeletal health have collaborated to tabulate up-to-date data on the burden of musculoskeletal diseases to educate health care professionals, policy makers and the public. The information presented here is an update of two previous editions entitled *Musculoskeletal Conditions in the United States*, published in 1992 and 1999 by the American Academy of Orthopaedic Surgeons, and the second edition of the most recent edition, renamed *The Burden of Musculoskeletal Diseases in the United States* when published in 2070. The book represents a true collaboration of a coalition of professional organizations committed to the mission of the US Bone and Joint Decade.

These data should stimulate increased investment in basic, translational, clinical and health policy research to delineate the underlying mechanisms of these diseases and their response to treatment. Through such research, novel preventive and therapeutic approaches with potential to mitigate the societal and personal impact of musculoskeletal disease will emerge.

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Chapter 1
Burden of Musculoskeletal Disease Overview

Musculoskeletal conditions are among the most disabling and costly conditions suffered by Americans. In March 2002, President George W. Bush proclaimed the years 2002–2011 as the United States Bone and Joint Decade, providing national recognition to the fact that musculoskeletal disorders and diseases are the leading cause of physical disability in this country.[1,2]

As the U.S. population rapidly ages in the next 25 years, musculoskeletal impairments will increase because they are most prevalent in the older segments of the population. By the year 2030, the number of individuals in the United States older than the age of 65 is projected to double, with persons aged 85 and over the most rapidly expanding segment of society. In Europe, by 2010, for the first time there will be more people older than 60 years of age than people younger than 20 years of age.[3] Health care services worldwide will be facing severe financial pressures in the next 10 to 20 years due to the escalation in the numbers of people affected by musculoskeletal diseases. Bone and joint disorders account for more than one-half of all chronic conditions in people older than 50 years of age in developed countries, and are the most common cause of severe, long-term pain and disability.[4]

The goal of the United States Bone and Joint Decade is to improve the quality of life for people with musculoskeletal conditions and to advance understanding and treatment of these conditions through research, prevention, and education. The cornerstone of the Bone and Joint Decade movement is the burden of musculoskeletal disease, defined as the incidence and prevalence of musculoskeletal conditions; the resources used to prevent, care, and cure for them; and the impact on individuals, families, and society.

The impact of musculoskeletal diseases includes loss of productivity for persons who live with a musculoskeletal condition that reduces their ability to work and perform activities of daily living, and those persons who die prematurely from a musculoskeletal condition. It also takes into consideration the quality of life, pain, discomfort, and disability for disabled persons and their relatives and friends. Direct costs of the burden of musculoskeletal disease include hospital inpatient, hospital emergency and outpatient services, physician outpatient services, other practitioner services, home health care, prescription drugs, nursing home cost, prepayment and administration and non-health sector costs. Indirect cost relates to morbidity and mortality, including the value of productivity losses due to premature death due to a disease and the value of lifetime earnings.

Musculoskeletal conditions are not among the top ten health conditions funded by research.[5] In spite of the widespread prevalence of musculoskeletal conditions; this is primarily due to the low mortality from musculoskeletal conditions in comparison with other health conditions. However, the morbidity cost of musculoskeletal conditions is tremendous, as musculoskeletal conditions often restrict activities of daily living, cause lost work days, and are the source of lifelong pain.

In 1998, the Institute of Medicine wrote "in setting national priorities NIH should strengthen its analysis in the use of health data, such as burdens of disease, and of data on the impact of research and the health of the public."[6] National health data in several countries show that musculoskeletal conditions rank among the top health concerns for citizens in the United States and worldwide. By current estimates, over 40%

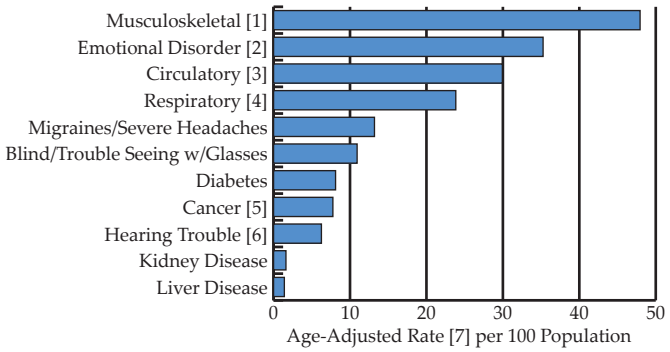
of the disabling conditions of persons aged 18 years and over are musculoskeletal related, yet research funding to alleviate this major health condition remains substantially below that of other major health conditions, such as cancer, respiratory, and circulatory (e.g., heart) diseases. Funding for the National Institute of Arthritis and Musculoskeletal and Skin Diseases (NIAMS) began in 1987. In subsequent years, research funding for these conditions has declined and since 2000, routinely less than 2% of the annual National Institutes of Health (NIH) budget is appropriated to musculoskeletal disease research. In fact, the annual average rate of funding continues to decline. (Table 1.1)

Clearly, musculoskeletal conditions are common, disabling, and costly. Yet they remain under-recognized, under-appreciated, and under-resourced. This book provides a strong case for the immediate and ongoing need to understand and support musculoskeletal conditions and reduce the burden it brings to our people.

Section 1.1: Prevalence of Select Medical Conditions in the U.S. Population

Musculoskeletal medical conditions were reported by 110.34 million adults in the U.S. in 2008 in the National Health Interview Survey (NHIS), representing nearly one in two persons aged 18 and over of the estimated 2008 population. The rate of chronic musculoskeletal conditions found in the adult population is 60% greater than that of chronic circulatory conditions, which include coronary and heart conditions, and more than twice that of all chronic respiratory conditions. On an age adjusted basis, which accounts for differences in the age distribution of the health care database sample and the actual population, musculoskeletal conditions are reported by 48% of the population, or 48 persons per every 100 in the population. This compares to a rate of 30 and 24 persons per every 100 in the population for circulatory and respiratory conditions, respectively. (Table 1.2 and Graph 1.1.1) The NHIS annual survey of self-reported health conditions is used throughout this chapter to highlight chronic health conditions of the U.S. population.

Graph 1.1.1: Prevalence of Self-Reported Primary Medical Conditions for Persons Aged 18 and Over, United States



[1] Includes arthritis, chronic joint symptoms (more than 3 months in duration), pain in lower back or neck (more than 3 months duration)
[2] Includes feelings that interfere with life and activities in past 30 days: sad, nervous, restless, hoplessness, worthlesness, depression, general anxiety, panic disorder, and living is an effort
[3] Includes coronary heart disease, angina pectoris, heart attack, stroke, chronic hypertension, heart disease
[4] Includes emphysema, chronic asthma, hay fever, sinusitis, chronic bronchitis
[5] Includes all types of cancer
[6] Includes respondents reporting "moderate trouble," "a lot of trouble" or "deaf" without a hearing aid/hearing device, or currently uses a hearing aid.
[7] Age-adjusted by direct method to US Census population estimate for July 1, 2008. Accessed June 22, 2009.
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Musculoskeletal conditions are found among all age groups, with the proportion of persons reporting these conditions increasing with age. Musculoskeletal conditions are reported by nearly three of four (69%) persons aged 75 years and over, slightly less than the 74% reporting circulatory conditions, the majority of whom report chronic hypertension. (Table 1.2)

Females, in general, on an age-adjusted basis, report a higher rate of occurrence than males for most major medical conditions. Among females, 53 women in every 100 females in the population report musculoskeletal conditions; among males the rate is 45 per 100, a slight increase in recent years. (Table 1.3)

Musculoskeletal conditions were reported at a higher rate among whites and persons of mixed or other race, with 51 and 53 persons, respectively,

in every 100 person in the population reporting a musculoskeletal condition. Among persons of the black/African American race, 43 in 100 reported a musculoskeletal condition. Persons of Asian descent reported the lowest level of musculoskeletal conditions, at a rate of 30 persons in every 100 persons in the population. (Table 1.4)

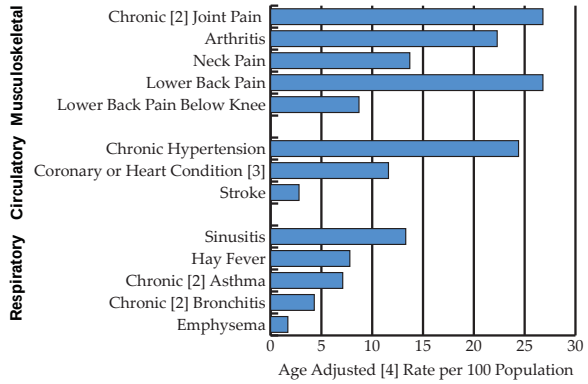
Section 1.1.1: Musculoskeletal, Circulatory, and Respiratory Conditions

On an age-adjusted basis, musculoskeletal conditions are reported equal to or more frequently than other common chronic or serious medical conditions related to the circulatory or respiratory systems by persons aged 18 and older. Three of the four most common medical conditions reported in 2008 were musculoskeletal conditions: low back pain, chronic joint pain, and arthritis. The other most commonly reported medical condition is chronic hypertension. (Table 1.5 and Graph 1.1.2)

Nearly 62.0 million adults reported low back pain, the most frequently reported musculoskeletal condition, an age-adjusted rate of 27 in 100 persons aged 18 or older reporting this condition. Among persons reporting low back pain, more than 20.1 million, or one-third, also reported pain radiating down the leg below the knee. Cervical/neck pain is also a commonly reported musculoskeletal disease, reported by 31.4 million adults in 2008.

In recent years, chronic joint pain, defined as joint pain lasting three months or longer, has approached the level of low back pain as a common musculoskeletal condition. Chronic joint pain, reported by 61.6 million adults aged 18 and older (27 of 100 persons), while 51.2 million (22 in 100) reported having been diagnosed with arthritis. Chronic joint pain and arthritis are not mutually exclusive and may be reported by the same individual. Although age is a general predictor of chronic joint pain and arthritis, with 7 out of 10 persons aged 65 and over reporting one or both of these conditions, the rate of reported chronic joint pain in younger persons is rapidly increasing. In 2008, nearly one in five persons aged 18 to 44 reported they suffer from chronic joint pain, while more than one-third (35%) aged 45 to 64 reported chronic joint pain. Active lifestyles will continue to be a major cause of joint pain in the coming years.

Graph 1.1.2: Prevalence of Self-Reported Select Medical Conditions [1] for Persons Aged 18 and Over, United States 2008



[1] Specific conditions are not mutually exclusive in overall condition category
[2] Symptoms lasting 3 months or longer
[3] Includes heart attack, angina pectoris, and other heart disease
[4] Age-adjusted by direct method to US Census population estimate for July 1, 2007. Accessed June 22, 2009.
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Chronic hypertension, defined as hypertension diagnosed at two or more physician visits, is the only other medical condition that approaches the rate of chronic musculoskeletal conditions. Among adults aged 18 and older, 56.1 million persons reported chronic hypertension in 2008, an age-adjusted rate of 24 in 100 persons. Coronary or heart conditions, which increase with age, were reported by 26.6 million, a rate of 12 in 100 persons. Chronic respiratory ailments, while common, are reported in significantly lower numbers, with sinusitis, reported by 30.6 million (13 in 100) persons, the most common condition.

Gender is a greater predictor of chronic musculoskeletal and respiratory conditions than of chronic circulatory conditions. Among all musculoskeletal and respiratory conditions, females are more likely to report a specific condition than are males. Similar proportions of males and females reported chronic circulatory conditions in 2008. (Table 1.6)

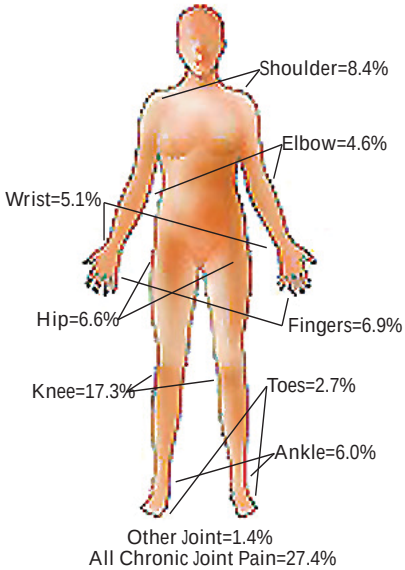
Chronic circulatory and respiratory conditions do not show the racial variation seen in musculoskeletal conditions, with the exception of the Asian population reporting all conditions at lower rates than other races. (Table 1.7) Musculoskeletal conditions, overall, are reported in higher proportions by persons of the white race than by persons of the black/African American or Asia races. Persons of other or mixed race report slightly higher rates of musculoskeletal conditions that those of the white race.

Section 1.1.2: Chronic Joint Pain

Chronic joint pain increases with age, but peaks in the 65 to 74 year age group. Among the 61.6 million persons reporting chronic joint pain in 2008, knee pain is the most frequently cited, with more than 39 million persons reporting knee pain. Chronic knee pain is reported by all ages in the age 18 and over population, with one in four persons aged 65 and older reporting knee pain. Shoulder pain, reported by 18.9 million persons aged 18 and older, is the second most common joint for chronic pain, with rates fairly equal aged 45 and over. Fingers account for chronic joint pain in 15.5 million persons, closely followed by hip pain reported by 14.8 million.

While multiple joints can be the source of chronic joint pain, overall, one in four persons over the age of 18 reports suffering from chronic joint pain. The ratio jumps to more than 2 in 5 persons after the age of 65. However, even among younger adults aged 18 to 44, nearly one in five reports they suffer from chronic joint pain. (Table 1.8 and Graph 1.1.3)

Graph 1.1.3: Proportion of Population [1] Aged 18 and Older Reporting Joint Pain [2], United States 2008



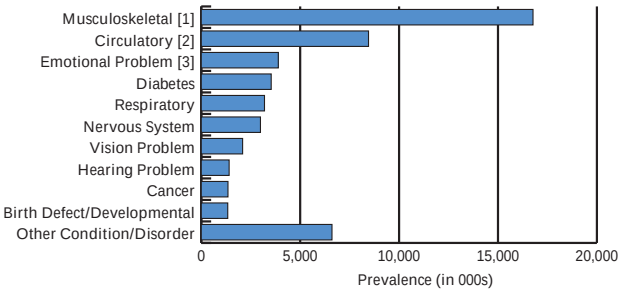
% of Population Reporting Joint Pain

[1] Age-adjusted to July 1, 2008 U.S. Census population estimates, 26.4% of all persons.
[2] Symptoms lasting 3 months or longer
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Section 1.2: Activity Limitation Due to Select Medical Conditions

Participants in the 2008 NHIS survey were asked about limitations they experience in activities of daily living due to medical conditions. Nearly 32.6 million adults aged 18 years and over, or 14% of the population, report they have difficulty performing routine daily activities of life without assistance due to medical conditions. An additional 5.5 million children between the ages of 1 and 17 years are reported by their parents as needing more assistance in daily activities than would be expected for their age due to a medical condition. (Table 1.9)

Graph 1.2.1: Self-Reported Impairment in Activities of Daily Living for Persons Due to Select Medical Conditions for Persons Aged 18 and Older, United States 2008

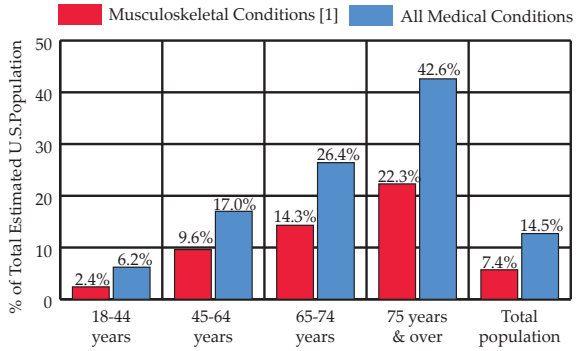


[1] Includes arthritis/rheumatism condition, back or neck problem, fracture/bone/joint injury, musculoskeletal/connective tissue condition, missing or amputated limb/finger/digit.
[2] Includes heart or hypertension, stroke, circulation or blood problem.
[3] Includes depression/anxiety/emotional problem.
Source: National Center for Health Statistics, National Health Interview Survey, Person Sample, 2008

The most frequently cited medical condition for which persons report limitations in the activities of daily life is musculoskeletal. More than 17 million adults aged 18 and over are limited by one or more musculoskeletal conditions, including arthritis or rheumatism, back or neck problems, fracture or bone/joint injury, a missing or amputated limb, or a musculoskeletal connective tissue condition. (Graph 1.2.1) Overall, 14% of adults aged 18 and over have reduced quality of life due to medical conditions, and more than one-half of these are due to musculoskeletal conditions. (Graph 1.2.2)

Reflecting the overall prevalence of medical conditions in females, females are also more likely to report impairment in activities of daily living than are males. This is particularly true for musculoskeletal conditions. Females account for 56% of all adults aged 18 and over reporting they are limited in activities of daily living; they account for 61% of those reporting a musculoskeletal condition impairment. (Table 1.10)

Graph 1.2.2: Self-Reported Impairment in Activities of Daily Living for Persons Due to Select Medical Conditions by Age, United States 2008



[1] Includes arthritis/rheumatism condition, back or neck problem, fracture/bone/joint injury, musculoskeletal/connective tissue condition, missing or amputated limb/finger/digit.
Source: National Center for Health Statistics, National Health Interview Survey, Person Sample, 2008

Members of the white and black/African American populations report limitations due to medical conditions in approximately the same proportions. Members of the Asian race are significantly less likely to report limitations in activities of daily living due to a medical condition. Members of other or mixed race are slightly more likely to report a limitation than found in other races. (Table 1.11)

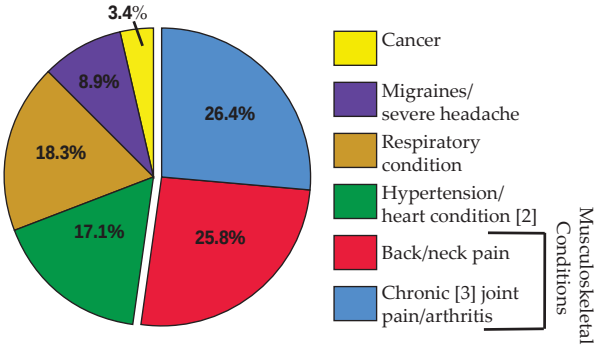
Section 1.3: Lost Work Days and Bed Days

Musculoskeletal conditions are also the greatest cause of total lost work days and medical bed days in the U.S. One in six persons (17%) employed in the previous 12 months in the U.S. at the time of the survey reported lost work days totaling more than 509 million days as a result of musculoskeletal conditions. Musculoskeletal conditions accounted for more than one-half of all persons reporting lost work days due to a medical condition. Chronic circulatory conditions accounted for 239 million lost work days, and were reported by just under 8% of the working population. Chronic respiratory conditions accounted for 228 million, and were reported by slightly more than 9% of the population. On average, workers lost nearly 13½ days in a 12-month period due to musculoskeletal conditions. Workers lost an average of only 0.3 days longer due to circulatory conditions than was lost for musculoskeletal conditions. (Table 1.12)

More than one in five persons (21%) reported at least one bed day in the previous 12 months due to a musculoskeletal condition, nearly twice the rate reported for circulatory and respiratory conditions. Total bed days due to musculoskeletal conditions were reported at more than one billion days. An average of nearly 18 bed days per person was reported. (Table 1.13)

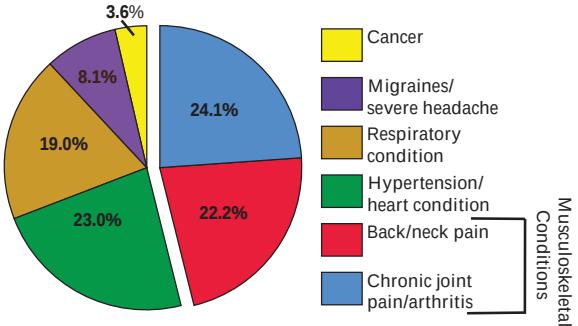
Musculoskeletal conditions accounted for approximately one-half of both lost work days and bed days due to major medical conditions in 2008. (Graphs 1.3.1 and 1.3.2) Compared to circulatory and respiratory conditions, musculoskeletal conditions accounted for more than twice the number of lost work days; they accounted for 29% and 53% more bed days than circulatory and respiratory conditions, respectively. (Graph 1.3.3)

Graph 1.3.1: Proportion of Total Lost Work Days [1] for Persons Age 18 and Over by Major Medical Condition, United States 2008



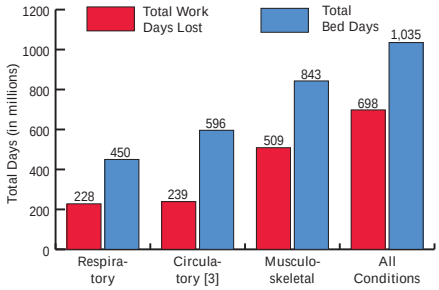
[1] Lost work days due to multiple conditions possible.
[2] Includes heart attack, angina pectoris, and other heart disease
[3] Symptoms lasting 3 months or longer OR 2 or more physician visits
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2008

Graph 1.3.2: Proportion of Total Bed Days [1] for Persons Age 18 and Over by Major Medical Condition, United States 2008



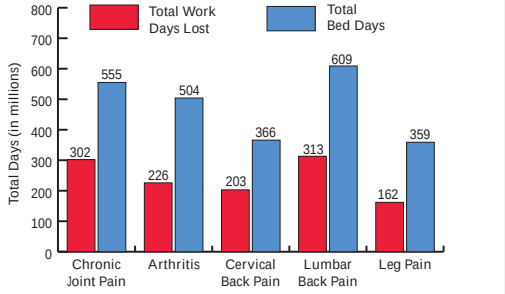
[1] Bed days due to multiple conditions possible.
[2] Includes heart attack, angina pectoris, and other heart disease
[3] Symptoms lasting 3 months or longer OR 2 or more physician visits
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2008

Table 1.3.4: Total Productivity Loss Due to Select Medical Conditions [1,2] for Persons Aged 18 and Over, United States, 2008



[1] Reported 'yes' to at least one of the 23 medical conditions (70% of the weighted population). Multiple conditions resulting in lost work or bed days possible.
[2] Symptoms lasting 3 months or longer OR 2 or more physician visits
[3] Includes heart attack, angina pectoris, and other heart disease
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.3.3: Total Productivity Loss Due to Select Musculoskeletal Conditions [1,2] for Persons Aged 18 and Over, United States, 2008



[1] Reported 'yes' to at least one of the 23 medical conditions (70% of the weighted population). Multiple conditions resulting in lost work or bed days possible.
[2] Symptoms lasting 3 months or longer OR 2 or more physician visits
[3] Includes heart attack, angina pectoris, and other heart disease
Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Major musculoskeletal causes of lost work days and medical bed days are chronic joint pain, arthritis, cervical/neck pain, and low back pain. (Graph 1.3.4) Persons reporting low back pain that radiates below the knee reported the highest average number of lost work days (25.8) and medical bed days (34.1) among all medical conditions. (Tables 1.12 and 1.13)

Overall, the high proportion of workers reporting lost work days or bed days as a result of a musculo-skeletal condition results in an economic burden on the economy that is twice that reported for chronic circulatory or chronic respiratory conditions.

Section 1.4: Summary Health Care Utilization and Economic Cost of Musculoskeletal Diseases

The annual average proportion of the U.S. population with a musculoskeletal condition requiring medical care has increased by more than two percentage points over the past decade and now constitutes more than 30% of the population. The increasing prevalence of musculoskeletal conditions, along with a growing and aging

population, has resulted in a more than 47% increase in total aggregate direct cost to treat persons with a musculoskeletal condition.

For the years 2004-2006, the annual average direct cost, in 2006 dollars, for musculoskeletal health care, both as a direct result of a musculoskeletal disease and for patients with a musculoskeletal disease in addition to other health issues, is estimated to be $576 billion, the equivalent of 4.5% of the national gross domestic product (GDP). Incremental medical cost, that proportion of total direct cost associated with treatment incurred beyond that of persons of similar demographic and health characteristics but who do not have one or more musculoskeletal diseases (i.e., most likely attributable to a musculoskeletal disease), is estimated to be $160.5 billion.

Indirect cost, expressed primarily as wage losses for persons aged 18 to 64 with a work history, add another $373.1 billion, or 2.9% of the GDP in 2004-2006, to the cost for all persons with a musculoskeletal disease, either treated as a primary condition or in addition to another condition. Annual indirect costs attributable to musculoskeletal disease alone (incremental cost) are estimated to account for $127 billion of these indirect costs.

The annual estimated direct and indirect cost attributable to persons with a musculoskeletal disease is $287 billion. Taking into account all costs for persons with a musculoskeletal disease, including other comorbid conditions, the cost of treating these individuals in addition to the cost to society in the form of decreased wages, is estimated to be nearly $950 billion per year.

Treatments that mitigate the long-term impacts of musculoskeletal conditions and return persons to full and active lives are needed.

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Section 1.5: Burden of Musculoskeletal Diseases Overview Data Tables

Table 1.1: National Institutes of Health (NIH) Funding, 2000-2008

National Institutes of Health (NIH) Organizations		Mean % of Total NIH Funding 2000-2006	Mean % of Total NIH Funding 2000-2008	Mean % Funding Variance 2006 Average to 2008 Average
NCI	National Cancer Institute	17.5%	17.3%	-0.2%
NIAID	National Institute of Allergy and Infectious Diseases	12.6%	13.1%	0.5%
NHLBI	National Heart, Lung, and Blood Institute	10.7%	10.6%	-0.1%
NIGMS	National Institute of General Medical Sciences	7.1%	7.0%	-0.1%
NIDDK	National Institute of Diabetes and Digestive and Kidney Diseases	6.5%	6.5%	0.0%
NINDS	National Institute of Neurological Disorders and Stroke	5.5%	5.5%	0.0%
NIMH	National Institute of Mental Health	5.1%	5.1%	0.0%
NICHD	National Institute of Child Health and Human Development	4.6%	4.5%	-0.1%
NCRR	National Center for Research Resources	4.0%	4.0%	0.0%
NIA	National Institute on Aging	3.7%	3.7%	0.0%
NIDA	National Institute on Drug Abuse	3.7%	3.6%	-0.1%
NIEHS	National Institute of Environmental Health Sciences	2.6%	2.6%	0.0%
NEI	National Eye Institute	2.4%	2.4%	0.0%
NIAMS	**National Institute of Arthritis and Musculoskeletal and Skin**	**1.9%**	**1.8%**	**-0.1%**
NHGRI	National Human Genome Research Institute	1.8%	1.8%	0.0%
NIAAA	National Institute on Alcohol Abuse and Alcoholism	1.6%	1.6%	0.0%
NIDCR	National Institute of Dental and Craniofacial Research	1.4%	1.4%	0.0%
NIDCD	National Institute on Deafness and Other Communication Disorders	1.4%	1.4%	0.0%
NLM	National Library of Medicine	1.1%	1.1%	0.0%
NIBIB	National Institute of Biomedical Imaging and Bioengineering	0.7%	0.7%	0.0%
NCMHD	National Center on Minority Health and Health Disparities	0.6%	1.6%	1.0%
NINR	National Institute of Nursing Research	0.5%	0.5%	0.0%
NCCAM	National Center for Complementary and Alternative Medicine	0.4%	0.4%	0.0%
FIC	John E. Fogarty International Center for Advanced Study in the Health Sciences	0.2%	0.2%	0.0%
OD	Office of the Director (includes Office of AIDS Research and Office of Research on Women's Health)	1.2%	1.8%	0.6%
Total Average Annual Funding (in 000s)		$ 24,783,710	$ 25,758,698	$ 974,988

Source: NIH Almanac-Appropriations. Available at: http://www.nih.gov/about/almanac/appropriations/index.htm. Last updated May 26, 2009. Accessed June 22, 2009.

Table 1.2: Prevalence and Age-Adjusted Rate of Self-Reported Select Medical Conditions by Age, United States 2008

	Prevalence Aged 18 & Over (in millions)					Age-Adjusted Rate [7] Per 100
Medical Condition	**18-44**	**45-64**	**65-74**	**75+**	**Total**	**Total Population**
Musculoskeletal [1]	41.946	43.340	13.048	12.002	110.336	47.95
Emotional Disorder [2]	38.071	30.796	6.629	5.641	81.137	35.26
Circulatory [3]	13.771	29.617	12.544	12.932	68.864	29.93
Respiratory [4]	23.437	21.176	5.846	4.401	54.861	23.84
Migraines or Severe Headaches	18.364	10.258	1.120	0.529	30.271	13.15
Blind or Trouble Seeing w/Glasses	7.999	10.672	2.825	3.660	25.156	10.93
Diabetes	2.555	9.247	3.931	2.929	18.662	8.11
Cancer [5]	2.523	6.838	3.814	4.687	17.862	7.76
Hearing Trouble [6]	2.413	4.833	2.678	4.484	14.408	6.26
Kidney Disease	0.797	1.372	0.596	0.955	3.720	1.62
Liver Disease	1.058	1.682	0.326	0.182	3.248	1.41

	Proportion of Population in Age Group Reporting Condition				
Medical Condition	**18-44**	**45-64**	**65-74**	**75+**	**Total**
Musculoskeletal [1]	37.9%	56.0%	65.8%	69.1%	49.0%
Emotional Disorder [2]	34.4%	39.8%	33.4%	32.5%	36.0%
Circulatory [3]	12.4%	38.3%	63.3%	74.5%	30.6%
Respiratory [4]	21.2%	27.3%	29.5%	25.4%	24.4%
Migraines or Severe Headaches	16.6%	13.2%	5.7%	3.0%	13.4%
Blind or Trouble Seeing w/Glasses	7.2%	13.8%	14.3%	21.1%	11.2%
Diabetes	2.3%	11.9%	19.8%	16.9%	8.3%
Cancer [5]	2.3%	8.8%	19.2%	27.0%	7.9%
Hearing Trouble [6]	2.2%	6.2%	13.5%	25.8%	6.4%
Kidney Disease	0.7%	1.8%	3.0%	5.5%	1.7%
Liver Disease	1.0%	2.2%	1.6%	1.0%	1.4%

[1] Includes arthritis, chronic joint symptoms (more than 3 months in duration), pain in lower back or neck (more than 3 months duration)

[2] Includes feelings that interfere with life and activities in past 30 days: sad, nervous, restless, hoplessness, worthlesness, depression, general anxiety, panic disorder, and living is an effort

[3] Includes coronary heart disease, angina pectoris, heart attack, stroke, chronic hypertension, heart disease

[4] Includes emphysema, chronic asthma, hay fever, sinusitis, chronic bronchitis

[5] Includes all types of cancer

[6] Includes respondents reporting "moderate trouble," "a lot of trouble'" or "deaf" without a hearing aid or hearing device, or currently uses a hearing aid.

[7] Age-adjusted by direct method to US Census population estimate for July 1, 2008. Accessed June 22, 2009.

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.3: Prevalence of Self-Reported Select Medical Conditions by Gender, United States 2008

	Prevalence Aged 18 & Over (in millions)		
Medical Condition	**Male**	**Female**	**Total**
Musculoskeletal [1]	49.104	61.232	110.336
Emotional Disorder [2]	32.607	48.530	81.137
Circulatory [3]	32.127	36.707	68.864
Respiratory [4]	20.968	33.893	54.861
Migraines or Severe Headaches	8.897	21.375	30.271
Blind or Trouble Seeing w/Glasses	10.073	15.083	25.156
Diabetes	8.946	9.715	18.662
Cancer [5]	6.896	10.966	17.862
Hearing Trouble [6]	8.551	5.857	14.408
Kidney Disease	1.757	1.963	3.720
Liver Disease	1.578	1.670	3.248

	Proportion of Population Aged 18 & Over by Sex Reporting Condition		
Medical Condition	**Male**	**Female**	**Total**
Musculoskeletal [1]	45.2%	52.6%	49.0%
Emotional Disorder [2]	30.0%	41.7%	36.0%
Circulatory [3]	29.6%	31.5%	30.6%
Respiratory [4]	19.3%	29.1%	24.4%
Migraines or Severe Headaches	8.2%	18.4%	13.4%
Blind or Trouble Seeing w/Glasses	9.3%	12.9%	11.2%
Diabetes	8.2%	8.3%	8.3%
Cancer [5]	6.3%	9.4%	7.9%
Hearing Trouble [6]	7.9%	5.0%	6.4%
Kidney Disease	1.6%	1.7%	1.7%
Liver Disease	1.5%	1.4%	1.4%

[1] Includes arthritis, chronic joint symptoms (more than 3 months in duration), pain in lower back or neck (more than 3 months duration)

[2] Includes feelings that interfere with life and activities in past 30 days: sad, nervous, restless, hoplessness, worthlesness, depression, general anxiety, panic disorder, and living is an effort

[3] Includes coronary heart disease, angina pectoris, heart attack, stroke, chronic hypertension, heart disease

[4] Includes emphysema, chronic asthma, hay fever, sinusitis, chronic bronchitis

[5] Includes all types of cancer

[6] Includes respondents reporting "moderate trouble," "a lot of trouble"' or "deaf" without a hearing aid or or hearing device, or currently uses a hearing aid.

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.4: Prevalence of Self-Report Selected Medical Conditions by Race, United States, 2008

Prevalence Aged 18 & Over (in millions)

Medical Condition	White	Black/ African American	Asian	Other or Mixed Race	Total
Musculoskeletal [1]	92.822	11.502	3.188	2.825	110.336
Emotional Disorder [2]	68.236	8.571	2.037	2.293	81.137
Circulatory [3]	56.438	8.728	2.156	1.542	68.864
Respiratory [4]	45.541	6.254	1.715	1.351	54.861
Migraines or Severe Headaches	24.927	3.525	0.845	0.974	30.271
Blind or Trouble Seeing w/Glasses	20.533	3.020	0.876	0.727	25.156
Diabetes	14.537	2.759	0.749	0.617	18.662
Cancer [5]	16.170	1.013	0.323	0.356	17.862
Hearing Trouble [6]	12.963	0.843	0.310	0.292	14.408
Kidney Disease	3.004	0.502	0.141	0.074	3.720
Liver Disease	2.751	0.251	0.143	0.104	3.248

Proportion of Population Aged 18 & Over by Race Reporting Condition

Medical Condition	White	Black/ African American	Asian	Other or Mixed Race	Total
Musculoskeletal [1]	50.8%	43.0%	30.4%	53.1%	49.0%
Emotional Disorder [2]	37.4%	32.0%	19.4%	43.1%	36.0%
Circulatory [3]	30.9%	32.6%	20.5%	29.0%	30.6%
Respiratory [4]	24.9%	23.4%	16.3%	25.4%	24.4%
Migraines or Severe Headaches	13.6%	13.2%	8.1%	18.3%	13.4%
Blind or Trouble Seeing w/Glasses	11.2%	11.3%	8.3%	13.7%	11.2%
Diabetes	8.0%	10.3%	7.1%	11.6%	8.3%
Cancer [5]	8.9%	3.8%	3.1%	6.7%	7.9%
Hearing Trouble [6]	7.1%	3.1%	3.0%	5.5%	6.4%
Kidney Disease	1.6%	1.9%	1.3%	1.4%	1.7%
Liver Disease	1.5%	0.9%	1.4%	1.9%	1.4%

[1] Includes arthritis, chronic joint symptoms (more than 3 months in duration), pain in lower back or neck (more than 3 months duration)

[2] Includes feelings that interfere with life and activities in past 30 days: sad, nervous, restless, hoplessness, worthlesness, depression, general anxiety, panic disorder, and living is an effort

[3] Includes coronary heart disease, angina pectoris, heart attack, stroke, chronic hypertension, heart disease

[4] Includes emphysema, chronic asthma, hay fever, sinusitis, chronic bronchitis

[5] Includes all types of cancer

[6] Includes respondents reporting "moderate trouble," "a lot of trouble'" or "deaf" without a hearing aid or or hearing device, or currently uses a hearing aid.

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.5: Prevalence of Most Frequently Reported Medical Conditions by Age, United States 2008

Medical Condition	Prevalence Aged 18 & Over (in millions) 18-44	45-64	65-74	75+	Total	Age-Adjusted Rate [4] Per 100 Total Population
Musculoskeletal [1, 2]	41.946	43.340	13.048	12.002	110.336	48.0
Chronic [2] Joint Pain	18.485	27.063	8.520	7.567	61.635	26.8
Arthritis	8.299	23.902	9.568	9.445	51.241	22.3
Neck Pain (Cervical Back Pain)	14.009	12.738	2.614	2.069	31.430	13.7
Lower Back Pain (Lumbar Back Pain)	27.136	22.788	6.345	5.446	61.715	26.8
Lower Back Pain Spreading Below Knee	6.571	9.159	2.608	1.766	20.104	8.7
Circulatory	13.771	29.617	12.544	12.932	68.864	29.9
Chronic Hypertension	9.642	25.157	10.738	10.583	56.121	24.4
Coronary or Heart Condition [3]	5.071	9.470	5.292	6.795	26.628	11.6
Stroke	0.714	2.258	1.231	2.239	6.442	2.8
Respiratory	23.437	21.176	5.846	4.401	54.861	23.8
Sinusitis	12.848	12.074	3.353	2.337	30.611	13.3
Hay Fever	7.379	7.825	1.531	1.272	18.007	7.8
Chronic [2] Asthma	7.945	5.765	1.546	1.109	16.365	7.1
Chronic [2] Bronchitis	3.492	4.251	1.168	0.917	9.828	4.3
Emphysema	0.222	1.575	1.118	0.873	3.788	1.7

Medical Condition	Proportion of Population in Age Group Reporting Condition 18-44	45-64	65-74	75+	Total
Musculoskeletal [1, 2]	37.9%	56.0%	65.8%	69.1%	49.0%
Chronic [2] Joint Pain	16.7%	35.0%	43.0%	43.6%	27.4%
Arthritis	7.5%	30.9%	48.3%	54.4%	22.7%
Neck Pain (Cervical Back Pain)	12.7%	16.5%	13.2%	11.9%	14.0%
Lower Back Pain (Lumbar Back Pain)	24.5%	29.4%	32.0%	31.4%	27.4%
Lower Back Pain Spreading Below Knee	5.9%	11.8%	13.2%	10.2%	8.9%
Circulatory	12.4%	38.3%	63.3%	74.5%	30.6%
Chronic Hypertension	8.7%	32.5%	54.2%	61.0%	24.9%
Coronary or Heart Condition [3]	4.6%	12.2%	26.7%	39.1%	11.8%
Stroke	0.6%	2.9%	6.2%	12.9%	2.9%
Respiratory	21.2%	27.3%	29.5%	25.4%	24.4%
Sinusitis	11.6%	15.6%	16.9%	13.5%	13.6%
Hay Fever	6.7%	10.1%	7.7%	7.3%	8.0%
Chronic [2] Asthma	7.2%	7.4%	7.8%	6.4%	7.3%
Chronic [2] Bronchitis	3.2%	5.5%	5.9%	5.3%	4.4%
Emphysema	0.2%	2.0%	5.6%	5.0%	1.7%

[1] Specific conditions are not mutually exclusive in overall condition category

[2] Symptoms lasting 3 months or longer

[3] Includes heart attack, angina pectoris, and other heart disease

[5] Age-adjusted by direct method to US Census population estimate for July 1, 2007. Accessed June 22, 2009.

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.6: Prevalence of Most Frequently Reported Medical Conditions by Gender, United States 2008

Medical Condition	Prevalence Age 18 & Over (in millions) Males	Females	Total
Musculoskeletal [1, 2]	49.104	61.232	110.336
Chronic [2] Joint Pain	22.710	33.925	61.635
Arthritis	31.536	38.878	70.414
Neck Pain (Cervical Back Pain)	12.368	19.062	31.430
Lower Back Pain (Lumbar Back Pain)	27.334	34.381	61.715
Lower Back Pain Spreading Below Knee	8.498	11.606	20.104
Circulatory	32.157	36.707	68.864
Chronic Hypertension	25.997	30.124	56.121
Coronary or Heart Condition [3]	13.171	13.457	26.628
Stroke	2.948	3.493	6.441
Respiratory	20.968	33.892	54.861
Sinusitis	10.072	20.540	30.611
Hay Fever	7.444	10.563	18.007
Chronic [2] Asthma	6.118	10.247	16.365
Chronic [2] Bronchitis	3.115	6.712	9.828
Emphysema	1.768	2.020	3.788

Medical Condition	Proportion of Population by Sex Reporting Condition Males	Females	Total
Musculoskeletal [1, 2]	45.2%	52.6%	49.0%
Chronic [2] Joint Pain	20.9%	29.1%	27.4%
Arthritis	18.5%	26.7%	22.7%
Neck Pain (Cervical Back Pain)	11.4%	16.4%	14.0%
Lower Back Pain (Lumbar Back Pain)	25.1%	29.5%	27.4%
Lower Back Pain Spreading Below Knee	7.8%	10.0%	8.9%
Circulatory	29.6%	31.5%	30.6%
Chronic Hypertension	23.9%	25.9%	24.9%
Coronary or Heart Condition [3]	12.1%	11.6%	11.8%
Stroke	2.7%	3.0%	2.9%
Respiratory	19.3%	29.1%	24.4%
Sinusitis	9.3%	17.6%	13.6%
Hay Fever	6.8%	9.1%	8.0%
Chronic [2] Asthma	5.6%	8.8%	7.2%
Chronic [2] Bronchitis	2.9%	5.8%	4.4%
Emphysema	1.0%	1.7%	1.7%

[1] Specific conditions are not mutually exclusive in overall condition category

[2] Symptoms lasting 3 months or longer

[3] Includes heart attack, angina pectoris, and other heart disease

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.7: Prevalence of Most Frequently Reported Medical Conditions by Race, United States 2008

	Prevalence Aged 18 & Over (in millions)				
Medical Condition	**White**	**American**	**Asian**	**Race**	**Total**
Musculoskeletal [1, 2]	92.822	11.502	3.188	2.825	110.336
Chronic [2] Joint Pain	52.415	6.372	1.338	1.511	61.635
Arthritis	43.618	5.367	1.118	1.112	51.214
Neck Pain (Cervical Back Pain)	26.702	2.785	0.923	1.021	31.430
Lower Back Pain (Lumbar Back Pain)	51.800	6.264	1.817	1.833	61.715
Lower Back Pain Spreading Below Knee	17.021	1.942	0.460	0.681	20.104
Circulatory	56.438	8.728	2.156	1.542	68.864
Chronic Hypertension	45.056	7.902	1.942	1.221	56.121
Coronary or Heart Condition [3]	23.087	2.443	0.463	0.635	26.628
Stroke	5.286	0.831	0.136	0.189	6.442
Respiratory	45.541	6.254	1.715	1.351	54.861
Sinusitis	25.597	3.644	0.728	0.642	30.611
Hay Fever	15.131	1.697	0.709	0.470	18.007
Chronic [2] Asthma	13.033	2.165	0.488	0.679	16.365
Chronic [2] Bronchitis	8.443	1.020	0.118	0.246	9.828
Emphysema	3.446	0.217	0.030	0.095	3.788
	Proportion of Population Aged 18 & Over by Race Reporting Condition				
Musculoskeletal [1, 2]	50.8%	43.0%	30.4%	53.1%	49.0%
Chronic [2] Joint Pain	28.7%	23.8%	12.7%	28.4%	27.4%
Arthritis	23.9%	20.1%	10.6%	20.9%	22.7%
Neck Pain (Cervical Back Pain)	14.6%	10.4%	8.8%	19.2%	14.0%
Lower Back Pain (Lumbar Back Pain)	28.4%	23.4%	17.3%	34.5%	27.4%
Lower Back Pain Spreading Below Knee	9.3%	7.3%	4.4%	12.8%	8.9%
Circulatory	30.9%	32.6%	20.5%	29.0%	30.6%
Chronic Hypertension	24.7%	29.5%	18.5%	23.0%	24.9%
Coronary or Heart Condition [3]	12.6%	9.1%	4.4%	11.9%	11.8%
Stroke	2.9%	3.1%	1.3%	3.6%	2.9%
Respiratory	24.9%	23.4%	16.3%	25.4%	24.4%
Sinusitis	14.9%	13.6%	6.9%	12.1%	13.6%
Hay Fever	8.3%	6.3%	6.8%	8.8%	8.0%
Chronic [2] Asthma	7.1%	8.1%	4.6%	12.8%	7.3%
Chronic [2] Bronchitis	4.6%	3.8%	1.1%	4.6%	4.4%
Emphysema	1.9%	0.8%	0.3%	1.8%	1.7%

[1] Specific conditions are not mutually exclusive in overall condition category

[2] Symptoms lasting 3 months or longer

[3] Includes heart attack, angina pectoris, and other heart disease

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.8: Prevalence of Chronic Joint Pain [1] by Joint by Age, United States 2008

	Persons with Self-Reported Chronic Joint Condition (in 000s)					Age-Adjusted Rate [2] per 100 Total Population	% Joint Represents of All Chronic Joint Pain Reported [3]
	18-44	45-64	65-74	75+	All Ages		
Knee	11,565	17,717	5,308	4,475	39,065	17.0	63.4%
Shoulder	4,864	8,630	2,868	2,517	18,879	8.2	30.6%
Fingers	3,146	7,154	2,790	2,449	15,539	6.8	25.2%
Hip	3,474	6,672	2,656	2,071	14,873	6.5	24.1%
Ankle	4,301	6,185	1,619	1,389	13,494	5.9	21.9%
Wrist	3,739	5,003	1,527	1,187	11,456	5.0	18.6%
Elbow	2,985	5,133	1,283	854	11,456	4.5	16.6%
Toes	1,143	3,204	1,108	723	6,078	2.6	9.9%
Other Joint	910	1,404	382	388	3,084	1.3	5.0%
All Chronic Joint	18,485	27,063	8,520	7,567	61,635	26.8	

	% Age Group w/Joint Pain				
Knee	10.5%	22.9%	26.8%	25.8%	17.3%
Shoulder	4.4%	11.1%	14.5%	14.5%	8.4%
Fingers	2.8%	9.2%	14.1%	14.1%	6.9%
Hip	3.1%	8.6%	13.4%	11.9%	6.6%
Ankle	3.9%	8.0%	8.2%	8.0%	6.0%
Wrist	3.4%	6.5%	7.7%	6.8%	5.1%
Elbow	2.7%	6.6%	6.5%	4.9%	4.6%
Toes	1.0%	4.1%	5.6%	4.2%	2.7%
Other Joint	0.8%	1.8%	1.9%	2.2%	1.4%
All Chronic Joint	16.7%	35.0%	43.0%	43.6%	27.4%

[1] Symptoms lasting 3 months or longer

[2] Age-adjusted to July 1, 2008 U.S. Census population estimates

[3] Chronic pain in multiple joints may be reported

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample, 2008

Table 1.9: Self-Reported Impairment in Activities of Daily Living for Persons Due to Select Medical Conditions by Age, United States 2008

	Prevalence (N) of Reported Impairment (in 000s)						
Condition	**0-17**	**18-44**	**45-64**	**65-74**	**75+**	**Total All Ages**	**Total Aged 18 & Over**
Musculoskeletal [1]	283	2,664	7,416	2,838	3,852	17,053	16,770
Circulatory [2]	*	663	3,447	1,842	2,503	8,455	8,455
Depression/Anxiety/Emotional Problem [3]	1,037	1,494	1,952	265	183	4,931	3,894
Diabetes	*	263	1,680	974	619	3,536	3,536
Respiratory (Lung Breathing Problem)	489	397	1,466	728	605	3,685	3,196
Nervous System [4]/Sensory Organ	127	816	1,388	336	452	3,119	2,992
Vision Problem	202	269	715	388	718	2,292	2,090
Hearing Problem	186	191	432	197	589	1,595	1,409
Cancer	*	151	573	266	360	1,350	1,350
Birth Defect/Mental Retardation/ Developmental Problem	432	932	350	24	33	1,771	1,339
Other Condition/Disorder	3,526	1,354	2,346	939	1,969	10,134	6,608
Total All Conditions	5,478	6,824	13,176	5,243	7,351	38,072	32,594
	Proportion of Persons with Reported Impairment within Age Group						
Musculoskeletal [1]	0.4%	2.4%	9.6%	14.3%	22.3%	5.7%	7.4%
Circulatory [2]	*	0.6%	4.4%	9.3%	14.5%	2.8%	3.8%
Depression/Anxiety/Emotional Problem [3]	1.4%	1.4%	2.5%	1.3%	1.1%	1.6%	1.7%
Diabetes	*	0.2%	2.2%	4.9%	3.6%	1.2%	1.6%
Respiratory (Lung Breathing Problem)	0.7%	0.4%	1.9%	3.7%	3.5%	1.2%	1.4%
Nervous System [4]/Sensory Organ	0.2%	0.7%	1.8%	1.7%	2.6%	1.0%	1.3%
Vision Problem	0.3%	0.2%	0.9%	2.0%	4.2%	0.8%	0.9%
Hearing Problem	0.3%	0.2%	0.6%	1.0%	3.4%	0.5%	0.6%
Cancer	*	0.1%	0.7%	1.3%	2.1%	0.5%	0.6%
Birth Defect/Mental Retardation/ Developmental Problem	0.6%	0.8%	0.5%	1.0%	0.2%	0.6%	0.6%
Other Condition/Disorder	4.8%	1.2%	3.0%	4.7%	11.4%	3.4%	2.9%
Total All Conditions	7.4%	6.2%	17.0%	26.4%	42.6%	12.7%	14.5%

[1] Includes arthritis/rheumatism condition, back or neck problem, fracture/bone/joint injury, musculoskeletal/connective tissue condition, missing or amputated limb/finger/digit; in 0-17 population defined as injury or bone/joint/muscle problem.

[2] Includes heart or hypertension, stroke, circulation or blood problem.

[3] Includes depression/anxiety/emotional problem; in 0-17 population, defined as emotional/behavioral problem.

[4] In 0-17 population, defined as epilepsy/seizures

* Reported number does not meet sample size reliability

Source: National Center for Health Statistics, National Health Interview Survey, Person Sample, 2008

Table 1.10: Self-Reported Impairment in Activities of Daily Living for Persons Aged 18 and Over Due to Select Medical Conditions by Gender, United States 2008

	Prevalence of Reported Impairment for Persons Age 18 and Over (in 000s)						
	Males			Females			
Condition	Prevalence (N)	% Total Male Population	% of Total N	Prevalence (N)	% Total Female Population	% of Total	Total Prevalence (N)
Musculoskeletal [1]	6,531	6.0%	38.9%	10,238	8.8%	61.1%	16,770
Circulatory [2]	3,889	3.6%	46.0%	4,565	3.9%	54.0%	8,454
Depression/Anxiety/Emotional Probler	1,488	1.4%	38.2%	2,406	2.1%	61.8%	3,894
Diabetes	1,530	1.4%	43.3%	2,006	1.7%	56.7%	3,536
Respiratory	1,281	1.2%	40.1%	1,915	1.6%	59.9%	3,196
Nervous System/Sensory Organ	1,247	1.1%	41.7%	1,745	1.5%	58.3%	2,992
Vision Problem	777	0.7%	37.2%	1,313	1.1%	62.8%	2,090
Hearing Problem	588	0.5%	41.7%	820	0.7%	58.3%	1,408
Birth Defect/Mental Retardation/ Developmental Problem	741	0.7%	55.4%	598	0.5%	44.6%	1,339
Cancer	629	0.6%	46.6%	721	0.6%	53.4%	1,350
Other Condition/Disorder	2,684	12.5%	40.6%	3,923	13.4%	59.4%	6,607
Total All Conditions	14,196	13.1%	43.6%	18,397	15.8%	56.4%	32,594

[1] Includes arthritis/rheumatism condition, back or neck problem, fracture/bone/joint injury, musculoskeletal/connective tissue condition, missing or amputated limb/finger/digit

[2] Includes heart or hypertension, stroke, circulation or blood problem.

Source: National Center for Health Statistics, National Health Interview Survey, Person Sample, 2008

Table 1.11: Self-Reported Impairment in Activities of Daily Living for Persons Aged 18 and Over Due to Select Medical Conditions by Race, United States 2008

	Prevalence of Reported Impairment for Persons Age 18 and Over (in 000s)								
	White		Black/ African American		Asian		Other or Mixed Race		
Condition	Prevalence (N)	% of Total Race	Prevalence (N)	% of Total Race	Prevalence (N)	% of Total Race	Prevalence (N)	% of Total Race	Total Prevalence (N)
Musculoskeletal [1]	13,953	7.6%	2,025	7.5%	302	2.9%	489	9.8%	16,770
Circulatory [2]	6,685	3.7%	1,437	5.4%	155	1.5%	176	3.6%	8,454
Depression/Anxiety/Emotional Proble	3,176	1.7%	500	1.9%	46	0.4%	70	3.4%	3,894
Diabetes	2,627	1.4%	723	2.7%	73	0.7%	113	2.3%	3,536
Respiratory	2,653	1.5%	407	1.5%	41	0.4%	96	1.9%	3,196
Nervous System/Sensory Organ	2,449	1.3%	344	1.3%	44	0.4%	155	3.1%	2,992
Vision Problem	1,714	0.9%	260	1.0%	50	0.5%	66	1.3%	2,090
Hearing Problem	1,217	0.7%	93	0.3%	28	2.0%	70	1.4%	1,408
Birth Defect/Mental Retardation/ Developmental Problem	1,019	0.6%	224	0.8%	36	0.3%	60	1.2%	1,339
Cancer	1,140	0.6%	116	0.4%	37	0.3%	58	1.2%	1,350
Other Condition/Disorder	5,432	3.0%	854	3.2%	155	1.5%	166	3.3%	6,607
Total All Conditions	26,703	14.6%	4,274	15.9%	638	6.0%	979	19.7%	32,594

[1] Includes arthritis/rheumatism condition, back or neck problem, fracture/bone/joint injury, musculoskeletal/connective tissue condition, missing or amputated limb/finger/digit

[2] Includes heart or hypertension, stroke, circulation or blood problem.

Source: National Center for Health Statistics, National Health Interview Survey, Person Sample, 2008

Table 1.12: Lost Work Days from Self-Reported Select Medical Conditions for Persons Aged 18 and Over, United States 2008

Condition	Total # w/ Condition (in 000s)	% U.S. Population Reporting Lost Work Days as a Result of Medical Condition	Total # Reporting Lost Work Days	Total Work Days Lost (in 000s)	Average Work Days Lost per Condition
All Conditions [1]	175,653	32.1%	72,360	697,540	9.6
Musculoskeletal	110,336	16.8%	37,920	509,392	13.4
Circulatory	68,864	7.7%	17,430	239,101	13.7
Respiratory	54,861	9.3%	20,961	227,913	10.9
Musculoskeletal Conditions					
Chronic [2] Joint Pain	61,635	8.8%	19,872	302,141	15.2
Arthritis	51,214	6.0%	13,574	226,472	16.7
Neck Pain (Cervical Back Pain)	31,430	5.3%	12,019	203,285	16.9
Lower Back Pain (Lumbar Back Pain)	40,284	9.8%	22,093	313,487	14.2
Lower Back Pain Spreading Below Knee	20,104	2.8%	6,283	162,319	25.8
Circulatory					
Chronic [2] Hypertension	66,278	7.6%	17,028	238,786	14.0
Coronary or Heart Condition [3]	26,628	2.6%	5,944	81,471	13.7
Stroke	1,473	0.4%	813	21,504	26.5
Respiratory					
Sinusitis	30,611	5.6%	12,641	150,005	11.9
Hay Fever	18,007	3.2%	7,215	79,164	11.0
Chronic [2] Asthma	16,365	2.7%	6,022	69,681	11.6
Chronic [2] Bronchitis	9,828	1.7%	3,774	57,177	15.2
Emphysema	3,788	0.2%	549	10,037	18.3
Migraines/Severe Headaches	30,271	6.1%	13,686	179,086	13.1
Cancer	17,862	1.7%	3,795	68,867	18.1

[1] Reported 'yes' to at least one of the 36 medical conditions (78% of the weighted population).

[2] Symptoms lasting 3 months or longer OR 2 or more physician visits

[3] Includes heart attack, angina pectoris, and other heart disease

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2008

Table 1.13: Bed Days from Self-Reported Select Medical Conditions for persons Aged 18 and Over, United States 2008

Condition	Total # w/ Condition	% U.S. Population Reporting Bed Days as a Result of Medical Condition	Total # Reporting Bed Days	Total Bed Days (in 000s)	Average Bed Days per Condition
All Conditions [1]	175,653	35.9%	80,757	1,035,005	12.8
Musculoskeletal	110,336	21.2%	47,655	842,867	17.7
Circulatory	68,864	12.1%	27,255	595,933	21.9
Respiratory	54,861	11.4%	25,766	450,378	17.5
Musculoskeletal Conditions					
Chronic [2] Joint Pain	61,635	12.2%	27,381	555,033	20.3
Arthritis	51,214	9.9%	22,326	504,164	22.6
Neck Pain (Cervical Back Pain)	31,430	7.1%	15,960	365,654	22.9
Lower Back Pain (Lumbar Back Pain)	40,284	12.9%	29,097	608,822	20.9
Lower Back Pain Spreading Below Knee	20,104	4.7%	10,525	359,190	34.1
Circulatory					
Chronic [2] Hypertension	66,278	11.1%	25,101	515,782	20.5
Coronary or Heart Condition [3]	26,628	5.2%	11,661	332,655	28.5
Stroke	1,473	1.3%	2,917	163,869	56.2
Respiratory					
Sinusitis	30,611	6.8%	15,335	269,590	17.6
Hay Fever	18,007	3.7%	8,366	124,238	14.9
Chronic [2] Asthma	16,365	3.6%	8,152	185,232	22.7
Chronic [2] Bronchitis	9,828	2.5%	5,680	168,225	29.6
Emphysema	3,788	0.8%	1,836	88,706	48.3
Migraines/Severe Headaches	30,271	7.6%	17,178	355,273	20.7
Cancer	17,862	3.2%	7,147	156,848	21.9

[1] Reported 'yes' to at least one of the 36 medical conditions (78% of the weighted population).

[2] Symptoms lasting 3 months or longer OR 2 or more physician visits

[3] Includes heart attack, angina pectoris, and other heart disease

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2008

Chapter 2
Spine: Low Back and Neck Pain

Lumbar/low back pain and cervical/neck pain are among the most common physical conditions requiring medical care and affecting an individual's ability to work and manage the daily activities of life. Back pain is also the most common physical condition for which patients visit their doctor. In a given year, between 12% and 15% of the United States population will visit their physician with a complaint of back pain. Over the past decade, this rate has shown a slow, but steady, increase. In 2006, more than 44.4 million patients visited a physician with a complaint of back pain.

Joint pain, also called musculoskeletal pain, from mild strains to severe disabling conditions, affects many. In the United States, two major annual health care surveys are conducted by the National Center for Health Statistics to identify the incidence and prevalence of select health conditions. One of the conditions included is referred to as "joint pain." In reality it is not pain arising from a joint, but rather a musculoskeletal pain in a defined body area. Joint pain is among the most frequently reported conditions in both surveys.

Back pain, including cervical/neck pain and lumbar/low back pain, is more common than severe headaches or allergies resulting from hay fever or sinus conditions. In recent years, between 48%[1] and 60%[2] of adult persons in the United States reported experiencing neck or low back pain in the previous 3 months, while severe headache or migraine was reported by 13% in the most recent survey. Hay fever or sinusitis was reported by 8% and 14%, respectively, in a previous 12-month period. Back pain is also reported more frequently than other musculoskeletal pain, including pain in the arm, shoulder, hip, or knee. Low back pain prevalence increases with age, while neck pain tends to peak in the 45 to 64 age range.

Eleven percent (11%) of the population aged 18 or older report they have a physical, mental, or emotional problem or illness that precludes work; 20% of persons with either low back or neck pain report they cannot work, while 33% of persons with multiple back pain sites are unable to work.[2] Back pain also greatly limits the type and duration of work a person can do. Three of four persons with multiple back pain sites report work limitations.

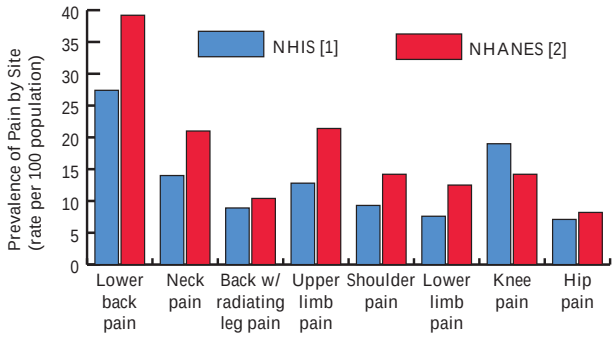
Estimated annual direct medical costs for all spine related conditions for the years 2002-2004 were $193.9 billion, with $30.3 billion estimated as the incremental cost directly related to spine pain. (Chapter 9: Health Care Utilization and Economic Cost of Musculoskeletal Diseases.) In addition, annual indirect costs of $14.0 billion in lost wages were incurred as a result of spine disorders.

Back pain often results from complex conditions that are not easily understood. Many are probably related to degeneration, but the actual underlying cause of a back pain episode is often uncertain. Thus, in reviewing administrative data sets for prevalence of conditions, it is important to realize that diagnostic categories may be inaccurate, reflecting the probable diagnosis rather than the definitive diagnosis.

Section 2.1: Low Back and Joint Pain

Between 2004 and 2008, 28% to 40% of people in the United States report they experienced low back pain in a previous 3 month period in the two self-reported health condition national health surveys. (Tables 2.1 and 2.2 and Graph 2.1.1) Among those persons reporting low back pain, one-fourth to one-third (26% to 33%) also experienced pain radiating into the leg. An additional 14% to 21% of persons reported

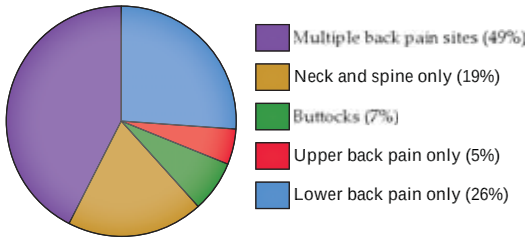
Graph 2.1.1: Prevalence of Self-Reported Joint Pain by Site for Persons Aged 18 and Over in Two National Health Surveys, United States 1999-2007



[1] Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2007
[2] Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 1999-2004

experiencing neck pain. Overall, about one in two persons report experiencing back pain at least once a year. This is a greater rate of pain than is reported for hips, knees, legs, shoulders, and the upper limb (arm, elbow, wrist, and hands). Approximately one-half of all persons reporting joint pain experience it in more than one site. This is true for persons reporting back pain and for persons reporting joint pain other than back pain. The most frequently reported single site of joint pain is in the lower back. (Graphs 2.1.2 and 2.1.3)

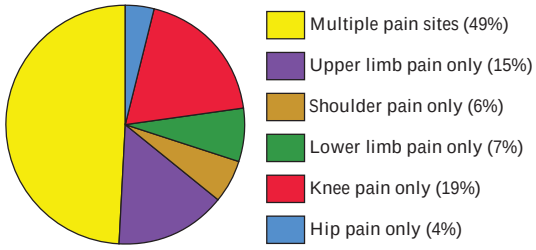
Graph 2.1.2: Distribution of Back Pain by Site for Persons Aged 18 and Over, United States 1999-2004



Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 1999-2004.

Back pain is reported by slightly higher rates among females than among males. Back pain is reported in the highest rate by persons over the age of 65 and lowest by those aged 18 to 44. Among racial groups, back pain is reported at the highest rate by those reporting an Other race, and lowest by those of the Asian race. (Tables 2.1, 2.2, 2.3 and 2.4) Back pain is not selective, but is a major health concern for persons of all ages and ethnic

Graph 2.1.3: Distribution of Joint Pain Other than Back Pain by Site for Persons Aged 18 and Over, United States 1999-2004



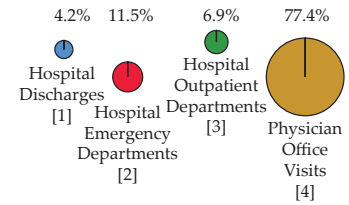
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 1999-2004.

backgrounds in the United States. On average, 4% to 5% of all annual health care visits to physicians, emergency departments, outpatient clinics, ad hospitals are for treatment of back pain.

The epidemiology of low back pain is not well understood and the overall prevalence, as supported by health care assessment databases, remains unclear. In 2006, 45.1 million patient visits to hospitals and physician offices had low back pain as the first diagnosis. More than 3 out of 4 visits were to a physician's office, but 4% entailed hospitalization. (Tables 2.5 and 2.5a and Graph 2.1.4) The two major diagnostic categories in patients with low back pain are disc degeneration and "back injury."

The most common diagnosis in patients with low back pain is disc degeneration. Until recently, degenerative back pain was thought to be primarily the result of use or wear and tear. Recent studies, however, have shown a strong genetic link.[3] Intervertebral disc degeneration is a common and natural process of the human spine.

Graph 2.1.4: Distribution of Health Care Visits for Low Back Pain, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2]Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

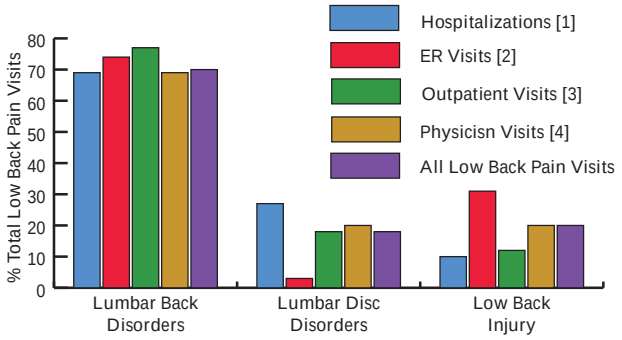
Degeneration occurs gradually with aging and can alter the biomechanics and function of the spine. Although these changes go unnoticed in many persons, in others they manifest in back pain and sometimes even neurological compromise.

In this discussion we are dividing the diagnostic codes into three groups: back disorders, disc disorders, and back injuries. This approach was chosen to allow comparison to earlier editions of this text. Back disorders include inflammatory spine conditions, spondylosis, spinal stenosis, lumbago, sciatica, backache, and disorders of the sacrum (ICD-9-CM codes 720, 721, and 724). Disc disorders include herniations, disc degeneration, and post laminectomy syndromes (ICD-9-CM code 722). Back injuries include fractures, dislocation, and sprains (ICD-9-CM codes 805, 806, 839, 846, and 847). This division, while useful in analyzing the databases, may not always accurately reflect the primary diagnosis. Further there is some overlap. For example, a patient with back pain of unknown origin could be given a diagnosis of lumbago, placing him or her in the back disorder category; a diagnosis of disc degeneration, falling into the disc disorder category; or a diagnosis of back strain, falling into the back injury category. Unfortunately, databases do not permit diagnostic verification, and sometimes a diagnosis is provided primarily for reimbursement purposes.

Back disorders accounted for 70% of 2006 low back pain health care resource visits. Hospital emergency room and outpatient hospital visits for back disorders accounted for more than three-quarters of back pain visits in 2006, and 69% of hospitalizations were for back disorders.

Disc disorders, which include disc displacement (herniation) and degeneration, were diagnosed in about one-half (18%) of the remaining low back pain resource visits. Disc disorders comprised 27% of the hospitalizations in 2006, but only 3% of emergency room visits.

Graph 2.1.5: Distribution of Health Care Resource Use for Low Back Pain by Type of Diagnosis, United States, 2006/2007

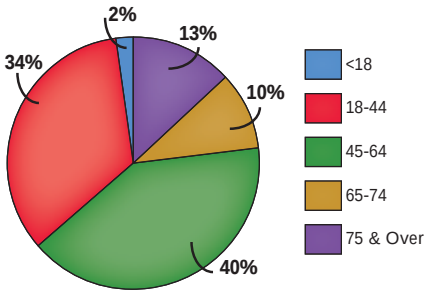


[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Back injury, which includes fractures, sprains, and strains, often reported as caused by over-exertion or overuse, accounted for 20% of 2006 low back pain resource visits. Note that diagnoses equate to more than 100%, indicating multiple diagnoses for some patients. Back injuries accounted for 32% of emergency room visits in 2006, but only 10% of hospitalizations. (Table 2.5a and Graph 2.1.5)

The incidence of low back pain is greatest in persons of young adult and middle age. In 2006, 74% of all health care visits for low back pain were made by persons between the ages of 18 and 64. (Table 2.5 and Graph 2.1.6) Low back pain in this group is

Graph 2.1.6: Distribution of Low Back Pain Health Care Resource Visits by Age, United States 2006/2007

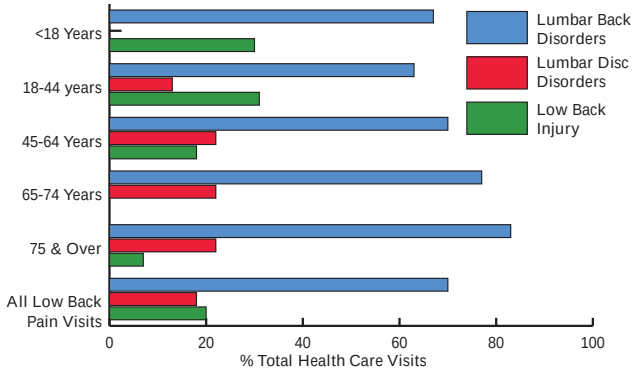


Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

often accompanied by reduced ability to work or inability to work at all. The socioeconomic impact of low back pain, including both direct and indirect costs of health care and disability attendant to the disorder, has been estimated to exceed $100 billion each year.[4]

Back disorders are found more frequently among persons aged 75 and over than in any other age group, accounting for 83% of health care visits in this age group in 2006. (Table 2.5a and Graph 2.1.7) This is probably a reflection of the prevalence of spinal stenosis in elderly patients. Among the small percentage of persons with low back pain who are younger than 18, back disorders represented 67% of their visits; the balance of visits for low back pain among the young were due to back injuries. Disc herniations and disc degeneration are rare in this age group. Lumbar back injuries accounted for 31% of the health care visits among persons aged 18 to 44, the highest proportion of all age groups. Disc disorders were seen in 22% of persons over the age of 45 in 2006.

Graph 2.1.7: Distribution of Health Care Resource Use for Low Back Pain by Type and Age, United States 2006/2007

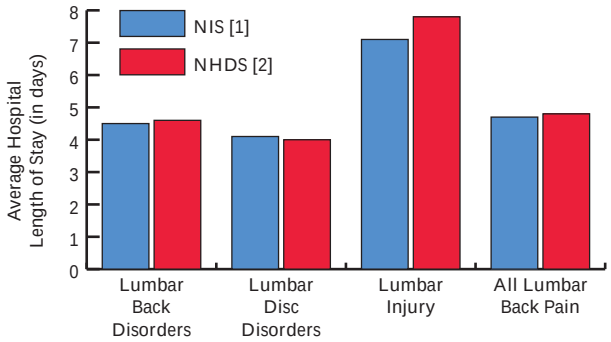


Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

The average age of persons hospitalized in 2007 for low back pain was 60.5 years. This compares to an average age of 42.1 years for persons visiting an emergency department, 48.8 years for visits to an outpatient department, and 51.4 years for visits to a physician. (Table 2.5)

Persons hospitalized for low back pain in 2007 spent an average of nearly 5 days in the hospital. (Table 2.8 and Graph 2.1.8) Persons hospitalized for lumbar back injuries were hospitalized for the longest period of time, an average of more than seven days.

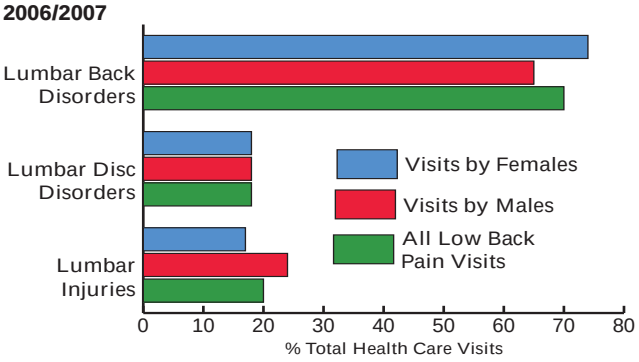
Graph 2.1.8: Average Length of Hospital Stay for Lumbar Spine Diagnosis, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Low back pain is found more frequently among females than males, with females representing 56% of the 2006 health care visits. Males were seen more often for low back injuries (24% of visits) while 18% of both males and females were diagnosed with disc disorders; 74% of the female visits for low back pain were diagnosed as back

Graph 2.1.9: Distribution of Health Care Resource Use for Low Back Pain by Type and Gender, United States, 2006/2007



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

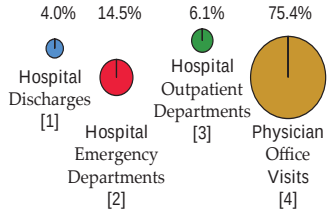
disorders. Again, this is probably a reflection of the prevalence of spinal stenosis. (Table 2.5 and Graph 2.1.9)

Overall, lumbar/low back pain accounted for 1 in 25 health care resource visits in 2006, a proportion that has been steady for the past several years. The staggering impact of low back pain on both the health care resources in the United States and the disability inflicted on the individual is difficult to fully quantify.

Section 2.2: Cervical/Neck Pain

Cervical/neck pain is a very common reason for visiting a doctor. In 2006, 13.2 million patient visits, or more than 1% of all health care visits to hospitals and physician offices, were for neck pain. Three out of four (75%) of the visits were to physician offices, while only 4% of patients with cervical/neck pain were hospitalized. (Table 2.6a and Graph 2.2.1)

Graph 2.2.1: Distribution of Health Care Visits for Cervical/Neck Pain, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2]Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

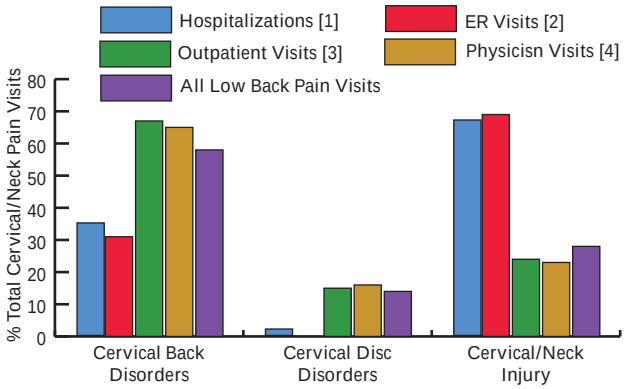
In presenting health care resource utilization for cervical pain, three categories of cervical pain are addressed. One is labeled cervical disc disorders, and includes disc displacements, herniations, and disc degeneration (ICD-9-CM code 722). A second group is cervical injuries, and includes sprains, strains, and fractures (ICD-9-CM codes 805, 806, 839, and 847). A third group, referred to as cervical disorders, includes pain caused by other disease entities, including cervical spondylosis and stenosis (ICD-9-CM codes 721 and 723).

Cervical disorders accounted for 58% of health care visits for upper back pain in 2006. (Table 2.6a) Patients with cervical disorders are treated primarily in outpatient settings, accounting for 67% of cervical pain patient visits in hospital outpatient settings and 65% of physicians office visits.

Cervical disc disorders accounted for only 14% of all neck pain health care visits in 2006, and were seen primarily in physicians offices and hospital outpatient clinics. (Table 2.6a and Graph 2.2.2) Neck injuries accounted for 28% of all neck pain. This is a higher percentage than found in low back pain injuries. The majority of patients with cervical injuries were treated in an outpatient setting, and accounted for 69% of all emergency department visits for cervical/ neck pain.

Inpatient care for cervical/neck pain is, on average, utilized primarily by older persons. The average age for persons hospitalized for cervical/neck pain in 2007 was 57.0 years, with persons having a neck injury being somewhat younger at 52.0 years. (Table 2.6) The average age of persons treated in an emergency department for neck injury was 37.0 years. The overall average age of emergency

Graph 2.2.2: Distribution of Health Care Resource Use for Cervical/Neck Pain by Type of Diagnosis, United States, 2006/2007

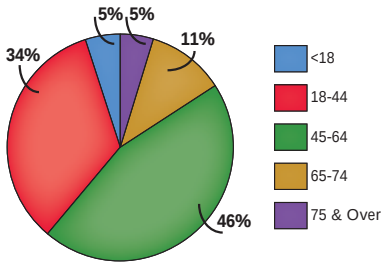


[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

room patients with a neck pain diagnosis was 38.0 years. Hospital outpatient and physician office patients were, on average, 47.3 and 49.5 years old, respectively.

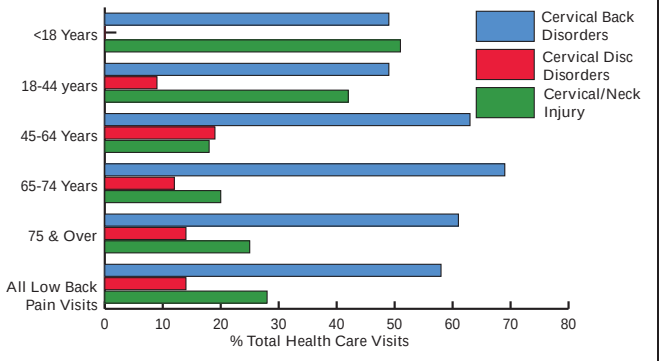
Four out of five neck pain diagnoses (80%) in 2006 were for persons between the ages of 18 and 64. (Table 2.6a and Graph 2.2.3) Only 5% of patients were over the age of 75, with 5% also younger than 18 years of age. Among persons aged 18 to 44 years, cervical injuries (42%) and cervical disorders (49%) accounted for nearly all health care visits for upper back pain. (Table 2.6a and Graph 2.2.4) Health care visits for neck injuries by persons under the age of 18 accounted for a larger share of total visits than was found in any other age group (51%). Cervical disc disorders, as the first diagnosis for neck pain, was found most frequently in persons aged 45 to 64 years.

Graph 2.2.3: Distribution of Cervical/Neck Pain Health Care Resource Visits by Age, United States 2006/2007



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

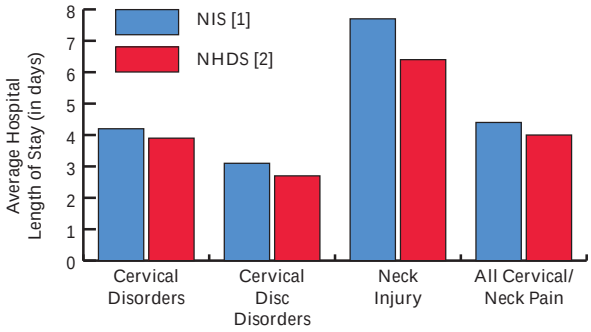
Graph 2.2.4: Distribution of Health Care Resource Use for Cervical/Neck Pain by Type and Age, United States 2006/2007



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Persons hospitalized for neck pain in 2007 spent an average of just under 5 days in the hospital. (Table 2.8 and Graph 2.2.5) Persons hospitalized for neck injuries were hospitalized for the longest period of time, an average of 8 days.

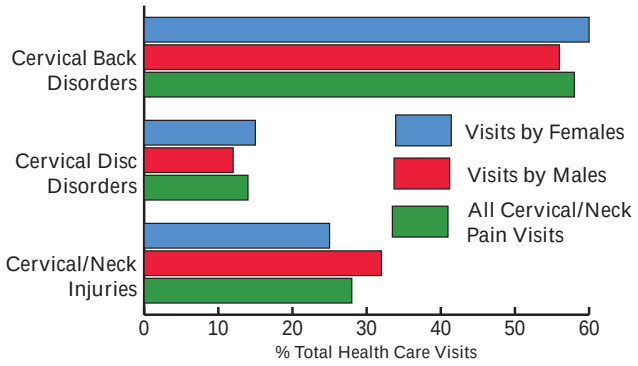
Graph 2.2.5: Average Length of Hospital Stay for Cervical Spine Diagnosis, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Females accounted for 58% of the health care visits for neck pain in 2006, a slightly higher proportion than was found with low back pain. (Table 2.6a and Graph 2.2.6) Cervical disorders accounted for 60% of visits by females, with injuries accounting for 25%. Among males, 32% of health care visits for cervical/neck pain were the result of neck injuries, with cervical neck disorders accounting for 56% of the visits.

Graph 2.2.6: Distribution of Health Care Resource Use for Cervical/Neck Pain by Type and Gender, United States, 2006/2007

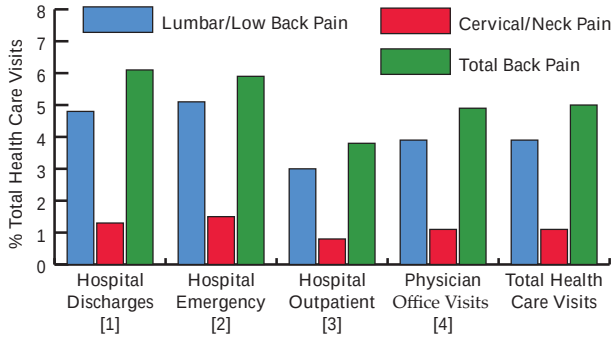


Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Section 2.3: Burden of Back Pain

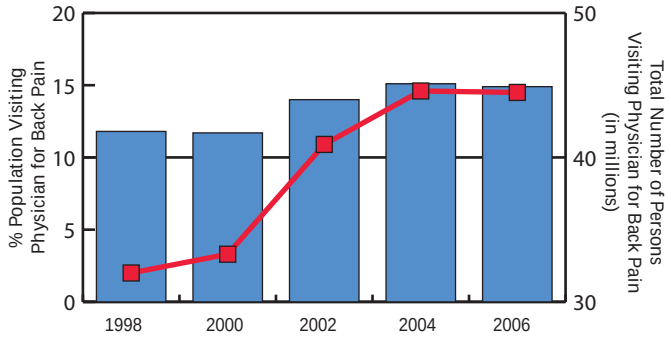
While lumbar/low back pain is more common than cervical/neck pain, together they accounted for 5%, or 1 in 20, health care visits in 2006. (Tables 2.7 and 2.7a and Graph 2.3.1) The majority of visits (77%) were physician office visits. Over the past 9 years, physician office visits for back pain have increased steadily. In 1998, 12% of the population aged 18 and over visited a physician for back pain, accounting for 32 million visits. In 2006, the proportion of the population visiting their physician for back pain had increased to 15%, and the total number of visits increased to nearly 45 million. (Table 2.9 and Graph 2.3.2)

Graph 2.3.1: Spine Diagnosis Visits as a Proportion of All Health Care Visits, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2]Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Graph 2.3.2: Trend in Number and Proportion of Population with Physician Visit for Back Pain, United States 1998-2006



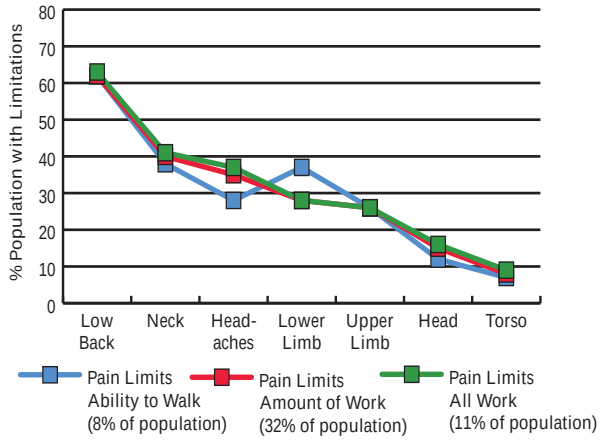
Source: National Center for Health Statistics, National Ambulatory Medical Care Survey,1998- 2006

The financial cost associated with back pain is obviously enormous and, unfortunately, rising. Greater understanding of the causes of back pain and its resultant disability is needed to thwart and reduce this rising trend. Understanding why disc degeneration causes pain in some, yet not in others, is needed to address the burden of pain and disability and the significant economic impact low back pain treatment creates on health care resources each year.

Section 2.3.1: Limitations Resulting from Back Pain

More than one in ten persons (11%) over the age of 18 in the United States report health care problems limit their ability to work, and one in three (32%) report their health limits the amount or type of work they can perform. An additional 8% of the population report that their ability to walk is impacted by their health. Pain is a major cause of these limitations. Back pain is cited more frequently than any other pain entity (e.g., head, shoulder, leg, foot) by persons reporting work or walking limitations. (Table 2.10 and Graph 2.3.3)

Graph 2.3.3: Proportion of Persons Aged 18 and Over Reporting Pain Limits Ability to Walk or Work by Pain Site, United States 1999-2004



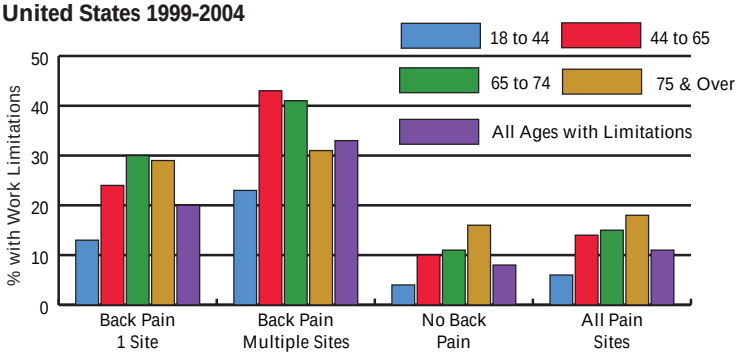
Source: National Center for Health Statistics, National Health and Nutrition Examination Survey Data, 1999-2004

Between 1999 and 2004, an average of 62% of the population who reported work or walking limitations also reported they had low back pain.

During this same time period, 38% to 41% reported they had neck pain. Low back pain was reported nearly twice as often as headaches or lower limb joint pain (hip, leg, foot) as the cause of work or walking limitations.

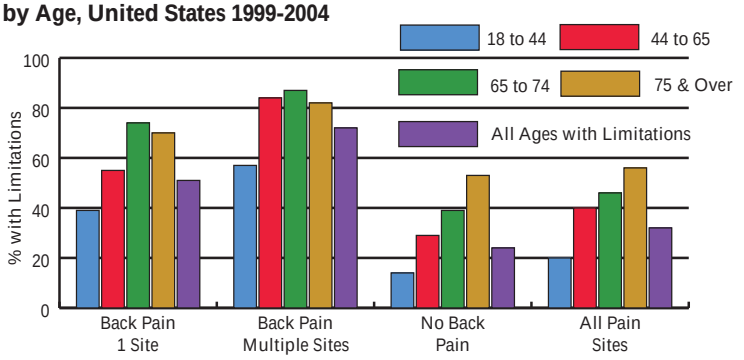
Work limitations due to back pain are reported in similar proportion by males and females. The presence of back pain in more than one site (e.g., low back, upper back, buttocks, neck, and spine) is more likely to be the cause of work limitations than back pain that is localized.

Graph 2.3.4a: Proportion of Persons Aged 18 with Work History for Whom Pain Limits Their Ability to Work by Age, United States 1999-2004



Source: National Center for Health Statistics, National Health and Nutrition Examination Survey Data, 1999-2004

Graph 2.3.4b: Proportion of Persons Aged 18 with Work History for Whom Pain Limits The Amount of Work They Can Perform by Age, United States 1999-2004



Source: National Center for Health Statistics, National Health and Nutrition Examination Survey Data, 1999-2004

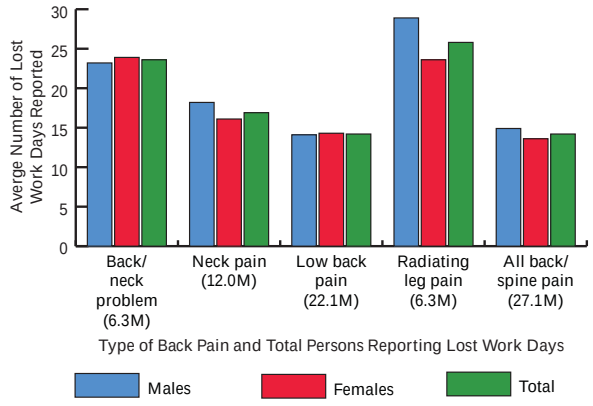
Back pain severe enough to keep people from working at any occupation is most likely to be reported by individuals aged 65 to 74, and may be the cause of involuntary early retirement. However, individuals in the prime working ages of 45 to 64 frequently report back pain as the cause of their inability to work at all; they also report that the pain places limitations on the amount or type of work they can do in nearly the same proportion as those aged 65 and older. Overall, 14% of the population aged 45 to 64 reports they cannot work at all due to health limitations; among this group, 24% to 43% report back pain as the cause. This compares to only 10% of persons in this age group with total work restrictions who report they have no back pain. Among the 32% of the population reporting limitations in the amount or type of work they can perform, the differences are even greater. Between 55% and 84% report back pain, while only 29% of those with no back pain report work restrictions. (Table 2.11 and Graphs 2.3.4a-b)

In another national study in 2006, bed days and lost work days were reported for persons self-reporting back pain in the previous 3 months. Of the total 74.3 million persons reporting back pain, approximately one in two (35.0 million) reported they spent one or more days in bed due to back pain. With an average of 19.2 bed days reported, persons in the United States spent a total of 671.1 million days in bed due to back pain in 2008. In addition, 27.1 million persons reporting back pain also reported losing an average of 14.2 work days. (Table 2.12 and Graphs 2.3.5a-b) Hence, in 2008, an estimated 385.0 million work days were lost due to back pain.

The most severe pain, resulting in the highest average number of bed and lost work days, was reported by persons with low back pain and radiating leg pain. This group of 10.5 million persons spent an average of 34.1 days in bed and lost an average of 25.8 work days. They probably include most patients with disc herniation and symptomatic spinal stenosis.

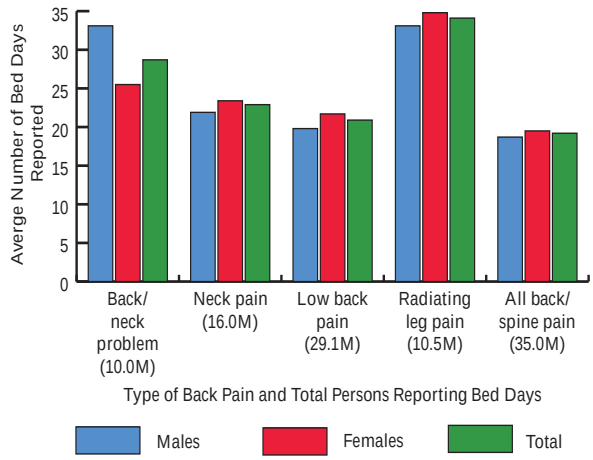
Females reported higher levels of back pain and slightly more bed than did males, but in 2008 males reported the highest number of lost work days (14.9 vs. 13.6, respectively).

Graph 2.3.5a: Average Lost Work Days for Persons Aged 18 and Over with Work History Reporting Back Pain by Pain Site, United States 2007



Source: National Center for Health Statistics, National Health Interview Survey, 2007

Graph 2.3.5b: Average Bed Days for Persons Aged 18 and Over Reporting Back Pain by Pain Site, United States 2007



Source: National Center for Health Statistics, National Health Interview Survey, 2007

Section 2.4: Spine Procedures

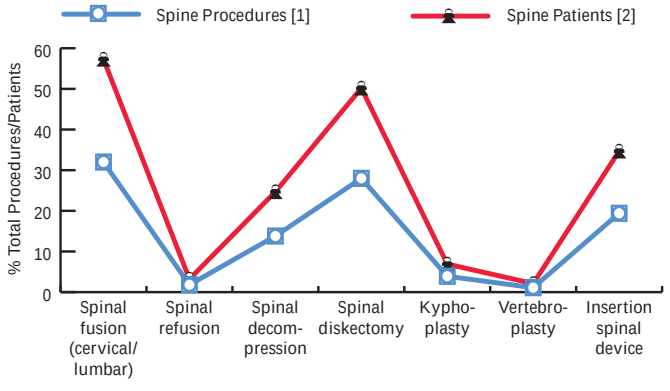
While nonsurgical treatment for back pain is the treatment of choice, when back pain becomes so disabling that patients can no longer function in the activities of daily living, spine surgery may be performed.

Four procedures accounted for 93% of spine procedures reported in 2007. The most frequently performed spine procedure in 2007 was a spinal fusion, accounting for 32% of spine procedures performed in an inpatient setting. Spinal diskectomy accounted for 28% of all spine procedures performed in 2007. Both were performed on more than one-half (57% and 50%, respectively) of spine pain patients hospitalized. The remaining two top procedures performed in 2007 were spinal decompression and the insertion of a spinal device. Decompression, which may or may not be performed in conjunction with a spinal fusion, accounted for 14% of all spine procedures and was performed on one-fourth (25%) of all hospitalized spine patients. The insertion of a spinal device, which includes replacement spinal disc procedures, accounted for 19% of all procedures and was performed on one-third (34%) of all hospitalized spine patients. (Table 2.13 and Graph 2.4.1).

Section 2.4.1: Spinal Fusion

The rate of spinal fusion procedures has risen rapidly over the past several decades. Spinal fusion is performed either alone or in conjunction with decompression and/or reduction of a spine deformity. Fusion is performed on the cervical, thoracic and lumbar regions of the spine.
The increase in spinal fusion rates has been documented by several authors, with increased rates of 55% between 1979 and 1990[5]; 220% between 1990 and 2001[6]; and 250% between 1990 and 2003[7] cited. Revision fusion rates have been reported at increased rates of 180% between 1990 and 2003.[7]

Graph 2.4.1: Spine Procedures as Proportion of Total Spine Procedures and of Spine Patients, United States 2007



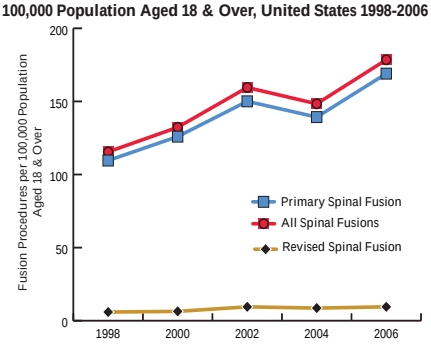
[1] Total number of procedures in 2007=1.19 million.
[2] Total number of spine procedure patients in 2007=0.66 million; multiple procedures for some patients possible.
Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Increased rates of spinal fusion have been noted since the 1980s. Likely explanations for these increases are advances in technology, including the development of new diagnostic techniques and new implant devices that allow for better surgical management; increased training in spinal surgery; and the aging of the population with inherent medical problems.

Lumbar spinal fusion rates have increased more rapidly than the rates for cervical or thoracic fusion and are increasingly being performed on an older population. Rates of lumbar fusion vary dramatically among geographic regions, hospitals, and even between surgeons in the same hospital, indicating that the outcomes and indications for lumbar fusion vary.[8] The primary diagnosis for several conditions have shown increased rates of fusion, with disc degeneration outpacing those of spondylolysis/ spondylolisthesis and spinal stenosis.[6]

Since the mid-1980s, cervical spinal fusion rates have been reported at 25% of the rates of lumbar fusion. Wide geographic variation is found in the rates of both cervical and lumbar fusion.[9] However, cervical rates may have been affected by reporting procedures, as it was not until 1995 that multilevel spinal procedures were reported with more than one procedural code. Between 1985 and 1996, cervical spinal fusion procedures were reported at an increased rate of 310%, while the same author reports increased rates of 286% in lumbar and 358% in thoracic fusion rates.[9]

Graph 2.4.2: Nine-Year Trend in Spinal Fusion Procedures per 100,000 Population Aged 18 & Over, United States 1998-2006



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2006, and U.S. Census population estimates published July 1st of each year.

In more recent years, 1998 to 2006, primary spinal fusion rates based on the Nationwide Inpatient Sample (NIS) have shown a continued rise, increasing by 73%. (Table 2.14 and Graph 2.4.2) This growth reflects a primary fusion procedure rate per 100,000 persons aged 18 and over of 115.5 in 1998 and 178.5 in 2006. Although data from 2004 showed a slight decline from 2002 in this growth curve, the rate spiked again in 2006. Whether the decline was is an indication of a slowing of the spinal fusion procedures rate or an anomaly in the 2004 data is unknown.

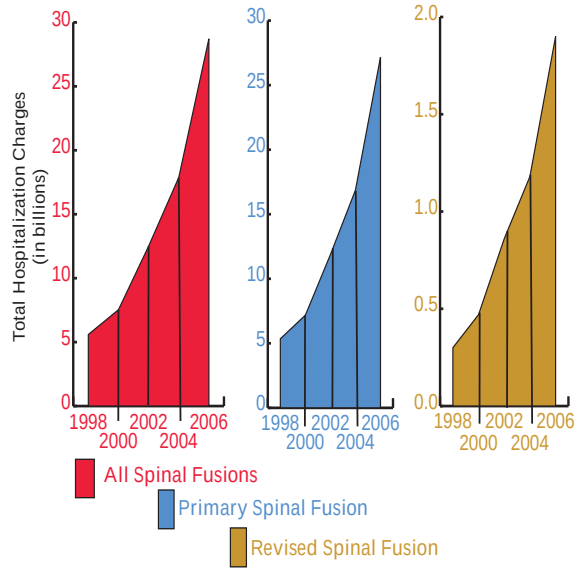
Between 1998 and 2006, the rate of revision fusion procedures increased by 69%. The revision rate over this 9 year period had a fluctuating rate, but overall continued growth. In 1998, revision spinal fusions were performed at a rate of 5.9 per 100,000 persons aged 18 and over. By 2006, the rate had increased to 9.5 per 100,000 persons.

During this 1998 to 2006 period, the cost of performing spinal fusion procedures increased by 191% for a primary spinal fusion and 272% for a revision spinal fusion procedure. In 2006, the mean hospital cost, as reported in the National Inpatient Sample for a primary spinal fusion was $77,000 and a revision spinal fusion was $96,000. Significant cost increases were seen between 2004 and 2006, an indication of the rising cost of medical care.

Combining the increased rate of procedures with the increasing cost of performing them, the estimated cost of primary spinal fusion procedures increased by 408% between 1998 and 2006, totaling $27.2 billion in 2006. An additional $1.9 billion was spent on revision spinal procedures, an increase of 535% between 1998 and 2006. (Table 2.14 and Graph 2.4.3)

Mean charges for lumbar spinal fusion procedures in 2006 were $87,100, based on an average hospital stay of 4.4 days. The average cost of a cervical spinal fusion procedure was nearly 40% less, $54,500, based on an average hospital stay of 3.2 days. (Table 2.16)

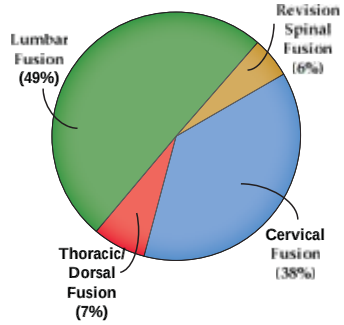
Graph 2.4.3: Nine-Year Trend in Total Hospitalization Charges for Spinal Fusion Procedures, United States 1998-2006



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2006.

In 2006, 380,000 spinal fusion procedures were performed on patients with lumbar/low back pain or cervical/neck pain. The number of primary lumbar fusion procedures was slightly higher than cervical procedures (197,000 versus 152,000, respectively), accounting for 49% versus 38% of all fusion procedures. (Table 2.15 and Graph 2.4.4) Because many more patients are operated on for low back pain problems requiring decompression only (e.g., disc herniations, some spinal stenosis), the percentage of patients who were fused in the low back group was lower (10.4%) than in the neck group (30.2%). Spinal fusion procedures were performed about equally on males and females; however, patients between the ages of 18 and 64 were significantly more likely to have the procedure than those under age 18 and those 65 years and older. (Table 2.16)

Graph 2.4.4 : Distribution of Spine Fusion Procedures by Spine Section, United States 2007



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Spinal fusion is most frequently performed following a diagnosis of cervical disc pain, accounting for 19% of first diagnosis of spinal fusion patients in 2004. (Table 2.17) Lumbar disc degeneration and lumbar disc displacement were the second and third most frequent first diagnosis, accounting for 13% and 11% of first diagnoses, respectively.

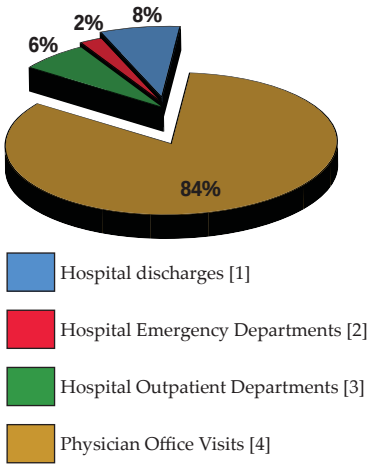
The introduction of motion preservation options in the past few years will most certainly have an impact on spinal fusion as the preferred treatment option.

Section 2.4.2: Ruptured Spine Diagnosis and Diskectomy Procedures

A diskectomy was the second most frequent inpatient spine procedure performed in 2006, accounting for nearly 331,200 procedures. Nine out of ten (90%) of diskectomy procedures were performed on patients with a ruptured disc diagnosis, primarily for a lumbar disc. (Tables 2.18 and 2.19) The average age at which a diskectomy was performed in 2006 was 51.7 years. Patients with a diskectomy performed spent a mean of 2.8 days in the hospital, at a mean cost of $50,890 per patient. Total health care cost for inpatient diskectomy procedures in 2006 was $16.8 billion.

Although the majority of persons with a ruptured disc diagnosis undergoing surgery were hospitalized in 2006, the health

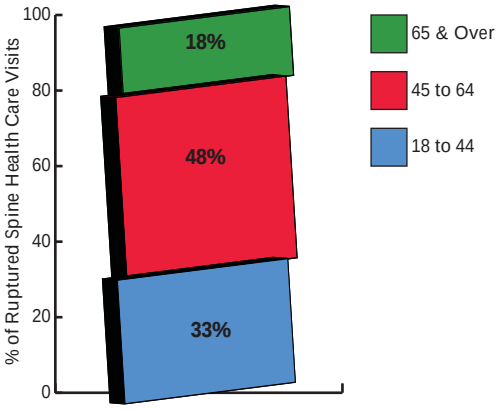
Graph 2.4.5: Health Care Visits for Ruptured Spine by Location, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

care impact and cost of a ruptured, or herniated, disc is much more severe due to only 8% of patients with this diagnosis being hospitalized. The majority (84%) of the total 4.8 million persons diagnosed with a ruptured disc in 2006 were seen in a physician's office. (Table 2.18 and Graph 2.4.5) A ruptured disk occurs primarily between the ages of 18 and 64 (81% of diagnoses); rarely does it occur in persons under the age of 18 or over the age of 65. (Graph 2.4.6)

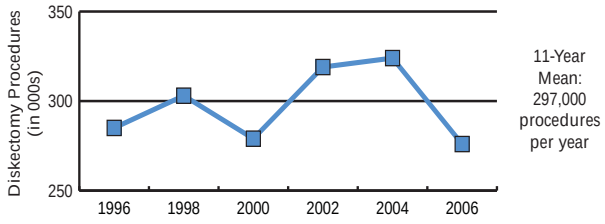
Graph 2.4.6: Health Care Visits for Ruptured Spine by Age, United States 2006



Sources: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006; National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

The mean number of diskectomy procedures reported by the National Hospital Discharge Survey over the past 11 years is 297,000 per year, with a range of 279,000 to 324,000 fluctuating around this mean. (Table 2.20 and Graph 2.4.7)

Graph 2.4.7: Ten Year Trend in Spinal Diskectomy Procedures, United States 1996-2006



Source: National Center for Health Statistics, National Hospital Discharge Survey, 1996-2006

Section 2.5: Neuromusculoskeletal Conditions

The spinal column is an extremely complex biomechanical structure with intimate neurological, muscular, and ligamentous interfaces. Functional and structural disorders of the spine often produce symptomatology affecting contiguous structures and regions. The resultant types of disorders affecting multiple domains have been referred to as neuromusculoskeletal or spine-related disorders. Included in this group are spinal subluxations, spinal sprains and strains, cervical, thoracic, lumbar and pelvic symptoms and ill-defined conditions; and spine-related (cervicogenic) headaches. These types of conditions are prevalent, disturbing, and compromising to patients' functional abilities. In 2007, over 152.7 million patient visits had a diagnosis of a neuromusculoskeletal condition, either as a primary diagnosis or secondary diagnosis. In part, the reason for the ill-defined nature of some of these conditions may lie in the intrinsic complexity of the spinal column and the multiple structures and systems with which it interfaces. For example, individuals with chronic lumbar or pelvic pain may also complain of depression, digestive problems, and sexual dysfunction. Many patients with chronic cervical symptoms suffer from headaches as well.

Since 1999, neuromusculoskeletal complaints have shown a steady increase in incidence. This increase may be associated with the increasingly sedentary lifestyle of Americans and the marked increase in occupational and recreational use of computers with attendant ergonomic risks. The proportionate rise in cervical and thoracic and lumbar spine symptoms and ill-defined conditions has been similar in distribution since 1999. In 2007, the number of patient visits with a diagnosis related to cervical spine symptoms and ill-defined conditions (64.3 million) were approximately equal in number to visits with a diagnosis for similar lumbar spine disorders (64.1 million). In 2007, thoracic symptoms and ill-defined disorders

diagnoses numbered 49.0 million, while pelvic disorders diagnoses numbered 26.6 million. Neuromusculoskeletal diagnoses related to the head and headaches numbered 22.1 million. Females are more prone than males to these spine-related disorders across a range of categories.

Section 2.6: Economic Cost of Spine Conditions

Chapter 9 summarizes the cost of musculoskeletal conditions based on analysis of the Medical Expenditures Panel Survey (MEPS) from 1996 to 2004. The MEPS, which began in 1996, is a set of large-scale surveys of families and individuals, their medical providers (doctors, hospitals, pharmacies, etc.) and their employers. MEPS collects data on the specific health services that Americans use, how frequently they use them, the cost of these services, and how they are paid for, as well as data on the cost, scope, and breadth of health insurance held by and available to U.S. workers. Currently MEPS collects data from two major components: households and insurance companies. The Household Component (MEPS-HC) provides data from individual households and their members, which is supplemented by data from their medical providers. The Insurance Component (MEPS-IC) is a separate survey of employers that provides data on employer-based health insurance. MEPS also includes a Medical Provider Component (MEPS-MPC), that covers hospitals, physicians, home health care providers, and pharmacies identified by MEPS-HC respondents. Its purpose is to supplement and/or replace information received from the MEPS-HC respondents.[10]

As with the National Health Interview Survey (NHIS), data in the household component is self-reported. Self-reported data from available databases indicates a range in the prevalence of all specific conditions. As noted earlier in this chapter, more than 58.4 million persons visited their physician, an emergency room, hospital outpatient center, or were hospitalized with a complaint of back pain in 2006, while 74.3 persons self-reported low back or neck pain in 2008 in the NHIS. Economic projections are based on the MEPS self-reported spine conditions, or 32.7 million incidences.

The estimated annual cost for medical care of spine conditions, discussed in Chapter 9, both as a primary condition and secondary to another condition, in 2004 was $193.9 billion or an average of $5,923 for each of the 32.7 million persons who reported having a spine condition. Of this total, $30.3 billion is estimated as the incremental cost directly related to spine conditions. A breakdown of the $193.9 billion cost due to spine conditions shows 34% for ambulatory care, 32% for emergency room or inpatient care, 20% for prescription drugs, and 14% for other expenses. The cost of spine conditions, in 2004 dollars, rose from $130.2 billion in 1996 to $193.9 billion in 2004, an increase of 49%. The increasing cost of prescription drugs accounts for the largest percentage of this total cost increase, rising from 13% of total cost to 20% over the 9-year period. Earnings loss, or indirect costs, due to spine conditions for persons between the ages of 18 to 64 years with a work history was estimated at $22.4 billion per year between 2000 and 2004.

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2. National Center for Health Statistics: National Health and Nutrition Examination Survey Data, 1998-2006.

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Section 2.7: Spine: Low Back + Neck Pain Data Tables

Table 2.1: Self-Reported Prevalence of Joint Pain by Site of Joint and Selected Demographic Characteristics for Persons Aged 18 and Over, National Health Interview Survey, United States 2008

		Prevalence of Pain by Site (rate per 100 persons)							
		Lower Back [1]	Neck [2]	Back w/ Radiating Leg Pain [3]	Upper Limb [4]	Shoulder [5]	Lower Limb [6]	Knee [7]	Hip [8]
Gender	Male	25.1	11.4	7.8	10.7	9.4	6.4	17.6	5.1
	Female	29.5	16.4	10.0	14.7	9.2	8.7	20.3	9.0
Age	18-44 years	24.5	12.7	5.9	7.5	5.2	4.8	12.1	3.5
	45-64 years	29.4	16.5	11.8	16.7	12.2	10.1	24.5	9.2
	65-74 years	32.0	13.2	13.2	21.0	15.4	10.7	28.1	13.8
	75 & over	31.4	11.9	10.2	19.7	15.5	10.2	27.7	13.2
Race	White	28.4	14.6	9.3	13.6	9.8	8.0	19.6	7.8
	Black	23.4	10.4	7.3	8.3	7.3	6.2	18.9	4.6
	Asian	17.3	8.8	4.4	6.3	4.7	2.8	8.4	1.6
	Other	34.5	19.2	12.8	20.1	12.2	10.0	20.0	8.5
Total		27.4	14.0	8.9	12.8	9.3	7.6	19.0	7.1

[1] "During the PAST THREE MONTHS, did you have …Low back pain?"

[2] "During the PAST THREE MONTHS, did you have ...Neck pain?"

[3] If low back pain, "Did this pain spread down either leg to areas below the knees?"

"DURING THE PAST 30 DAYS, have you had any symptoms of pain, aching, or stiffness in or around a joint?"

[4] Hand, wrist, fingers

[5] Shoulder

[6] Ankle, foot

[7] Knee, right/left

[8] Hip, right/left

Source: National Center for Health Statistics, National Health Interview Survey, Adult Sample Level File, 2008

Table 2.2: Self-Reported Prevalence of Joint or Back Pain by Site and Selected Demographic Characteristics for Persons Aged 18 and Over, United States 1999-2004

		Prevalence of Pain by Site (rate per 100 persons)							
		Lower Back [1]	Neck [2]	Back w/ Radiating Leg Pain [3]	Upper Limb [4]	Shoulder [5]	Lower Limb [6]	Knee [7]	Hip [8]
Gender	Male	36.7	18.8	9.0	19.4	14.4	10.4	14.4	6.1
	Female	41.4	23.0	11.7	23.3	14.0	14.5	14.0	10.2
Age	18-44 years	38.0	19.8	8.0	15.6	10.2	9.1	10.2	4.8
	45-64 years	41.5	24.0	13.8	28.5	19.4	16.3	19.4	11.5
	65-74 years	37.0	19.9	12.1	26.6	16.7	16.5	16.7	12.2
	75 & over	39.7	17.0	10.3	26.8	17.9	16.4	17.9	14.6
Race	White	40.2	21.9	10.3	23.2	15.1	13.3	15.1	9.4
	Black/Arcian American	36.6	16.5	11.3	14.3	11.8	11.9	11.8	6.4
	Mexican American	33.3	18.2	9.1	17.6	9.6	8.6	9.6	4.2
	Other Hispanic	31.6	16.4	9.2	18.6	11.8	8.5	11.8	4.2
	Other	43.8	25.2	12.5	20.3	15.0	11.8	15.0	5.9
Total		39.2	21.0	10.4	21.4	14.2	12.5	14.2	8.2

[1] "During the PAST THREE MONTHS, did you have ...Low back pain?"

[2] "During the PAST THREE MONTHS, did you have ...Neck pain?"

[3] If low back pain, "Did this pain spread down either leg to areas below the knees?"

"DURING THE PAST 30 DAYS, have you had any symptoms of pain, aching, or stiffness in or around a joint?"

[4] Hand, wrist, fingers

[5] Shoulder

[6] Ankle, foot

[7] Knee, right/left

[8] Hip, right/left

Source: National Center for Health Statistics, National Health and Nutrition Examination Survey, 1999-2004

Table 2.3: Distribution of Back Pain by Site and Selected Demographic Characteristics for Persons Aged 18 and Over, United States 1999-2004

		Proportion of Persons Reporting Back Pain				
		Lower Back Pain Only [1]	Upper Back Pain Only [2]	Buttocks [3]	Neck and Spine Only [4]	Multiple Back Pain Sites [5]
Gender	Male	28%	5%	6%	22%	40%
	Female	25%	5%	9%	17%	44%
Age	18-44 years	28%	6%	4%	20%	42%
	45-64 years	23%	5%	10%	18%	44%
	65-74 years	26%	4%	12%	21%	38%
	75 & over	33%	6%	11%	14%	36%
Race	White	25%	5%	7%	20%	43%
	Black/African American	39%	3%	7%	15%	36%
	Mexican American	27%	3%	8%	23%	40%
	Other Hispanic	25%	8%	8%	17%	43%
	Other	28%	3%	4%	23%	42%
Total		26%	5%	7%	19%	42%

[1] "With respect to pain problem, located in …low back pain?"

[2] "With respect to pain problem, located in …upper back pain?"

[3] "With respect to pain problem, located in …buttocks?"

[4] "With respect to pain problem, located in …neck and spine?"

[5]"With respect to pain problem, located in …multiple sites of back"

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 1999-2004.

Table 2.4: Distribution Joint Pain by Site and Selected Demographic Characteristics for Persons Aged 18 and Over, United States 1999-2004

		Proportion of Persons Reporting Joint Pain (excluding back pain)					
		Hip Pain Only [1]	Knee Pain Only [2]	Lower Limb Pain Only [3]	Shoulder Pain Only [4]	Upper Limb Pain Only [5]	Multiple Pain Sites [6]
Gender	Male	3%	21%	7%	8%	16%	45%
	Female	5%	18%	7%	5%	14%	52%
Age	18-44 years	3%	22%	8%	8%	17%	42%
	45-64 years	4%	18%	6%	5%	13%	53%
	65-74 years	5%	16%	8%	5%	13%	54%
	75 & over	6%	15%	6%	5%	13%	54%
Race	White	4%	18%	7%	6%	15%	49%
	Black/African American	5%	26%	10%	7%	10%	43%
	Mexican American	3%	17%	5%	5%	19%	50%
	Other Hispanic	5%	21%	4%	9%	20%	41%
	Other	4%	15%	5%	10%	13%	52%
Total		4%	19%	7%	6%	15%	49%

[1] "With respect to pain problem, located in …hip pain?"

[2] "With respect to pain problem, located in …knee pain?"

[3] "With respect to pain problem, located in …leg, foot pain?"

[4] "With respect to pain problem, located in …shoulder pain?"

[5] "With respect to pain problem, located in …elbow, wrist or finger pain"

[6] "With respect to pain problem, located in …multiple joint pain sites"

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 1999-2004.

Table 2.5: Prevalence of Lumbar/Low Back Disorders by Gender and Age, United States 2006/2007

	Total	Gender		Age in Years					Ave Age for Dx
		Male	Female	<18	18-44	45-64	65-74	75 & over	
Hospital Discharges [1]	Total Number of Hospital Discharges for Low Back Disorders (in 000s)								
Back Disorders	1,312	535	777	*	224	446	236	276	62.0
Disc Disorders	521	236	283	*	127	207	85	77	57.5
Back Injury	191	87	104	*	47	41	23	46	60.6
All Lumbar/Low Back Pain (N)	1,898	805	1,091	14	379	660	321	370	60.5
Hospital Emergency Room Visits [2]	Total Number of Emergency Room Visits for Low Back Disorders (in 000s)								
Back Disorders	3,830	1,724	2,106	124	2,029	1,195	197	285	43.5
Disc Disorders	164	69	95	*	53	55	18	29	52.6
Back Injury	1,641	738	903	97	1,011	426	52	55	38.6
All Lumbar/Low Back Pain (N)	5,199	2,355	2,844	221	2,867	1,515	261	335	42.1
Hospital Outpatient Visits [3]	Total Number of Outpatient Department Visits for Low Back Disorders (in 000s)								
Back Disorders	2,380	958	1,421	71	860	968	219	263	50.2
Disc Disorders	556	242	314	*	165	286	42	63	52.7
Back Injury	384	189	196	33	219	102	*	*	37.6
All Lumbar/Low Back Pain (N)	3,107	1,295	1,812	103	1,165	1,278	261	300	48.8
Physician Office Visits [4]	Total Number of Physician Visits for Low Back Disorders (in 000s)								
Back Disorders	24,067	9,820	14,258	501	6,551	10,175	2,807	4,034	53.2
Disc Disorders	6,978	3,084	3,894	23	1,599	3,383	842	1,130	54.7
Back Injury	6,889	3,769	3,120	182	3,452	2,674	272	309	43.4
All Lumbar/Low Back Pain (N)	34,945	15,529	19,416	705	10,970	14,768	3,676	4,825	51.4
Total Health Care Visits for Lumbar/Low Back Pain, 2004									
	Total Number of Health Care Visits for Low Back Disorders (in 000s)								
Back Disorders	31,589	13,037	18,562	703	9,664	12,784	3,459	4,858	
Disc Disorders	8,219	3,631	4,586	33	1,944	3,931	987	1,299	
Back Injury	9,105	4,783	4,323	318	4,729	3,243	364	423	
All Lumbar/Low Back Pain (N)	45,149	19,984	25,163	1,043	15,381	18,221	4,519	5,830	
Percent of Total		44%	56%	2%	34%	40%	10%	13%	
Hospital Discharges [1]	1,898	805	1,091	14	379	660	321	370	60.5
Hospital Emergency Room Visits [2]	5,199	2,355	2,844	221	2,867	1,515	261	335	42.1
Hospital Outpatient Visits [3]	3,107	1,295	1,812	103	1,165	1,278	261	300	48.8
Physician Office Visits [4]	34,945	15,529	19,416	705	10,970	14,768	3,676	4,825	51.4
All Lumbar/Low Back Pain (N)	45,149	19,984	25,163	1,043	15,381	18,221	4,519	5,830	
Percent of Total		44%	56%	2%	34%	40%	10%	13%	

* Estimate does not meet standards for reliability

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 2.5a: Prevalence Rate of Lumbar and Low Back Disorders by Gender and Age, United States 2006/2007

		Gender		Age in Years				
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over
Hospital Discharges [1]	Proportion of Hospital Discharges for Low Back Disorders							
Back Disorders	69%	66%	71%	*	59%	68%	74%	75%
Disc Disorders	27%	29%	26%	*	34%	31%	26%	21%
Back Injury	10%	11%	10%	*	12%	6%	7%	12%
All Lumbar and Low Back Pain (in 000s)	1,898	805	1,091	14	379	660	321	370
Hospital Emergency Room Visits [2]	Proportion of Emergency Room Visits for Low Back Disorders							
Back Disorders	74%	73%	74%	56%	71%	79%	75%	85%
Disc Disorders	3%	3%	3%	*	2%	4%	0	0
Back Injury	32%	31%	32%	44%	35%	28%	20%	16%
All Lumbar and Low Back Pain (in 000s)	5,199	2,355	2,844	221	2,867	1,515	261	335
Hospital Outpatient Visits [3]	Proportion of Hospital Outpatient Department Visits for Low Back Disorders							
Back Disorders	77%	74%	78%	69%	74%	76%	84%	88%
Disc Disorders	18%	19%	17%	*	14%	22%	16%	0
Back Injury	12%	15%	11%	0	19%	8% *		*
All Lumbar and Low Back Pain (in 000s)	3,107	1,295	1,812	103	1,165	1,278	261	300
Physician Office Visits [4]	Proportion of Physician Office Visits for Low Back Disorders							
Back Disorders	69%	63%	73%	71%	60%	69%	76%	84%
Disc Disorders	20%	20%	20%	0	15%	23%	23%	23%
Back Injury	20%	24%	16%	26%	31%	18%	7%	6%
All Lumbar and Low Back Pain (in 000s)	34,945	15,529	19,416	705	10,970	14,768	3,676	4,825
Total Health Care Visits for Lumbar and Low Back Pain, 2004	Proportion of Health Care Visits for Low Back Disorders							
Back Disorders	70%	65%	74%	67%	63%	70%	77%	83%
Disc Disorders	18%	18%	18%	0	13%	22%	22%	22%
Back Injury	20%	24%	17%	30%	31%	18%	8%	7%
All Lumbar and Low Back Pain (in 000s)	45,149	19,984	25,163	1,043	15,381	18,221	4,519	5,830

		% by Resource		
	Total Diagnoses (in 000s)	Low Back Disorders as % of Total Diagnoses	Low Back Disorders Distribution by Resource	All Medical Conditions Distribution by Resource
Hospital Discharges [1]	39,434	4.8%	4.2%	3.4%
Hospital Emergency Room Visits [2]	119,192	5.1%	11.5%	10.3%
Hospital Outpatient Visits [3]	102,208	3.0%	6.9%	8.8%
Physician Office Visits [4]	901,954	3.9%	77.4%	77.6%
All Lumbar/Low Back Pain Diagnoses (in 000s)	1,162,788	3.9%	45,149	1,162,788

* Estimate does not meet standards for reliability

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 2.6: Prevalence of Neck and Cervical Spine Disorders by Gender and Age, United States 2006/2007

		Gender		Age in Years					Ave Age
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over	for Dx
Hospital Dischargess [1]	Total Number of Hospital Discharges for Cervical Pain Disorders (in 000s)								
Cervical Disorders	301	137	164	*	51	128	51	50	59.4
Cervical Disc Disorders	177	81	96	*	44	90	22	*	54.8
Neck Injury	71	41	30	*	26	18	*	11	52.0
All Cervical/Neck Pain	503	237	266	*	111	212	73	72	57.0
Hospital Emergency Room Visits [2]	Total Number of Emergency Room Visits for Cervical Pain Disorders s (in 000s)								
Cervical Disorders	645	274	372	59	366	164	34	23	38.9
Cervical Disc Disorders	36	17	19	*	24	*	*	*	42.8
Neck Injury	1,222	488	734	154	698	223	94	53	37.0
All Cervical/Neck Pain	1,831	754	1,076	196	1,048	380	133	74	38.0
Hospital Outpatient Visits [3]	Total Number of Outpatient Department Visits for Cervical Pain Disorders (in 000s)								
Cervical Disorders	517	165	351	*	166	218	86	33	50.4
Cervical Disc Disorders	117	43	74	*	27	74	*	*	51.4
Neck Injury	186	42	144	34	95	43	*	*	36.2
All Cervical/Neck Pain	774	240	534	47	263	317	97	50	47.3
Physician Office Visits [4]	Total Number of Physician Visits for Cervical Pain Disorders (in 000s)								
Cervical Disorders	6,222	2,565	3,657	166	1,613	3,277	826	285	50.8
Cervical Disc Disorders	1,529	537	991	*	319	1,000	139	71	52.0
Neck Injury	2,211	1,219	992	116	1,078	794	138	86	43.3
All Cervical/Neck Pain	9,513	4,105	5,408	282	2,903	4,817	1,070	442	49.5
Total Health Care Visits for Lumbar and Low Back Pain, 2004									
	Total Number of Health Care Visits for Cervical Pain Disorders (in 000s)								
Cervical Disorders	7,685	3,141	4,544	242	2,196	3,787	997	391	
Cervical Disc Disorders	1,859	678	1,180	0	414	1,169	180	91	
Neck Injury	3,690	1,790	1,900	308	1,897	1,078	293	164	
All Cervical/Neck Pain	13,234	5,609	7,624	550	4,507	6,034	1,470	646	
Percent of Total		42%	58%	4%	34%	46%	11%	5%	
Hospital Discharges [1]	503	237	266	*	111	212	73	72	55.2
Hospital Emergency Room Visits [2]	1,831	754	1,076	196	1,048	380	133	74	35.0
Hospital Outpatient Visits [3]	774	240	534	47	263	317	97	50	46.0
Physician Office Visits [4]	9,513	4,105	5,408	282	2,903	4,817	1,070	442	48.4
All Cervical /Neck Pain Diagnoses	13,234	5,609	7,624	550	4,507	6,034	1,470	646	
Percent of Total		42%	58%	4%	34%	46%	11%	5%	

* Estimate does not meet standards for reliability

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 2.6a: Prevalence Rate of Neck and Cervical Spine Disorders by Gender and Age, United States 2006/2007

		Gender		Age in Years				
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over
Hospital Discharges [1]	Proportion of Hospital Discharges for Cervical Pain Disorders							
Cervical Disorders	35%	36%	35%	0	35%	43%	26%	31%
Cervical Disc Disorders	2%	2%	2%	*	2%	*	*	*
Neck Injury	67%	65%	68%	79%	67%	59%	71%	72%
All Cervical/Neck Pain (N)	504	237	266	*	111	212	73	72
Hospital Emergency Room Visits [2]	Proportion of Emergency Room Visits for Cervical Pain Disorders							
Cervical Disorders	31%	30%	31%	26%	28%	39%	*	*
Cervical Disc Disorders	*	*	*	*	*	*	*	*
Neck Injury	69%	70%	69%	74%	72%	61%	100%	100%
All Cervical/Neck Pain (N)	1,831	754	1,076	196	1,048	380	133	74
Hospital Outpatient Visits [3]	Proportion of Outpatient Department Visits for Cervical Pain Disorders							
Cervical Disorders	67%	69%	66%	*	63%	69%	89%	1
Cervical Disc Disorders	15%	18%	14%	*	10%	23%	*	*
Neck Injury	24%	18%	27%	1	36%	14%	*	*
All Cervical/Neck Pain (N)	774	240	534	47	263	317	97	50
Physician Office Visits [4]	Proportion of Physician Visits for Cervical Pain Disorders							
Cervical Disorders	65%	62%	68%	59%	56%	68%	77%	64%
Cervical Disc Disorders	16%	13%	18%	*	11%	21%	13%	16%
Neck Injury	23%	30%	18%	41%	37%	16%	13%	19%
All Cervical/Neck Pain	9,513	4,105	5,408	282	2,903	4,817	1,070	442
Total Health Care Visits for Lumbar and Low Back Pain, 2004								
	Proportion of Health Care Visits for Cervical Pain Disorders							
Cervical Disorders	58%	56%	60%	49%	49%	63%	68%	61%
Cervical Disc Disorders	14%	12%	15%	0	9%	19%	12%	14%
Neck Injury	28%	32%	25%	51%	42%	18%	20%	25%
All Cervical/Neck Pain (N)	13,234	5,609	7,624	605	4,507	6,034	1,470	646

			% by Resource	
	Total Diagnoses (in 000s)	Cervical Disorders as % of Total Diagnoses	Cervical Disorders Distribution by Resource	All Medical Conditions Distribution by Resource
Hospital Discharges [1]	39,434	1.3%	4.0%	3.4%
Hospital Emergency Room Visits [2]	119,192	1.5%	14.5%	10.3%
Hospital Outpatient Visits [3]	102,208	0.8%	6.1%	8.8%
Physician Office Visits [4]	901,954	1.1%	75.4%	77.6%
All Cervical/Neck Pain (in 000s)	1,162,788	1.1%	13,234	1,162,788

* Estimate does not meet standards for reliability

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 2.7: Summary of Resource Allocation of Total Health Care Occurrences for Back Pain and Related Conditions by Gender and Age, United States 2006/2007

		Gender		Age in Years							
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over	Ave Age at Dx	Diagnoses All Conditions (in 000s)	Lumbar/Low Back Pain as % of Total Diagnoses
Lumbar/Low Back Pain	Total Number of Spinal Diagnoses (in 000s)										
Hospital Discharges [1]	1,898	805	1,091	14	379	660	321	370	60.5	39,434	4.8%
Hospital Emergency Room Visits [2]	5,199	2,355	2,844	221	2,867	1,515	261	335	42.1	119,192	5.1%
Hospital Outpatient Visits [3]	3,107	1,295	1,812	103	1,165	1,278	261	300	48.8	102,208	3.0%
Physician Office Visits [4]	34,945	15,529	19,416	705	10,970	14,768	3,676	4,825	51.4	901,954	3.9%
All Lumbar/Low Back Pain Diagnoses	45,149	19,984	25,163	1,043	15,381	18,221	4,519	5,830		1,162,788	3.9%
Percent of Total		44%	56%	2%	34%	40%	10%	13%			
Cervical/Neck Pain	Total Number of Spinal Diagnoses (in 000s)										
Hospital Discharges [1]	503	237	266	*	111	212	73	72	55.2	39,434	1.3%
Hospital Emergency Room Visits [2]	1,831	754	1,076	196	1,048	380	133	74	35.0	119,192	1.5%
Hospital Outpatient Visits [3]	774	240	534	47	263	317	97	50	46.0	102,208	0.8%
Physician Office Visits [4]	9,513	4,105	5,408	282	2,903	4,817	1,070	442	48.4	901,954	1.1%
All Cervical/Neck Pain Diagnoses	13,234	5,609	7,624	605	4,507	6,034	1,470	646		1,162,788	1.1%
Percent of Total		42%	58%	5%	34%	46%	11%	5%			
Total Back Pain (Lumbar and Cervical) Diagnoses	Total Number of Spinal Diagnoses (in 000s)										
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over	Ave Age at Dx	Diagnoses All Conditions (in 000s)	Spine/Back Pain as % of Total Diagnoses
Hospital Discharges [1]	2,401	1,042	1,357	14	490	872	394	442	59.9	39,434	6.1%
Hospital Emergency Room Visits [2]	7,030	3,109	3,920	417	3,915	1,895	394	409	41.5	119,192	5.9%
Hospital Outpatient Visits [3]	3,881	1,535	2,346	150	1,428	1,595	358	350	48.8	102,208	3.8%
Physician Office Visits [4]	44,458	19,634	24,824	987	13,873	19,585	4,746	5,267	51.9	901,954	4.9%
All Back Pain Diagnoses	58,383	25,593	32,787	1,648	19,888	24,255	5,989	6,476		1,162,788	5.0%
Percent of Total		44%	56%	3%	34%	42%	10%	11%			

* Estimate does not meet standards for reliability

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[5] Diagnosis with both lumbar and cervical pain possible.

Table 2.7a: Summary of Resource Allocation as a Proportion of Total Health Care Occurrences for Back Pain and Related Conditions by Gender and Age, United States 2006/2007

Lumbar/Low Back Pain	Proportion of Total Lumbar/Low Back Pain Diagnoses by Resource								Ave Age at Dx	Diagnoses All Conditions (in 000s)	Lumbar/Low Back Pain as % of Total Diagnoses
		Gender		Age in Years							
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over			
Hospital Discharges [1]	4.2%	4.0%	4.3%	*	2.5%	3.6%	7.1%	6.3%	60.5	39,434	4.8%
Hospital Emergency Room Visits [2]	11.5%	11.8%	11.3%	21.2%	18.6%	8.3%	5.8%	5.7%	42.1	119,192	5.1%
Hospital Outpatient Visits [3]	6.9%	6.5%	7.2%	9.9%	7.6%	7.0%	5.8%	5.1%	48.8	102,208	3.0%
Physician Office Visits [4]	77.4%	77.7%	77.2%	67.6%	71.3%	81.0%	81.3%	82.8%	51.4	901,954	3.9%
All Lumbar and Low Back Pain Diagnoses	45,149	19,984	25,163	1,029	15,381	18,221	4,519	5,830		1,162,788	3.9%
Percent of Total		44%	56%	2%	34%	40%	10%	13%			

Cervical/Neck Pain	Proportion of Total Cervical/Neck Pain Diagnoses by Resource								Ave Age at Dx	Diagnoses All Conditions (in 000s)	Cervical/ Neck Pain as % of Total Diagnoses
		Gender		Age in Years							
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over			
Hospital Discharges [1]	3.8%	4.2%	3.5%	*	2.5%	3.5%	5.0%	11.1%	55.2	39,434	1.3%
Hospital Emergency Room Visits [2]	13.8%	13.4%	14.1%	32.4%	23.3%	6.3%	9.0%	11.5%	35.0	119,192	1.5%
Hospital Outpatient Visits [3]	5.8%	4.3%	7.0%	7.8%	5.8%	5.3%	6.6%	7.7%	46.0	102,208	0.8%
Physician Office Visits [4]	71.9%	73.2%	70.9%	46.6%	64.4%	79.8%	72.8%	68.4%	48.4	901,954	1.1%
All Cervical (Neck) Back Pain Diagnoses (ir	13,234	5,609	7,624	605	4,507	6,034	1,470	646		1,162,788	1.1%
Percent of Total		42%	58%	5%	34%	46%	11%	5%			

Total Back Pain (Lumbar and Cervical) Diagnoses	Proportion of Total Back Pain Diagnoses by Respource								Ave Age at Dx	Diagnoses All Conditions (in 000s)	Spine/Back Pain as % of Total Diagnoses
		Gender		Age in Years							
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over			
Hospital Discharges [1]	4.2%	4.1%	4.1%	0.8%	2.5%	3.6%	6.6%	6.8%	59.9	39,434	6.1%
Hospital Emergency Room Visits [2]	12.2%	12.1%	12.0%	25.3%	19.7%	7.8%	6.6%	6.3%	41.5	119,192	5.7%
Hospital Outpatient Visits [3]	6.7%	6.0%	7.2%	9.1%	7.2%	6.6%	6.0%	5.4%	48.8	102,208	3.8%
Physician Office Visits [4]	77.0%	76.7%	75.7%	59.9%	69.8%	80.7%	79.2%	81.3%	51.9	901,954	4.8%
All Back Pain Diagnoses (in 000s)	57,770	25,593	32,787	1,648	19,888	24,255	5,989	6,476		1,162,788	4.8%
Percent of Total		44%	57%	3%	34%	42%	10%	11%			

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

* Estimate does not meet standards for reliability

Table 2.8: Average Length of Hospital Stay for Spine Diagnoses, United States 2004 & 2006/2007

	Average LOS (in days), 2004		Average LOS (in days), 2006/2007	
	NIS [1]	NHDS [2]	NIS [3]	NHDS [4]
Spinal Deformity & Related Conditions	5.5	5.1	5.3	5.3
Lumbar/Low Back Pain				
Back Disorders	4.7	4.3	4.5	4.6
Disc Disorders	4.1	3.6	4.1	4.0
Back Injury	7.3	7.9	7.1	7.8
All Lumbar and Low Back Pain	4.8	4.5	4.7	4.8
Cervical/Neck Pain				
Neck Disorders	4.3	3.6	4.2	3.9
Cervical Disc Disorders	3.1	2.8	3.1	2.7
Neck Injury	8.2	10.2	7.7	6.4
All Cervical Back Pain	4.7	4.6	4.4	4.0
Total	4.8	4.6	4.6	4.7

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004

[2] Source: National Center for Health Statistics, National Hospital Discharge Survey, 2004

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Table 2.9: Trends in Physician Visits for Back Pain, United States 1998-2006

Physician Visits for Back Pain

	Total Number of Patients (in 000s)				
	1998	2000	2002	2004	2006
Physician Visits for Lumbar/Low Back Pain					
Back Disorders	15,885,027	16,151,063	20,040,222	21,813,342	24,067,360
Disc Disorders	3,004,051	3,727,512	4,997,489	6,497,275	6,977,543
Back Injury	5,252,323	6,835,017	7,351,373	5,454,239	6,888,624
Total, Back Pain	23,037,014	25,018,925	29,145,552	31,539,908	34,944,733
Physician Visits for Cervical/Neck Pain					
Neck Disorders	4,337,258	4,806,514	6,691,617	8,637,699	6,221,797
Disk Disorders	567,516	867,893	1,266,028	1,689,635	1,528,678
Neck Injury	4,324,183	2,936,164	4,776,856	3,444,789	2,211,089
Total, Cervical Back Pain	8,922,199	8,266,345	11,726,898	13,104,000	9,513,081
Physician Visits for Back Pain (Lumbar and Cervical)					
Total Visits	31,959,213	33,285,270	40,872,450	44,643,908	44,457,814

Physician Visits for Back Pain as Proportion of Total Population

	Proportion of Total U.S. Population [1]				
	1998	2000	2002	2004	2006
Physician Visits for Lumbar/Low Back Pain					
Back Disorders	5.9%	5.7%	6.9%	7.4%	8.1%
Disc Disorders	1.1%	1.3%	1.7%	2.2%	2.3%
Back Injury	1.9%	2.4%	2.5%	1.8%	2.3%
Total, Back Pain	8.5%	8.8%	10.0%	10.6%	11.7%
Physician Visits for Cervical/Neck Pain					
Cervical Disorders	1.6%	1.7%	2.3%	2.9%	2.1%
Disk Disorders	0.2%	0.3%	0.4%	0.6%	0.5%
Neck Injury	1.6%	1.0%	1.6%	1.2%	0.7%
Total, Cervical Back Pain	3.3%	2.9%	4.0%	4.4%	3.2%
Physician Visits for Back Pain (Lumbar and Cervical)					
Total Visits	11.8%	11.7%	14.0%	15.1%	14.9%

[1] Proportion of total population based on U.S. Census Population Estimates as of July 1 for each year.

Source: National Center for Health Statistics, National Ambulatory Medical Care Survey,1998- 2006

Table 2.10: Work Limitations with Reported Joint or Back Pain for Persons Aged 18 and Over, United States 1999-2004

Pain in Site Reported	% Reporting Site Pain		
	Pain Limits All Work (11% of population)	Pain Limits Amount of Work (32% of population)	Pain Limits Ability to Walk (8% of population)
Low Back Pain	63%	62%	62%
Neck Pain	41%	40%	38%
Headaches	37%	35%	28%
Lower Limb (Leg, Foot)	28%	28%	37%
Upper limb (Shoulder, Girdle, Arm, Hand)	26%	26%	26%
Head	16%	15%	12%
Torso (Sternum, Chest, Abdomen)	9%	8%	7%

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 1999-2004.

Table 2.11: Limitation in Work Due to Back Pain by Gender and Age for Persons Age 18 and Over, United States 1999-2004

		Proportion of Persons Reporting Work Limitations							
		Pain Keeps from Working [1]				Back Pain Limits Amount of Work Can Do [2]			
Status of Back Pain		With Back Pain in One Site [3]	With Back Pain in Multiple Sites [4]	No Back Pain Reported	All Pain Sites	With Back Pain in One Site [3]	With Back Pain in Multiple Sites [4]	No Back Pain Reported	All Pain Sites
Gender	Male	18%	33%	8%	10%	51%	69%	25%	31%
	Female	21%	33%	8%	11%	51%	75%	31%	34%
Age	18-44 years	13%	23%	4%	6%	39%	57%	14%	20%
	45-64 years	24%	43%	10%	14%	55%	84%	29%	40%
	65-74 years	30%	41%	11%	15%	74%	87%	39%	46%
	75 & over	29%	31%	16%	18%	70%	82%	53%	56%
Total		20%	33%	8%	11%	51%	72%	25%	32%

[1] 11% of the population reports a long-term physical, mental or emotional problem keeps them from working.

[2] 32% of the population reports a long-term physical, mental or emotional problem limits the kind or amount of work they can do.

[3] "With respect to pain problem, located in …Low back pain, upper back pain, buttocks, neck and spine?"

[4] "With respect to pain problem, located in …multiple sites of back"

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 1999-2004.

Table 2.12: Bed and Lost Work Days Associated with Back Pain for Persons Aged 18 and Over, United States 2008

	Incidence of Reported Condition (N in 000s)	% of Total Population	Incidence of Bed Days (N in 000s)	% of Total Population	Average Number of Bed Days	Total Bed Days (in 000s)	Incidence of Lost Work Days (N in 000s)	% of Total Population	Average Number of Work Days Lost	Total Lost Work Days (in 000s)
Back/Neck Problem Causes Difficulty with Activity										
Male	8,408	7.7%	4,156	3.8%	33.1	137,564	2,826	2.6%	23.2	65,563
Female	10,640	9.1%	5,865	5.0%	25.5	149,558	3,511	3.0%	23.9	83,913
Total	19,048	8.5%	10,021	4.4%	28.7	287,603	6,338	2.8%	23.6	149,577
Neck Pain in Past 3 Months										
Male	12,368	11.4%	5,610	5.2%	21.9	122,859	4,543	4.2%	18.2	82,683
Female	19,062	16.4%	10,350	8.9%	23.4	242,190	7,475	6.4%	16.1	120,348
Total	31,430	14.0%	15,960	7.1%	22.9	365,484	12,019	5.3%	16.9	203,121
Low Back Pain in Past 3 Months										
Male	27,334	25.1%	11,858	10.9%	19.8	234,788	10,004	9.2%	14.1	141,056
Female	34,381	29.5%	17,239	14.8%	21.7	374,086	12,090	10.4%	14.3	172,887
Total	61,715	27.4%	29,097	12.9%	20.9	608,127	22,093	9.8%	14.2	313,721
Radiating Leg Pain (with Low Back Pain)										
Male	8,498	7.8%	3,963	3.6%	33.1	131,175	2,670	2.5%	28.9	77,163
Female	11,606	10.0%	6,561	5.6%	34.8	228,323	3,613	3.1%	23.6	85,267
Total	20,104	8.9%	10,525	4.7%	34.1	358,903	6,283	2.8%	25.8	162,101
All Spine Pain or Problems										
Male	32,135	29.5%	13,776	12.7%	18.7	257,611	11,761	10.8%	14.9	175,239
Female	42,182	36.2%	21,188	18.2%	19.5	413,166	15,353	13.2%	13.6	208,801
Total	74,317	33.0%	34,954	15.5%	19.2	671,117	27,113	12.0%	14.2	385,005

Source: National Center for Health Statistics, National Health Interview Survey, 2008

Table 2.13: Select Spine Procedures as a Proportion of All Spine Procedures and Spine Patients, United States 2007

	All Spine Procedures, 2007 [1]		
Procedure	Number of Patients w/Procedure	% of Total Spine Procedures	% of Total Spine Patients [2]
Spinal fusion (cervical, lumbar, dorsal, other)	379,912	32.0%	57.3%
Spinal diskectomy	332,525	28.0%	50.2%
Insertion of spinal device	224,522	18.9%	33.9%
Spinal decompression	163,385	13.8%	24.7%
Kyphoplasty	45,878	3.9%	6.9%
Spinal refusion	21,279	1.8%	3.2%
Vertebroplasty	13,646	1.1%	2.1%
Replacement spinal disc procedure	5,557	0.5%	0.8%
All select spine procedures	1,186,704	100.0%	179.1%
Total spine procedure patients	662,446		

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Multiple procedures performed on some patients

Table 2.14: Trends in Spinal Fusion Procedures, United States 1998-2006

ICD-9-CM	Description	Year	Number of Patients	Rate of Two Year-to-Year Cycle Increase in Patients	Number of Procedures [1]	Rate of Two Year-to-Year Cycle Increase in Procedures	Rate Per 100,000 Population Aged 18 & Over [2]	Mean Age of Patient	Mean Length of Stay	Mean Hospitalization Charge [3]	Rate of Two Year-to-Year Cycle Increase in Mean Charge	Total Hospitalization Charges (in Billions)	Rate of Two Year-to-Year Cycle Increase in Total Hospital Charges
81.00-81.08	Spinal Fusion	1998	204,000		220,000		109.57	49.0	4.7	$26 ,000		$5.35	
		2000	242,000	18%	263,000	20%	125.93	49.4	4.3	$32 ,000	21%	$7.18	34%
		2002	289,000	20%	323,000	23%	150.07	50.2	4.4	$42 ,000	29%	$11.87	65%
		2004	307,000	6%	307,000	-5%	139.29	51.8	4.5	$56 ,000	34%	$16.87	42%
		2006	354,000	15%	380,000	24%	169.02	53.2	4.2	$77 ,000	38%	$27.17	61%
9-Year Change				73%		73%					191%		408%
81.30-81.393	Spinal Refusion [4]	1998	12,000		12,000		5.90	47.1	4.6	$26 ,000		$0.30	
		2000	13,000	12%	13,000	12%	6.36	49.0	5.4	$39 ,000	49%	$0.47	57%
		2002	19,000	43%	20,000	53%	9.47	50.0	4.4	$46 ,000	20%	$0.86	83%
		2004	19,000	1%	19,000	-7%	8.62	52.7	4.8	$63 ,000	37%	$1.18	37%
		2006	20,000	4%	21,000	12%	9.47	53.8	5.0	$96 ,000	52%	$1.90	62%
9-Year Change				69%		80%					272%		535%
81.00-81.08 + 81.30-81.393	Total	1998	214,000		231,000		115.48	48.9	4.7	$26 ,000		$5.59	
		2000	253,000	18%	277,000	20%	132.28	49.4	4.3	$32 ,000	22%	$7.53	35%
		2002	304,000	20%	343,000	24%	159.54	50.2	4.3	$42 ,000	29%	$12.50	66%
		2004	321,000	5%	327,000	-5%	148.37	51.8	4.5	$56 ,000	34%	$17.87	43%
		2006	373,000	16%	401,000	23%	178.49	53.2	4.2	$77 ,000	38%	$28.72	61%
9-Year Change				74%		73%					193%		414%

[1] Up to 15 diagnosis per patient were included; multiple spine procedures per patient can be coded

[2] Computed from U.S. Census population estimates released July 1st of each year (www.census.gov).

[3] "Charge" refers to hospitalization charges and does not include professional (i.e., physician fees), drugs or non-covered charges

[4] Prior to 2002, spinal refusion procedures were coded to the single code, 81.09. In 2002, this code was dropped and multiple codes implemented.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2006

Table 2.15: Distribution of Spine Fusion Procedures by Spine Section, United States 2004 & 2007

	2007 Spine Fusion Procedures [1]				2004 Spine Fusion Procedures [2]			
	Number	% of Total Spine Fusion Procedures	% of Total Spine Fusion Patients [3]	% of Total Spine Patients	Number	% of Total Spine Fusion Procedures	% of Total Spine Fusion Patients [3]	% of Total Spine Patients
Cervical Fusion	152,360	38.0%	43.1%	6.3%	134,761	41.2%	44.3%	6.6%
Thoracic or Dorsal Fusion	26,735	6.7%	7.6%	1.1%	23,601	7.2%	7.8%	1.2%
Lumbar Fusion	196,867	49.1%	55.7%	8.1%	149,516	45.7%	49.2%	7.3%
Other or Unspecified Fusion	3,950	1.0%	1.1%	0.2%				
Spine Refusion Procedures	21,279	5.3%	6.0%	0.9%	18,935	5.8%	6.2%	0.9%
Total Spinal Fusion or Refusion Procedures	401,191	100.0%	113.4%		326,813	100.0%	107.5%	
Total Spine Fusion Patients	353,694			14.6%	303,904			14.9%
All Spine Diagnosed Patients	2,428,956				2,036,165			

[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2004

[3] Multiple procedures performed on some patients

Table 2.16: Proportion of Back Pain Diagnoses with Spinal Fusion Procedure by Gender and Age, United Sta

	Total Number of Spinal Diagnosis (in 000s)										
		Gender		Age in Years						Mean Length of Stay (in days)	Mean Charges
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over	Ave Age for Fusion		
Lumbar/Low Back Pain											
All Lumbar/Low Back Pain Diagnoses	1,898	805	1,091	14	379	660	321	370	60.5	4.7	$ 32,775
Total Lumbar Spine Fusion Procedures (ICD-9-CM=8106)	197	79	101	*	43	81	34	19	55.2	4.4	$ 87,073
% Diagnoses with Spinal Fusion Procedure	10.4%	9.8%	9.3%	*	11.3%	12.3%	10.6%	5.1%			
Cervical/Neck Pain (Neck)											
All Cervical/Neck Pain Diagnoses	503	237	266	*	111	212	73	72	55.2	4.4	$ 37,623
Total Cervical Spine Fusion Procedures (ICD-9-CM=8102)	152	75	76	*	39	83	19	81	52.6	3.2	$ 54,510
% Diagnoses with Spinal Fusion Procedure	30.2%	31.6%	28.6%	*	35.1%	39.2%	26.0%	112.5%			
All Back Pain											
All Back Pain Diagnoses	2,401	1,042	1,357	14	490	872	394	442	56.2	4.6	$ 33,714
Total Spine Fusion Procedures (ICD-9-CM= 810,813)	380	169	196	9	92	177	57	30	53.2	4.2	$ 76,924
% Diagnoses with Spinal Fusion Procedure	15.8%	16.2%	14.4%	64.3%	18.8%	20.3%	14.5%	6.8%			

* Estimate does not meet standards for reliability

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 2.17: Primary (1st) Diagnosis for Spinal Fusion Procedures, United States 2007

Diagnosis		Number	% of Total Spine 1st Diagnosis w/Fusion Procedure
722.00	Cervical Disc Displacement	50,038	14.3%
722.52	Lumbar Disc Degeneration	42,246	12.0%
722.10	Lumbar Disc Displacement	35,001	10.0%
724.02	Lumbar Spinal Stenosis	31,384	8.9%
738.40	Acquired Spondylolisthesis	22,698	6.5%
721.00	Cervical Spondylosis	21,024	6.0%
721.10	Cervical Spondylosis with Myelopathy	19,767	5.6%
722.71	Cervical Disk Disorder	17,522	5.0%
721.30	Lumbosacral Spondylosis	16,688	4.8%
722.40	Cervical Disc Degeneration	11,307	3.2%
723.00	Cervical Spinal Stenosis	10,274	2.9%
756.12	Spondylolisthesis	8,358	2.4%
737.30	Idiopathic Scoliosis	7,378	2.1%
996.49	Complication of Internal Orthopaedic Device	3,897	1.1%
805.40	FX Lumbar Vertebra-Closed	3,513	1.0%
	All Other Diagnoses	49,710	14.2%
All Primary(1st) Diagnosis for Fusion Procedure		350,806	100.0%

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 2.18: Health Care Visits for Ruptured Spine and Spinal Diskectomy Procedures, United States 2006/2007

Health Care Visits for Ruptured (Herniated) Spine Diagnosis [1]	Total Number of Spinal Diagnosis (in 000s)									% of Total Visits	Mean Length of Stay (in days)	Mean Charges
	Total	Gender		Age (in years)					Average Age			
		Male	Female	<18	18-44	45-64	65-74	75 & over				
Hospital Discharges [2]	366.4	180.3	184.0	0.8	122.8	163.4	45.3	28.5	52.0	7.6%	3.1	$ 37,373
Hospital Emergency Department Visits [3]	115.2	33.5	81.6	0.0	64.5	30.5	10.5	9.6	46.7	2.4%	NA	NA
Hospital Outpatient Visits [4]	311.7	129.4	182.3	0.0	125.7	173.1	10.6	2.3	47.8	6.4%	NA	NA
Physician Office Visits [5]	4,044.6	2,112.2	1,932.3	22.6	1,277.8	1,970.3	327.8	446.0	50.5	83.6%	NA	NA
All Ruptured Spine Diagnoses	4,837.9	2,455.4	2,380.2	23.4	1,590.8	2,337.3	394.2	486.4		100.0%		
Percent of Total		50.8%	49.2%	0.5%	32.9%	48.4%	8.2%	10.1%				
Spinal Diskectomy Procedure [6]											Mean Length of Stay (in days)	Mean Charges
Hospital Discharges [2]	330.7	166.6	164.0	1.40	105.4	159.7	43.4	20.4	51.7		2.8	$ 50,884
Percent of Total		50.4%	49.6%	0.4%	31.9%	48.3%	13.1%	6.2%				
Proportion of Inpatient [1] Diskectomy Procedures with Ruptured Spine Diagnosis	90%	92%	89%	175%	86%	98%	96%	72%				Total Procedures Cost
Total Hospital Charges for Diskectomy Procedures (in billions)												$ 16.8

* Estimate does not meet standards for reliability

[1] ICD-9-CM diagnosis codes: 722.00, 722.10, 722.11, 722.20, 722.70, 722.71, 722.72, 722.73

[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[5] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[6] ICD-9-CM procedure codes: 805.00, 805.10

Table 2.19: Primary (1st) Diagnosis for Spine Diskectomy Procedures, United States 2007

Diagnosis		Number	% of Total Spine 1st Diagnosis w/Diskectomy Procedure
722.10	Lumbar Disc Displacement	124,576	37.5%
722.00	Cervical Disk Displacement	48,862	14.7%
722.52	Lumbar Disc Degeneration	26,149	7.9%
721.00	Cervical Spondylosis	18,015	5.4%
722.71	Cervical Disk Disorder	15,229	4.6%
724.02	Lumbar Spinal Stenosis	15,065	4.5%
721.10	Cervical Spondylosis with Myelopathy	12,938	3.9%
722.40	Cervical Disc Degeneration	10,071	3.0%
738.40	Acquired Spondylolisthesis	9,292	2.8%
721.30	Lumbosacral Spondylosis	8,560	2.6%
723.00	Cervical Spinal Stenosis	7,093	2.1%
722.73	Thoracic Disc Disorder with Myelopathy	5,234	1.6%
756.12	Spondylolisthesis	3,201	1.0%
	All Other diagnoses	26,997	8.1%
All Primary (1st) Diagnosis for Diskectomy Procedure		331,282	100.0%

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 2.20: Diskectomy Procedure Trends, United States 1996 to 2006

Year	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	11 Year Mean
Procedures [1] (to nearest 000)	285,000	281,000	303,000	303,000	279,000	289,000	319,000	317,000	324,000	292,000	276,000	297,000

[1] ICD-9-CM Procedure Code: 805.00 or 805.10

Source: National Center for Health Statistics; Centers for Disease Control and Prevention, National Hospital Discharge Survey, 1996-2006

Chapter 3
Spinal Deformity and Related Conditions

The term spinal deformity includes several conditions in which the spine is abnormally curved or aligned. One of the more frequent spinal deformities is scoliosis, or a side to side abnormal curvature of the spine. Spinal deformity and scoliosis can be found at birth due to genetic causes, develop during childhood, or develop late in life due to degenerative disc and joint disease.

Common signs of scoliosis are a prominent shoulder, shoulder blade, or chest wall asymmetry. Another sign is uneven hips with one hip seemingly higher than the other. (Figure 3.0.1) It is important not to confuse scoliosis with poor posture and to realize that scoliosis will usually not disappear with age. Other deformities include kyphosis, an exaggerated rounding of the back that may occur by itself or in conjunction with osteoporosis, and spondylolisthesis, a slippage of one vertebra onto its neighboring vertebra. A variety of other spinal deformity conditions will be discussed in this chapter including spondylolysis and Scheuermann kyphosis.

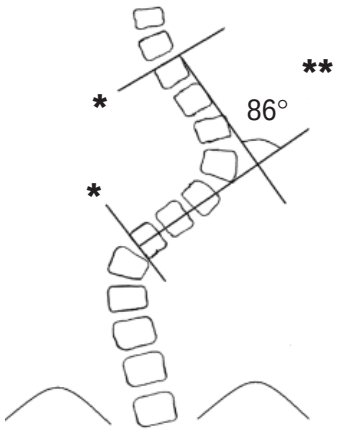
In spite of the severity of these conditions and the impact they have on the lives of children and adults, the prevalence of spinal deformities in children under the age of 18 is difficult to determine due to relatively low numbers and the degree to which the condition manifests initially in pain or disability. Estimated prevalence of spinal deformity conditions has been cited in numerous studies. (Table 3.1)

Section 3.1: Scoliosis and Spinal Deformity in Children

There are several different types of scoliosis. The most common type of scoliosis is idiopathic, meaning the cause of the curve is unknown. Approximately 80 to 85% of scoliosis cases are idiopathic.[1] Idiopathic scoliosis can initially occur as early as the first three years of life (infantile idiopathic scoliosis), from 4 to 10 years of age (juvenile idiopathic scoliosis), or from 10 years of age to skeletal maturity (adolescent idiopathic scoliosis). Adolescent idiopathic scoliosis is the most common type.

Figure 3.0.1: Scoliosis

Figure 3.1.1: Cobb Angle



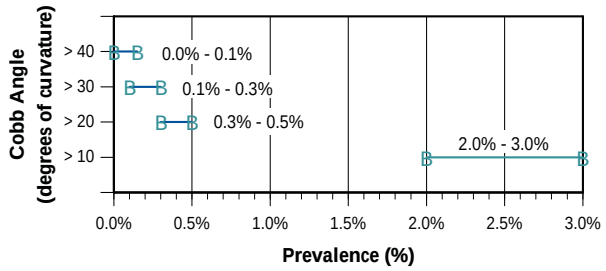
*Both lines are drawn along the end of the vertebrae that are most tilted from the horizontal.
** The Cobb angle is the angle formed by the intersection of these two lines.

Scoliosis, if severe enough (>25°), is usually treated with bracing if the child is growing or with surgery if the curvature is more severe (>45°-50°). The standard radiographic/x-ray measurement technique for all forms of scoliosis is the Cobb angle measurement technique (Figure 3.1.1), measured from the end-plates of the maximally tilted end vertebral bodies in a standing radiograph.[2] Whether the curve is >25° or >40°-45°, the treatment is preventative in nature, helping to avoid progression of the curve and more significant future problems if left untreated. While this preventative aspect is hugely valuable and intuitively important, its benefit is difficult to measure from a public health standpoint, especially for rare conditions of childhood, such as juvenile and adolescent pediatric scoliosis.

Section 3.1.1: Adolescent Idiopathic Scoliosis

According to the Scoliosis Research Society (SRS), idiopathic scoliosis is diagnosed when a patient has asymmetry on forward bending combined with a curve of at least 10°.[3] By this definition, the prevalence of adolescent idiopathic scoliosis in children from 10 to 16 years of age is 2%-3%. (Table 3.2 and Graph 3.1.1) Though the male-to-female ratio for smaller curves is about equal, larger curves seem to be more common in females. Similar results were found in a study conducted in 1985, where 29,195 children were screened for idiopathic scoliosis.[4]

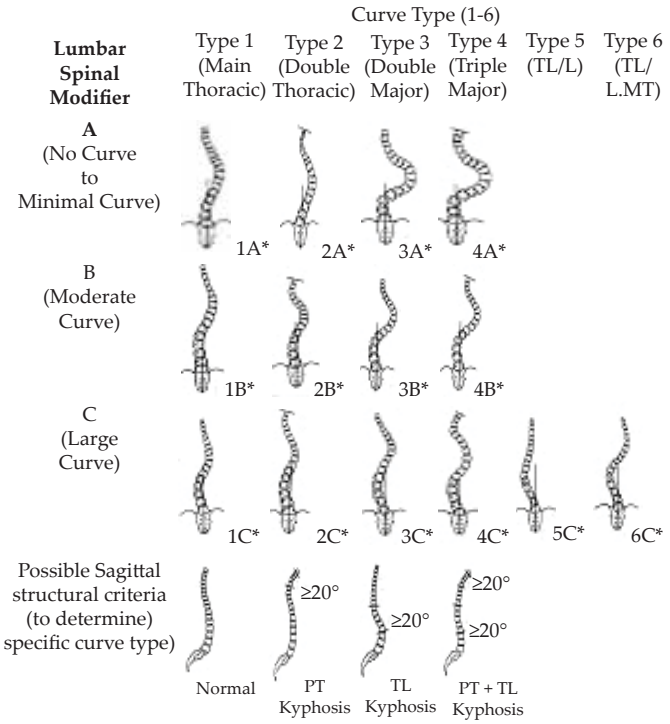
Graph 3.1.1: Prevalence of Adolescent Idiopathic Scoliosis



Data reprinted with permission from Weinstein SL. Adolescent idiopathic scoliosis: Prevalence and natural history. *Instr Course Lect* 1988;38:115–126.

Several studies have investigated the natural history and natural course of curve progression in adolescent idiopathic scoliosis. All report the strongest predictive factors in the development of idiopathic scoliosis are age, magnitude of curve, and gender.[5-9] Girls are more likely to have adolescent idiopathic scoliosis than boys, and some

Figure 3.1.2: Lenke Classification



Source: Lenke LG, Betz RR, Harms J, et al: Adolescent idiopathic scoliosis: A new classification to determine extent of spinal arthrodesis. *J Bone Joint Surg Am* 2001;83(8):1169-81.

studies report the onset is earlier in girls than boys. A factor highly correlated with curve progression is age at diagnosis; patients diagnosed at a younger age have a greater risk of curve progression. It should be noted, however, that those diagnosed at a younger age seem to have a more favorable response to milder forms of treatment, supporting school screening to detect and lead to earlier diagnosis for those children with a smaller degree of curvature.

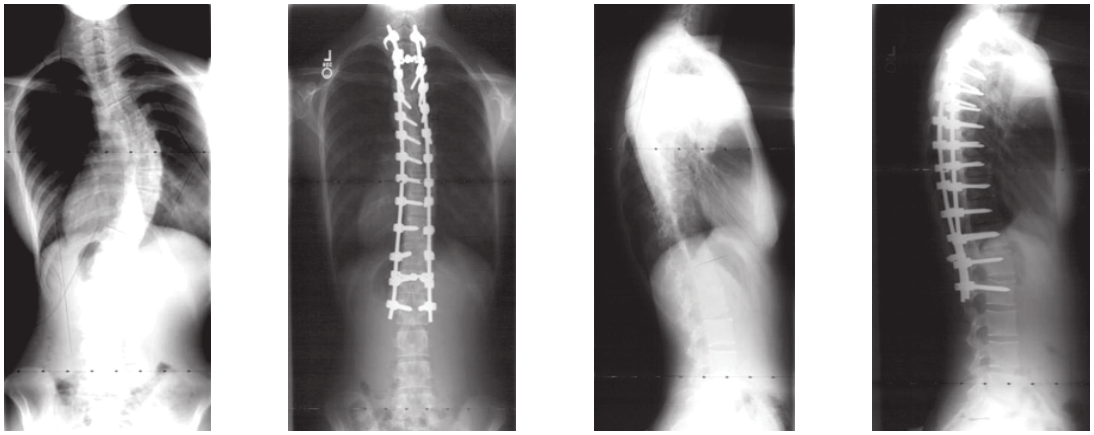
Within the past several years, a two-dimensional classification system, the Lenke classification system, was developed to assess the type of a curve for adolescent idiopathic scoliosis. (Figure 3.1.2)

The three components included in this system include curve type, lumbar spine modifier, and sagittal thoracic modifier.[10] A study conducted in 2001 evaluated the prevalence of six curve types in 606 adolescent patients diagnosed with idiopathic scoliosis. Approximately one-half (51%) of the patients were found to have a Type 1, or main thoracic, curve.

Treatment decisions for individuals with adolescent idiopathic scoliosis are made based on location, shape, pattern, and cause of the curve. The treatment choice is also a function of the patient's future growth potential. Treatment choices include observation, bracing, and surgery. Observation is usually reserved for patients who have curves ≤25°. Bracing, which is used to stop curve progression (rather than for lasting correction of the curve), is usually used for patients who have curves ≥25° and who are still growing. Surgery is generally used for patients with curves ≥45°. (Figure 3.1.3)

While technical outcomes of surgery are well known and show obvious benefits for those with significant deformity, long-term health related outcomes have yet to be precisely documented. The paucity of quality, long-term studies of sufficient size hampers our understanding of the mortality and morbidity rates for patients with congenital and idiopathic scoliosis, both with and without treatment. Fifty years of follow-up studies of children and adolescents with untreated scoliosis have shown conflicting results, with some studies indicating a higher risk of mortality and respiratory compromise.[11,12] Another study shows compromise only in patients with early reduced lung function and a large curvature.[13] Yet another study has shown no differences in untreated childhood scoliosis and a control group.[14] Several articles from the 1960s and one recent article report that low back pain does not occur more frequently in untreated scoliosis patients than in the general population,[14-16] unless the curvature is greater than 40°.[17,18] It has also been shown that persons treated with surgery, rather than bracing, for adolescent idiopathic scoliosis have less pain at 10 to 20 year follow-up, although function remains similar.[19,20] The cosmetic/self-image aspect of scoliosis is obvious and important, and often a major factor affecting the lives of individuals with this condition.

Figure 3.1.3: Idiopathic Scoliosis



Section 3.1.2: Juvenile Idiopathic Scoliosis

In 12% to 21% of idiopathic scoliosis cases, the diagnosis is made between 4 and 10 years of age. When diagnosed at this age the condition is called juvenile idiopathic scoliosis.[21] Between the ages of 4 and 6, the female-to-male ratio of juvenile idiopathic scoliosis is 1:1; however, the ratio of female to male cases rises to between 2:1 and 4:1 in children between the ages of 4 and 10, and to 8:1 in children who are 10 years of age.[21] Both right and left curves are found with equal frequency for patients younger than 6 years, but rise to a 3:1 ratio of right versus left thoracic curves after the age of 6.[22]

Observation is the main treatment for patients with a small curve less than 20° to 25°. Follow-up visits are recommended every 4, 6, 9, or 12 months depending on the patient's age, the degree of the curve, and the characteristics of the clinical deformity.[21]

Curves between 25° and 50° are usually treated with bracing in this age group. Bracing can be done either on a part-time or full-time basis, depending on the size of the curve as well as the age of the child.[21] A study completed in 1982 evaluating the success of bracing reported an excellent prognosis when part-time bracing was utilized for patients with a curve of ≤35° and rib-vertebra angle difference (RVAD)[i] of ≤20°; however, curves ≥45° and RVAD of ≥20° had a less favorable prognosis for successful treatment with bracing.[21]

Overall, the curve patterns in patients with juvenile idiopathic scoliosis are similar to those with adolescent idiopathic scoliosis. Approximately 70% of patients with juvenile idiopathic scoliosis exhibit curve progression and require some form of treatment. In a study conducted in 1981, 55 of 98 patients (56%) with juvenile idiopathic scoliosis required spinal surgery.[21] The most common and traditional surgery is posterior instrumentation and fusion.[21]

Section 3.1.3: Infantile Idiopathic Scoliosis

Infantile scoliosis currently accounts for less than 1% of all cases of idiopathic scoliosis in the United States. Boys are affected by infantile idiopathic scoliosis at a higher rate than girls (3:2 ratio).[23] Infantile scoliosis curves tend to be left-sided (75%-90%). Past studies have indicated this rare type of scoliosis occurs more frequently in Europe than in North America.[24]

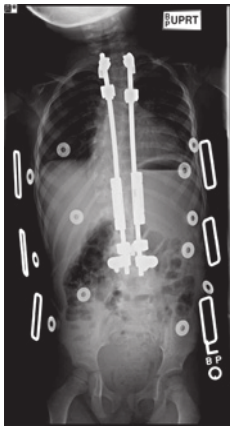
Treatment for patients with infantile idiopathic scoliosis is determined by anticipated or actual curve progression.[23] In addition to measuring the Cobb angle, the RVAD is used as a common predictor of curve progression.[25] Patients with a Cobb angle of ≤25° and a RVAD of ≤20° are at a low risk for progression and should be re-evaluated every 4 to 6 months.[23]

Nonoperative treatment, such as bracing or casting, will be initiated if a curve progression of ≥ 10° occurs. Surgical treatment should be considered when nonoperative measures, including both bracing and casting, are not successful.[23] Surgical treatment is utilized when a curve is ≥ 45° and progressive in an immature child.[23] Overall, surgical methods are continually evolving with the goal of obtaining and maintaining curve correction while simultaneously preserving or encouraging spinal and trunk growth.

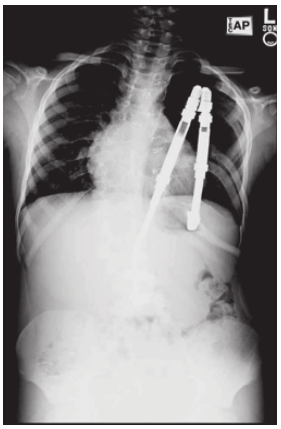
Surgical options currently utilized include various types of spinal fusion or hemiepiphysiodesis, a minimally invasive implant procedure to slow progression of curve growth. Additional techniques include growing-rod instrumentation (rods that expand and support the deformed spine) and vertical expandable (telescoping) prosthetic

[i] **RVAD - Rib Vertebral Angle Degree**: The angle formed on each side between the apical thoracic vertebra and its corresponding rib. The rib-vertebra angle difference is the difference between the rib-vertebral angle on the convexity of the curve subtracted from that on the concavity and may be either a positive or negative value. In a normal spine the rib-vertebra angle difference at any vertebra is zero. Resolving curves are nearly always thoracic and when first seen the rib-vertebral angle difference is less than 20° in 80% of patients. The usual pattern is for the rib-vertebral angle difference to decrease as the curve resolves. (Bradford Book, 1986) Available at: http://www.infantilescoliosis.org/terms.htm. Accessed October 3, 2007.

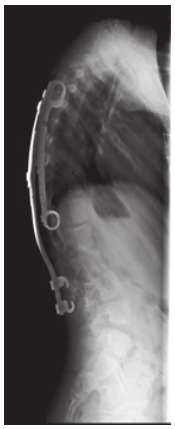
Figure 3.1.4: Infantile Idiopathic Scoliosis



Growing Rod



VEPTR: Back view



VEPTR: Side view

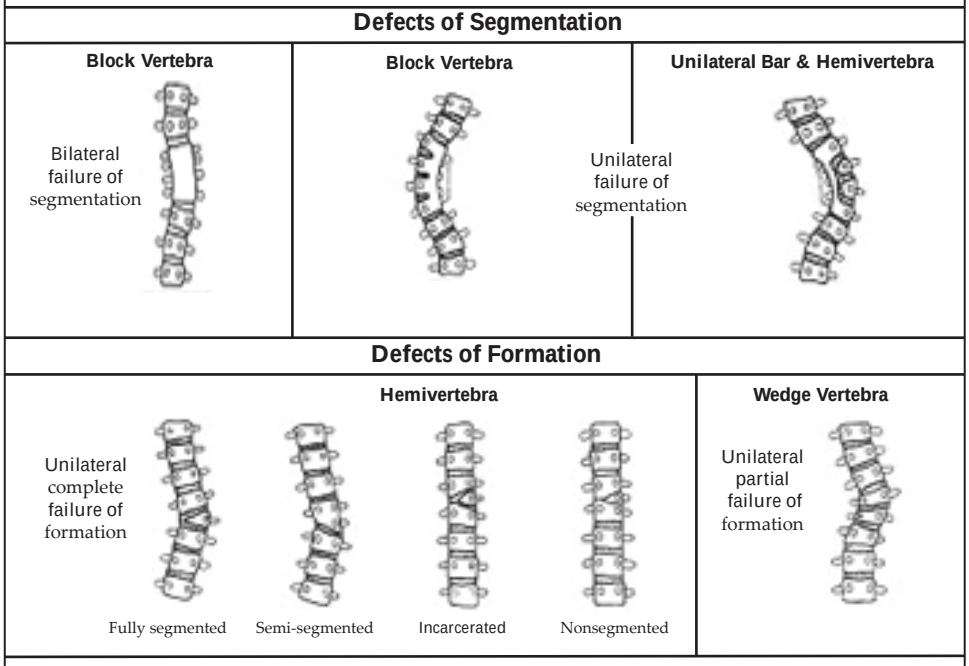
titanium rib (VEPTR) instrumentation.[ii] (Figure 3.1.4) The goal of using surgical methods is to halt the progression of the curve and gain correction of the deformity, allowing maximum growth of the spine, lungs, and thoracic cage.[23]

Section 3.1.4: Congenital Scoliosis

Congenital scoliosis is believed to affect approximately 1 child for every 1000 live births.[26] The cause is unknown in most cases, but in some cases it is associated with various syndromes. (Figure 3.1.5) Diagnosis is occasionally made during prenatal ultrasound. In cases of congenital scoliosis, additional congenital conditions, such as chest wall malformation or kidney or heart abnormalities, are often present. Treatment options for congenital scoliosis are bracing and/or surgery, and are similar to those discussed for idiopathic scoliosis. Bracing is not as effective for congenital scoliosis as it is for idiopathic scoliosis.

Major abnormal spinal deformity presenting during infancy or early childhood poses a clinical problem because of the anticipated long growth period (at least 10 years); variable presentation and treatment methods; and the length of time that must pass before meaningful outcome results can be assessed in the small number of patients for definitive studies. Curves that result from congenital scoliosis are often not treated as easily as idiopathic curves because the deformity is in the bones rather than the soft tissue, causing the curve to be rigid.[27]

Figure 3.1.5: Congenital Anomalies



Source: McMaster MJ: Congenital scoliosis, in: Weinstein SL (ed): *The Pediatric Spine: Principles and Practice*, ed 2. Philadelphia, PA: Lippinncott Williams & Wilkins; 2001; p 163.

Section 3.1.5: Neuromuscular Scoliosis

Scoliosis also occurs in conjunction with several congenital conditions that occur in infancy or childhood. These include muscular dystrophy,

[ii] **Titanium Rib or VEPTR** (Vertical Expandable Prosthetic Titanium Rib): An expandable titanium metal rod placed in a vertical position alongside the spine and attached to the ribs and pelvis or the spine. The VEPTR expands and supports a deformed chest wall cavity giving the lungs room to operate and grow. Used to treat many chest wall deforming and/or spine defect diagnoses which result in Thoracic Insufficiency Syndrome. Available at: http://www.infantilescoliosis.org/terms.htm. Accessed October 3, 2007.

cerebral palsy, spina bifida, and spinal muscular atrophy. Scoliosis associated with these conditions is referred to as neuromuscular scoliosis. Both the likelihood and the severity of the scoliosis generally increases with the severity of the underlying condition. For example, a child with severe cerebral palsy who is unable to walk is more likely to have severe scoliosis than a child with mild cerebral palsy who can walk. These conditions are also discussed in Chapter 6, Congenital and Infantile Developmental Conditions of the Musculoskeletal System.

Cerebral palsy (CP) is defined as a non-progressive disturbance in the developing brain of the fetus or infant. Musculoskeletal problems are frequently seen as a result of the motor disorder. The more common musculoskeletal problem is scoliosis. Besides bracing, which is usually an ineffective form of treatment for more severe muscular scoliosis, surgical procedures are frequently indicated in pediatric patients with CP. In 2005, more than 100,000 children under the age of 18 were disabled with CP, and its prevalence has increased by 18% in the past two decades.[28] In 1997, 37,000 pediatric patients were discharged from hospitals with a diagnosis of CP. Among these patients, spinal fusion with instrumentation was among the top five most commonly performed surgical procedures, and was performed on 765 patients that year in the United States. Treatment for CP with spinal fusion accounted for more than 4,000 hospital days and charges of nearly $40 million.[28]

The prevalence of spina bifida (a failure of the spine—usually, the lower spine—to close and form normally during fetal development) has decreased dramatically since the 1970s with the introduction of folic acid into the diet of pregnant women. Since 1990, the annual incidence of spina bifida has been reported at 3.2 cases per 10,000 live births, with no variation in ethnic groups observed.[29]

There are several different types of muscular dystrophy (i.e., abnormal function of muscle), but all are genetic in cause and due to a lack of protein that helps muscle cells function. The most common type is Duchenne muscular dystrophy, and it primarily affects males who inherit a defective gene through their mother.[30] Duchenne muscular dystrophy occurs in approximately 1 in 3500 live male births.[30] Many patients with Duchenne muscular dystrophy develop scoliosis by the age of 12.[31] Because muscular dystrophy is usually progressive, patients are typically treated surgically, usually with spinal fusion.[32] Potential advantages of surgery include comfort and sitting tolerance, cosmetic improvement, elimination of the need for orthopaedic braces, ease of nursing care for parents, and pain relief.

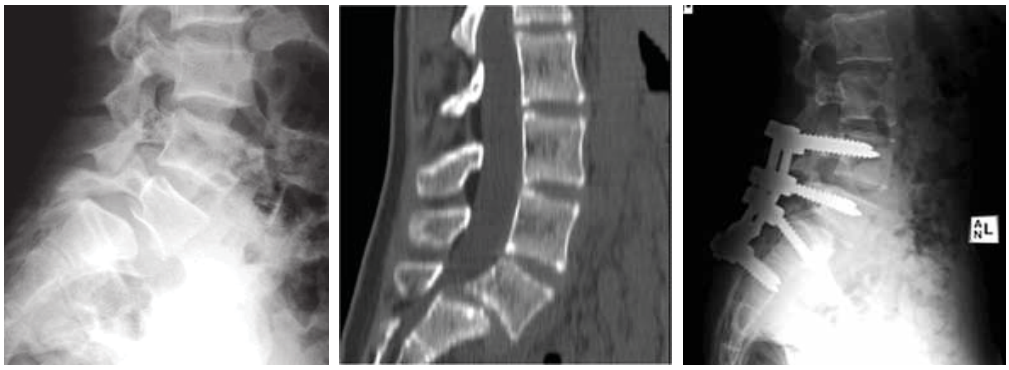
Spinal muscular atrophy (SMA) affects eight children out of every 100,000 live births. The prevalence of scoliosis for patients with SMA is directly related to the severity of the disease and the specific type of SMA that the patient has.[33] SMA equally affects both females and males.[34] There is no specific treatment for SMA, but bracing can slow the inevitable progression of a scoliotic curve and postpone surgical treatment in some cases. Surgical treatment is generally spinal fusion or a segmental spinal instrumentation, and is performed when the curve progresses to greater than 50° to 60°. The goal of surgical treatment is to improve balance and sitting capability of the patient.[33]

Section 3.2: Other Childhood Spinal Conditions

Additional spinal conditions seen in children include spondylolysis, a stress fracture of the lower end of the spine; spondylolisthesis, a condition where one of the spinal vertebrae (usually in the lower/lumbar spine) slips forward on the one below it; Scheuermann kyphosis, an often painful condition manifested in exaggerated roundness of the upper part of the spine; and others. Occasionally, children have herniated discs that require surgical intervention. Children also can have different types of spinal infections and tumors. While most of these conditions are quite

rare, they can cause significant disability if not recognized early and treated appropriately. Again, the preventative nature of treatment is intuitively obvious, but difficult to measure for these rare conditions.

Figure 3.2.1: Spondylolysis and Spondylolisthesis



Preoperative radiograph CT Scan Postoperative radiograph

Section 3.2.1: Spondylolysis and Spondylolisthesis

Spondylolysis is disintegration or dissolution of a vertebra. It is usually accompanied by spondylolisthesis, a forward displacement of a lumbar vertebra on the one below it, especially the fifth lumbar vertebra on the sacrum, producing pain by compression of nerve roots. (Figure 3.2.1) Although spondylolysis is virtually nonexistent in newborns, by the age of 6 the incidence has reached approximately 6% for the general pediatric population. Both spondylolysis and spondylolisthesis are found at higher levels in certain populations. Examination of Eskimo skeletons indicates the incidence of spondylolysis is 13% in pediatric patients. A study conducted in 1953 found an overall incidence of 4.2% in the general pediatric population, with incidence of 6.4% in white males, 2.8% in black males, 2.3% in white females, and 1.1% in black females. Most reports have found a higher incidence of spondylolysis in males than in females (2:1 ratio, respectively), although females have a higher risk of progression.[35]

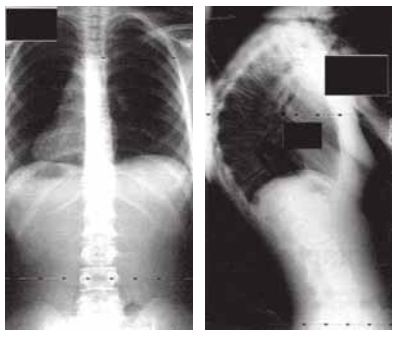
Many children with spondylolysis do not experience back pain and, therefore, may not require treatment. If the child remains asymptomatic, he or she is examined every 3 to 6 months; if the child begins to experience pain, a bone scan and proper radiographs are often used to reassess the situation and confirm the diagnosis. Conservative management, such as bracing, may help. Spondylolysis that progresses or remains painful in spite of conservative measures, and which interferes with daily activities, is treated with a localized spinal fusion. A similar observation/ treatment pattern is used for children with spondylolisthesis. Surgery is recommended if the slip of one vertebra over another is greater than 50%. Overall, the goal of surgery for either condition is to stabilize the spondylolytic segment, prevent further slippage, relieve pain and/or nerve root irritation, and prevent neurological deficit. When indicated, surgery can help correct hamstring tautness, poor posture, and abnormality of gait.[34]

Section 3.2.2: Scheuermann Kyphosis

Scheuermann kyphosis affects 0.4% to 8% of healthy children. Kyphosis is an exaggerated outward curvature of the thoracic region of the

Figure 3.2.2: Scheuermann Kyphosis

Note the increased curvature of the upper back associated with wedging and end plate irregularity of individual vertebrae at the apex.



spinal column resulting in a rounded upper back. (Figure 3.2.2) There is no definitive answer to whether it affects males or females at higher rates, with prevalence leaning to both sexes found in studies.[36] Patients who are skeletally mature with acceptable kyphosis (curvature) and no observable symptoms do not require treatment. If the individual is still growing and the kyphosis is severe, treatment is required, and bracing or casting is usually used, with surgery rarely indicated and only for skeletally mature patients with chronic back pain and a curve of more than 60°.[34]

Section 3.3: Adult Spinal Deformity and Degenerative Scoliosis

Deformity of the adult spine includes patients with curvature of the spine (scoliosis) of varying magnitudes caused or impacted by degenerative disc and joint disease. Adult scoliosis may be the result of persistent or progressive deformity since adolescence or a new, de novo, onset of deformity as a result of degeneration or "aging" of the spine. Degenerative scoliosis accounts for the majority of scoliosis cases in older populations aged 65 years and older, as reflected in the low proportion of older patients with a diagnosis of primary idiopathic scoliosis.

The prevalence of adult spinal deformity and scoliosis is not well established, with estimates ranging from 2.5% to 25% of the population.[16, 37-41] A recent study reported mild to severe adult scoliosis prevalence as high as 68% in a healthy (no known scoliosis or spine surgery) population aged 60 and over.[42] Many cases of degenerative scoliosis are undiagnosed, but elderly patients often seek care because of back and leg pain that may be caused by scoliosis and associated spinal stenosis.

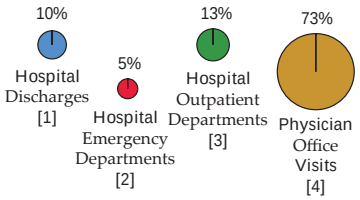
Degenerative scoliosis is one of the most challenging spine conditions to treat due to the variability of the condition. It is generally thought to originate with the degeneration of the intervertebral discs, which leads to misalignment of the vertebral column. Degenerative scoliosis, particularly in the very elderly, is often associated with other conditions, such as osteoporosis. Treatment outcomes for both nonsurgical and surgical procedures are not well documented; hence, recognition and earlier intervention are important to ward off the more complex problems of adult scoliosis. The role played by undiagnosed, mild idiopathic adolescent scoliosis on the development of degenerative scoliosis in later life is unknown.

Section 3.4: Health Care Resource Use for Spinal Deformity in 2004

While the incidence of spinal deformity among patients seeking care in any given year can be estimated, the relatively low proportion of the population seeking care for spinal deformity conditions precludes statistically reliable numbers. In addition, many persons do not seek care, or seek care for severe or disabling back or leg pain that is often caused by spinal deformity. Hence, the overall prevalence of spinal deformity in the total population is projected to be much higher than current data implies. Furthermore, degenerative scoliosis is rarely a primary, or 1st, diagnosis and may not be included as a diagnosis at all.

Idiopathic and degenerative scoliosis are both found in a higher proportion of females than males.[3] As the ratio of the curve increases, indicating more severe scoliosis, the female to male ratio is reported as high as 10:1 among persons with a curve of greater than 30°.[13,43]

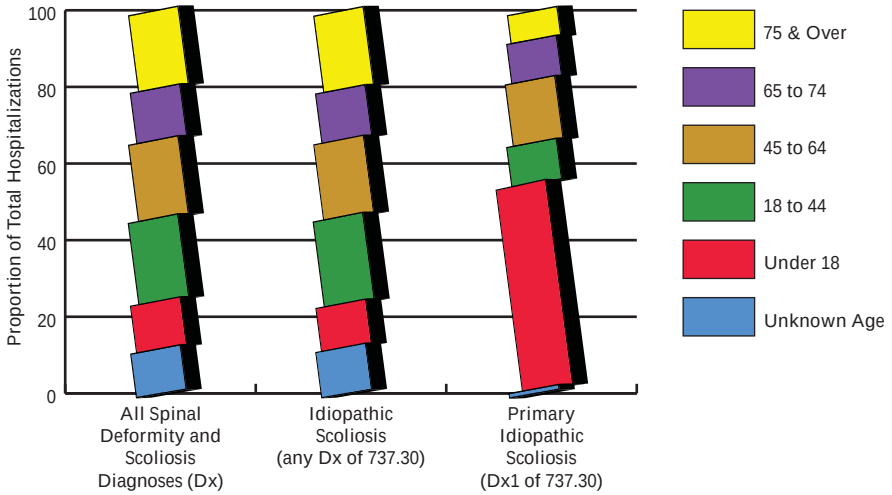
Graph 3.4.1: Distribution of Health Care Visits for Spinal Deformity and Related Conditions Diagnoses, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2]Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006
[4] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

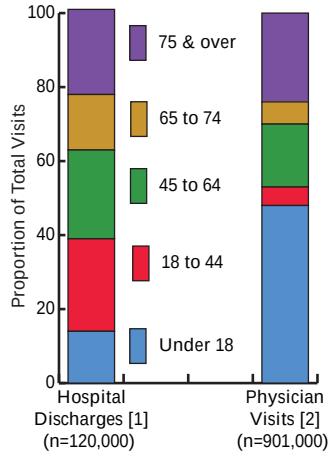
In 2007, an estimated 1.24 million patients utilized health care resources for care of problems associated with a spinal deformity. (Table 3.3) The majority (73%) of these care episodes were with a physician (Graph 3.4.1), and involved non-surgical and pre-surgical management of this complex patient population. In addition, more than 200,000 persons visited hospital outpatient or emergency centers for care, while approximately 120,000 persons were hospitalized with a diagnosis of spinal deformity. although not the only diagnosis, virtually all hospitalized patients had a diagnosis of scoliosis. Other diagnoses were kyphosis, a curvature of the thoracic region of the spinal column resulting in a rounded upper back, or excessive lordosis (swayback), an increased amount of curvature of the lumbar or cervical regions of the spinal column.

Graph 3.4.3: Relationship of Spinal Deformity and Primary Idiopathic Scoliosis Diagnoses by Age, United States 2007



Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Graph 3.4.2: Hospitalization and Physician Visits for Spinal Deformity and Related Conditions Diagnosis by Age, United States 2006/2007



[1] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[2] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

NOTE: Data by age groups does not meet standards of reliability.

The overwhelming majority of spinal deformity and scoliosis patients in 2007 were female (69%), and close to one-half (44%) were under the age of 18. While hospitalizations for spinal deformity are represented nearly equally by all age groups in 2007, physician visits are primarily the young (under age 18) and the old (aged 75 and over). (Graph 3.4.2)

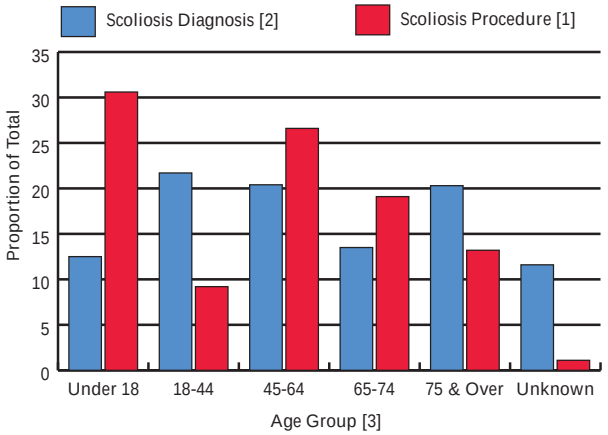
In 2007, 89% (107,200) of patients released from a hospital with a scoliosis diagnosis had a diagnosis of idiopathic scoliosis (ICD-9-CM code of 737.30). Eight percent (8%, or 8,300) of these 107,200 patients had a primary, or 1st, diagnosis of idiopathic scoliosis; 92% had an idiopathic scoliosis diagnosis that was in addition to their primary diagnosis.

Of these 107,200 patients with idiopathic scoliosis diagnoses, 12% were under the age of 18 years, while 20% were aged 75 and over. (Tables 3.4, 3.4c, and Graph 3.4.3) However, a primary (1st) diagnosis of idiopathic scoliosis was far more common in young persons, with 54% under the age of 18, supporting the assumption that degenerative scoliosis or spinal deformity is frequently not the primary (1st) diagnosis of elderly patients.

More than one-half of the young patient group (55%) were between the ages of 14 and 17 years. Another 37% were between the ages of 11 and 13, with the remainder aged 10 years or younger.

Three of four patient visits to a physician's office in 2007 with a primary (1st) diagnosis of idiopathic scoliosis (72%) were for patients under the age of 18 years. More than 90% of these visits were for children aged 11 and older. (Table 3.5)

Graph 3.4.4: Relationship of Scoliosis Diagnosis and Spine Surgical Procedures by Age, United States 2007



[1] Scoliosis procedures includes ICD-9-CM procedure codes 81.04, 81.05, 81.06, 81.08, 81.62, 61.63, 81.64, 84.51.
[2] Scoliosis conditions includes ICD-9-CM diagnostic codes 737.30, 737.31, 737.32, 737.33, 737.34, 737.39.
[3] Data by age group does not meet criteria for reliability.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Although only 12% of scoliosis diagnosed patients in 2007 were for children under the age of 18, the young patients accounted for 31% of spine surgical procedures for scoliosis. Overall, one in six persons (17%) hospitalized with a scoliosis diagnosis underwent a surgical procedure for scoliosis, but 2 in 5 persons under the of 18 underwent scoliosis surgical procedures. (Table 3.6 and Graph 3.4.4)

Section 3.4.1: Estimated 2007 Cost for Treatment of Scoliosis and Spinal Deformity

A conservative estimate of the hospitalization cost for adult scoliosis in 2007 was $520.9 million. This estimate, which generally does not include professional fees, is based on the average cost per hospital stay for four age groups of patients aged 18 and over with a primary (1st) diagnosis of idiopathic scoliosis. Child and adolescent primary idiopathic scoliosis hospitalization fees added an additional $511.2 million, for a total estimated hospitalization cost to treat primary idiopathic scoliosis in 2007 of $1.04 billion. (Table 3.4)

Additional hospital costs of nearly $3.2 billion were incurred by patients with a diagnosis of idiopathic scoliosis in addition to their primary (1st) diagnosis. It is unknown what proportion of these costs resulted directly from treatment given as a result of scoliosis; however, it can be assumed some proportion of these additional costs would not have occurred in the absence of the sc≥oliosis condition.

In addition to health care costs associated with surgery for spinal deformity and scoliosis, significant nonsurgical resources are utilized by adults with scoliosis, increasing the burden of this condition on the health care system. A study of nonsurgical resource use, including exercise, bracing, medications, steroid injections, and formal pain management, by adults with a spinal curvature of ≥30° showed 90% of patients utilized non-surgical resources, with those patients with a high level of symptoms using more resources than those with a low level of symptoms.[44]

Overall, the cost related to spinal deformity is significant, with more than one million patient visits each year for treatment of pain due to this condition. A majority of spinal deformity cases each year are the result of degenerative scoliosis. With the aging of the U.S. population, increased awareness, identification, and treatment of spinal deformity in its earliest stages is necessary to reduce the current and future burden of this condition.

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Section 3.5: Spinal Deformity and Related Conditions Data Tables

Table 3.1: Estimated and Normalized Prevalence of Spinal Deformity and Related Conditions

	Cited Prevalence Rate (midpoint of range cited)			Normalized Prevalence Rate (per 100 persons)	Prevalence Rate (per 100,000 persons)
Congenital scoliosis [1]	1	in	1,000	0.100	100
Infantile idiopathic scoliosis [2]	0.04	in	100	0.040	40
Juvenile idiopathic scoliosis [3]	0.06	in	100	0.060	60
Adolescent idiopathic scoliosis [4]	2.5	in	100	2.500	2,500
Spina bifida [5]	4.6	in	10,000	0.046	46
Cerebral palsy [6]	0.001	in	100	0.001	1
Muscular Dystrophy [7]	1	in	3,500	0.029	29
Spondylolysis, age 6 [8]	6	in	100	6.000	6,000
Spinal muscular atrophy [9]	8	in	100,000	0.008	8
Scheuermann kyphosis [9,10]	4	in	100	4.000	4,000
Adult spinal deformity or scoliosis (age >18 yrs) [11,12,13]	11.3	in	100	11.300	11,300
Adult spinal deformity or scoliosis (age >60 yrs) [14]	68	in	100	68.000	68,000

[1] Hedequist D, Emans J: Congenital scoliosis: a review and update. *J Pediatr Ortho* 2007:27:106-116.

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[14] Schwab F, Dubey A, Galez L, et al: Adult scoliosis: prevalence, SF-36, and nutritional parameters in an elderly volunteer population. *Spine* 2005:30:1082-1085.

Table 3.2: Prevalence of Adolescent Idiopathic Scoliosis

Cobb Angle	Female-to-Male Ratio	Prevalence (%)
>10	1.4-2.0 : 1	2.0%-3.0%
>20	5.4 : 1	0.3%-0.5%
>30	10 : 1	0.1%-0.3%
>40	Not applicable	<0.1%

Source: Reprinted with permission from Weinstein SL. Adolescent idiopathic scoliosis: Prevalence and natural history. *Instr Course Lect* 1988;38:115–126.

Table 3.3: Health Care Resource Usage with Spinal Deformity and Related Conditions Diagnosis by Gender and Age, United States 2004

	Total Occurrences (in 000s)[2]								
		Gender		Age (in years)					Average Age at Diagnosis
	Total	Male	Female	<18	18-44	45-64	65-74	75 & over	
Spinal Deformity & Related Conditions [1]									
Hospital Discharges [3]	120	30	90	15	26	25	16	24	58.8
Hospital Emergency Departments [4]*	59	30	29	*	22	*	12	23	55.4
Hospital Outpatient Departments [5]	156	55	101	106	8	*	*	40	31.8
Physician Office Visits [6]*	901	272	628	428	44	157	56	217	39.0
All Spinal Deformity & Related Conditions Diagnoses	1,236	387	848	549	100	182	84	304	

Spinal Deformity & Related Conditions	% by Resource	Proportion of Spinal Deformity & Related Conditions Treated at Resource by Demographic Group						
Hospital Discharges [3]	10%	25%	75%	14%	25%	24%	15%	23%
Hospital Emergency Departments [4]*	5%	51%	49%	*	*	*	*	*
Hospital Outpatient Departments [5]	13%	35%	65%	68%	5%	*	*	26%
Physician Office Visits [6]*	73%	30%	70%	48%	5%	17%	6%	24%
All Spinal Deformity & Related Conditions Diagnoses	100%	31%	69%	44%	8%	15%	7%	25%

* Estimate does not meet standards for reliability

[1] Spinal deformity & related conditions includes ICD-9-CM codes 737.00 to 737.19, 737.20 to 737.22, 73729, 737.30 to 737.34, 737.39, 737.40 to 737.43, 737.80, 737.90

[2] Multiple occurrences per patient possible

[3] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[5] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient, 2006

[6] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 3.4: Hospitalization and Mean Hospital Cost [1] for Scoliosis and Idiopathic Scoliosis by Gender and Age, United States 2007

	All Diagnoses	Proportion by Age and Gender Group	Proportion All Spinal Deformity Diagnoses of Total Group	Mean Charge	Mean Length of Stay (LOS)	Estimated Total Cost (in millions)	Proportion Estimated Cost by Age Group
Hospital Discharges with Scoliosis Diagnosis [2]							
				(n=117,766)	(n-119.953)		
TOTAL	119,957			$ 44,099	5.3	$ 5,290.0	
Male	29,550	24.6%					
Female	90,348	75.3%					
<18	14,982	12.5%		$ 72,203	5.8	$ 1,081.7	20.4%
18-44	26,024	21.7%		$ 30,804	4.8	$ 801.6	15.2%
45-64	24,428	20.4%		$ 53,039	5.4	$ 1,295.6	24.5%
65-74	16,208	13.5%		$ 53,076	5.1	$ 860.3	16.3%
75 & over	24,356	20.3%		$ 37,182	5.3	$ 905.6	17.1%
Unknown	13,959	11.6%					
18 & over	91,016	75.9%		$ 42,460	5.2	$ 3,864.5	73.1%
Hospital Discharges with Idiopathic Scoliosis Diagnosis [3]							
				(n=105,169)	(n=107,205)		
TOTAL	107,209		89.4%	$ 40,220	5.2	$ 4,311.9	
Male	25,729	24.0%	87.1%				
Female	81,426	76.0%	90.1%				
<18	12,284	11.5%	82.0%	$ 66,354	5.6	$ 815.1	18.9%
18-44	24,350	22.7%	93.6%	$ 28,990	4.8	$ 705.9	16.4%
45-64	21,583	20.1%	88.4%	$ 48,161	5.3	$ 1,039.5	24.1%
65-74	14,163	13.2%	87.4%	$ 47,930	5.1	$ 678.8	15.7%
75 & over	21,917	20.4%	90.0%	$ 34,815	5.3	$ 763.0	17.7%
Unknown	12,913	12.0%	92.5%				
18 & over	82,013	76.5%	90.1%	$ 38,875	5.1	$ 3,188.3	73.9%

[1] Generally, total charges do not include professional fees and non-covered charges. In the rare cases where professional fees cannot be removed, they are included in the database. Emergency department charges incurred prior to admission to the hospital may be included in total charges.

[2] Scoliosis conditions includes ICD-9-CM codes 737.30, 737.31, 737.32, 737.33, 737.34, 737.39.

[3] Idiopathic scoliosis includes ICD-9-CM code 737.30.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 3.4: Hospitalization and Mean Hospital Cost [1] for Idiopathic Scoliosis by Gender and Age, United States 2007 (continued)

	All Idiopathic Scoliosis Diagnoses	Proportion by Age and Gender Group	Proportion All Idiopathic Scoliosis Diagnoses	Mean Charge	Mean Hospital Length of Stay	Estimated Total Cost (in millions)	Proportion Estimated Cost by Age Group
Hospital Discharges with Primary (Dx1) Diagnosis of Idiopathic Scoliosis [2]							
				(n=8,265)	(n=8,283)		
TOTAL	8,283		7.7%	$ 125,213	5.7	$1,037.1	
Male	2,133	25.8%	8.3%				
Female	6,128	74.0%	7.5%				
<18	4,452	53.7%	36.2%	$ 114,815	5.2	$511.2	49.3%
18-44	877	10.6%	3.6%	$ 130,776	6.2	$114.7	11.1%
45-64	1,361	16.4%	6.3%	$ 161,940	7.1	$220.4	21.3%
65-74	870	10.5%	6.1%	$ 141,024	5.6	$122.7	11.8%
75 & over	625	7.5%	2.6%	$ 100,634	5.6	$62.9	6.1%
Unknown	98	1.2%	0.7%				
18 & over	3,733	45.1%	4.1%	$ 139,544	6.3	$520.9	50.2%

Hospital Discharges with Pediatric Idiopathic Scoliosis Diagnosis (Age <18 Years)*

	<18 Years Idiopathic Scoliosis (All Diagnoses)	Proportion Idiopathic in All Spinal Deformity Diagnoses by Age Group	Primary Diagnosis (Dx1)	Proportion Primary in All Idiopathic Diagnoses by Age Group
TOTAL	12,284		4,452	36.2%
0-3	653	5.3%	*	0.0%
4-7	1035	8.4%	96	2.2%
8-10	1,138	9.3%	255	5.7%
11-13	3,411	27.8%	1,648	37.0%
14-17	6,047	49.2%	2,449	55.0%

* Estimate does not meet standards for reliability

[1] Generally, total charges do not include professional fees and non-covered charges. In the rare cases where professional fees cannot be removed, they are included in the database. Emergency department charges incurred prior to admission to the hospital may be included in total charges.

[2] Idiopathic scoliosis includes ICD-9-CM code 737.30.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 3.5: Physician Office Visits for Idiopathic Scoliosis* by Gender and Age, United States 2006

Physician Office Visits for Spinal Deformity [1]*

	All Diagnoses of Spinal Deformity	Proportion All Spinal Deformity by Age and Gender
TOTAL	900,833	
Male	272,405	30%
Female	628,428	70%
<18	427,718	47.5%
18-44	43,952	4.9%
45-64	156,777	17.4%
65-74	55,625	6.2%
75 & over	216,761	24.1%
18 & over	473,115	52.6%

Primary Diagnosis of Idiopathic Scoliosis (DX1 = 737.30) [2]*

	Primary Idiopathic Scoliosis	Proportion Primary Idiopathic Diagnosis by Age and Gender	Proportion Primary Idiopathic to All Idiopathic Diagnoses
TOTAL	408,426		74.3%
Male	65,571	16.1%	55.9%
Female	342,855	83.9%	79.2%
<18	292,877	71.7%	83.0%
18-44	32,135	7.9%	83.3%
45-64	*	0.0%	0.0%
65-74	*	0.0%	0.0%
75 & over	83,414	20.4%	98.3%
18 & over	115,549	28.3%	58.6%

Idiopathic Scoliosis [2]*

	Idiopathic Scoliosis Diagnosis	Proportion Idiopathic Diagnosis by Age and Gender	Proportion Idiopathic to All Spinal Deformity Diagnoses
TOTAL	549,965		61.1%
Male	117,315	21.3%	43.1%
Female	432,650	78.7%	68.8%
<18	352,718	64.1%	82.5%
18-44	38,567	7.0%	87.7%
45-64	59,276	10.8%	37.8%
65-74	14,568	2.6%	26.2%
75 & over	84,836	15.4%	39.1%
18 & over	197,247	35.8%	41.7%

Pediatric (<18 Years) Idiopathic Scoliosis Diagnosis [2]*

	Prevalence Idiopathic Scoliosis in Under 18 Population (All Diagnoses)	Proportion Idiopathic Diagnoses by Age	Primary (Dx1) Diagnosis	Proportion Primary Idiopathic Diagnoses by Age
TOTAL	352,718		292,877	83.0%
0-3	*	0.0%	*	0.0%
4-7	30,792	8.7%	30,792	10.5%
8-10	2,636	0.7%	*	0.0%
11-13	198,510	56.3%	167,627	57.2%
14-17	120,780	34.2%	94,458	32.3%
Total 0-17	352,718	100.0%	292,877	100.0%

* Estimates do not meet standards for reliability. Data is included because it constitutes the majority of patient visits for spinal deformity and scoliosis in 2006.

[1] Spinal deformity & related conditions includes ICD-9-CM codes 737.00 to 737.19, 737.20 to 737.22, 73729, 737.30 to 737.34, 737.39, 737.40 to 737.43, 737.80, 737.90

[2] Idiopathic scoliosis includes ICD-9-CM code 737.30.

Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 3.6: Spine Procedures [1] with Scoliosis Diagnosis [2] by Age, United States 2007

	Age [3]						
	Under 18	18-44	45-64	65-74	75 & Over	Unknown	Total
Scoliosis Diagnosis (N)	14,982	26,024	24,428	16,208	24,356	13,959	119,957
Proportion of Total by Age Group	12.5%	21.7%	20.4%	13.5%	20.3%	11.6%	100.0%
Scoliosis Procedure (N)	6,118	1,844	5,319	3,817	2,637	227	19,961
Proportion of Total by Age Group	30.6%	9.2%	26.6%	19.1%	13.2%	1.1%	100.0%
Proportion of Age Group with Sciolosis Diagnosis and Scoliosis Procedure	40.8%	7.1%	21.8%	23.6%	10.8%	1.6%	16.6%

[1] Scoliosis procedures includes ICD-9-CM procedure codes 81.04, 81.05, 81.06, 81.08, 81.62, 61.63, 81.64, 84.51.

[2] Scoliosis conditions includes ICD-9-CM diagnostic codes 737.30, 737.31, 737.32, 737.33, 737.34, 737.39.

[3] Data by age group does not meet criteria for reliability.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Chapter 4
Arthritis and Related Conditions

In adults, arthritis is the most common cause of disability[1] and is among the leading conditions causing work limitations.[2] Over the next 25 years the number of people affected with doctor-diagnosed arthritis and the corresponding arthritis-attributable activity limitations are projected to increase by 40% in the United States.[3] Estimating the prevalence and burden of the various conditions that comprise arthritis and other rheumatic conditions (AORC) is important to understanding the current and potential impact of these conditions on health care and the public health systems. Equally important is identifying the gaps in our understanding of these measures.

Prevalence estimates presented in this chapter are based on studies[4,5] recently published by the National Arthritis Data Workgroup (NADW), a consortium of experts in epidemiology organized to provide a single source of national data on the prevalence and impact of AORC. The NADW found that for estimates of specific conditions they often had to rely on a few, small-sized studies of uncertain generalizability to the U.S. population. Until there are better data, the results of NADW reviews are the best prevalence estimates available and their application to the 2005 population provides the best estimate of the number of people affected by AORC overall and by selected rheumatic conditions.

This update also includes data from most recently available datasets analyzed specifically for this book. The reader should be aware that both self-reported data and annual data may include both data errors and response errors that produce variations from a norm found when analyzing data across multiple years.

Section 4.1: Prevalence of Arthritis and Other Rheumatic Conditions

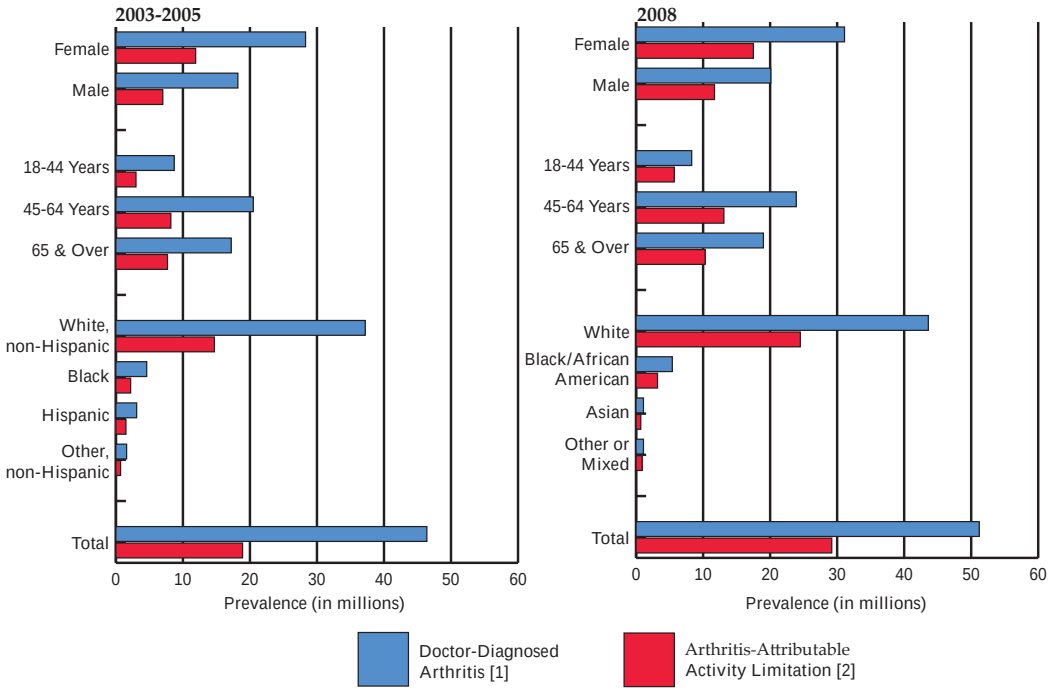
The NADW focuses on AORC, as distinct from other highly prevalent musculoskeletal conditions such as back problems and osteoporosis. Initially, AORC was defined in terms of ICD-9-CM codes, a definition still in use for analyses of health care system data. (Table 4.1) However, due to changes in national surveys previously used to estimate prevalence of AORC, prevalence is now estimated using self-reported, doctor-diagnosed arthritis, defined as a "yes" response to the question, "Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?"

Section 4.1.1: Prevalence of Arthritis and Other Rheumatic Conditions

Using doctor-diagnosed arthritis as the basis for analysis, the prevalence of AORC among U.S. adults aged 18 or older was 21.6%, or 46.4 million, in 2003-2005[6]. (Table 4.2 and Graph 4.1.1) Although arthritis prevalence is higher in older age groups, with half of adults aged 65 and over now affected, nearly two-thirds of the adults reporting doctor-diagnosed arthritis are younger than 65 years. More than 60% are women.

Adjusting prevalence by age, the prevalence of all types of arthritis is higher among women than men (24% versus 18%). Among race/ethnic groups, AORC is similar for non-Hispanic whites and African Americans (~22%), while lower among Hispanics (16.5%).

Graph 4.1.1: Prevalence of Self-Reported Doctor-Diagnosed Arthritis and Arthritis-Attributable Activity Limitations Among Adults Aged 18 & Older by Age, Sex, and Race/Ethnicity, United States, 2003-2005 and 2008



[1] Responded "yes" when asked: Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?
[2] Responded "yes" when asked: Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?
Source: National Center for Health Statistics, National Health Interview Survey, 2003-2005 and 2008

By 2030, the number of persons with doctor-diagnosed arthritis is projected to increase by 40% over current levels to nearly 67 million, or 25% of the adult population.[3]

Section 4.1.2: Impact and Health Care Utilization for All Arthritis and Other Rheumatic Conditions

In 2003-2005, an estimated 8.8% of all adults in the United States, or nearly 19 million persons over the age of 18, had self-reported arthritis-attributable activity limitations. In 2008, these numbers had jumped to 13.0% of adults aged 18 and over, or more than 29 million persons. (Table 4.2 and Graph 4.1.1). This rapid increase in arthritis-attributable activity limitations is not clearly understood. However, a similar increase in the response to arthritis-attributable activity limitations was found in the 2006 and 2007 NHIS surveys. Future analysis by NADW may be able to explain the increase.

The prevalence of activity limitations increases as people age. Among adults aged 65 years and older, 22% reported arthritis-attributable activity limitations in the 2003-2005 time period, while nearly 28% did so in 2008. Activity limitations are also higher among women, but lower among Hispanics and Asians.

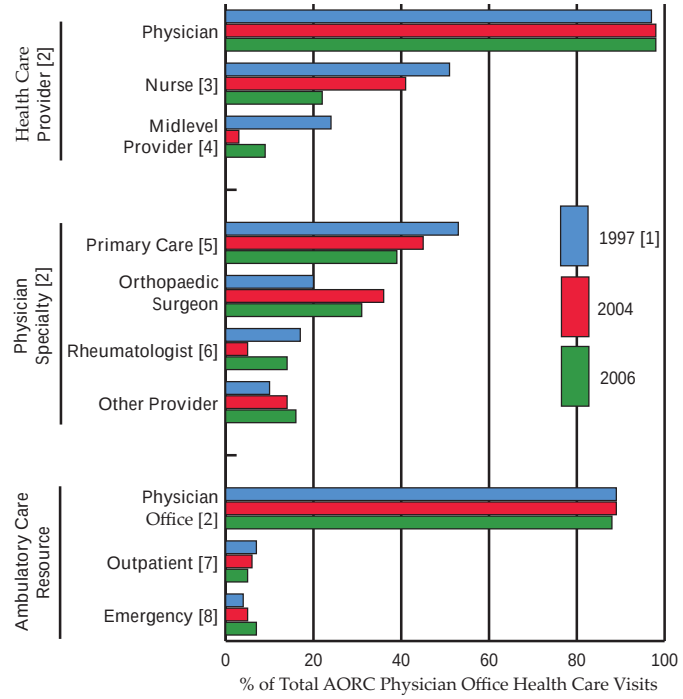
Among all adults with doctor-diagnosed arthritis, arthritis or joint symptoms limited activities in over 40% in 2003-2005, jumping to 57% in 2008. Arthritis-attributable activity limitations are projected to affect 9.3% of the adult population, or 25 million persons, by the year 2030,[3] a number that was already surpassed in the 2008 data. Future analysis may find the 2008 numbers higher than the norm across multiple years.

The high prevalence of arthritis and of arthritis-related activity limitations results in significant personal and societal burdens; this burden often differs by race or ethnicity.[7] For example, "arthritis and rheumatism" is the most common cause of disability in the U.S.,[1] and affected persons have a substantially lower health-related quality of life.[8] In 1997, AORC was the underlying cause of death for 9,340 persons,[9] while 19% of nursing home residents were diagnosed with AORC.[10] The estimated incremental cost of medical care expenditures and earnings losses for persons with an AORC condition was $128 billion in 2003.[11]

AORC, as a primary, or 1st, diagnosis for persons aged 18 and older accounted for 50.3 million non-injury ambulatory care visits in 2006, or 5.0% of all health care visits, and affected broad components of the health care system. (Tables 4.3 and 4.3a) Health care visits for AORC occurred in physicians offices (88%), outpatient departments (5%), and emergency departments (7%), a proportion that has changed little since 1997. (Table 4.4) By physician specialty, physician office visits in 2006 were to primary care physicians (39%), orthopaedic surgeons (31%), rheumatologists, neurologists or physical medicine and rehabilitation specialists (14%), and other providers (16%). Since 1997, the proportion of AORC patients seeing an orthopaedic surgeon has increased, although there was a slight decline in this proportion between 2004 and 2006. Health care providers included physicians (98%), nurses (22%), and midlevel practitioners (9%), with many patients seeing multiple providers. (Table 4.4 and Graph 4.1.2)

AORC, as the primary diagnosis, accounted for 1.17 million nonfederal, short stay hospitalizations in 2007, or 3.1% of all such disease-related (nondelivery) hospitalizations in 2007. Two-thirds (67%) of the primary diagnosis AORC cases involved joint arthroplasty procedures of the hip or knee, an increasingly common treatment to restore function in arthritis diseased joints. AORC, as either a principal or secondary diagnosis, accounted for 5.24 million hospitalizations, or over 14% of all disease-related hospitalizations, in 2007. In addition to the above numbers, persons hospitalized with a principal diagnosis of an orthopaedic procedure, rather than an arthritis condition, or those related to arthritis treatment complications (e.g., gastrointestinal bleeding related to NSAID use) add to the overall burden of arthritis in this country.

Graph 4.1.2: Health Care Resource Use for Non-Injury Arthritis and Other Rheumatic Conditions (AORC) for Persons Aged 18 and Older, United States, 1997, 2004 & 2006



[1] Source: Hootman JM, Helmick CG, Schappert SM. Magnitude and characteristics of arthritis and other rheumatic conditions on ambulatory medical care visits, United States, 1997. *Arthritis Rheum* 2002;47:571–581.
[2] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2004 & 2006
[3] Includes registered nurse, licensed practical nurse, and medical/nursing assistant.
[4] Includes physician assistant and nurse practitioner/midwife
[5] Includes family practice, family practice (geriatric medicine), sports medicine (family practice), general practice, general surgery, internal medicine, geriatric medicine (internal medicine).
[6] Includes rheumatology, neurology, physical medicine and rehabilitation, and pain specialists.
[7] Source: National Center for Health Statistics, National Hospital Ambulatory Care Survey, Outpatient Centers, 2004 & 2006
[8] Source: National Center for Health Statistics, National Hospital Ambulatory Care Survey, Hospital Emergency, 2004 & 2006

Section 4.2: Osteoarthritis

Osteoarthritis (OA), also known as degenerative joint disease, is the most common type of arthritis. It is characterized by progressive damage to the cartilage and other joint tissues, and frequently affects the hand, knees, and hips.

Section 4.2.1: Prevalence and Incidence of Osteoarthritis

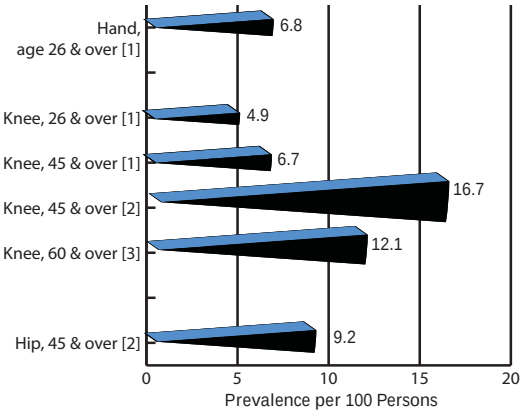
Estimating the prevalence of OA is difficult as radiographic changes related to the presence of osteoarthritis can be seen in most persons as they age. However, these changes may not be accompanied by symptoms. Symptomatic OA,

experienced as frequent pain and radiographic changes indicating osteoarthritis in the joint, is considered a better measure of important or consequential OA and is used to identify prevalence.

Longitudinal studies conducted in several communities, some as long as 40 years or more, have focused on identifying the prevalence of osteoarthritis, as well as other factors related to its causes. The longest study has been of adults aged 26 years and older living in Framingham, MA. The prevalence of symptomatic hand OA in the Framingham study is 6.8% of adults aged 26 and over; however, in older adults it is found much more frequently. Among persons aged 71 and older, OA is found in 26.2% of females and in 13.4% of males. The NADW estimated that 13.1 million adults in the United States experienced symptomatic hand OA in 2005.

The prevalence of symptomatic knee OA is about 5% of adults aged 26 years and older in the Framingham study. In another study conducted in Johnston County, NC, 17% of adults aged 45 and over were found to have symptomatic knee OA, while the 1988-1994 NHANES III survey found 12.1% of adults aged 60 years and older suffered from symptomatic knee OA. Again, older adults and females were more affected, and an estimated 9.3 million adults had symptomatic knee OA in 2005. (Table 4.5 and Graph 4.2.1)

Graph 4.2.1: Prevalence of Symptomatic Osteoarthritis in the Hands, Knees and Hips, United States



*Age-standardized to the projected 2000 census population; exception is the NHANES III estimates are standardized to the 1980 U.S. population
Sources:
[1] Framingham (Massachusetts) Osteoarthritis Study
[2] Johnston County (North Carolina) Osteoarthritis Study
[3] NHANES III, 1988-1994

The prevalence of symptomatic hip OA was 10% among adults aged 45 years and older in the Johnston County study. No prevalence estimates for symptomatic OA at multiple joints exists, but the NADW estimated that clinical OA in at least one joint, based on a physician's examination in a national survey, affected 26.9 million adults in 2005.

Section 4.2.2: Impact and Health Care Utilization for Osteoarthritis

Osteoarthritis as a primary diagnosis accounted for 11.25 million ambulatory care visits in 2006, or 22.3% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Table 4.3) Osteoarthritis as the primary diagnosis accounted for 70% of the 1.17 million nonfederal, short stay hospitalizations in 2007. This estimate does not capture arthritis hospitalizations with orthopaedic procedures as the principal diagnosis or those related to arthritis treatment complications, such as gastrointestinal bleeding related to NSAID use.

Section 4.3: Rheumatoid Arthritis

Rheumatoid arthritis (RA) is a chronic autoimmune disease that causes pain, stiffness, swelling, and limitation in the motion and function of multiple joints. Though joints are the principal body parts affected by RA, inflammation can develop in other organs as well.

Section 4.3.1: Prevalence of Rheumatoid Arthritis

The only current source of data from which to estimate the prevalence of rheumatoid arthritis is a study from Rochester, MN. This study reported a prevalence of RA in 1985 of 1.07% among adults aged 35 years and older, but by 1995 this estimate had fallen to 0.85%.

Twice as many women as men are affected by rheumatoid arthritis (1.06% vs. 0.61%).[4] Trends in prevalence in Rochester, MN, by age and calendar year, show increasing prevalence with older age but reflect the decreasing overall prevalence in most age groups in more recent time periods. (Table 4.6 and Graphs 4.3.1) This observation, along with the expected rapid growth in the population of Americans aged 60 years and older, suggests that RA associated morbidity, mortality, and disability are likely to increase among older adults. The NADW studies found that older adults and females are more affected, and estimated that 1.3 million adults over the age of 17 years, 0.6% of all adults, had RA in 2005.

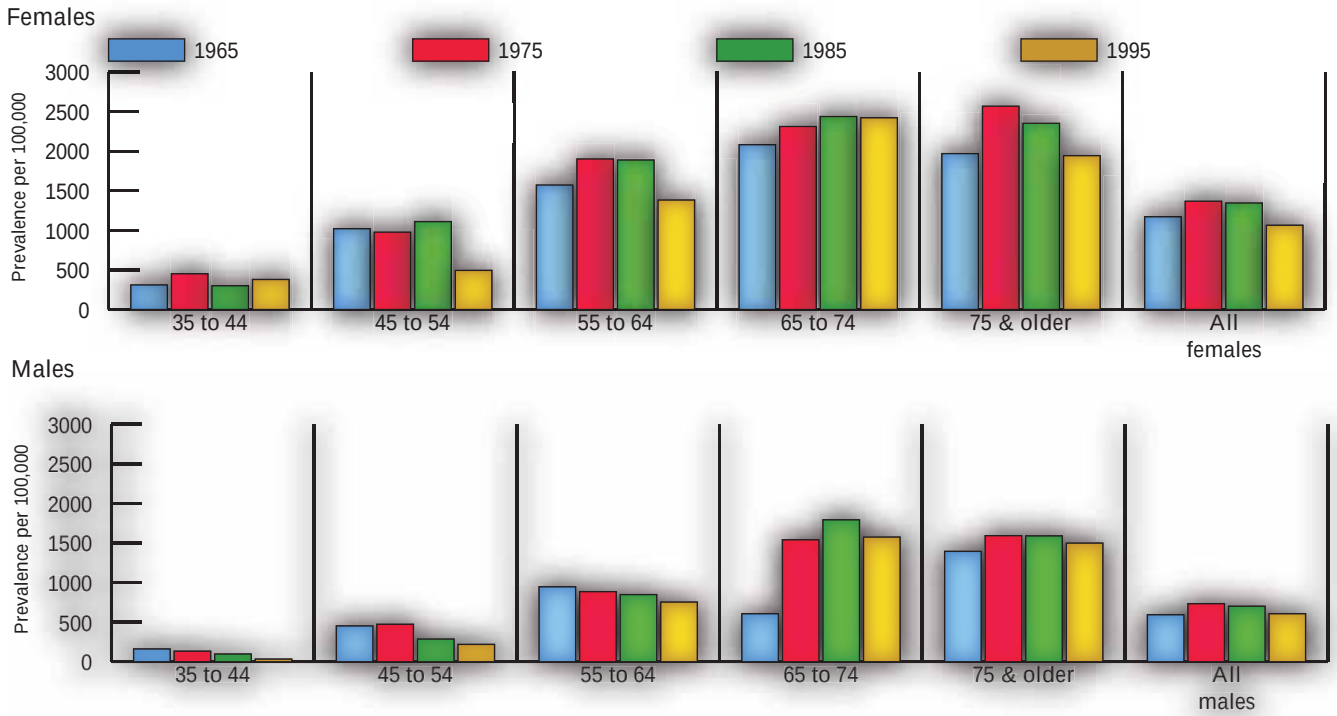
Section 4.3.2: Impact and Health Care Utilization for Rheumatoid Arthritis

Rheumatoid arthritis as a primary diagnosis accounted for 2.9 million ambulatory care visits in 2006, representing 4.4% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Table 4.3) As the primary diagnosis, RA accounted for about 15,400, or 1.3%, of the 1.17 million nonfederal, short stay hospitalizations for AORC in 2007. This estimate does not capture arthritis hospitalizations with orthopaedic procedures as the principal diagnosis or those related to arthritis treatment complications, such as gastrointestinal bleeding related to NSAID use.

Section 4.4: Other Forms of Arthritis

AORC, as a group of conditions, includes more than 100 kinds of arthritis and rheumatic diseases, most of which last a lifetime. Although prevalence numbers for these individual conditions do not begin to approach those of osteoarthritis and rheumatoid arthritis, these conditions are as disabling, and often more so, than medical conditions found in higher numbers. Because these conditions are less common and affect fewer numbers of patients, research to treat or prevent them has fallen behind that of other conditions.

Graph 4.3.1: Trends in Prevalence of Rheumatoid Arthritis by Age [1], Rochester, MN 1965-1995



[1] Age-adjusted to U.S. White population, 2000
Source: Helmick CG, Felson DT, Lawrence RC, et. al. National Arthritis Data Workgroup: Estimates of the prevalence of arthritis and other rheumatic conditions in the United States: Part I. *Arthritis Rheum*;2008(58:1):15-25.

Only a few of these conditions are described below, but many more need to be brought to awareness and supported with research funding.

Section 4.4.1: Juvenile Arthritis

Juvenile arthritis appears in a variety of types, with the most common form being juvenile rheumatoid arthritis. All types cause joint inflammation, begin before the age of 16, and are often associated with symptoms and complications that are different from those in adults. Although some types of juvenile arthritis resolve over time and with maturity, damage to young joints can remain throughout a lifetime.

The prevalence of juvenile arthritis in children is very difficult to estimate because of the variety of the diseases and their subtypes.[12] The NADW reported a novel approach using pediatric ambulatory care visits[4,13] to estimate that 294,000 (95% CIi 188,000-400,000) children aged 0 to 17 were affected by the broadly defined "arthritis or other rheumatic conditions" annually for the years 2001 to 2004. The same study estimates these children made 827,000 ambulatory care visits per year during the same time period.

Section 4.4.2: Gout and Other Crystal Arthropathies

Gout is a painful, episodic, recurrent, and sometimes chronic and disabling form of arthritis that has been recognized since ancient times. Symptoms typically consist of intense episodes of painful swelling in single joints, most often in the feet and especially in the big toe. The underlying metabolic cause is an excess of serum uric acid that results in the deposition of crystal in joints and elsewhere.

The self-reported prevalence of gout in a 12- month period prior to the interview has increased over time, reaching 0.94% of all adults aged 18 years and older in 1996.[5] Prevalence increases with age, is higher in men than women at all ages, and is higher in African Americans than whites aged 45 years and older. Lifetime self-reported prevalence was 2.6% of adults aged 20 and older between the years 1988-1994, with 8% in adults aged 70 to 79 years reporting they have suffered from gout at some point in their lives. The NADW estimates 3.0 million adults aged 18 years and older had gout in the previous 12 months in 2005, while 6.1 million adults had experienced gout during their lifetime. Prevalence numbers may be overestimated as they are based on self-reported data rather than clinical examination.

Gout and other crystal arthropathies as a primary diagnosis accounted for 1.57 million ambulatory care visits in 2006, or 3.1% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) Gout and other crystal arthropathies as the principal diagnosis accounted for 1.5% of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.4.3: Connective Tissue Diseases

Section 4.4.3a: Systemic Lupus Erythematosus

Systemic lupus erythematosus, also called SLE or lupus, is an autoimmune disorder that can affect the skin, joints, kidneys, lungs, nervous system, and other organs of the body. The most common symptoms include skin rashes and arthritis, often accompanied by fatigue and fever. The clinical course of SLE varies from mild to severe, and typically involves alternating periods of remission and relapse.

Estimates of the prevalence of SLE vary considerably because it is difficult to diagnose and because few good surveys have been done. The NADW used data from the San Francisco study[4,14] and estimates that definite and suspected SLE together affects 322,000 persons, with women affected far more than men, and African Americans far more than whites. Diffuse diseases of connective tissue, mainly SLE, as a primary diagnosis accounted for 762,100 ambulatory care

visits in 2006, or 1.5% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) Diffuse diseases of connective tissue, mainly SLE, as the principal diagnosis accounted for 1.4% of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.4.3b: Systemic Sclerosis (SSc, scleroderma)

Diffuse systemic sclerosis (SSc) is an autoimmune disease that causes thickening and hardening of the skin. It can also affect the lungs, the heart, gastrointestinal tract, and other internal organs. A population-based study in southeast Michigan estimates the prevalence of SSc to be 27.6 cases per 100,000 population, translating to 49,000 adults nationally, with women affected far more frequently than men and African Americans slightly more than whites in 2005.[4]

Section 4.4.3c: Primary Sjögren's Syndrome

Sjögren's syndrome is an autoimmune, inflammatory disease that most often affects the tear and saliva glands, leading to dry eyes and mouth. "Primary" Sjögren's syndrome occurs in people with no other rheumatologic disease. "Secondary" Sjögren's syndrome occurs in people also diagnosed with another rheumatologic disease, most often SLE and rheumatoid arthritis. The NADW reports the prevalence of primary Sjögren's syndrome to range from 0.19% to 1.39% of the adult population, affecting from 0.4 to 3.1 million adults in 2005.[4]

Sjögren's syndrome, as a primary diagnosis accounted for 197,500 ambulatory care visits in 2006, or 0.4% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) Diffuse diseases of connective tissue, mainly SLE, as the principal diagnosis accounted for less than 500 of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.4.4: Other Rheumatic Conditions

Section 4.4.4a: Fibromyalgia

Fibromyalgia is a clinical syndrome defined by chronic widespread muscular pain, fatigue and tenderness of unknown cause. Primary fibromyalgia occurs in people with no other rheumatologic disease. Secondary fibromyalgia occurs in people who are diagnosed with another rheumatologic disease, most often SLE and rheumatoid arthritis.

The NADW used a 1993 Wichita, Kansas, study and estimates about 5.0 million adults aged 18 years and older had primary fibromyalgia in 2005. Prevalence is much higher among women than among men (3.4% vs. 0.5%).[5] A primary diagnosis of "myalgia and myositis, unspecified", a very crude surrogate for primary fibromyalgia, accounted for 1.8 million ambulatory care visits in 2006, or 3.5% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) "Myalgia and myositis, unspecified" as the principal diagnosis accounted for less than 1% of the 1.17 million nonfederal, short stay hospitalizations in 2007. Ambulatory and hospital visits declined by approximately one-half from those reported in 2004.

Section 4.4.4b: Polymyalgia Rheumatica and Giant Cell (temporal) Arteritis

Polymyalgia rheumatica (PMR) typically causes a symmetrical and rapidly developing aching and stiffness around the upper arms, neck, lower back and thighs among persons aged 50 and older. It is closely related to giant cell arteritis (GCA), an inflammation of blood vessels. The most commonly involved blood vessels are the arteries of the scalp and head. The NADW used the only population-based study of PMR and GCA, conducted in Olmsted County, Minnesota, to estimate that among persons 50 years of age or older in the U.S., PMR affected 711,000 (0.74%) and GCA affected 228,000 (0.28%) in 2005.[5] In both of these conditions, prevalence is higher in women than men, and increases dramatically with age.

PMR and GCA, as a primary diagnoses accounted for 576,300 ambulatory care visits in 2006, or 1.1% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) As the principal diagnosis, they accounted for 6,000 , approximately ½ of a percent, of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.4.4c: Spondylarthropathies

Spondylarthropathies are a family of diseases that include ankylosing spondylitis (AS), reactive arthritis (formerly known as Reiter's syndrome), psoriatic arthritis, enteropathic arthritis (associated with ulcerative colitis or Crohn's disease), juvenile spondylarthropathy, and undifferentiated spondylarthropathy, which encompasses disorders expressing elements of, but failing to fulfill, criteria for the above diseases.

The NADW estimates the prevalence of spondylarthropathies to range roughly from 0.35% to 1.31% of the population aged 25 and older, affecting between 639,000 and 2,417,000 adults. Spondylosis/spondylitis and allied disorders as a primary diagnosis accounted for 3.8 million ambulatory care visits in 2006, or 7.5% of the 50.3 million non-injury visits with a primary diagnosis of AORC. (Tables 4.3a and 4.3b) Spondylosis/ spondylitis and allied disorders as the primary diagnosis accounted for 9% of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.4.5: Joint Symptoms and Joint Pain

Longitudinal prevalence numbers for joint pain are not available; however, as noted in Chapter 1, Burden of Musculoskeletal Diseases Overview, chronic joint pain, pain experienced for at least 3 months, was self-reported by 61.6 million persons aged 18 and older in 2008.[15] Chronic joint pain is experienced by persons of all ages, with one in five (20%) of adults under the age of 44 reporting chronic joint pain in 2008, and with more than one-third (35%) between the ages of 45 and 64 reporting it. In 2006, an estimated 14.1 million ambulatory care visits, or 28.1% of the 50.3 million non-injury visits with a primary diagnosis of AORC were for joint pain. (Tables 4.3a and 4.3b) Joint pain as the principal diagnosis accounted for 4.1% of the 1.17 million nonfederal, short stay hospitalizations in 2007.

Section 4.5: Treatments and Prevention of Arthritis

In recent years, a greater variety of medications have been used to address pain and disability associated with arthritis and other rheumatic conditions. For pain, acetaminophen has remained a primary treatment. For conditions thought to involve inflammation, generic non-steroidal anti-inflammatory drugs (NSAIDs) remain in widespread use. More specific NSAIDs, the Cox-2 inhibitors, have also been developed, although concerns about heart disease as a side effect have limited their use. For specific types of inflammatory arthritis, disease modifying anti-rheumatic drugs (DMARDs) are being used earlier in the course of disease and more widely to try to prevent joint damage and disability. A major improvement in the treatment of rheumatoid arthritis and other types of inflammatory arthritis has been the introduction of expensive, but effective, biological agents, such as tumor necrosis factor-alpha (TNF-α) inhibitors, which often work well where other DMARDs have failed.

Primary prevention, the preventing of an occurrence of AORC, remains a sought-after but elusive goal. Risk factors are not well understood for most of the conditions, and studies are needed to identify these before preventive measures can be developed. Secondary prevention, which is early diagnosis and treatment to help prevent joint damage, is a goal for those with rheumatoid arthritis and other inflammatory types of arthritis. Tertiary prevention, or the prevention of complications for those with AORC, is being pursued through the use of medications and other recommended interventions, such as self-management of the disease, education,

physical activity, and weight loss. Cures at specific joint sites may come about through joint replacement surgery.

Section 4.6: Arthroplasty and Total Joint Procedures

Total joint arthroplasty remains the definitive treatment for advanced, symptomatic joint destruction regardless of the underlying cause. Arthroplasty procedures have been developed for a multitude of joints, including hips, knees, shoulders, spine, ankles, elbows, wrists and smaller joints of the hand and foot. The most frequently replaced joints are the knee and hip, followed by the shoulder. The frequency of arthroplasty procedures involving the hand and foot, such as carpal metacarpal arthroplasty, is difficult to estimate because these procedures are often performed on an outpatient basis. Outpatient surgical data are not captured as reliably as inpatient procedure; however, the 2006 National Survey of Ambulatory Surgery reported 32,300 hand arthroplasty procedures and 58,100 finger arthroplasty procedures were performed.

Section 4.6.1: Anatomic Distribution of Joint Arthroplasty

In 2006, hip and knee replacements, including revision replacement procedures, accounted for 96% of the nearly one million inpatient arthroplasty procedures performed. (Table 4.7 and Graph 4.6.1) Shoulder procedures accounted for another 3%, with all other joint replacement procedures representing only 1% of the total inpatient arthroplasty procedures performed. As previously noted, hand and foot arthroplasties are often performed on an outpatient basis, and are not included in these numbers.

Section 4.6.2: Underlying Diagnoses

Total hip and primary knee replacements are done almost exclusively due to an underlying diagnosis of osteoarthritis (86% and 97%, respectively). (Table 4.8) A small proportion of patients having primary knee replacement have an underlying diagnosis of rheumatoid arthritis or other disorders. Among patients having primary total hip replacement, 3% were due to fracture and 7% to other disorders, such as avascular necrosis, a disease resulting from the temporary or permanent loss of the blood supply to the bone. Partial hip replacement, generally a hemiarthoplasty, in which the prosthesis is placed in the femur but not in the acetabulum, is performed principally for hip fracture (76% of cases).

Section 4.6.3: Age and Gender Distribution of Arthroplasty Procedures

Females undergo twice as many hip, knee and shoulder joint replacement procedures as males, accounting for 63% to 64% of these procedures. Males and females are more equally divided on other types of joint replacement, which includes wrist, ankle, spine, and upper/lower extremity joint replacements. Hip and knee revision rates are also more evenly done on males and females. (Table 4.7)

The most striking difference in procedure rates between males and females occurs in partial hip replacement, 73% of which were performed on females in 2006. This difference reflects the much greater incidence of osteoporotic hip fracture in females than occurs in males. The difference in total hip and knee replacements likely reflects the

Graph 4.6.1: Arthroplasty Procedures By Type, United States 2006

Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

greater prevalence of osteoarthritis in females than in males, which in turn reflects disproportionate distributions of risk factors. In particular, females have higher prevalence of obesity, which has been identified as a risk factor in osteoarthritis of the knee.

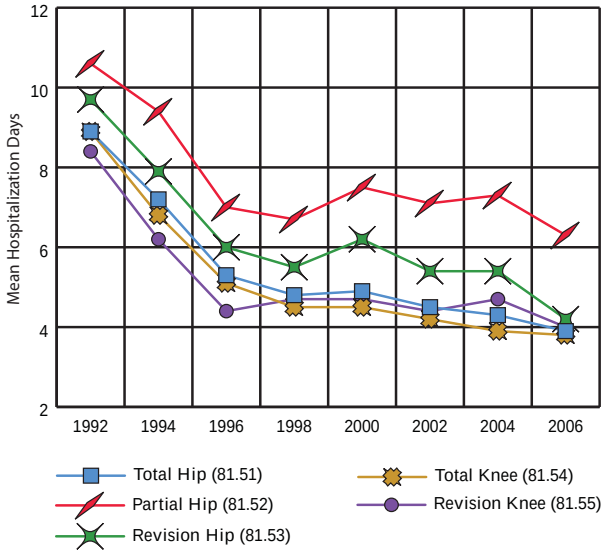
Age distributions of joint arthroplasty procedures are predictable on the basis of the underlying diagnosis. The mean age of patients at the time various arthroplasty procedures are performed has declined only a few years since 1992, varying between 66 to 68 years of age in 2006. The exception is partial hip replacements, which are performed on patients approximately a decade older due to the incidence of hip fracture in the elderly population. (Table 4.9) Two-thirds (66%) of partial hip replacements were performed in patients older than 74 years in 2006, with 25% performed on patients older than 85. Primary and revision total hip and knee arthroplasty procedures are distributed across the adult age strata, but about 50% of each of these procedures are performed on patients aged 65 and older.

Section 4.6.4: Hospitalization for Arthroplasty Procedures

The length of the average hospital stay following total joint procedures has declined by 50% since 1992. Although the reductions appear to have reached a plateau between 2000 and 2004, the most recent data again shows a decline in the length of hospital stay for arthroplasty procedures. (Table 4.10 and Graph 4.6.2) The length of stay for partial hip replacement remains considerably higher than those for elective total hip and knee replacement, reflecting the older age and more frail medical status of the hip fracture population. Additionally, surgery is not always done on the day of admission for hip fracture patients, as it generally is for the elective total joint arthroplasty population. While in the past patients generally remained as inpatients for up to a day longer for revision procedures than did those with primary procedures, consistent with the greater level of complexity of revision than of primary elective procedures, the most recent data shows similar hospitalization time for both primary and revision hip and knee procedures.

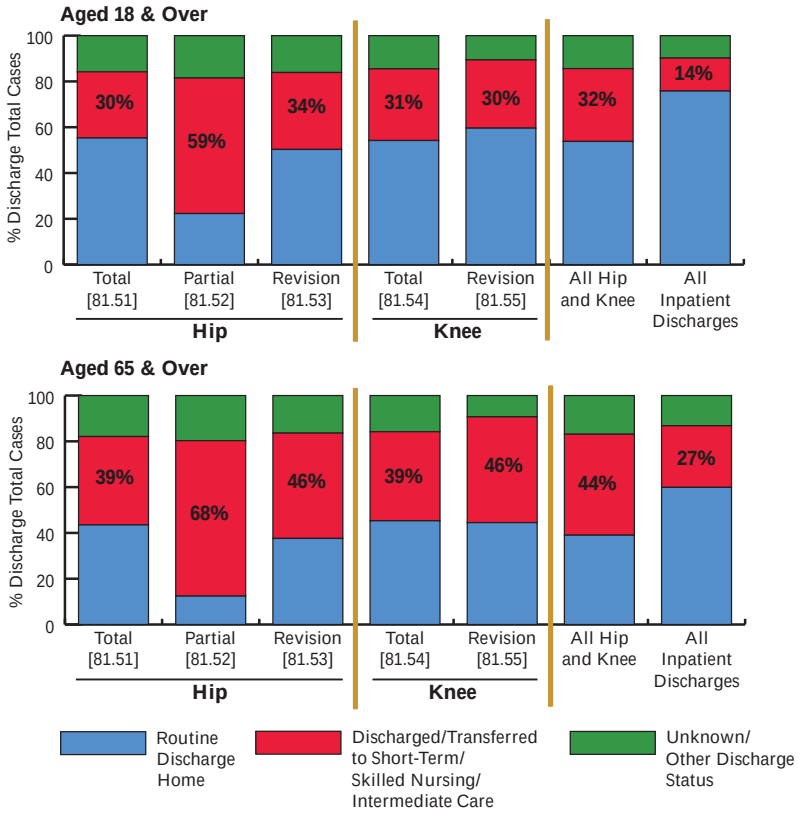
Length of stay provides only part of the story of inpatient utilization following total joint arthroplasty. Rates of discharge to home (routine), short-term/skilled nursing/intermediate care, or other discharge sites varies with the national database analyzed and the age of the population. Overall, rates of routine discharge to home are lower in the Nationwide Inpatient Survey (NIS) than are shown in the National Hospital Discharge Survey (NHDS). Using the most optimum picture (NHDS), nearly one-half of joint arthroplasty recipients (44%) who are aged 65 and over are discharged to rehabilitation and nursing facilities for an additional period of inpatient recovery and rehabilitation. (Table 4.11 and Graph 4.6.3) This rate compares to 27% of all hospital inpatient discharges of patients aged 65 and older to another care facility. Even more striking is the 68% of partial hip replacement recipients discharged to long or short-term care facilities for further care in 2006, reflecting the frailty of this population.

Graph 4.6.2: Average In Patient Length of Stay for Selected Arthroplasty Procedures, United States 1992-2006



Source: National Center for Health Statistics, National Hospital Discharge Survey, 1992-2006

Graph 4.6.3: Discharge Status for Patients Aged 18 & Over and Aged 65 and Over Undergoing Selected Major Joint Procedures, United States 2006



Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Thus, hospital length of stay, by itself, substantially underestimates the totality of health system care, especially for the hip fracture population.

Section 4.6.5: Trends in Recent Utilization of Joint Arthroplasty Procedures

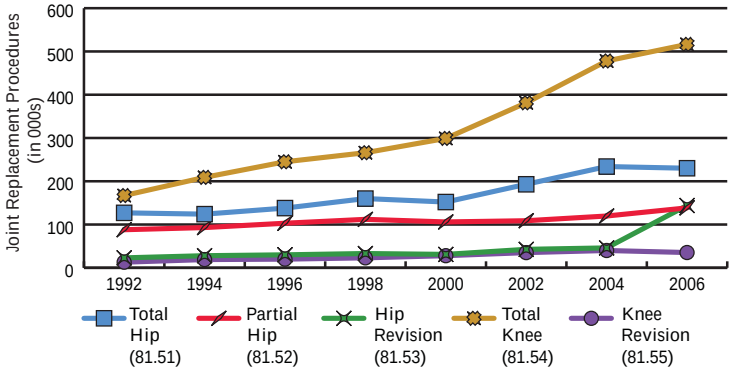
From 1991 to 2004, the annual number of primary knee replacements increased by almost 3-fold, while the annual number of primary total hip replacements doubled. In the last two years, the number of primary knee replacement procedures continued to increase, while total hip procedures reflected a leveling off (Table 4.12 and Graph 4.6.4)

Partial hip joint replacements have seen the slowest rate of increase over the past couple of decades. However, in the past few years the number of partial hip replacement procedures in the National Hospital Discharge Survey (NHDS)was significantly higher than was found in the Nationwide Inpatient Sample. To adjust for these differences, partial hip procedures with a primary (first) diagnosis of spine disorders or spinal fracture were removed from the NHDS numbers. In 2006, the number of partial hip replacement procedures was estimated to be about 138,000.

Revision joint arthroplasty procedures for total knee replacement between 1991 and 2006 have remained consistent at 8% to 9% of the primary procedures in both the national databases. Hip revision procedures are substantially higher, with the rate of revision to primary hip procedures averaging 19% to 20% between 1991 and 2004. In 2006, data in both national health care databases saw a significant increase in the hip revision procedure rate, jumping to 63% to 65% of the primary total hip replacement procedures. The reason for this increase is unknown, and may be an anomaly in the data for that year. Future rates of revision hip arthroplasty will be watched to see if this rate is increasing, or if the 2006 data were in error.

The increases in joint arthroplasty utilization are far more dramatic than would be expected from overall population growth and from the increase in the proportion of the population that is elderly.[16]

Graph 4.6.4: Total Hip and Knee Joint Replacement Procedures, United States, 1992 to 2006



Source: National Center for Health Statistics, National Hospital Discharge Survey, 1992-2006

As joint replacement procedures become safer and more durable, the range of symptoms for which joint replacement is successful is broadening. Total hip and knee replacement are now suggested to younger and more active patients on the one hand, and older and more frail patients on the other. The more modest increase in partial hip replacements, a procedure reflective of the epidemiology of age-related hip fracture rather than of physiological changes, supports this hypothesis of total replacement in younger, active patients.

The slower increase in the rate of revisions than in primary procedures likely reflects the temporal lag between primary and revision procedures, which generally occurs with a wearing out of the original replacement device. One would expect that the rate of increase in revisions will reflect the increased rate in primaries after 10 to 15 years. This assumption may be what is happening to the hip revision rate in the most recent data.

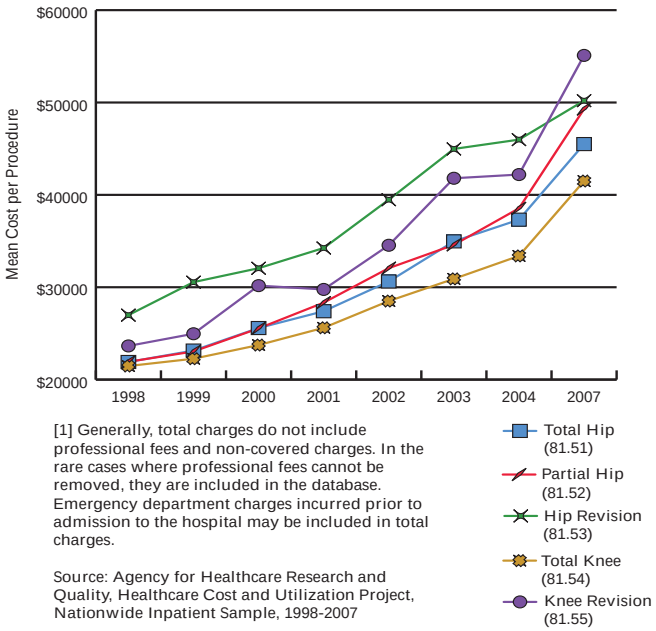
Section 4.6.6: Cost of Arthroplasty Procedures

The mean hospitalization cost of hip and knee joint replacement procedures, excluding charges not routinely billed by the hospital such as physician and prescription costs, increased in the last decade (1998 to 2007) by an average 109%. Nearly one-fourth of the increase was seen in the past three years (2004 to 2007), in spite of the reported shorter hospital length of stay for the procedures.

Partial hip replacements (125%) and knee revision procedures (133%) have shown the highest levels of increase. (Table 4.13 and Graph 4.6.5) Total knee replacements and revision hip replacements, with mean increases of 93% and 86%, respectively, in hospitalization cost, showed the lowest level of per procedure cost increase.

In spite of this, due to the rapid increase in the number of total knee procedures performed, the total estimated cost of performing total knee replacement procedures jumped from $5.36 billion in 1998 to $22.88 billion in 2007, an increase of 327%. (Table 4.13 and Graph 4.6.6) The total hospitalization cost of hip and knee joint replacements in 2007 was approximately $50 billion.

Graph 4.6.5: Mean Hospitalization Charges [1] for Hip and Knee Joint Replacement Procedures, United States, 1998 to 2007

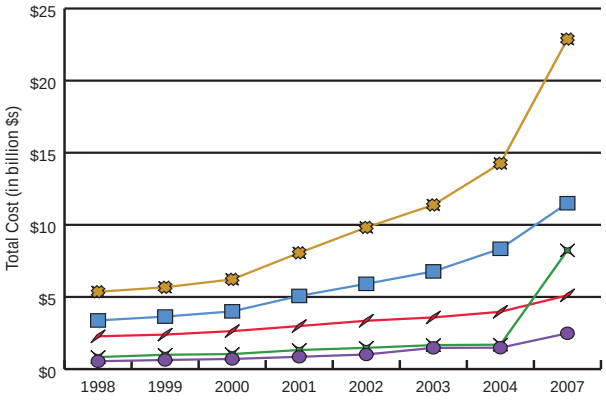


[1] Generally, total charges do not include professional fees and non-covered charges. In the rare cases where professional fees cannot be removed, they are included in the database. Emergency department charges incurred prior to admission to the hospital may be included in total charges.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2007

Joint replacement procedures are proven to be one of the most successful procedures available today. In the vast majority of cases, the procedure

Graph 4.6.6: Total Hospitalization Charges [1] for Hip and Knee Joint Replacement Procedures, United States, 1998 to 2007



[1] Generally, total charges do not include professional fees and non-covered charges. In the rare cases where professional fees cannot be removed, they are included in the database. Emergency department charges incurred prior to admission to the hospital may be included in total charges.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2007

significantly improves quality of life and the patient's ability to continue work, activities of daily living, and recreational activities. Continued research to improve the longevity of implants with younger, more active patients will reduce the overall burden of arthritis and damaged joints on future generations.

Section 4.6.7: Forecasting Future Utilization of Joint Arthroplasty Procedures

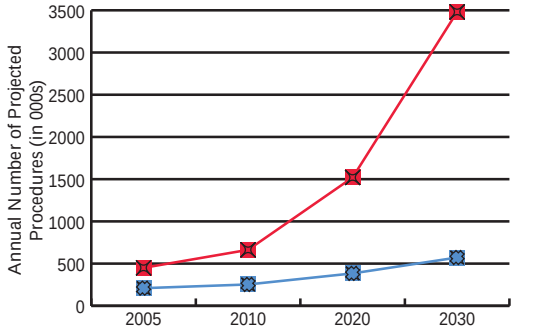
Kurtz and colleagues have performed sophisticated modeling of projected growth in hip and knee replacement procedures.[17] These investigators included in their estimates the growth in the overall population and in the proportion of elderly, as well as recent age and sex specific increases in arthroplasty rates. The results are striking. The investigators estimate that by 2030 there will be over 570,000 primary total hip replacements performed annually in the U.S. and nearly 3.5 million primary total knee replacements. (Table 4.14 and Graph 4.6.7) Although the rate of revision procedures is expected to slowly decline, revisions are projected to remain at a rate of 17% to 18% of primary hip replacements and around 8% of primary knee replacements. (Table 4.14 and Graph 4.6.8) Such staggering growth will have profound consequences for manpower needs, operating room capacity, and health care costs. In 2007 dollars, this volume of total joint replacement would generate costs exceeding $100 billion, or 1% of the gross domestic product (GDP). It is critical that the orthopaedic profession anticipate these profound needs for total knee and hip replacement services over the next generation.

Section 4.7: Economic Cost of Arthritis and Related Conditions

The estimated annual cost for medical care of arthritis and joint pain for patients with any diagnosis in 2004 was $281.5 billion, an average of $7,500 for each of the 37.6 million persons who reported having arthritis or joint pain. (Chapter 9: Health Care Utilization and Economic Cost of Musculoskeletal Diseases) Of this total, $37.3 billion is estimated to be incremental cost that can be directly attributed to arthritis and joint pain, and not a combination of arthritis and other medical conditions. A breakdown of the $281.5 billion cost due to arthritis and joint pain shows 32% for ambulatory care, 32% for emergency room or inpatient care, 23% for prescription drugs, and 13% for other expenses. The cost of arthritis and joint pain, in 2004 dollars, rose from $184.3 billion in 1996 to the $281.5 billion in 2004, an increase of 53%. The increasing cost of prescription drugs accounts for the largest percentage of this total cost increase, rising from 15% of total cost to 23% over the 9 year period.

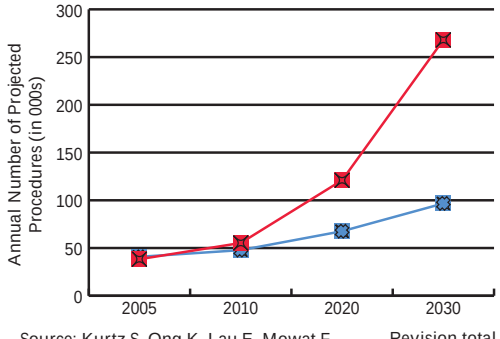
The indirect cost of earnings losses for persons aged 18 to 64 years with a work history due to three major

Graph 4.6.7: Projected Number of Primary Total Hip and Knee Arthroplasties, United States 2005-2030



Source: Kurtz S, Ong K, Lau E, Mowat F, et al. The future burden of hip and knee arthroplasties: U.S. projections from 2005 to 2030. Paper presented at: 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons: Chicago, IL; 2006. Used with permission of the primary author.

Graph 4.6.8: Projected Number of Revision Total Hip and Knee Arthroplasties, United States 2005-2030



Source: Kurtz S, Ong K, Lau E, Mowat F, et al. The future burden of hip and knee arthroplasties: U.S. projections from 2005 to 2030. Paper presented at: 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons: Chicago, IL; 2006. Used with permission of the primary author.

AORC conditions totals $54.3 billion per year. This includes an estimated $15.2 billion due to gout, $22 billion as a result of osteoarthritis and allied disorders, and $17.1 billion resulting from rheumatoid arthritis.

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17. Source: Kurtz S, Lau E, Mowat F, et al: The future burden of hip and knee revisions: U.S. projections from 2005 to 2030. Paper presented at: 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons: Chicago, IL;2006.

Section 4.8: Arthritis and Related Conditions Data Tables

Table 4.1: Diagnostic Categories ICD-9-CM Codes for Arthritis and Other Rheumatic Conditions (AORC)

Osteoarthritis and allied disorders
- 715-Osteoarthritis and allied disorders

Rheumatoid arthritis
- 714-Rheumatoid arthritis and other inflammatory polyarthropathies

Gout and other crystal arthropathies
- 274-Gout
- 712-Crystal arthropathies

Joint pain, effusion and other unspecified joint disorders
- 716.1, .3-.6-.9 - Other unspecified arthropathies
- 719.0, .4-.9-Other and unspecified joint disorders

Spondylarthropathies
- 720-AS/inflammatory spondylopathies
- 721-Spondylosis and allied disorders
- 99.3-Reiter's Disease
- 696.0-Psoriatic arthopathy

Systemic Lupus Erythematosus (SLE)
- 710.0-Systemic lupus erythematosus

Systemic Sclerosis (SSC, scleroderma)
- 710.1-Systemic sclerosis

Fibromyalgia
- 729.1-Myalgia and myositis unspecified

Sjögren's syndrome
- 710.2-Sicca syndrome (also called Sjögren's syndrome)

Polymyalgia rheumatica (PMR) and Giant cell (temporal) arteritis (GCA)
- 725-Polymyalgia rheumatica
- 446.5-Polyarteritis nodosa and allied conditions

Other specified rheumatic conditions
- 710-Diffuse connective tissue disease [excl 710.0-.2]

Carpal tunnel syndrome
- 354.0-Carpal tunnel syndrome

Other specified rheumatic conditions (continued)

Other AORC
- 711-Arthritis associated with infections
- 713-Arthropathy associated w/disorders classified elsewhere
- 716.0, .2, .8-Specified arthropathies
- 719.2, .3-Specified joint disorders
- 95.6-Syphilis of muscle
- 95.7-Syphilis of synovium/tendon/bursa
- 98.5-Gonococcal infection of joint
- 136.1-Behcet's syndrome
- 277.2-Other disorders purine/pyrimidine metabolism
- 287.0-Allergic purpura
- 344.6-Cauda equina syndrome
- 353.0-Brachial plexus/thoracic outlet lesions
- 355.5-Tarsal tunnel syndrome
- 357.1-Polyneuropathy in collagen vascular disease
- 390-Rheumatic fever w/o heart disease
- 391-Rheumatic fever w/heart disease
- 437.4-Cerebral arteritis
- 443.0-Raynaud's syndrome
- 446-Polyarteritis nodosa and allied conditions [excl 446.5]
- 447.6-Arteritis, unspecified

Soft tissue disorders (excluding back)
- 726-Peripheral enthesopathies and allied disorders
- 727-Other disorders of synovium/tendon/bursa
- 728.0-.3, .6–.9-Disorders of muscle/ligament/fascia
- 729.0-Rheumatism, unspecified and fibrositis [excl 729.1]
- 729.4-Fascitis, unspecified

Source: Centers for Disease Control and Prevention, Arthritis Program, National Arthritis Data Workgroup. Available at: http://www.cdc.gov/arthritis/data_statistics/arthritis_codes_2004.pdf. Accessed: August 16, 2007

Table 4.2: Prevalence of Self-Reported Doctor-Diagnosed Arthritis and Arthritis-Attributable Activity Limitations Among Adults Aged 18 & Older by Age, Sex, and Race/Ethnicity, United States, 2003-2005 and 2008

2003-2005 Data Analyzed by National Arthritis Data Workgroup

	Arthritis and Arthritis-Attributable Activity Limitation Prevalence						Proportion with Arthritis-Attributable Activity Limitation Among Those with Doctor-Diagnosed Arthritis	
	Doctor-Diagnosed Arthritis [1]			Arthritis-Attributable Activity Limitation [2]				
	Unadjusted Prevalence (in millions)	% Age Unadjusted	% Age-Adjusted [3]	Unadjusted Prevalence (in millions)	% Age Unadjusted	% Age-Adjusted [3]	% Age Unadjusted	% Age-Adjusted [3]
Gender								
Male	18.2	17.6%	18.1%	7.0	6.8%	7.0%	38.8%	36.6%
Female	28.3	25.4%	24.4%	11.9	10.7%	10.3%	42.3%	39.0%
Age								
18-44 years	8.7	7.9%	na	3.0	2.7%	na	34.6%	na
45-64 years	20.5	29.3%	na	8.2	11.8%	na	40.3%	na
65 & over	17.2	50.0%	na	7.7	22.4%	na	44.9%	na
Race/Ethnicity								
White, non-Hispanic	37.2	24.3%	22.6%	14.7	9.6%	8.9%	39.5%	36.4%
Black, non-Hispanic	4.6	19.2%	21.4%	2.2	9.2%	10.3%	47.8%	44.3%
Hispanic	3.1	11.4%	16.5%	1.5	5.4%	8.2%	47.6%	45.2%
Other non-Hispanic	1.6	14.7%	17.3%	0.7	6.0%	7.2%	41.1%	40.5%
Total	46.4	21.6%	21.5%	18.9	8.8%	8.8%	40.9%	38.1%

[1] Responded "yes" when asked: Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?

[2] Responded "yes" when asked: Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?

[3] Age adjusted to the projected 2000 population age 18 years or older by three age groups: 18-44, 45-64 and 65 & over

Source: National Center for Health Statistics, National Health Interview Survey, 2003-2005

2008 Data Analyzed by AAOS Project Analyst

	Arthritis and Arthritis-Attributable Activity Limitation Prevalence						Proportion with Arthritis-Attributable Activity Limitation Among Those with Doctor-Diagnosed Arthritis
	Doctor-Diagnosed Arthritis [1]			Arthritis-Attributable Activity Limitation [2]			
	Unadjusted Prevalence (in millions)	% Age Unadjusted	% Age-Adjusted [3]	Unadjusted Prevalence (in millions)	% Age Unadjusted	% Age-Adjusted [3]	% Age Unadjusted
Gender							
Male	20.1	18.5%	na	11.7	10.8%	na	58.2%
Female	31.1	26.7%	na	17.5	15.0%	na	56.3%
Age							
18-44 years	8.3	7.5%	7.3%	5.7	5.2%	5.0%	68.7%
45-64 years	23.9	30.9%	30.6%	13.1	16.9%	16.8%	54.8%
65 & over	19.0	51.1%	48.9%	10.3	27.7%	26.5%	54.2%
Race/Ethnicity							
White, non-Hispanic	43.6	23.9%	na	24.5	13.4%	na	56.2%
Black, non-Hispanic	5.4	20.1%	na	3.2	12.0%	na	59.3%
Asian	1.1	10.6%	na	0.7	6.7%	na	63.6%
Other or Mixed	1.1	20.9%	na	0.9	17.0%	na	81.8%
Total	51.2	22.7%	na	29.2	13.0%	na	57.0%

[1] Responded "yes" when asked: Have you EVER been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?

[2] Responded "yes" when asked: Are you now limited in any way in any of your usual activities because of arthritis or joint symptoms?

[3] Age-adjusted by direct method to US Census population estimate for July 1, 2008. Accessed June 22, 2009.

Source: National Center for Health Statistics, National Health Interview Survey, 2008

Table 4.3a: Impact and Health Care Utilization for Select Arthritis and Other Rheumatic Conditions for Adults Aged 18 & Older, United States, 2006/2007

All Diagnoses

	Visits (in 000s)				
		Ambulatory Care Services			
AORC Condition [1]	Inpatient Hospitalization [2]	Physician Visits [3]	ER Visits [4]	Outpatient Visits [5]	Total Ambulatory Care
Osteoarthritis	2,544.9	18,431.6	186.2	1,322.4	19,940.2
Rheumatoid Arthritis	399.2	3,196.6	40.0 *	344.6	3,581.2
Gout and Other Crystal Arthropathies	552.1	2,306.8	277.8	265.0	2,849.6
Systemic Lupus Erythematosus (SLE)	166.5	1,061.5 *	44.0 *	85.6	1,191.1
Systemic Sclerosis (SSc, scleroderma)	0.0	0.0	0.0	0.0	-
Primary Sjögren's Syndrome	27.2	462.2 *	0.0	10.9 *	473.1
Fibromyalgia	262.2	3,182.5	412.7	369.1	3,964.3
Polymyalgia Rheumatica and Giant Cell Arteritis	96.1	707.2 *	4.2 *	10.7 *	722.1
Spondylarthropathies	418.6	6,378.4	38.2 *	361.5	6,778.1
Joint Pain	816.6	18,961.1	1,957.6	2,051.9	22,970.6
All Other Arthritis and Other Rheumatic Condition	707.3	18,586.2	892.6	1,728.1	21,206.9
Total AORC Diagnoses	5,240.5	66,590.9	3,632.6	5,965.7	76,189.2
All Visits	39,542.0	720,394.6	92,881.8	78,529.0	885,464.2

Primary Diagnosis (Dx1)

	Visits (in 000s)				
		Ambulatory Care Services			
AORC Condition [1]	Inpatient Hospitalization [2]	Physician Visits [3]	ER Visits [4]	Outpatient Visits [5]	Total Ambulatory Care
Osteoarthritis	814.9	10,505.7	76.9 *	663.8	11,246.4
Rheumatoid Arthritis	15.4	1,948.4	8.3 *	236.9	2,193.6
Gout and Other Crystal Arthropathies	18.0	1,307.3	185.6	79.0 *	1,571.9
Systemic Lupus Erythematosus (SLE)	16.0	693.5 *	16.3 *	52.3 *	762.1
Systemic Sclerosis (SSc, scleroderma)	0.0	0.0	0.0	0.0	-
Primary Sjögren's Syndrome	0.5	192.7 *	0.0	4.8 *	197.5
Fibromyalgia	6.7	1,323.9	270.8	175.5	1,770.2
Polymyalgia Rheumatica and Giant Cell Arteritis	6.0	562.9 *	4.2 *	9.2 *	576.3
Spondylarthropathies	103.4	3,570.3	14.7 *	209.0	3,794.0
Joint Pain	47.6	11,489.4	1,448.3	1,182.3	14,120.0
All Other Arthritis and Other Rheumatic Condition	138.7	12,498.8	506.5	1,134.9	14,140.2
Total Primary AORC Diagnoses	1,166.3	44,046.2	2,531.5	3,747.1	50,324.8
% Primary AORC of All AORC Diagnoses	22.3%	66.1%	69.7%	62.8%	66.1%

* Estimate does not meet standards for reliability

[1] ICD-9-CM diagnosis codes for AORC listed in Table 4.1.

[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[3] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[5] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient Centers, 2006

NOTE: This table and all related graphs created by the Burden of Musculoskeletal Diseases project analyst.

Table 4.3b: Proportion of Total AORC Visits for Select Arthritis and Other Rheumatic Conditions for Adults Aged 18 & Older, United States, 2006/2007

All Diagnoses

	Proportion of Total AORC Visits				
		Ambulatory Care Services			
AORC Condition [1]	Inpatient Hospitalization [2]	Physician Visits [3]	ER Visits [4]	Outpatient Visits [5]	Total Ambulatory Care
Osteoarthritis	48.6%	27.7%	5.1%	22.2%	26.2%
Rheumatoid Arthritis	7.6%	4.8%	1.1% *	5.8%	4.7%
Gout and Other Crystal Arthropathies	10.5%	3.5%	7.6%	4.4%	3.7%
Systemic Lupus Erythematosus (SLE)	3.2%	1.6% *	1.2% *	1.4%	1.6%
Systemic Sclerosis (SSc, scleroderma)	0.0%	0.0%	0.0%	0.0%	0.0%
Primary Sjögren's Syndrome	0.5%	0.7% *	0.0%	0.2% *	0.6%
Fibromyalgia	5.0%	4.8%	11.4%	6.2%	5.2%
Polymyalgia Rheumatica and Giant Cell Arteritis	1.8%	1.1% *	0.1% *	0.2% *	0.9%
Spondylarthropathies	8.0%	9.6%	1.1% *	6.1%	8.9%
Joint Pain	15.6%	28.5%	53.9%	34.4%	30.1%
All Other Arthritis and Other Rheumatic Conditions	13.5%	27.9%	24.6%	29.0%	27.8%
% Total AORC Diagnoses to All Diagnoses	14.3%	8.4%	4.0%	7.3%	7.5%
% of Ambulatory Visits by Resource		87.4%	4.8%	7.8%	

Primary Diagnosis (Dx1)

	Proportion of Total AORC Visits				
		Ambulatory Care Services			
AORC Condition [1]	Inpatient Hospitalization [2]	Physician Visits [3]	ER Visits [4]	Outpatient Visits [5]	Total Ambulatory Care
Osteoarthritis	69.9%	23.9%	3.0% *	17.7%	22.3%
Rheumatoid Arthritis	1.3%	4.4%	0.3% *	6.3%	4.4%
Gout and Other Crystal Arthropathies	1.5%	3.0%	7.3%	2.1% *	3.1%
Systemic Lupus Erythematosus (SLE)	1.4%	1.6% *	0.6% *	1.4% *	1.5%
Systemic Sclerosis (SSc, scleroderma)	0.0%	0.0%	0.0%	0.0%	0.0%
Primary Sjögren's Syndrome	0.0%	0.4% *	0.0%	0.1% *	0.4%
Fibromyalgia	0.6%	3.0%	10.7%	4.7%	3.5%
Polymyalgia Rheumatica and Giant Cell Arteritis	0.5%	1.3% *	0.2% *	0.2% *	1.1%
Spondylarthropathies	8.9%	8.1%	0.6% *	5.6%	7.5%
Joint Pain	4.1%	26.1%	57.2%	31.6%	28.1%
All Other Arthritis and Other Rheumatic Conditions	11.9%	28.4%	20.0%	30.3%	28.1%
% Total AORC Primary Diagnoses to All Diagnoses	3.1%	5.6%	2.8%	4.7%	5.0%
% of Ambulatory Visits by Resource		87.5%	5.0%	7.4%	

* Estimate does not meet standards for reliability

[1] ICD-9-CM diagnosis codes for AORC listed in Table 4.1.

[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[3] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[5] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient Centers, 2006

NOTE: This table and all related graphs created by the Burden of Musculoskeletal Diseases project analyst.

Table 4.4: Ambulatory Care Resource Use for Non-Injury Arthritis and Other Rheumatic Conditions (AORC) for Persons Aged 18 and Older, United States, 1997, 2004, and 2006

Proportion of All Primary (1st) Diagnosis of AORC, United States 1997

		Physician Office Visits			
Ambulatory Care Resource		Physician Specialty		Health Care Provider	
Physician Office	89%	Primary Care Physician	53%	Physician	97%
Outpatient Department	7%	Orthopaedic Surgeon	20%	Nurse	51%
Emergency Department	4%	Rheumatologist	17%	Midlevel Provider	24%
		Other Provider	10%		

Total Visits for Primary AORC 36.5 million AORC as % All Health Care Visits 3.8%

Source: Hootman JM, Helmick CG, Schappert SM. Magnitude and characteristics of arthritis and other rheumatic conditions on ambulatory medical care visits, United States, 1997. *Arthritis Rheum* 2002;47:571–581.

Proportion of All Primary Diagnosis (Dx1) of AORC, United States 2004

		Physician Office Visits [1]			
Ambulatory Care Resource		Physician Specialty		Health Care Provider Visits	
Physician Office [1]	89%	Primary Care Physician [4]	45%	Physician	98%
Outpatient Department [2]	6%	Orthopaedic Surgeon	36%	Nurse [6]	41%
Emergency Department [3]	5%	Rheumatologist, PM&R [5]	5%	Midlevel Provider [7]	3%
		Other Provider	14%	Other Provider	8%

Total Visits for Primary AORC 41.2 million AORC as % All Health Care Visits 5.6%

Proportion of All Primary Diagnosis (Dx1) of AORC, United States 2006

		Physician Office Visits [1]			
Ambulatory Care Resource		Physician Specialty		Health Care Provider Visits	
Physician Office [1]	88%	Primary Care Physician [4]	39%	Physician	98%
Outpatient Department [2]	5%	Orthopaedic Surgeon	31%	Nurse [6]	22%
Emergency Department [3]	7%	Rheumatologist, PM&R [5]	14%	Midlevel Provider [7]	9%
		Other Provider	16%	Other Provider	12%

Total Visits for Primary AORC 50.3 million Primary AORC as % All Health Care Visits 5.0%

[1] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2004 & 2006

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Care Survey, Outpatient Centers, 2004 & 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Care Survey, Hospital Emergency, 2004 & 2006

[4] Includes family practice, family practice (geriatric medicine), sports medicine (family practice), general practice, general surgery, internal medicine, geriatric medicine (internal medicine).

[5] Includes rheumatology, neurology, physical medicine and rehabilitation, and pain specialists.

[6] Includes registered nurse, licensed practical nurse, and medical/nursing assistant.

[7] Includes physician assistant and nurse practitioner/midwife.

Table 4.5: Prevalence of Symptomatic Osteoarthritis in the Hands, Knees and Hips, United States, Various Studies

			Symptomatic Osteoarthritis Prevalence per 100 Persons*		
	Age	Source	Male	Female	Total
Hands	26 & over	[1]	3.8	9.2	6.8
Knees	26 & over	[1]	4.6	4.9	4.9
	45 & over	[1]	5.9	7.2	6.7
	45 & over	[2]	13.5	18.7	16.7
	60 & over	[3]	10.0	13.6	12.1
Hips	45 & over	[2]	8.7	9.3	9.2

*Age-standardized to the projected 2000 census population; exception is the NHANES III estimates are standardized to the 1980 U.S. population

[1] Framingham (Massachusetts) Osteoarthritis Study

[2] Johnston County (North Carolina) Osteoarthritis Study

[3] NHANES III, 1988-1994

Table 4.6: Trends in Prevalence of Rheumatoid Arthritis by Sex and Age [1], Rochester, MN, 1965-1995

Females	Prevalence (in 100,000s)			
Age-group	1965	1975	1985	1995
35-44	310	451	300	379
45-54	1,020	977	1,110	494
55-64	1,572	1,901	1,888	1,382
65-74	2,081	2,312	2,438	2,421
75+	1,969	2,568	2,352	1,943
All Females	1,171	1,368	1,345	1,064

Males	Prevalence (in 100,000s)			
Age-group	1965	1975	1985	1995
35-44	161	133	97	33
45-54	452	473	286	219
55-64	946	885	848	753
65-74	606	1,540	1,792	1,574
75+	1,394	1,592	1,589	1,498
All Males	593	733	701	606

[1] Age-adjusted to U.S. White population, 2000

Source: Helmick CG, Felson DT, Lawrence RC, *et. al* . National Arthritis Data Workgroup: Estimates of the prevalence of arthritis and other rheumatic conditions in the United States: Part I. *Arthritis & Rheumatism* ; 2008;58(1):15-25.

Table 4.7 Inpatient Arthroplasty Procedures by Type by Gender, United States, 2006

	Male		Female		All Persons		
	Number of Procedures	% of Total Procedures by Gender	Number of Procedures	% of Total Procedures by Gender	Number of Procedures	% of Total Jonit Replacement Procedures [8]	% of Total Procedures Performed
All Hip Replacement Procedures [1]	151,658	37.6%	251,890	62.4%	403,548	40.6%	1.0%
Total Hip Replacement (81.51)	101,598	44.1%	128,546	55.9%	230,144	23.1%	0.6%
Partial Hip Replacement (81.52) [7]	34,436	24.9%	104,111	75.1%	138,547	13.9%	0.4%
Revision Hip Replacement (81.53)	62,763	436.0%	81,236	56.4%	143,999	14.5%	0.4%
All Knee Replacement Procedures [2]	200,542	36.4%	350,803	63.6%	551,345	55.4%	1.4%
Total Knee Replacement (81.54)	185,998	36.0%	330,437	64.0%	516,435	51.9%	1.3%
Revision Knee Replacement (81.55)	14,544	41.2%	20,758	58.8%	35,302	3.5%	0.1%
All Shoulder Replacement Procedures [3]	11,047	36.4%	19,331	63.6%	30,378	3.1%	0.1%
All Other Joint Replacement Procedures [4]	5,597	51.5%	5,261	48.5%	10,858	1.1%	<0.1%
All Joint Replacement Procedures [5, 6]	368,209	37.0%	626,882	63.0%	995,091	100%	2.6%

[1] Includes ICD-9-CM procedure codes for total, partial, revision, and hip repair procedures

[2] Includes ICD-9-CM procedure codes for total, revision, and knee repair procedures

[3] Includes ICD-9-CM procedure codes for primary and revision shoulder arthroplasty

[4] Includes ICD-9-CM procedure codes finger, wrist, hand, elbow, toe, foot, ankle, and lower extremity

[5] Includes ICD-9-CM procedure codes for all above procedures.

[6] Total procedures may include cases with multiple procedures.

[7] An unknown error in the partial hip replacement data occurred in the NHDS 2006 data file. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx)

[8] Multiple procedures per patient may have occurred.

Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Table 4.8: Principal Diagnoses Associated with Hip and Knee Joint Replacement, United States 2006

	Proportion of Total Replacement Procedures		
	Total Hip Replacement [1]	Partial Hip Replacement [2, 4]	Primary Knee Replacement [3]
Osteoarthritis, Primary and Secondary	85.5%	0.5%	96.9%
Rheumatoid Arthritis	0.3%		0.9%
Other or Unspecified Arthropathy	2.0%		1.1%
Fracture of Neck of Femur, Femur or Lower Leg, Including Pathological Fracture	3.2%	75.7%	
Other Diseases of Bone and Cartilage	7.0%	4.4%	
Congenital or acquired deformities	0.6%	9.9%	
Complications of specific procedures	0.3%	4.8%	
All Other	1.1%	4.7%	1.1%
Total Procedures	230,144	138,547	516,435

[1] ICD-9-CM procedure code 8151. [2] ICD-9-CM procedure code 8152. [3] ICD-9-CM procedure code 8154.

[4] An unknown error in the partial hip replacement data occurred in the NHDS 2006 data file. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx)

Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

Table 4.9: Arthroplasty Procedures By Type by Mean Age, United States, 1992-2006

	Mean Age of Joint Replacement Patients				
	Total Hip Replacement [1]	Partial Hip Replacement [2,6]	Revision Hip Replacement [3]	Total Knee Replacement [4]	Revision Knee Replacement [5]
1992	67.0	76.7	68.1	69.6	68.7
1994	66.6	79.7	63.6	69.1	68.5
1996	67.6	78.6	65.9	69.4	67.8
1998	67.7	79.5	68.9	68.4	70.3
2000	65.6	78.9	66.2	68.3	67.7
2002	66.7	79.9	68.4	67.6	69.7
2004	65.9	74.8	68.4	67.2	67.0
2006	65.2	75.6	66.7	67.1	64.2
15-Year Average	66.5	78.0	67.0	68.3	68.0

[1] ICD-9-CM procedure code 81.51.

[2] ICD-9-CM procedure code 81.52.

[3] ICD-9-CM procedure code 81.53

[4] ICD-9-CM procedure code 81.54.

[5] ICD-9-CM procedure code 81.55

[6] An unknown error in the partial hip replacement data occurred in the NHDS 2004 data file. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx). The resulting age drop may be due to this error.

Source: National Center for Health Statistics, National Hospital Discharge Survey, 1992-2006

Table 4.10: Average Inpatient Length of Stay for Select Arthroplasty Procedures, United States 1992-2006

	Mean Days of Hospitalization for Procedure				
	Total Hip Replacement [1]	Partial Hip Replacement [2, 6]	Revision of Hip Replacement [3]	Total Knee Replacement [4]	Revision of Knee Replacement [5]
1992	8.9	10.6	9.7	8.9	8.4
1994	7.2	9.4	7.9	6.8	6.2
1996	5.3	7.0	6.0	5.1	4.4
1998	4.8	6.7	5.5	4.5	4.7
2000	4.9	7.5	6.2	4.5	4.7
2002	4.5	7.1	5.4	4.2	4.4
2004	4.3	7.3	5.4	3.9	4.7
2006	3.9	6.3	4.2	3.8	4.0

[1] ICD-9-CM procedure code 81.51.

[2] ICD-9-CM procedure code 81.52.

[3] ICD-9-CM procedure code 81.53

[4] ICD-9-CM procedure code 81.54.

[5] ICD-9-CM procedure code 81.55

[6] An unknown error in the partial hip replacement data occurred in the NHDS 2004 data file. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx)

Source: National Center for Health Statistics, National Hospital Discharge Survey, 1992-2006

Table 4.11: Discharge Status for Patients Aged 18 & Over and 65 & Over Undergoing Hip or Knee Joint Replacement Procedures, Comparison of Two National Health Care Hospital Discharge Surveys, United States 2006/2007

Aged 18 Years and Older

NHDS Survey [1]

	Proportion of Total Replacement Patients						
	Total Hip Replacement [3]	Partial Hip Replacement [4,8]	Revision Hip Replacement [5]	Total Knee Replacement [6]	Revision Knee Replacement [7]	All Hip and Knee Replacements	All Inpatient Discharges
Routine Discharge Home	55.3%	22.3%	50.3%	54.2%	59.6%	53.8%	75.8%
Discharged/ Transferred to Short-Term/Skilled Nursing/Intermediate Care	28.9%	59.2%	33.6%	31.3%	29.8%	31.8%	14.4%
Unknown/ Other Discharge Status	15.8%	18.5%	16.1%	14.5%	10.6%	14.4%	9.8%
Total Cases	230,103	136,409	143,706	516,382	35,302	1,060,142	31,949,366

NIS Survey [2]

	Proportion of Total Replacement Patients						
	Total Hip Replacement [3]	Partial Hip Replacement [4]	Revision Hip Replacement [5]	Total Knee Replacement [6]	Revision Knee Replacement [7]	All Hip and Knee Replacements	All Inpatient Discharges
Routine Discharge Home	23.3%	6.5%	23.6%	24.8%	24.8%	23.0%	72.4%
Term/Skilled Nursing/Intermediate Care	38.6%	82.7%	38.8%	36.8%	33.8%	40.4%	14.5%
Home Health Care	38.0%	8.9%	37.1%	38.3%	41.2%	36.2%	9.9%
Unknown/ Other Discharge Status	0.1%	1.9%	0.5%	0.1%	0.2%	0.4%	3.2%
Total Cases	243,009	68,492	153,838	539,621	43,565	938,433	30,194,233

Aged 65 Years and Older

NHDS Survey [1]

	Proportion of Total Replacement Patients						
	Total Hip Replacement [3]	Partial Hip Replacement [4,8]	Revision Hip Replacement [5]	Total Knee Replacement [6]	Revision Knee Replacement [7]	All Hip and Knee Replacements	All Inpatient Discharges
Routine Discharge Home	43.5%	12.4%	37.6%	45.3%	44.5%	39.0%	59.9%
Discharged/ Transferred to Short-Term/Skilled Nursing/Intermediate Care	38.6%	67.9%	46.0%	38.9%	46.2%	44.1%	26.9%
Unknown/ Other Discharge Status	17.9%	19.7%	16.4%	15.8%	9.3%	16.9%	13.2%
Total Cases	125,841	114,922	87,789	313,527	18,554	614,916	13,070,499

NIS Survey [2]

	Proportion of Total Replacement Patients						
	Total Hip Replacement [3]	Partial Hip Replacement [4]	Revision Hip Replacement [5]	Total Knee Replacement [6]	Revision Knee Replacement [7]	All Hip and Knee Replacements	All Inpatient Discharges
Routine Discharge Home	16.1%	4.3%	15.2%	19.9%	18.7%	18.7%	52.9%
Discharged/ Transferred to Short-Term/Skilled Nursing/Intermediate Care	53.5%	87.0%	56.3%	47.1%	45.2%	53.3%	27.2%
Home Health Care	30.1%	6.7%	27.9%	32.9%	35.8%	29.3%	15.9%
Unknown/ Other Discharge Status	0.3%	2.0%	0.6%	0.1%	0.3%	-1.3%	4.0%
Total Cases	129,288	59,790	79,109	308,363	23,991	542,380	10,705,554

[1] Source: National Center for Health Statistics, National Hospital Discharge Survey, 2006

[2] Source: National Center for Health Statistics, Nationwide Inpatient Sample, 2007

[3] ICD-9-CM procedure code 81.51

[4] ICD-9-CM procedure code 81.52

[5] ICD-9-CM procedure code 81.53

[6] ICD-9-CM procedure code 81.54

[7] ICD-9-CM procedure code 81.55

[8] An unknown error in the partial hip replacement data occurred in the NHDS 2006 data file. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx)

Table 4.12: Joint Replacement Procedures, All Ages, in the United States, 1991-2006/2007

National Hospital Discharge Survey

		Joint Replacement Procedures (in 000s)														
Description	ICD-9 CM Code	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2006
Total Hip Replacement	81.51	117.0	127.0	125.0	124.0	134.0	138.0	144.0	160.0	168.0	152.0	165.5	193.0	220.1	234.0	230.1
Partial Hip Replacement [1]	81.52	90.0	88.0	84.0	93.0	97.0	103.0	103.0	112.0	106.0	106.0	118.5	108.8	108.0	119.7	138.5
Revision of Hip Replacement [2]	81.53	25.0	23.0	26.0	28.0	29.0	30.0	37.0	33.0	30.0	31.0	36.1	42.7	35.6	46.0	144.0
Ratio Hip Revision to Primary		21.4%	18.1%	20.8%	22.6%	21.6%	21.7%	25.7%	20.6%	17.9%	20.4%	21.8%	22.1%	16.2%	19.7%	62.6%
Total Knee Replacement	81.54	160.0	167.0	179.0	209.0	216.0	245.0	259.0	266.0	267.0	299.0	325.6	381.3	418.3	478.0	516.4
Revision of Knee Replacement	81.55	17.0	13.0	15.0	19.0	18.0	20.0	25.0	23.0	25.0	28.0	29.4	35.1	33.1	40.0	35.3
Ratio Knee Revision to Primary		10.6%	7.8%	8.4%	9.1%	8.3%	8.2%	9.7%	8.6%	9.4%	9.4%	9.0%	9.2%	7.9%	8.4%	6.8%
TOTAL Hip and Knee Replacement/Revision Procedures		409.0	418.0	429.0	473.0	494.0	536.0	568.0	594.0	596.0	616.0	675.1	760.8	815.1	917.7	954.1

[1] An unknown error in the partial hip replacement data occurred in the NHDS 2004 and 2006 data files. A correction for total partial hip cases was made by excluding cases with diagnosis of spine (720.xx-724.xx, 737.xx, 756.xx, 805.xx, 806.xx)

[2] A significant jump in the number of hip revision procedures was found between the 2004 and the 2006/2007 data. However, the increase was similar in both the NHDS and NIS data sets, indicating the increase occurred.

Source: National Center for Health Statistics, National Hospital Discharge Survey, 1991-2006

Nationwide Inpatient Sample

		Joint Replacement Procedures (in 000s)														
Description	ICD-9 CM Code	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2007
Total Hip Replacement	81.51	135.7	139.9	144.1	148.2	152.6	157.0	161.6	166.7	171.7	176.1	181.5	187.7	194.3	227.5	252.7
Partial Hip Replacement	81.52	96.3	97.9	99.5	100.8	102.2	103.5	104.7	105.8	106.8	107.4	108.7	109.9	111.2	105.1	103.7
Revision of Hip Replacement [2]	81.53	27.5	28.3	29.1	29.9	30.8	31.7	32.5	33.5	34.4	35.2	36.2	37.2	38.3	37.9	164.0
Ratio Hip Revision to Primary		20.3%	20.2%	20.2%	20.2%	20.2%	20.2%	20.1%	20.1%	20.0%	20.0%	19.9%	19.8%	19.7%	16.7%	64.9%
Total Knee Replacement	81.54	192.2	203.6	215.5	227.9	241.1	255.1	270.0	286.6	304.0	321.8	342.0	365.3	391.1	435.5	551.3
Revision of Knee Replacement	81.55	16.5	17.5	18.5	19.5	20.7	21.9	23.2	24.6	26.1	27.6	29.3	31.2	33.4	36.2	45.0
Ratio Knee Revision to Primary		8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.6%	8.5%	8.5%	8.3%	8.2%
TOTAL Hip and Knee Replacement/Revision Procedures		468.2	487.2	506.7	526.3	547.4	569.2	592.0	617.2	643.0	668.1	697.7	731.3	768.3	842.2	999.5

[2] A significant jump in the number of hip revision procedures was found between the 2004 and the 2006/2007 data. However, the increase was similar in both the NHDS and NIS data sets, indicating the increase occurred.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1991-2007

Table 4.13: Mean and Total Hospitalization Charges [1] for Hip and Knee Joint Replacement Procedures, United States, 1998-2007

	Average (Mean) Charges Per Hospitalization (rounded to nearest 000)							
	(rounded to nearest 000							(in 00s)
	1998	1999	2000	2001	2002	2003	2004	2007
Total Hip Replacement [2]	$22,000	$23,000	$26,000	$27,000	$31,000	$35,000	$37,000	$45,500
Partial Hip Replacement [3]	$22,000	$23,000	$26,000	$28,000	$32,000	$35,000	$39,000	$49,300
Revision Hip Replacement [4]	$27,000	$31,000	$32,000	$34,000	$39,000	$45,000	$46,000	$50,200
Total Knee Replacement [5]	$21,000	$22,000	$24,000	$26,000	$29,000	$31,000	$33,000	$41,500
Revision Knee Replacement [6]	$24,000	$25,000	$30,000	$30,000	$35,000	$42,000	$42,000	$55,100

	Total Hospitalization Charges for Joint Replacements (in billions)							
	1998	1999	2000	2001	2002	2003	2004	2007
Total Hip Replacement [2]	$3.37	$3.64	$4.00	$5.07	$5.91	$6.77	$8.34	$11.50
Partial Hip Replacement [3]	$2.27	$2.39	$2.63	$2.98	$3.35	$3.58	$3.97	$5.11
Revision Hip Replacement [4]	$0.83	$0.99	$1.04	$1.32	$1.47	$1.66	$1.69	$8.23
Total Knee Replacement [5]	$5.36	$5.67	$6.22	$8.06	$9.82	$11.38	$14.26	$22.88
Revision Knee Replacement [6]	$0.54	$0.63	$0.70	$0.85	$1.01	$1.47	$1.48	$2.48
Total Hip and Knee Replacement Cost	$12.37	$13.32	$14.59	$18.29	$21.57	$24.86	$29.74	$50.20

[1] Generally, total charges do not include professional fees and non-covered charges. In the rare cases where professional fees cannot be removed, they are included in the database. Emergency department charges incurred prior to admission to the hospital may be included in total charges.

[2] ICD-9-CM procedure code 81.51 [3] ICD-9-CM procedure code 81.52 [4] ICD-9-CM procedure code 81.53
[5] ICD-9-CM procedure code 81.54 [6] ICD-9-CM procedure code 81.55

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 1998-2004

Table 4.14: Projected Number of Hip and Knee Arthroplasties, United States 2005-2030

	Annual Number of Procedures (in 000s)							
	2005		2010		2020		2030	
	Variable Rate [1]	Constant Rate [2]	Variable Rate [1]	Constant Rate [2]	Variable Rate [1]	Constant Rate [2]	Variable Rate [1]	Constant Rate [2]
Primary Total Hip Arthroplasty	209	179	253	194	384	236	572	277
Primary Total Knee Arthroplasty	450	301	663	329	1,520	415	3,481	488
Revision Total Hip Arthroplasty	40.8	36.0	47.8	38.9	67.6	47.2	96.7	56.6
Revision Total Knee Arthroplasty	38.3	25.9	55.3	28.1	121.0	35.1	268.0	41.7

[1] Projection based on arthroplasty rate increase due to aging of population and changes in the rate of joint replacement surgery.

[2] Projection based on the historical rate of procedures found in the Nationwide Inpatient Sample, 1990 to 2003.

Source: Kurtz S, Lau E, Mowat F, et al: The future burden of hip and knee revisions: U.S. projections from 2005 to 2030. Paper presented at: 73rd Annual Meeting of the American Academy of Orthopaedic Surgeons:Chicago, IL;2006. Used with permission of the primary author.

Chapter 5
Osteoporosis and Bone Health

Osteoporosis has been called the "silent disease" because it typically progresses without symptoms until a fracture occurs.[1] Osteoporosis is age-related and characterized by low bone mass due to the loss of bone in the aging process. Bones are easier to break even from falls at low heights, such as standing, or during the course of simple daily activities. In 2002, the National Osteoporosis Foundation estimated 44 million persons over the age of 50 in the United States were at risk for fracture due to osteoporosis or low bone mass. By 2020, if current trends continue and effective treatments are not found and widely implemented, it is estimated that over 61 million persons will be at risk.[1]

The economic burden of inpatient, outpatient and long-term care of incident osteoporotic fractures in the U.S. was estimated at nearly $17 billion in 2005; cumulative cost over the next 2 decades are estimated to be $474 billion.[2] In addition to dollar cost, osteoporosis-related fractures bring a burden of pain and disability, resulting in time lost from work or the inability to perform activities of daily living.

Section 5.1: Osteoporosis and Low Bone Mass

Osteoporosis is a disease characterized by low bone mass and deterioration of bone structure that causes bone fragility and increases the risk of fracture. Gradual loss of bone with aging is normal; however, that loss may be accelerated by factors such as menopause, serious health conditions or their treatment, and lifestyle factors such as inadequate diet, lack of exercise, smoking, or excessive alcohol consumption.

Although often considered a disease primarily of females, within the past decade it has become apparent that osteoporosis is not solely a women's disease. It affects an estimated 2 million men in the United States, particularly older men. In men, as in women, the low bone mineral density characteristic of osteoporosis is associated with an increased risk of bone fracture. Fracture most commonly affects the hip and lumbar vertebrae, but the radius, tibia, and ribs also may be affected. Rates of fracture-related morbidity and mortality are significant in all older persons, but are substantially higher in men than in women.

The presentation and cause of osteoporosis differ between men and women in several important ways. For example, the condition manifests later in life in men, probably because men initially have a greater bone mass. Moreover, unlike among women, for nearly half of men with osteoporosis an underlying cause can be identified. Among the causes of osteoporosis in men are corticosteroid therapy for arthritis or asthma, hypogonadism in patients being treated for cancer of the prostate with androgen-withdrawal therapy, consumption of large amounts of alcohol, hyperthyroidism, and vitamin D deficiency.

Currently, the diagnosis of osteoporosis is defined by the World Health Organization (WHO), and is based on the results of dual energy x-ray absorptiometry (DXA) testing, which evaluates the bone mineral density (BMD) present at several sites. WHO defines osteoporosis as a BMD value more than 2.5 standard deviations (SD) below the average value for a young, healthy woman (a T-score of <-2.5 SD).[3] Osteopenia, or low bone mass, is defined as -1.0 to -2.5 SD, or 10% to 30%, below the normal bone mass.[4]

Section 5.1.1: Osteoporosis Disease Classifications Defined

For purposes of this chapter, osteoporosis-related conditions will be presented using three broad categories, based on ICD-9-CM diagnosis codes. (Table 5.1) Primary osteoporosis includes only persons who have a diagnosis of osteoporosis. It is found primarily among elderly persons, with postmenopausal women affected at the highest rates. The reasons why some persons develop osteoporosis while others do not is unclear; however, estrogen deficiency has been identified by the U.S. Department of Health and Human Services, Office of the Surgeon General, as a primary cause in both men and women.[4]

Low energy fractures, formerly referred to as fragility fractures, occur from an event such as a fall from a standing height or less (versus a high energy cause such as a vehicular accident). In general, the lower the BMD, the higher risk of a low energy fracture. However, the reasons why some women and men with low BMD do not experience low energy fractures in circumstances similar to those who do are not well understood.

Secondary osteoporosis occurs when another condition or treatment causes erosion of bone health. Causes of secondary osteoporosis include certain diseases, such as hyperthyroidism or celiac disease, and certain medications, especially glucocorticoids. In addition, some lifestyle habits, such as low activity levels, diets with low calcium intake, and smoking are believed to contribute to the development of osteoporosis. In 2006, 5.4 million persons aged 45 and over in the United States were treated for a condition that can contribute to the development of osteoporosis. This number does not take into account persons with a previous condition diagnosis who were not treated in 2006.

In recent years, knowledge about osteoporosis risk factors, diagnostic criteria, and treatment options has advanced rapidly.[1,5] Research into treatments and preventive measures is flourishing. Clinical trials have shown that suppression of bone turnover markers, an indication of a slowing of bone loss, can be achieved in as little as three months of using prescription therapies, reducing the risk for low energy fractures.[6] However, it is also known that many patients diagnosed with osteoporosis do not follow the treatment regime, often due to medication side effects, and that not all patients respond to current therapies. Perhaps most important, current data demonstrate that the majority of patients who suffer a low energy fracture and are subsequently among those at highest risk for repeat fracture typically are not evaluated for osteoporosis, much less treated.

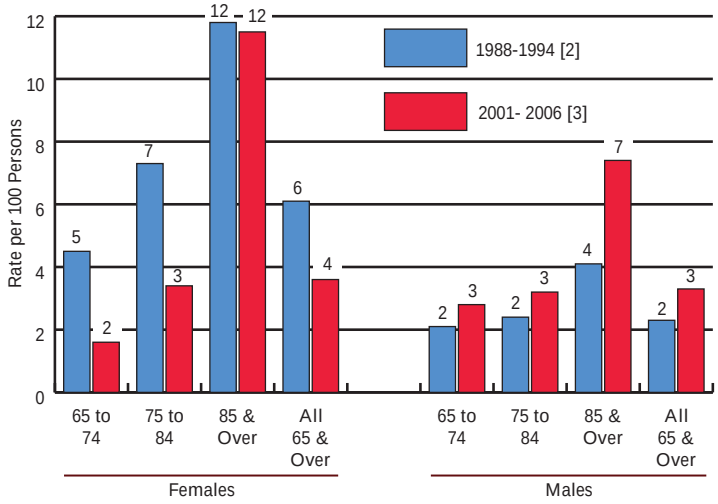
Section 5.1.2: Prevalence of Osteoporosis

Estimates of the prevalence of osteoporosis and low bone mass are based on the best available scientific information from leading researchers. There are no definitive sources of information on the numbers of persons with osteoporosis or at risk for low energy fractures, as this is truly a "silent disorder." Estimates of prevalence among white females are generally believed to be more reliable because this group has been studied the most due to their high fracture rate. The incidence or prevalence among males and racial groups is even more difficult to estimate as there are no definitions of what constitutes osteoporosis and low bone mass in these groups as there are with white women. However, the incidence of osteoporosis and low bone mass among these groups is believed to be higher than previously estimated. The leading national study that provides data upon which to make these estimates is the National Health and Nutrition Examination Study (NHANES), a self-reported study that includes questions related to diagnosis and treatment of osteoporosis, fractures, and cause of fracture. Data from the NHANES surveys for the years 2001-2002, 2003-2004, and 2005-2006 were merged and analyzed for this report to provide estimated prevalence.

The National Osteoporosis Foundation (NOF) estimated there were 29.5 million women and 11.7 million men in the United States with osteoporosis or low bone mass in 2002. Asian and non-Hispanic white women are affected about equally, and at higher proportions than Hispanic and non-Hispanic black women. The prevalence of osteoporosis and low bone mass among males was substantially lower, but followed the same general racial patterns.[1]

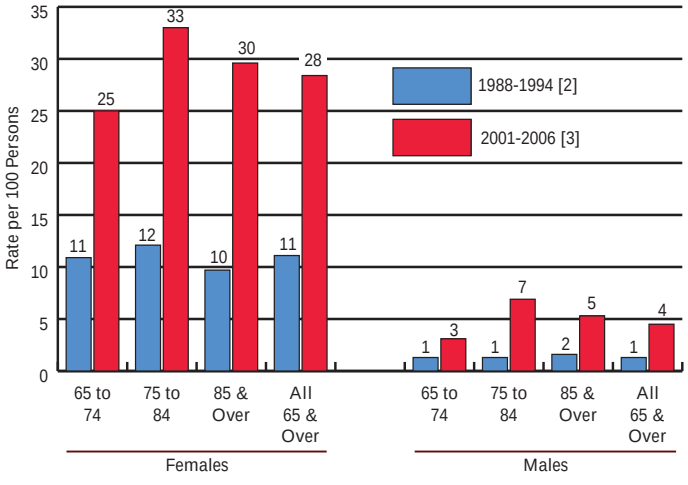
Based on data in the NHANES self-reported study, the prevalence of osteoporosis in both females and males aged 65 and over in 2001-2006 was 260% that reported in 1988-1994. (Table 5.2 and Graph 5.1.1) The rapid increase in the prevalence of osteoporosis diagnosis is likely due to the extensive educational and awareness efforts aimed at both the general public and health care professionals, as well as increased testing of bone mass in older women. During that same time frame, females of this age group reported a slight decline in the rate of hip fractures, while males aged 65 and over reported an increased rate of hip fracture. (Graph 5.1.2) A similar decline in hip fracture rates was found by a team of Dartmouth researchers in examination of Medicare databases.[4] Although reasons for this shift are unknown, greater awareness of osteoporosis and fracture potential, increased testing, and the impact of recent treatments in females may be contributing factors. Awareness of osteoporosis among men is less prevalent. They are less likely to be evaluated early for osteoporosis, even in the face of serious, contributing medical conditions.

Graph 5.1.2: Self-Reported Rate of Hip Fracture [1] for Persons Aged 65 and Over in the United States, 1988-1994 and 2001-2006



[1] Has a doctor ever told you that you had broken or fractured your hip?
[2] Source: Praemer A, Furner S, Rice DP. *Musculoskeletal Conditions in the United States*, ed 2. Rosemont, IL: American Academy of Orthopaedic Surgeons; 1999.
[3] Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006.

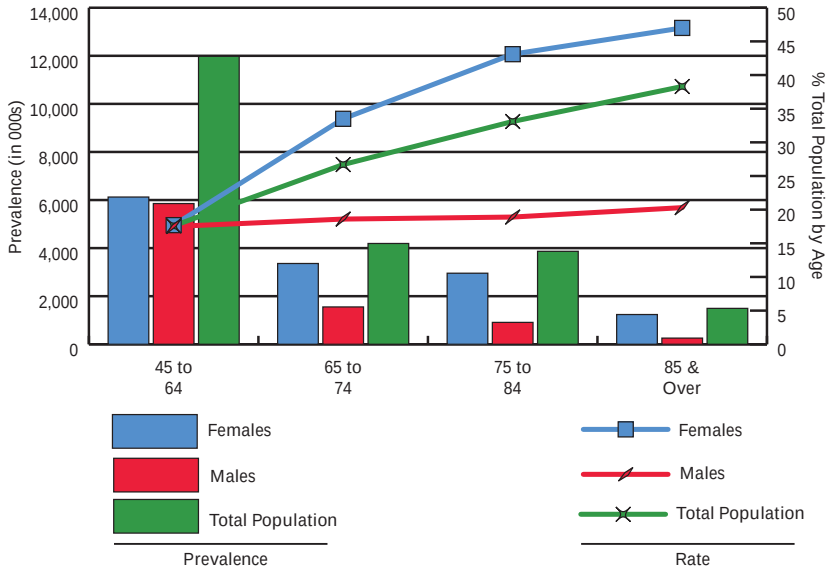
Graph 5.1.1: Self-Reported Rate of Osteoporosis [1] for Persons Aged 65 and Over in the United States, 1988-1994 and 2001-2006



[1] Has a doctor ever told you that you had osteoporosis, sometimes called thin or brittle bones?
[2] Source: Praemer A, Furner S, Rice DP. *Musculoskeletal Conditions in the United States*, ed 2. Rosemont, IL: American Academy of Orthopaedic Surgeons; 1999.
[3] Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006.

On average, for each year between 2001 and 2006, 22.3 million people over the age of 45 reported they were told by their doctor they had osteoporosis or had sustained a fracture of the hip, spine, or wrist, the most common locations of fractures associated with osteoporosis. (Table 5.3 and Graph 5.1.3) These self-reports were primarily among women in all age groups; the sole exception was persons aged 45 to 64, among whom the self-reports were nearly evenly divided between the females and males (51% to 49%, respectively.) Among those 85 years of age or older, 83% self-reporting a diagnosis of osteoporosis or fracture were female, most likely reflecting the longevity of females and their preponderance in this age group.

Graph 5.1.3: Self-Reported Prevalence of Osteoporosis or Fracture of Hip, Spine or Wrist for Persons Aged 45 and Over, United States, 2001-2006



Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006

The higher proportions of women in older age groups reporting a diagnosis of osteoporosis and/or low energy fractures may also be due to the fact that, as the population ages, the incidence of both of these conditions rises steadily among women, while that of males remains relatively steady. Between the ages of 45 and 64, approximately 18% of both females and males report they have been told by a doctor they have osteoporosis or have had a fracture of the hip, spine, or wrist. By the age of 85 or older, 47% of females report osteoporosis and/or a fracture, while only 20% of males in this age group do so.

Thirty-six percent (36%) of females, compared to 48% of males, reporting an osteoporosis condition were under the age of 65 years. (Table 5.3) The reason for this variation is not known.

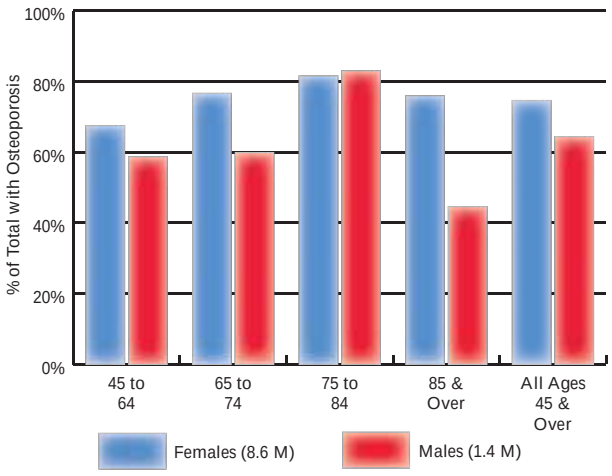
Rates of treatment for osteoporosis reported between 2001 and 2006 were slightly higher for females than for males under the age of 75; however, the differences narrowed in individuals between the ages of 65 and 84. Treatment rates for females aged 85 and over are nearly twice that for similar aged males. (Table 5.3 and Graph 5.1.4) The data suggest that if patients recognize they have osteoporosis, the likelihood they will receive treatment rises, an indication that education about screening or testing for osteoporosis is an important factor in ensuring better long term outcomes.

Section 5.2: Health Care Resource Utilization for Osteoporosis and Low Energy Fractures

Section 5.2.1: Patient Visits, 2006

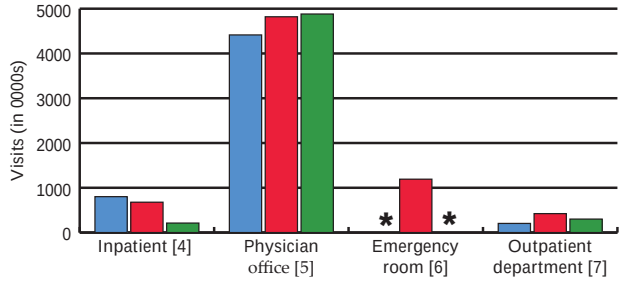
In 2006, 5.4 million persons aged 45 and over with a diagnosis of primary osteoporosis utilized health care resources;, while 7.1 million persons of this age with low energy fractures also utilized health care resources. (Table 5.4) An additional 5.4 million persons aged 45 and over were diagnosed with a condition that can contribute to the development of osteoporosis, and were therefore at risk for secondary osteoporosis. Nearly 56,000 persons sustained a vertebral fracture with spinal cord injury as a result of a low

Graph 5.1.4: Self-Reported Treatment for Osteoporosis [1] by Gender for Persons Aged 45 and Over, United States, 2001-2006



[1] Replied "yes" when asked if ever been told by a doctor that you had osteoporosis and had been treated for osteoporosis.
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006

Graph 5.2.1: Health Care Visits for Osteoporosis [1] and Low Energy Fractures [2] for Persons Aged 45 and Over by Site, United States, 2006/2007



* Estimate does not meet standards for reliability.
[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.
[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).
[3] Diagnosis of another medical condition that may lead to or contribute to the development of osteoporosis.
[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[5] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006
[6] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[7] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient Centers, 2006

Primary osteopoeosis [1]
Low energy fracture [2]
Secondary osteoporosis [3]

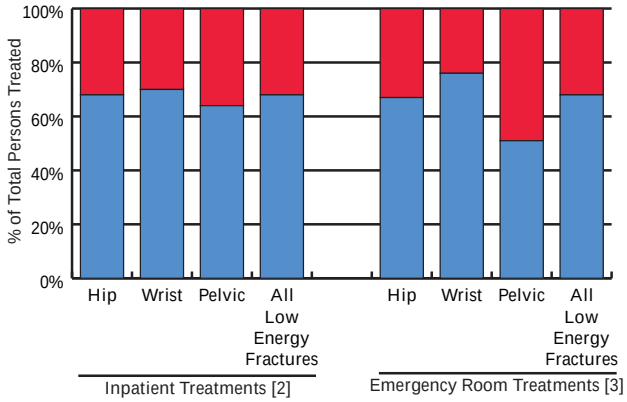
energy fall, unlike in 2004 when the 1.4 million spinal cord injuries were all the result of a high energy impact (i.e., motor vehicle accident). (Table 5.4)

Health care utilization by persons aged 45 and over with a diagnosis of primary osteoporosis and low energy fractures involves primarily physician office visits. In 2006, 81% of patients aged 45 and over with primary osteoporosis were diagnosed in a physician's office, while 68% of patients over the age of 45 with a low energy fracture were treated in a physician's office. (Table 5.4 and Graph 5.2.1)

Persons aged 45 and over hospitalized with a diagnosis of primary osteoporosis or a low energy fracture accounted for 4% of all inpatient admissions in 2006, representing 1.5 million incidents. In addition, 1.2 million low energy fractures of persons aged 45 and over were treated in emergency rooms, 17% of all low energy fractures utilizing health care resources in 2006. (Table 5.4)

Eighty-nine percent (89%) of individuals aged 45 and over diagnosed with primary osteoporosis in an inpatient setting in 2006 were females. (Table 5.5) Among individuals age 45 and over, low energy fractures occurred in females at a fairly constant 2:1 ratio to males. This is a change from two years earlier, when the ratio was closer to 3:1, females to males. (Tables 5.5 and 5.6 and Graph 5.2.2)

Graph 5.2.2: Low Energy Fracture [1] Treatment for Persons Aged 45 and Over by Sex and Site, United States, 2006/2007



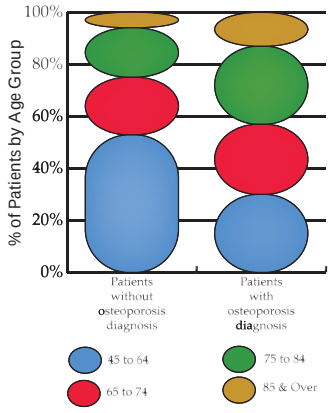
[1] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).
[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency Room, 2006

Compared to data analyzed two years earlier, the proportion of low energy fractures occurring in males increased substantially, comprising about one-third of all fractures treated in inpatient settings and close to one-half of emergency room treatments. A slight increase in the proportion of males diagnosed with osteoporosis in an inpatient setting was also found. (Tables 5.5 and 5.6)

Section 5.2.2: Age at Time of Osteoporosis Diagnosis or Low Energy Fracture Incident, 2004

Although osteoporosis may occur in younger patients, it is primarily a condition of older adults. Among patients 45 years of age or older, the mean age at time of diagnosis of osteoporosis in a physician's office in 2006 was 70.8 years, more than six years older than the average patient. One-third

Graph 5.2.3: Age Distribution for Osteoporosis Diagnosis in Physician's Office for Persons Aged 45 and Over, United States, 2006



Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

of these diagnoses (30%) were for females between the ages of 45 and 64, an increase of 4% over two years earlier, indicating that diagnosis of osteoporosis may be being made at younger ages. (Graph 5.2.3) Due to the very small number of males diagnosed with osteoporosis, this age is primarily representative of females.

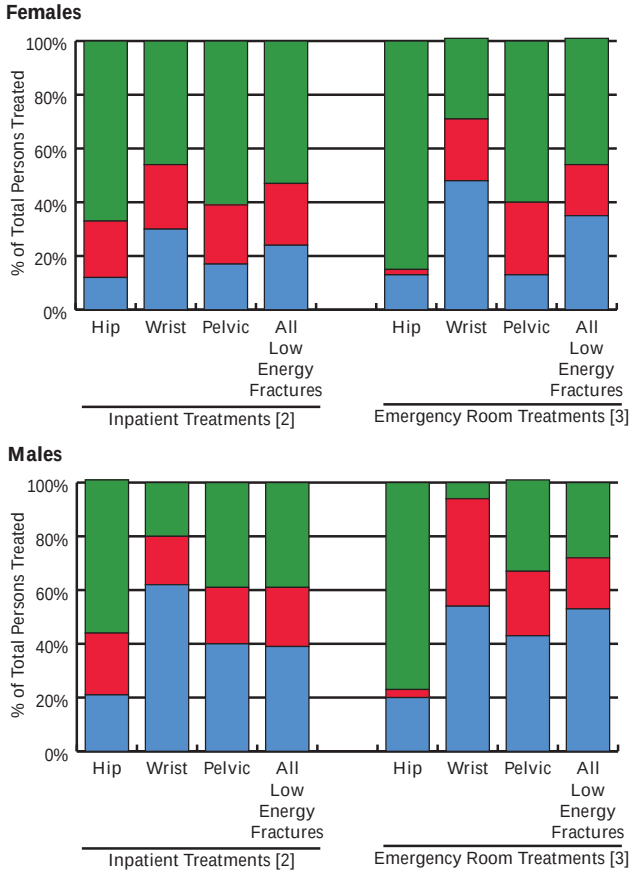
The mean age of females aged 45 or over receiving a diagnosis of primary osteoporosis in an inpatient setting was 73.4 years, with 55% of the diagnosed patients aged 75 or over. The age of patients with an osteoporosis diagnosis dropped from 2004 by more than four years; the proportion of patients aged 75 and older dropped by 11%. The proportion of women aged 18 to 44 with an osteoporosis diagnosis rose from 13% in 2004 to 18% in 2006, while the proportion between the ages of 65 and 74 changed from 21% to 27%. This shift may be a preliminary indication that the age at which osteoporosis is recognized in females is lowering.

Males aged 45 or over received a diagnosis of primary osteoporosis at a slightly younger mean age of 71.7 years. A higher proportion of males (24%) than females (18%) between the ages of 45 and 64 had a diagnosis of osteoporosis. (Table 5.5)

Low energy fractures also occur more frequently in the elderly, particularly among females. Among female patients 45 years of age and older and treated for a hip fracture, 67% treated in an inpatient setting and 85% treated in an emergency department were aged 75 years or older. However, wrist fractures treated in emergency departments were more commonly seen in younger women between the ages of 45 and 64 (48%). Among females aged 45 to 64, 24% of all low energy fractures treated in an inpatient setting were this age, while 35% seen in an emergency department were females of this age. (Graph 5.2.4)

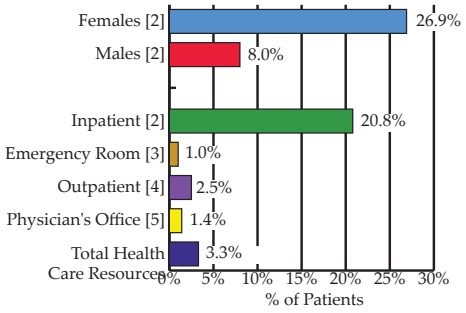
With the exception of hip fractures, males aged 45 and over are more likely to have a low energy fracture at a younger age than are women. This could be due to exposure to more physical activity or settings in which low energy impacts more frequently occur. Overall, 39% of low energy fractures treated in an inpatient setting and 53% treated in emergency departments were males aged 45 to 64 in 2006. (Graph 5.2.4)

Graph 5.2.4: Low Energy Fracture [1] Treatment for Persons Aged 45 and Over by Age, Gender, and Site, United States, 2006/2007



[1] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).
[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency Room, 2006

Graph 5.2.5: Proportion of Low Energy Fracture [1] **Patients Aged 45 and Over with a Diagnosis of Osteoporosis by Health Care Resource and Gender, United States 2006/2007**



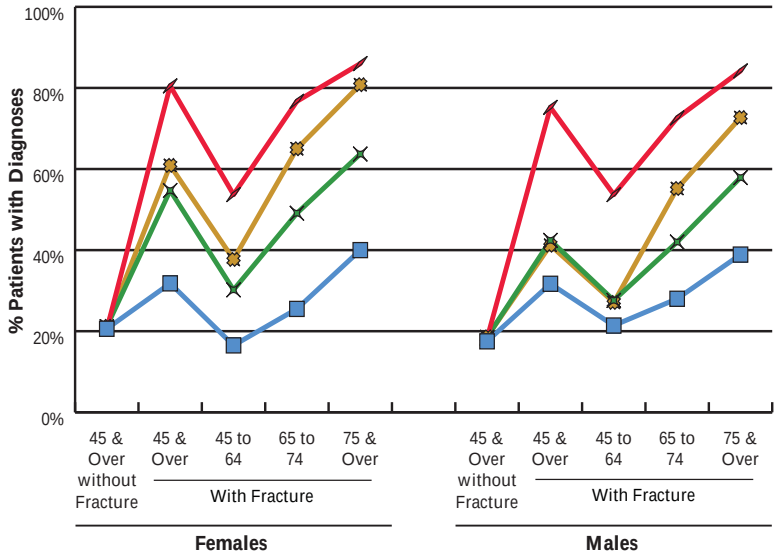
[1] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).
[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006
[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient Centers, 2006
[5] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

In 2006, the proportion of low energy fractures in persons aged 45 and over who also are diagnosed with osteoporosis as a potential contributing cause was very low. Among all patients aged 45 and older with a low energy fracture seen in a physician's office, an emergency room, or an outpatient setting in 2004, fewer than 2% were also diagnosed with osteoporosis. Even in an inpatient setting, only 20.8% of low energy fracture patients also had an osteoporosis diagnosis, an indication that osteoporosis is under-diagnosed even when patients are admitted to a hospital. Females with a low energy fracture were three times as likely as males with a fracture to be diagnosed with osteoporosis. The failure to recognize osteoporosis as a possible contributing cause of the fracture increases the possibility of future fractures in this already at risk population. (Tables 5.4 and 5.5 and Graph 5.2.5)

Section 5.2.3: Short/Long-Term Care for Low Energy Fracture Patients

Regardless of the age at which a low energy fracture occurs, both females and males are more likely to be transferred to a short, intermediate, or long-term skilled nursing care setting upon their release from inpatient care than are persons without a fracture. The older the patient, the greater the likelihood that such a transfer will be necessary. Among non-fracture female patients aged 45 and over, approximately 23% were released to additional care settings in 2006, while 36% of non-fracture patients aged 75 and over were released to another care setting. By contrast, among all female hip fracture patients, the proportions are 83% for all patients and 86% those aged 75 and over. Even female patients with a wrist fracture are more likely to be released to additional care, with 45% of all patients aged 45 and over with this type of fracture going to another care setting, and 60% of those aged 75 and over doing so. The rates for males with a low energy

Graph 5.2.6: Hospital Discharge to Short/Intermediate/Skilled Nursing Care for Persons Aged 45 and Over by Age and Sex for Persons with Osteoporosis, Low Energy Fractures [1]**, and without a Fracture, United States, 2007**



[1] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

fracture released to an additional care setting are slightly lower, but still substantially higher than for patients with no fracture. (Table 5.7 and Graph 5.2.6) The cost of additional care for patients with low energy fractures has not been quantified due to lack of available data.

Section 5.2.4: Nursing Home Population and Risks of the Fragile Elderly

After an elderly person has sustained a fall resulting in fracture, his or her ability to live independently is reduced due to pain and limitations in activity. These patients are also at risk of additional falls and consequent fractures. These patients require additional care and resources. Among persons in the nursing home population in 2004, 7,640 (< 1% of total admissions) were diagnosed with osteoporosis at the time of their admission; the majority were aged 75 and older. (Table 5.8) A substantially larger number, more than 118,000 (8% of admissions), had sustained a low energy fracture at the time of admission, most likely due to osteoporosis and fragile bones. Females accounted for more than 82% of the nursing home admittances due to fracture; 92% of the nursing home admittances were aged 75 years of age or older at the time of the fracture. Hip fractures are the most common type of fracture that places older persons in a nursing home, accounting for 44% of admittances due to fracture. However, pelvic, upper and lower limb, ankle or foot, and stress fractures are also a common cause of placement in a nursing home for persons aged 75 and older.

At the time of interview in 2004, nearly 40,200 nursing home residents aged 65 and older had sustained a new fracture since being admitted. The majority of these were females (74%); more than one-half (58%) were 85 years of age or older. Nearly 522,000 nursing home residents aged 65 and older, or two in five, reported a fall within the past 6 months. Of those falling, 2%, or 27,600, sustained a hip fracture within the past 6 months, and 33,900 (3%) another type of fracture.

As the number of U.S. persons over the age of 75 increases in the next few decades, the burden placed on nursing home care due to fragile bones will increase. Reducing the incidence and severity of osteoporosis will be critical to maintaining the health of the aging population, as well as reducing health care costs.

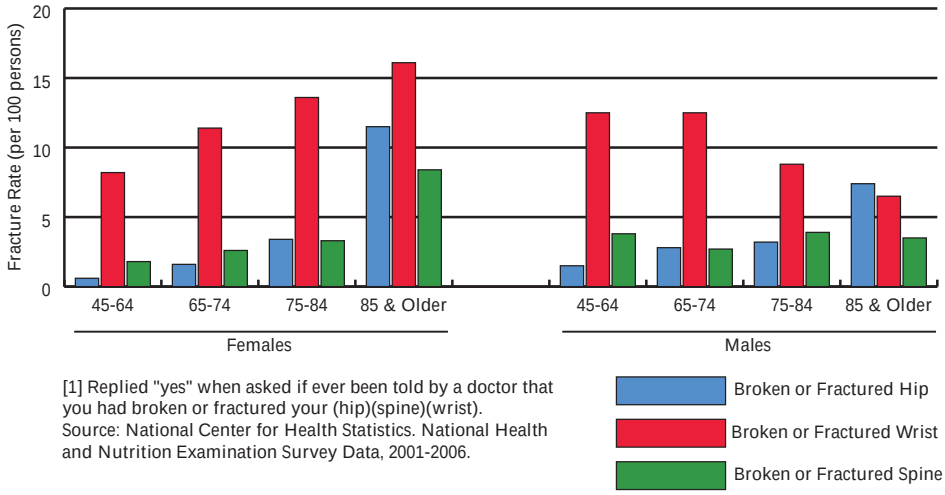
Section 5.3: Falls and Low Energy Fractures

Falls are the leading cause of injury, including mortality and non-fatal injuries, for persons aged 65 and older in the United States and a leading cause of hospitalization among persons of all ages. In 2000, falls accounted for 46% of all hospitalizations from injuries; 309 out of every 100,000 persons suffering a fall were hospitalized.[7] In 2002, 12% of unintentional injury deaths resulted from falls and 1.6 million nonfatal injuries from falls were treated at hospital emergency departments throughout the United States.[8]

Fractures are the primary cause of hospitalization or death following a fall, particularly among individuals aged 65 and over. Osteoporosis is a leading underlying cause of low energy fractures after a fall, especially among the elderly. One in two women and one in four men over aged 50 will have an osteoporosis-related fracture in her or his remaining lifetime.[9]

Self-reported fracture rates for hip, wrist, and spine, from 2001 to 2006, indicate an increasing rate of fracture among females as the population ages, particularly among individuals aged 85 and older. Among males, relatively stable rates of spine fracture occurred between the ages of 45 and older, while wrist fracture rates decreased with age and hip fracture rates increased. (Table 5.9 and Graph 5.3.1) Overall, 12% of fractures reported for persons aged 45 and over were hip fractures; 19% were spine fractures; and 69% were wrist fractures.

Graph 5.3.1: Self-Reported Fracture Rate [1] for Select Fractures by Sex and Age, United States 2001-2006



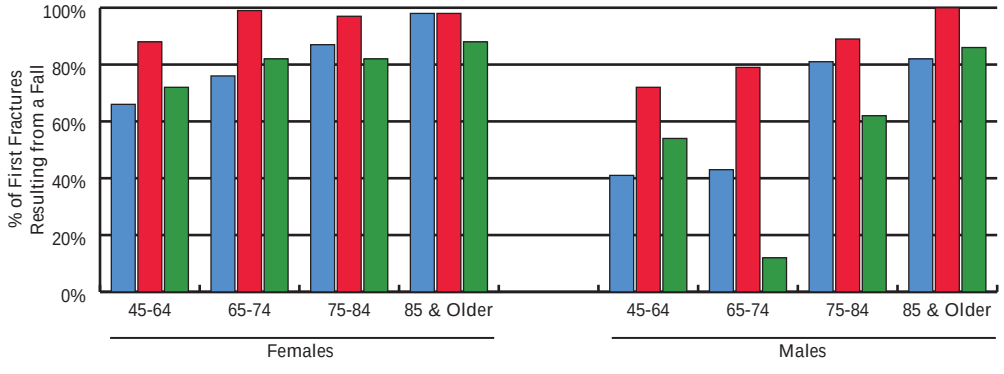
[1] Replied "yes" when asked if ever been told by a doctor that you had broken or fractured your (hip)(spine)(wrist).
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006.

Hip fractures significantly impact quality of life, and are invariably associated with chronic pain, reduced mobility, disability, and an increasing degree of dependence.[10] The mortality rate in the first 12 months after hip fracture is 20%, and is higher in males than females.[9] Some studies suggest that mortality may be higher, with a 30% rate following hip fracture surgery noted.[11] Current estimates are that one in four hip fractures occur in males, and recent research indicates that men will have a different course of recovery than women, with higher rates of disability as well as mortality.[12,13] Fifty percent of persons experiencing a hip fracture will be unable to walk without assistance, and 25% will require long term care.[14]

There is no generally accepted definition of a spine fracture, also referred to as compression fractures, resulting in a wide variation of overall prevalence estimates.[15] Only about one in four spinal fractures are diagnosed as a result of falls. The most widely accepted definition of suspected spine fractures in use today is a 20% loss of height from early adulthood, hence compressing the vertebral column. Since many of these fractures occur without acute symptoms and patients are rarely admitted to the hospital, it is easier to obtain prevalence than incidence. Often they are diagnosed when the patient complains of chronic back pain as the result of compression or stress on the weakened spine.[4] Even without acute symptoms, vertebral compression fractures can impact significantly on quality of life, affecting the ability to walk, balance, and sometimes cause upper back, neck or abdominal pain. The presence of existing vertebral fractures are generally considered a predictor for future fracture risk of the spine, wrist and hip.

Among all females aged 45 and over, falls were responsible for nearly all wrist fractures, as well as for the majority of hip fractures, treated between 2001 and 2006. Males follow a similar pattern, although falls account for a slightly lower proportion of fractures among men. In 2001 to

Graph 5.3.2: Proportion of Self-Reported First Fractures Resulting from a Fall [1] for Select Fractures by Sex and Age, United States 2001-2006

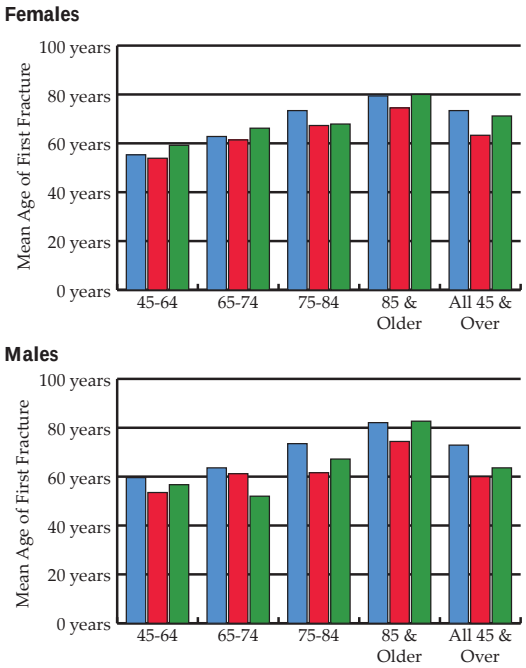


[1] Replied "yes" when asked if ever been told by a doctor that you had broken or fractured your (hip)(spine)(wrist) with self-reported cause as a "fall/tripped/slipped/fell out of bed" or "hard fall off ladder/stool/downstairs.".
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006.

2006, three-fourths of spine fractures were caused by falls; other causes, including automobile accidents, accounted for the remainder. The older the patient, the more likely that a fall is the cause of a fracture. (Table 5.9 and Graph 5.3.2)

In 2001-2006, the mean age at time of first fracture of the wrist caused by a fall for all females aged 45 and over reporting a wrist fracture was 63.3 years. The mean age at first fracture of the spine was 71.2 years; for first hip fracture it was 73.4 years. Wrist fractures are more common among younger females, but the rate for all types of fracture increase significantly among females aged 85 and older. Among males aged 45 and older, the mean age of first wrist fracture was 60.0 years, reflecting a slightly increasing rate of wrist fracture as males age. The mean age of first hip fracture among males, at 72.9 years, was only a few months younger than females, unlike in the previous study when a difference of nearly 5 years was observed. Spine fractures due to a fall also occur at a younger age, 63.6 years, among males. As the population ages, the age at which they report their first fracture also rises. (Table 5.9 and Graph 5.3.3)

Graph 5.3.3: Mean Age of Self-Reported First Fractures When Cause is a Fall [1] for Select fractures by Sex and Age, United States 2001-2006



[1] Self-reported age at time of first fracture and reported cause of fracture was "fall/tripped/slipped/fell out of bed" or "hard fall off ladder/stool/downstairs.".
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006.

The mean number of lifetime fractures of all sites reported by all persons in the NHANES for the years 2001 to 2006 was slightly over one; however, some persons reported multiple fractures of two lifetime hip fractures, up to six lifetime wrist fractures, and up to ten lifetime spine fractures.[16]

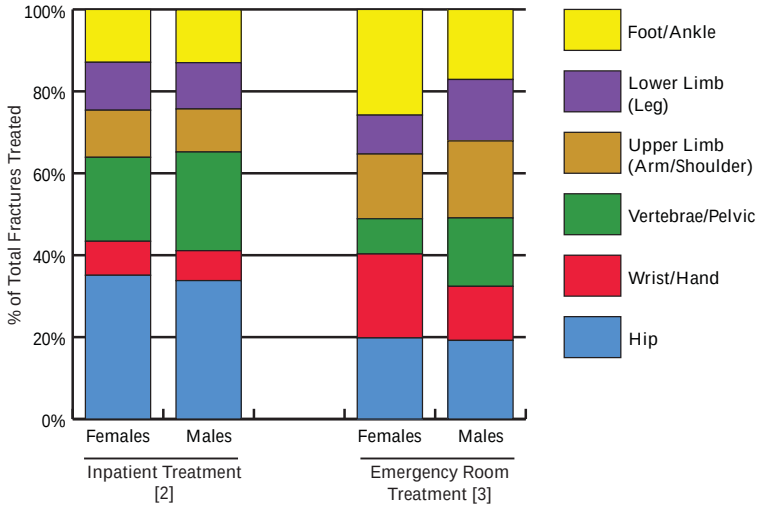
Section 5.3.1: Inpatient Treatment for Low Energy Fractures, 2004

In 2007, slightly more than 677,000 persons over age 45 were discharged from the hospital after sustaining a low energy fracture. More than one-third of the inpatient fractures were hip fractures, evenly distributed between females and males. Vertebrae/ pelvic fractures comprised about one-fifth (20% and 24% for females and males, respectively). The remaining fracture sites accounted for 13% or less of all fractures treated in inpatient facilities. In 2006, nearly 1.2 million fractures to persons aged 45 and older were treated in emergency rooms. Low energy fractures among females were spread among all sites, with fractures of the foot/ankle accounting for the largest share (26%). Among males, fracture sites were even more evenly distributed. The wrist/hand accounted for the lowest share of low energy fractures in males (13%).This was followed by fractures of the foot and ankle and upper limb (arm/shoulder) fractures. (Table 5.10 and Graph 5.3.4)

Section 5.4: Cost and Burden of Osteoporosis and Low Energy Fractures, 2004

The mean length of inpatient stay for persons aged 45 and older with a diagnosis of osteoporosis (but not a fracture) in 2007 was 5.0 days, about one-half day shorter than the mean stay of 5.3 days

Graph 5.3.4: Proportion of Fracture Treatment [1] for Persons Aged 45 and Over by Anatomic Site and Treatment Location, United States, 2006/2007



[1] Osteoporosis and related condition ICD-9-CM codes shown in the Section 5.4
[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency Room, 2006

for patients without an osteoporosis diagnosis. Osteoporosis patients with a low energy fracture were hospitalized only 0.1 day longer than those with no fracture or osteoporosis diagnosis.

The mean cost per inpatient stay for persons aged 45 and older with an osteoporosis diagnosis in 2007 was $28,549, which was 13% less than that of patients with similar demographics but without an osteoporosis diagnosis. The estimated cost in 2007 of treating patients aged 45 and older who were hospitalized and had a diagnosis of osteoporosis was $22.9 billion. (Table 5.11) It is unlikely the osteoporosis diagnosis was the primary diagnosis for which the patients were hospitalized.

The mean length of inpatient stay for persons aged 45 and older with a low energy fracture in 2007 was 6.1 days, or 17% longer than the mean stay of 5.2 days for patients without a fracture injury. The mean cost per inpatient stay for persons aged 45 and older with a low energy fracture in 2007 was $37,982, a cost that was 13% greater than that of patients with similar demographics but without a fracture. The estimated cost in 2007 of treating low energy fractures in patients aged 45 and older who were hospitalized as a result of the fracture was $25.8 billion. (Table 5.11)

The burden of osteoporosis is already high, and it is growing. The costs associated with this disease are also increasing in both men and women and in all ethnic groups. These data provide strong support for the initiation of society-wide prevention measures, including early and regular screening for bone health, as well as for greater emphasis on the diagnosis of individuals at risk for osteoporosis and identification of new strategies to improve treatment and treatment adherence in high risk groups.

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16. National Center for Health Statistics (NCHS): *National Health and Nutrition Examination Survey 2003-2004: Documentation*, *Codebook*, *and Frequencies*. Hyattsville, MD: Centers for Disease Control, 2006, p 34.

Section 5.5: Osteoporosis and Bone Health Data Tables

For purposes of this study, osteoporosis has been categorized into the three classifications. Primary osteoporosis is a diagnosis of osteoporosis. Low energy fracture is one caused by an event such as a fall from a standing height. (A high energy fracture, by contrast, is caused by involvement in a motor vehicle accident.) Secondary osteoporosis is the presence of another condition or treatment that may cause eroding of bone health and osteoporosis. Codes included in these three osteoporosis categories are as shown in Table 5.1.

Table 5.1: Osteoporosis and Bone Health: Analysis Codes

OSTEOPOROSIS

CODE	ICD-9-CM CODE DESCRIPTION
73300	Osteoporosis NOS
73301	Senile Osteoporosis
73302	Idiopathic Osteoporosis
73303	Disuse Osteoporosis
73309	Osteoporosis NEC

LOW ENERGY FRACTURES

Vertebral and Pelvic Fractures

CODE	ICD-9-CM CODE DESCRIPTION
80500	Vertebral Fracture (Closed)
80501	Vertebral Fracture (Closed)
80502	Vertebral Fracture (Closed)
80503	Vertebral Fracture (Closed)
80504	Vertebral Fracture (Closed)
80505	Vertebral Fracture (Closed)
80506	Vertebral Fracture (Closed)
80507	Vertebral Fracture (Closed)
80508	Vertebral Fracture (Closed)
80520	Vertebral Fracture (Closed)-Thoracic
80540	Vertebral Fracture (Closed)-Lumbar
80560	Pelvic Fracture (Closed)-Sacrum and Coccyx
80580	Vertebral Fracture (Closed)-Unspecified
80800	Pelvic Fracture (Closed)-Acetabulum
80820	Pelvic Fracture (Closed)-Pubis
80841	Pelvic Fracture (Closed)-Ilium
80842	Pelvic Fracture (Closed)-Ischium
80843	Pelvic Fracture (Closed)-Multiple
80849	Pelvic Fracture (Closed)-Other
80880	Pelvic Fracture (Closed)-Uunspecified

Upper Limb Fracture (Shoulder and Arm)

CODE	ICD-9-CM CODE DESCRIPTION
81000	Upper limb Fracture (Closed)-Clavicle (Shoulder)
81001	Upper limb Fracture (Closed)-Clavicle (Shoulder)
81002	Upper limb Fracture (Closed)-Clavicle (Shoulder)
81003	Upper limb Fracture (Closed)-Clavicle (Shoulder)
81100	Upper limb Fracture (Closed)-Scapula (Shoulder)
81101	Upper limb Fracture (Closed)-Scapula (Shoulder)
81102	Upper limb Fracture (Closed)-Scapula (Shoulder)
81103	Upper limb Fracture (Closed)-Scapula (Shoulder)
81109	Upper limb Fracture (Closed)-Scapula (Shoulder)
81200	Upper limb Fracture (Closed)-Humerus Upper End
81201	Upper limb Fracture (Closed)-Humerus Upper End
81202	Upper limb Fracture (Closed)-Humerus Upper End
81203	Upper limb Fracture (Closed)-Humerus Upper End
81209	Upper limb Fracture (Closed)-Humerus Upper End
81220	Upper limb Fracture (Closed)-Humerus Upper End
81221	Upper limb Fracture (Closed)-Humerus Upper End
81240	Upper limb Fracture (Closed)-Humerus Upper End
81241	Upper limb Fracture (Closed)-Humerus Upper End
81242	Upper limb Fracture (Closed)-Humerus Upper End
81243	Upper limb Fracture (Closed)-Humerus Upper End
81244	Upper limb Fracture (Closed)-Humerus Upper End
81249	Upper limb Fracture (Closed)-Humerus Upper End

Wrist and Hand Fracture

CODE	ICD-9-CM CODE DESCRIPTION
81300	Wrist Fracture (Closed)-Radius and Ulna Upper End
81301	Wrist Fracture (Closed)-Radius and Ulna Upper End
81302	Wrist Fracture (Closed)-Radius and Ulna Upper End
81303	Wrist Fracture (Closed)-Radius and Ulna Upper End
81304	Wrist Fracture (Closed)-Radius and Ulna Upper End
81305	Wrist Fracture (Closed)-Radius and Ulna Upper End
81306	Wrist Fracture (Closed)-Radius and Ulna Upper End
81307	Wrist Fracture (Closed)-Radius and Ulna Upper End
81308	Wrist Fracture (Closed)-Radius and Ulna Upper End
81320	Wrist/forearm Fracture (Closed)-Radius and Ulna Shaft
81321	Wrist/forearm Fracture (Closed)-Radius and Ulna Shaft
81322	Wrist/forearm Fracture (Closed)-Radius and Ulna Shaft
81323	Wrist/forearm Fracture (Closed)-Radius and Ulna Shaft
81340	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81341	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81342	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81343	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81344	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81345	Wrist/forearm Fracture (Closed)-Radius and Ulna Lower End
81380	Wrist/forearm Fracture (Closed)-Radius and Ulna Unspecified
81381	Wrist/forearm Fracture (Closed)-Radius and Ulna Unspecified
81382	Wrist/forearm Fracture (Closed)-Radius and Ulna Unspecified
81383	Wrist/forearm Fracture (Closed)-Radius and Ulna Unspecified
81400	Wrist Fracture (Closed)-Carpal Bones
81401	Wrist Fracture (Closed)-Carpal Bones
81402	Wrist Fracture (Closed)-Carpal Bones
81403	Wrist Fracture (Closed)-Carpal Bones
81404	Wrist Fracture (Closed)-Carpal Bones
81405	Wrist Fracture (Closed)-Carpal Bones
81406	Wrist Fracture (Closed)-Carpal Bones
81407	Wrist Fracture (Closed)-Carpal Bones
81408	Wrist Fracture (Closed)-Carpal Bones
81409	Wrist Fracture (Closed)-Carpal Bones
81500	Hand Fracture (Closed)-Metacarpal Bones
81501	Hand Fracture (Closed)-Metacarpal Bones
81502	Hand Fracture (Closed)-Metacarpal Bones
81503	Hand Fracture (Closed)-Metacarpal Bones
81504	Hand Fracture (Closed)-Metacarpal Bones
81509	Hand Fracture (Closed)-Metacarpal Bones

Table 5.1 continued next page.

Table 5.1: Osteoporosis and Bone Health: Analysis Codes (continued)

CODE	ICD-9-CM CODE DESCRIPTION
Ankle and Foot Fracture	
82400	Ankle Fracture (Closed)-Medial Malleolus
82420	Ankle Fracture (Closed)-Lateral Malleolus
82440	Ankle Fracture (Closed)-Bimalleolar
82460	Ankle Fracture (Closed)-Trimalleolar
82480	Ankle Fracture (Closed)-Unspecified
82500	Foot Fracture (Closed)- Calcaneus
82520	Foot Fracture (Closed)-Unspecified (Instep)
82521	Foot Fracture (Closed)-Astragalus
82522	Foot Fracture (Closed)-Navicular (Scaphoid)
82523	Foot Fracture (Closed)-Cuboid
82524	Foot Fracture (Closed)-Cuneiform
82525	Foot Fracture (Closed)-Metatarsal Bone(s)
82529	Foot Fracture (Closed)-Other (Tarsal with Metatarsal)
Stress and Pathological Fractures	
73310	Unspecified Pathological Fracture
73311	Pathological Fracture-Humerus
73312	Pathological Fracture-Wrist
73313	Pathological Fracture-Vertebrae
73314	Pathological Fracture-Femur Neck
73315	Pathological Fracture-Other Femur
73316	Pathological Fracture-Tibia/Fibula
73319	Other Specified Pathological Fracture
73393	Stress Fracture of Tibia or Fibula
73394	Stress Fracture of the Metatarsals
73395	Stress Fracture of Other Bone
Exclude all cases with E-code of:	
E800-E807	Railway
E810-E819	Motor Vehicle Traffic
E820-E825	Motor Vehicle Nontraffic
E826-E829	Other Road Vehicles
E830-E838	Water
E840-E845	Air and Space
E846-E848	Other Vehicle Accidents Not Elsewhere Clssified
E990-E999	Operations of War

CODE	ICD-9-CM CODE DESCRIPTION
Hip Fracture	
82000	Hip Fracture (Closed)-Neck of Femur
82001	Hip Fracture (Closed)-Neck of Femur
82002	Hip Fracture (Closed)-Neck of Femur
82003	Hip Fracture (Closed)-Neck of Femur
82009	Hip Fracture (Closed)-Neck of Femur
82020	Hip Fracture (Closed)-Neck of Femur
82021	Hip Fracture (Closed)-Neck of Femur
82022	Hip Fracture (Closed)-Neck of Femur
82080	Hip Fracture (Closed)-Neck of Femur
Lower Limb, excluding foot and ankle	
82100	Lower limb fracture (Closed Only)-Thigh/Upper Leg
82101	Lower limb fracture (Closed Only)-Thigh/Upper Leg
82120	Lower limb Fracture (Closed)-Lower End Femur Unspecified
82121	Lower limb Fracture (Closed)-Lower End Femur Condoyle
82122	Lower limb Fracture (Closed)-Lower End Femur Eepiphysis
82123	Lower limb Fracture (Closed)-Lower End Femur Supracondylar
82129	Lower limb Fracture (Closed)-Lower End Femur Multiple Fractures
82200	Lower limb fracture (Closed Only)-Patella
82300	Lower limb fracture (Closed Only)-Tibia and Fibula
82301	Lower limb fracture (Closed Only)-Tibia and Fibula
82302	Lower limb fracture (Closed Only)-Tibia and Fibula
82320	Lower limb fracture (Closed Only)-Tibia and Fibula Shaft
82321	Lower limb fracture (Closed Only)-Tibia and Fibula Shaft
82322	Lower limb fracture (Closed Only)-Tibia and Fibula Shaft
82380	Lower limb fracture (Closed Only)-Tibia and Fibula Unspecified
82381	Lower limb fracture (Closed Only)-Tibia and Fibula Unspecified
82382	Lower limb fracture (Closed Only)-Tibia and Fibula Unspecified

Table 5.1 continued next page.

Table 5.1: Osteoporosis and Bone Health: Analysis Codes (continued)

SECONDARY OSTEOPOROSIS

Diagnosis That May Lead to Osteoporosis

CODE	ICD-9-CM CODE DESCRIPTION
24290	Thyrotox NOS-No Crisis
24291	Thyrotox NOS-with Crisis
25200	Hyperparathyroidism NOS
25201	Primary Hyperparathyroid
25202	Secondary Hyperparathyroid-Nonrenal
25208	Hyperparathyroidism NEC
25500	Cushing's Syndrome
25530	Corticoadren Overact NEC
25620	Postablativ Ovarian Failure
25631	Premature Menopause
25639	Other Ovarian Failure
25710	Postblat Testic Hypofun
25720	Testicular Hypofunction NEC
25930	Ectopic Hormone Secondary NEC
25990	Endocrine Disorder NOS
26820	Osteomalacia NOS
26890	Vitamin D Deficiency NOS
58800	Renal Osteodystrophy
58881	Secondary Hyperparathyroid-Renal
62720	Female Climacteric State
62740	Artificial Menopause States
62780	Menopausal Disorder NEC
62790	Menopausal Disorder NOS

Vertebral Fractures with Spinal Cord Injury

CODE	ICD-9-CM CODE DESCRIPTION
80600	C1-C4 Fracture-Closed/Cord Injury NOS
80601	C1-C4 Fracture-Closed/Complete Lesion of Cord
80602	C1-C4 Fracture-Closed/Anterior Cord Syndrome
80603	C1-C4 Fracture-Closed/Central Cord Syndrome
80604	C1-C4 Fracture-Closed/Cord Injury NEC
80605	C5-C7 Fracture-Closed/Cord Injury NOS
80606	C5-C7 Fracture-Closed/Complete Lesion of Cord
80607	C5-C7 Fracture-Closed/Anterior Cord Syndrome
80608	C5-C7 Fracture-Closed/Central Cord Syndrome
80609	C5-C7 Fracture-Closed/Cord Injury NEC
80610	C1-C4 Fracture-Open/Cord Injury NOS
80611	C1-C4 Fracture-Open/Complete Lesion of Cord
80612	C1-C4 Fracture-Open/Anterior Cord Syndrome
80613	C1-C4 Fracture-Open/Central Cord Syndrome
80614	C1-C4 Fracture-Open/Cord Injury NEC
80615	C5-C7 Fracture-Open/Cord Injury NOS
80616	C5-C7 Fracture-Open/Complete Lesion of Cord
80617	C5-C7 Fracture-Open/Anterior Cord Syndrome
80618	C5-C7 Fracture-Open/Central Cord Syndrome
80619	C5-C7 Fracture-Open/Cord Injury NEC
80620	T1-T6 Fracture-Closed/Cord Injury NOS
80621	T1-T6 Fracture-Closed/Complete Lesion of Cord
80622	T1-T6 Fracture-Closed/Anterior Cord Syndrome
80623	T1-T6 Fracture-Closed/Central Cord Syndrome
80624	T1-T6 Fracture-Closed/Cord Injury NEC
80625	T7-T12 Fracture-Closed/Cord Injury NOS
80626	T7-T12 Fracture-Closed/Complete Lesion of Cord
80627	T7-T12 Fracture-Closed/Anterior Cord Syndrome
80628	T7-T12 Fracture-Closed/Central Cord Syndrome
80629	T7-T12 Fracture-Closed/Cord Injury NEC
80630	T1-T6 Fracture-Open/Cord Injury NOS
80631	T1-T6 Fracture-Open/Complete Lesion of Cord
80632	T1-T6 Fracture-Open/Anterior Cord Syndrome
80633	T1-T6 Fracture-Open/Central Cord Syndrome
80634	T1-T6 Fracture-Open/Cord Injury NEC
80635	T7-T12 Fracture-Open/Cord Injury NOS
80636	T7-T12 Fracture-Open/Complete Lesion of Cord
80637	T7-T12 Fracture-Open/Anterior Cord Syndrome
80638	T7-T12 Fracture-Open/Central Cord Syndrome
80639	T7-T12 Fracture-Open/Cord Injury NEC
80640	Closed Lumbar Fracture with Cord Injury
80650	Open Lumbar Fracture with Cord Injury
80660	Fracture Sacrum-Closed/Cord Injury NOS
80661	Fracture Sacrum-Closed/Cauda Equina Lesion
80662	Fracture Sacrum-Closed/Cauda Injury NEC
80669	Fracture Sacrum-Closed/Cord Injury NEC
80670	Fracture Sacrum-Closed/Cord Injury NOS
80671	Fracture Sacrum-Closed/Cauda Equina Lesion
80672	Fracture Sacrum-Closed/Cauda Injury NEC
80679	Fracture Sacrum-Open/Cord Injury NEC
80680	Vertebrae Fracture NOS-Closed with Cord Injury
80690	Vertebrae Fracture NOS-Open with Cord Injury

Table 5.2: Self-Reported Rate of Osteoporosis and Hip Fracture for Persons Aged 65 and Over, United States 1988-1994 and 2001-2006

	Prevalence (Rate per 100 Persons)					
	Osteoporosis [1]		Hip Fracture [2]		Either Condition	
	1988-1994 [3]	2001-2006 [4]	1988-1994 [3]	2001-2006 [4]	1988-1994 [3]	2001-2006 [4]
Females						
65 to 74 Years	10.9	25.0	4.5	1.6	14.2	26.0
75 to 84 Years	12.1	33.0	7.3	3.4	17.7	34.2
85 Years & Over	9.7	29.6	11.8	11.5	19.1	34.6
All Females 65 Years & Over	11.1	28.4	6.1	3.6	15.8	30.0
Males						
65 to 74 Years	1.3	3.1	2.1	2.8	3.3	5.7
75 to 84 Years	1.3	6.9	2.4	3.2	3.0	9.6
85 Years & Over	1.6	5.3	4.1	7.4	5.4	10.9
All Males 65 Years & Over	1.3	4.5	2.3	3.3	3.5	7.5
Total						
65 to 74 Years	6.7	15.0	3.4	2.2	10.0	16.8
75 to 84 Years	8.0	22.2	5.4	3.3	13.4	24.1
85 Years & Over	7.0	21.7	9.4	10.2	16.4	26.9
All Persons 65 Years & Over	7.0	18.3	4.5	3.5	10.7	20.5

[1] Has a doctor ever told you that you had osteoporosis, sometimes called thin or brittle bones?

[2] Has a doctor ever told you that you had broken or fractured your hip?

[3] Source: Praemer A, Furner S, Rice DP. *Musculoskeletal Conditions in the United States* . Rosemont, IL. 1999, American Academy of Orthopaedic Surgeons.

[4] Source: National Center for Health Statistics, National Health and Nutrition Examination Survey Data, 12001-2006

Table 5.3: Self-Reported Prevalence of Osteoporosis, Osteoporosis Treatment or Related Fracture [1] for Persons Aged 45 and Over, United State, 2001-2006

	Prevalence (in 000s)			Occurrence by Sex		Distribution by Age		Prevalence Rate (% of population within age group)		
Age Group	Females	Males	Total Population	Females	Males	Females	Males	Females	Males	Total Population
Ever been told had osteoporosis?										
45-64	3,073	653	3,726	82.5%	17.5%	35.6%	50.0%	8.9%	2.0%	5.5%
65-74	2,507	256	2,763	90.7%	9.3%	29.1%	19.6%	25.0%	3.1%	15.0%
75-84	2,264	330	2,594	87.3%	12.7%	26.2%	25.3%	33.0%	6.9%	22.2%
85+	780	67	847	92.1%	7.9%	9.0%	5.1%	29.6%	5.3%	21.7%
Total Aged 45 & Over	8,623	1,306	9,929	86.8%	13.2%	100.0%	100.0%	15.9%	2.7%	9.7%
Ever been treated for osteoporosis? (if responded "Yes" to osteoporosis)								Proportion w/Osteoporosis Treated		
45-64	2,075	384	2,459	84.4%	15.6%	32.4%	45.6%	67.5%	58.7%	66.0%
65-74	1,904	154	2,057	92.5%	7.5%	29.7%	18.3%	76.6%	59.9%	75.0%
75-84	1,844	274	2,118	87.1%	12.9%	28.7%	32.6%	81.5%	83.0%	81.7%
85+	592	30	622	95.2%	4.8%	9.2%	3.5%	75.9%	44.6%	73.4%
Total Aged 45 & Over	6,414	841	7,255	88.4%	11.6%	100.0%	100.0%	74.6%	64.4%	73.2%
Ever been told had broken or fractured your hip?								Prevalence Rate		
45-64	208	499	706	29.4%	70.6%	22.9%	50.8%	0.6%	1.5%	1.0%
65-74	162	233	396	41.1%	58.9%	17.9%	23.8%	1.6%	2.8%	2.2%
75-84	235	156	390	60.1%	39.9%	25.8%	15.9%	3.4%	3.2%	3.3%
85+	304	94	397	76.5%	23.5%	33.4%	9.5%	11.5%	7.4%	10.2%
Total Aged 45 & Over	909	981	1,889	48.1%	51.9%	100.0%	100.0%	1.7%	2.1%	1.9%
Ever been told had broken or fractured your spine?								Prevalence Rate		
45-64	625	1,255	1,881	33.2%	66.8%	47.0%	73.3%	1.8%	3.8%	2.8%
65-74	256	224	480	53.3%	46.7%	19.3%	13.1%	2.6%	2.7%	2.6%
75-84	226	188	415	54.6%	45.4%	17.0%	11.0%	3.3%	3.9%	3.5%
85+	221	44	265	83.5%	16.5%	16.7%	2.5%	8.4%	3.5%	6.8%
Total Aged 45 & Over	1,329	1,712	3,040	43.7%	56.3%	100.0%	100.0%	2.5%	3.6%	3.0%
Ever been told had broken or fractured your wrist?								Prevalence Rate		
45-64	2,827	4,178	7,005	40.4%	59.6%	53.1%	72.9%	8.2%	12.5%	10.3%
65-74	1,139	1,044	2,183	52.2%	47.8%	21.4%	18.2%	11.4%	12.5%	11.9%
75-84	931	426	1,357	68.6%	31.4%	17.5%	7.4%	13.6%	8.8%	11.6%
85+	424	82	506	83.8%	16.3%	8.0%	1.4%	16.1%	6.5%	13.0%
Total Aged 45 & Over	5,320	5,731	11,051	48.1%	51.9%	100.0%	100.0%	9.8%	12.0%	10.8%
Ever been told had osteoporosis, been treated for osteoporosis, or had broken or fractured hip, spine or wrist?								Prevalence Rate		
45-64	6,125	5,854	11,979	51.1%	48.9%	44.8%	68.3%	17.7%	17.5%	17.6%
65-74	3,360	1,553	4,193	80.1%	37.0%	24.6%	18.1%	33.5%	18.6%	26.7%
75-84	2,956	910	3,867	76.5%	23.5%	21.6%	10.6%	43.1%	18.9%	33.1%
85+	1,237	256	1,493	82.9%	17.1%	9.0%	3.0%	47.0%	20.3%	38.3%
Total Aged 45 & Over	13,678	8,573	22,251	61.5%	38.5%	100.0%	100.0%	25.2%	17.9%	21.8%

[1] Replied "Yes" when asked if ever been told by a doctor that you had osteoporosis, been treated for osteoporosis, or had broken or fractured your (hip)(spine)(wrist).

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006

Table 5.4: Health Care Visits for Osteoporosis and Related Conditions [1] for Persons Aged 45 and Older by Site, United States 2006/2007

	Visits (in 000s)				
	Inpatient Hospitalization [4]	Physician Visits [5]	Emergency Room Encounters [6]	Outpatient Visits [7]	Total All Health Care Resources
Primary Osteoporosis or Low Bone Der	802.4	4,413.6	*	204.4	5,442.2
% of Total Osteoporosis Visits	14.7%	81.1%	0.7%	3.8%	
Low Energy Fracture [2]					
Hip	205.8	*	232.1	*	772.5
Wrist/ Hand	47.3	*	213.7	125.1	1,855.9
Vertebrae/ Pelvic	128.8	*	133.5	*	756.0
Upper Limb (Arm/ Shoulder)	66.6	*	218.3	*	1,027.4
Lower Limb (Leg)	68.9	*	133.5	89.5	1,194.6
Foot/Ankle	76.7	*	270.8	102.9	1,254.2
All Low Energy Fractures	678.1	4,819.7	1,192.0	423.3	7,113.1
% of Total Low Energy Fracture Visits	9.5%	67.8%	16.8%	6.0%	
% of Low Energy Fracture Patients with Osteoporosis Diagonsis	20.8%	1.4%	1.0%	2.5%	3.3%
Osteoporosis & Low Energy Fracture Visits as Proportion of Total Visits	3.7%	1.0%	1.0%	0.6%	1.1%
Secondary Osteoporosis Diagnosis [3]					
Contributing Condition	212.0	4,880.6	*	300.7	5,436.0
Vertebral Fracture w/Spinal Cord Injury (resulting from low energy impact)	*	*	*	0.0	55.8

* Estimate does not meet standards for reliability.

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

[3] Diagnosis of another medical condition that may lead to or contribute to the development of osteoporosis.

[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[5] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[6] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency, 2006

[7] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Outpatient Centers, 2006

Table 5.5: Inpatient Resource Utilization for Osteoporosis and Related Conditions [1] for Persons Age 45 and Older by Age and Sex, United States 2007

Females	% by Age Group			Total Aged 45 & Older (in 000s)	Mean Age (in years)	Distribution by Gender		Total Inpatient Hospitalizations (in 000s)
	45-64	65-74	75 & Older			Females	Males	
Primary Osteoporosis	18.4%	26.7%	54.9%	712.8	73.4	89%	11%	802.4
Low Energy Fracture [2]								
Hip	12.3%	20.9%	66.9%	140.0	75.8	68%	32%	205.8
Wrist/ Hand	29.8%	23.9%	46.3%	33.0	70.6	70%	30%	47.3
Vertebrae/ Pelvic	17.3%	21.9%	60.8%	81.9	74.1	64%	36%	128.8
Upper Limb (Arm/ Shoulder)	25.4%	26.6%	48.1%	46.1	71.6	69%	31%	66.6
Lower Limb (Leg)	37.3%	24.6%	38.1%	46.7	68.6	68%	32%	68.9
Foot/Ankle	50.9%	23.7%	25.4%	51.4	64.8	67%	33%	76.7
All Low Energy Fractures	23.6%	23.2%	53.2%	459.3	72.4	68%	32%	678.1
Low Energy Fracture with Osteoporosis Diagnosis								
% Low Energy Fracture Patients with Osteoporosis Diagnosis	14.7%	26.4%	32.7%	20.8%		26.9%	8.0%	20.8%
Secondary Osteoporosis Diagnosis [3]								
Contributing Condition	46.6%	25.5%	27.9%	133.6	65.6	63%	37%	212.0
Vertebral Fracture w/Spinal Cord Injury	*	*	*	0.0	NA	35%	65%	*
Males								
Primary Osteoporosis	24.5%	25.5%	49.9%	89.5	71.7			
Low Energy Fracture [2]								
Hip	20.6%	22.5%	56.8%	65.6	73.2			
Wrist/ Hand	62.4%	18.0%	19.6%	14.1	61.4			
Vertebrae/ Pelvic	39.8%	21.3%	38.9%	46.8	67.8			
Upper Limb (Arm/ Shoulder)	45.9%	21.5%	32.6%	20.4	66.2			
Lower Limb (Leg)	62.3%	18.1%	19.7%	22.0	61.7			
Foot/Ankle	68.4%	17.7%	13.9%	25.0	59.9			
All Low Energy Fractures	38.9%	21.8%	39.4%	217.8	68.0			
Low Energy Fracture with Osteoporosis Diagnosis								
% Low Energy Fracture Patients with Osteoporosis Diagnosis	4.0%	7.9%	12.0%	8.0%				
Secondary Osteoporosis Diagnosis [3]								
Contributing Condition	50.0%	25.3%	24.7%	78.3	64.7			
Vertebral Fracture w/Spinal Cord Injury	*	*	*	0.0	NA			

* Does not meet standards of reliability.

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

[3] Diagnosis of another medical condition that may lead to or contribute to the development of osteoporosis.

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 5.6: Hospital Emergency Room Resource Utilization for Low Energy Fractures [1] for Persons Aged 45 and Older by Age and Sex, United States 2006

	% by Age Group			Total 45 & Older (in 000s)	Mean Age (in years)	Distribution by Gender		Total Emergency Room Treatments (in 000s)
FEMALES	45-64	65- 74	75 & Older			Females	Males	
Low Energy Fracture [2]								
Hip	12.7%	1.9%	85.4%	156.4	80.9	67%	33%	232.1
Wrist/Hand	47.5%	22.7%	29.8%	161.8	68.2	76%	24%	213.7
Vertebrae/Pelvic	13.3%	27.2%	59.6%	67.8	77.6	51%	49%	133.5
Upper Limb (Arm/ Shoulder)	37.7%	17.8%	44.5%	124.5	72.2	57%	43%	218.3
Lower Limb (Leg)	38.1%	20.9%	40.9%	74.6	69.7	56%	44%	133.5
Foot/Ankle	49.2%	31.3%	19.4%	203.6	63.6	75%	25%	270.8
All Low Energy Fractures	34.7%	18.5%	46.8%	809.0	71.7	68%	32%	1,192.0
% w/Osteoporosis Dx	0.0%	0.0%	3.1%	1.5%				
MALES								
Low Energy Fracture [2]								
Hip	19.8%	3.0%	77.3%	75.7	78.2			
Wrist/Hand	53.7%	40.4%	6.0%	52.0	61.6			
Vertebrae/Pelvic	42.5%	23.8%	33.7%	65.7	66.7			
Upper Limb (Arm/ Shoulder)	54.0%	28.1%	17.9%	93.8	64.5			
Lower Limb (Leg)	65.6%	19.2%	15.2%	59.0	59.4			
Foot/Ankle	92.1%	7.9%	0.0%	67.2	52.8			
All Low Energy Fractures	53.1%	19.3%	27.5%	383.0	65.0			
% w/Osteoporosis Dx	0.0%	0.0%	0.0%	0.0%				

* Estimate does not meet standards for reliability

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency Room, 2006

Table 5.7: Hospital Discharge to Short/Intermediate/Skilled Nursing Care for Persons with Osteoporosis and Related Conditions [1] Aged 45 and Older by Age and Sex, United States 2007

	% of Total WITH Condition				% of Total WITHOUT Condition			
FEMALES	45-64	65-74	75 & Older	All 45 & Over	45-64	65-74	75 & Older	All 45 & Over
Primary Osteoporosis	16.5%	25.5%	40.0%	31.8%	10.9%	21.7%	34.5%	20.6%
Low Energy Fracture [2]								
Hip	53.7%	76.7%	86.0%	80.5%	10.9%	21.4%	33.6%	20.5%
Wrist/Hand	15.9%	37.1%	58.8%	40.8%	11.1%	22.0%	35.0%	21.3%
Vertebrae/Pelvic	30.2%	49.1%	63.7%	54.7%	11.0%	21.9%	34.7%	21.1%
Upper Limb (Arm/Shoulder)	21.5%	42.1%	62.7%	46.8%	11.1%	22.0%	34.9%	21.3%
Lower Limb (Leg)	37.7%	65.0%	80.8%	60.9%	11.0%	21.9%	34.9%	21.2%
Foot/Ankle	21.4%	49.2%	70.6%	40.4%	11.0%	21.9%	35.0%	21.3%
All Low Energy Fractures	**29.4%**	**52.6%**	**69.5%**	**56.2%**	**10.6%**	**20.7%**	**31.3%**	**19.7%**
MALES								
Primary Osteoporosis	21.4%	28.0%	38.9%	31.7%	12.5%	19.1%	29.2%	17.5%
Low Energy Fracture [2]								
Hip	53.7%	72.6%	84.2%	75.2%	12.4%	18.7%	28.5%	18.2%
Wrist/Hand	18.5%	37.6%	54.1%	28.9%	12.5%	19.2%	29.4%	18.6%
Vertebrae/Pelvic	27.6%	42.0%	57.9%	42.4%	12.4%	19.1%	29.2%	18.5%
Upper Limb (Arm/Shoulder)	22.6%	41.9%	58.7%	38.8%	12.5%	19.2%	29.3%	18.6%
Lower Limb (Leg)	27.1%	55.2%	72.7%	41.2%	12.4%	19.2%	29.3%	18.6%
Foot/Ankle	16.2%	34.7%	59.1%	25.5%	12.5%	19.2%	29.4%	18.6%
All Low Energy Fractures	**26.7%**	**49.2%**	**66.6%**	**47.2%**	**12.2%**	**18.6%**	**27.9%**	**17.9%**

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 5.8: Osteoporosis and Related Conditions [1] in Nursing Home Population Aged 65 and Over, United States 2004

	Prevalence (in 00s)					
	65-74	75-84	85 & Over	Male	Female	Total Population
Diagnosis at Time of Admittance (based on age at time of admission)						
Primary Osteoporosis	*	21.6	49.9	*	71.0	76.4
Low Energy Fracture (All)	90.8	387.8	650.5	207.5	973.1	1,180.6
Hip	35.0	171.6	302.6	103.4	411.7	515.1
Vertebrae/Pelvic	*	49.3	106.3	*	148.5	173.1
Upper Limb (Arm, Shoulder)	*	35.1	32.9	*	66.3	77.8
Lower Limb (Leg)	25.2	98.9	135.1	47.0	235.9	282.9
Ankle/Foot	*	*	*	*	42.9	51.7
Secondary Osteoporosis Condition Present				*	*	*
Current Primary Diagnosis (based on age at time of interview)						
Primary Osteoporosis	*	33.8	104.4	*	149.8	152.5
Low Energy Fracture (All)	22.3	113.2	234.6	104.6	297.0	401.6
Hip	*	47.4	102.5	36.8	122.8	159.5
Vertebrae/Pelvic	*	*	46.7	*	52.9	73.6
Upper Limb (Arm, Shoulder)	*	*	*	*	*	*
Lower Limb (Leg)	*	29.6	47.3	*	73.0	98.8
Ankle/Foot	*	*	*	*	*	*
Secondary Osteoporosis Condition Present	*	*	*	*	*	29.0
Current Secondary Diagnosis (based on age at time of interview)						
Primary Osteoporosis	155.9	666.7	1,272.0	170.6	2,018.3	2,188.8
Secondary Osteoporosis Condition Present	42.5	164.4	297.8	68.3	479.8	548.1
Falls and Fractures (based on age at time of interview)						
Reported Fall Within Past 6 Months	*	1,849.0	2,560.0	1,498.0	3,719.0	5,217.0
Sustained Hip Fracture Within Past 180 Days	*	95.0	141.0	69.0	206.0	276.0
Sustained Other Fracture Within Past 180 Days	*	107.0	159.0	78.0	260.0	339.0
Total Nursing Home Population Aged 65 & Older, 2004	1,741.2	4,688.7	6,742.1	3,368.2	9,803.9	13,172.1

* Estimate does not meet standards for reliability.

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

Source: National Center for Health Statistics, National Nursing Home Survey, 2004

Table 5.9: Self-Reported Fracture (Ever) for Persons Aged 45 and Over by Age and Sex, United States 2001-2006

FEMALES

	Rate per 100 Persons				
	45-64	65-74	75-84	85 & Older	45 & Over
Broken or Fractured Hip	0.6	1.6	3.4	11.5	1.7
Broken or Fractured Wrist	8.2	11.4	13.6	16.1	9.8
Broken or Fractured Spine	1.8	2.6	3.3	8.4	2.5
	% of First Fractures Caused by a Fall [1]				
Broken or Fractured Hip	66%	76%	87%	98%	88%
Broken or Fractured Wrist	88%	99%	97%	98%	95%
Broken or Fractured Spine	72%	82%	82%	88%	83%
	Mean Age of First Fracture Caused by a Fall (in years)				
Broken or Fractured Hip	55.3	62.8	73.4	79.4	73.4
Broken or Fractured Wrist	53.9	61.4	67.3	74.5	63.3
Broken or Fractured Spine	59.2	66.2	67.9	80.0	71.2

MALES

	Rate per 100 Persons				
	45-64	65-74	75-84	85 & Older	45 & Over
Broken or Fractured Hip	1.5	2.8	3.2	7.4	2.1
Broken or Fractured Wrist	12.5	12.5	8.8	6.5	12.0
Broken or Fractured Spine	3.8	2.7	3.9	3.5	3.6
	% of First Fractures Caused by a Fall [1]				
Broken or Fractured Hip	41%	43%	81%	82%	64%
Broken or Fractured Wrist	72%	79%	89%	100%	79%
Broken or Fractured Spine	54%	12%	62%	86%	58%
	Mean Age of First Fracture Caused by a Fall (in years)				
Broken or Fractured Hip	59.6	63.6	73.5	82.1	72.9
Broken or Fractured Wrist	53.5	61.2	61.6	74.4	60.0
Broken or Fractured Spine	56.7	52.0	67.2	82.7	63.6

[1] Self-reported cause as a "fall/tripped/slipped/fell out of bed" or "hard fall off ladder/stool/downstairs."

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey Data, 2001-2006

Table 5.10: Low Energy Fractures [1] Treated as Inpatient or Emergency Room Visits for Persons Aged 45 and Over by Anatomic Site by Sex, United States 2006/2007

	Inpatient Treatment [2]					
	Females		Males		Total	
	Prevalence (in 000s) [4]	% of Total Fracture Sites	Prevalence (in 000s) [4]	% of Total Fracture Sites	Prevalence (in 000s) [4]	% of Total Fracture Sites
Hip	140.0	35.1%	65.6	33.8%	205.6	34.7%
Wrist/Hand	33.0	8.3%	14.1	7.3%	47.1	7.9%
Vertebrae/Pelvic	81.9	20.5%	46.8	24.1%	128.7	21.7%
Upper Limb (Arm/Shoulder)	46.0	11.5%	20.4	10.5%	66.4	11.2%
Lower Limb (Leg)	46.7	11.7%	22.0	11.3%	68.7	11.6%
Foot/Ankle	51.4	12.9%	25.0	12.9%	76.4	12.9%
All Low Energy Fractures	459.3	100.0%	217.8	100.0%	677.1	100.0%

	Emergency Room Treatment [3]					
	Females		Males		Total	
	Prevalence (in 000s) [4]	% of Total Fracture Sites	Prevalence (in 000s) [4]	% of Total Fracture Sites	Prevalence (in 000s) [4]	% of Total Fracture Sites
Hip	156.5	19.8%	75.7	19.2%	232.2	19.6%
Wrist/Hand	161.8	20.5%	52.0	13.2%	213.8	18.1%
Vertebrae/Pelvic	67.8	8.6%	65.7	16.7%	133.5	11.3%
Upper Limb (Arm/Shoulder)	124.5	15.8%	73.8	18.8%	198.3	16.8%
Lower Limb (Leg)	74.6	9.5%	59.0	15.0%	133.6	11.3%
Foot/Ankle	203.6	25.8%	67.2	17.1%	270.8	22.9%
All Low Energy Fractures	809.0	100.0%	383.0	100.0%	1192.0	100.0%

[1] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries)

[2] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Hospital Emergency Room, 2006

[4] Multiple fractures sites per patient possible.

Table 5.11: Inpatient Cost Associated with Osteoporosis [1] and Low Energy Fractures [2] for Persons Aged 45 and Older, United States 2007

	Prevalence (in 000s)	Mean Length of Stay (in days)	Mean Cost per Patient Stay	Estimated Total Cost (in billions)
Osteoporosis Diagnosis Patients				
Osteoporosis Without Fracture	658.8	5.0	$ 27,737	$ 18.27
Osteoporosis With Low Energy Fracture [2]	140.9	5.4	$ 32,176	$ 4.53
Osteoporosis With High Energy Fracture [2]	2.6	5.7	$ 38,202	$ 0.10
All Osteoporosis Diagnosis	**802.4**	**5.1**	**$ 28,549**	**$ 22.91**
Non-Osteoporosis Patients	18,710.4	5.3	$ 34,204	$ 639.97
Low Energy Fracture Patients				
Hip	205.8	6.6	$ 42,390	$ 8.72
Wrist/Hand	47.3	4.9	$ 32,330	$ 1.53
Vertebrae/Pelvic	128.8	6.4	$ 38,508	$ 4.96
Upper Limb (Arm/Shoulder)	66.6	5.4	$ 35,688	$ 2.38
Lower Limb (Leg)	68.9	5.8	$ 39,303	$ 2.71
Foot/Ankle	76.7	4.4	$ 27,667	$ 2.12
All Low Energy Fractures	**678.1**	**6.1**	**$ 37,982**	**$ 25.76**
All High Energy Fractures	64.6	7.7	$ 61,827	$ 3.99
Non-Fracture Patients	18,767.6	5.2	$ 33,739	$ 633.20

[1] Osteoporosis and related condition ICD-9-CM codes shown in the Table 5.1.

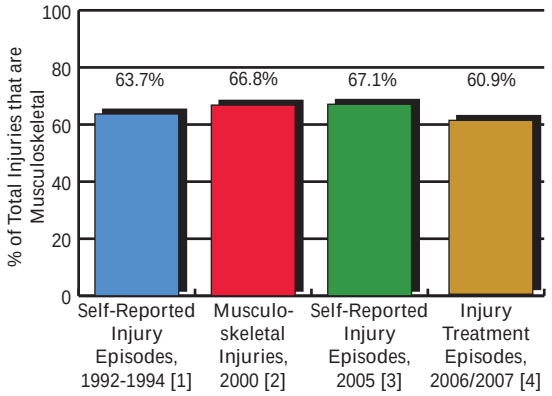
[2] Treatment for fractures, excluding those with high energy causes (i.e., vehicular [auto, air, water] accidents, war injuries, violence/abuse).

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Chapter 6
Musculoskeletal Injuries

More than three of every five unintentional injuries that occur annually in the United States are to the musculoskeletal system. Although the incidence of total unintentional injuries is difficult to estimate, numerous databases and reports have shown that a consistent 60% to 67% of injuries that occur annually involve the musculoskeletal system. (Table 6.1 and Graph 6.0.1)

Graph 6.0.1: Musculoskeletal Injuries as Propotion of Total Injuries, United States 1992-1994, 2000, 2005, and 2006/2007



[1] Praemer A, Furner S, Rice DP. Musculoskeletal Conditions in the United States, 1999. American Academy of Orthopaedic Surgeons, Rosemont, IL. P. 83.
[2] Finkelstein EA, Corso PS, Miller TR. The Incidence and Economic Burden of Injuries in the United States. 2006. Oxford University Press, New York, NY. P. 13.
[3] National Center for Health Statistics. National Health Interview Survey, 2005
[4] National Center for Health Statistics. National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006; Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007.

Musculoskeletal injuries are injuries occurring to the neck, spine, pelvis and extremities; they include fractures, derangements, dislocations, sprains and strains, contusions, crushing injuries, open wounds, and traumatic amputations. The most common cause of musculoskeletal injuries is falls. Additional major causes of musculoskeletal injuries are sports injuries, playground accidents, motor vehicle crashes, civilian interpersonal violence, war injuries, stress injuries, over-exertion, and repetitive workplace injuries.

In 2006/2007, more than 61.2 million annual episodes of treatment for musculoskeletal injuries were recorded in physician offices, emergency rooms, outpatient clinics, and hospitalizations. This compares to 100.4 million episodes of treatment for all kinds of injuries, including burns, poisoning, and drowning.

Section 6.1: Prevalence of Musculoskeletal Injuries

While the number of self-reported injury episodes has been declining since 1997 and is believed to be under-reported,[1] the distribution of types of musculoskeletal injuries is similar for both self-reported and injury treatment episodes. In 2008, persons in the civilian non-institutionalized population self-reported 22.8 million musculoskeletal injury episodes in the annual National Health Interview Survey. This compares to an annual average of 36.9 million musculoskeletal injury episodes reported in the same survey 1992-1994,[2] and to 61.2 million musculoskeletal injury treatment episodes in physician offices, emergency rooms, outpatient clinics, and hospitalizations reported in 2006/2007. (Table 6.2) Injury treatment episodes in 2006/2007 reflect actual injury burden more reliably than self-reported injury episodes and will define the musculoskeletal injury burden in this chapter.

Section 6.1.1: Musculoskeletal Injuries by Type

Among self-reported musculoskeletal injuries, sprains and strains were the most frequent, accounting for 44%. Fractures, representing 25%

of self-reported musculoskeletal injuries, were the second most frequent. Among musculoskeletal injury treatment episodes, these two types of injuries were nearly equal, accounting for 30% and 26% of the total injury treatment episodes, respectively. Open wounds and contusions accounted for 16% to 17% of both self-reported and injury treatment episodes, while dislocations accounted for 5% of injury treatment episodes and only 2% of self-reported injury episodes. (Table 6.3 and Graph 6.1.1)

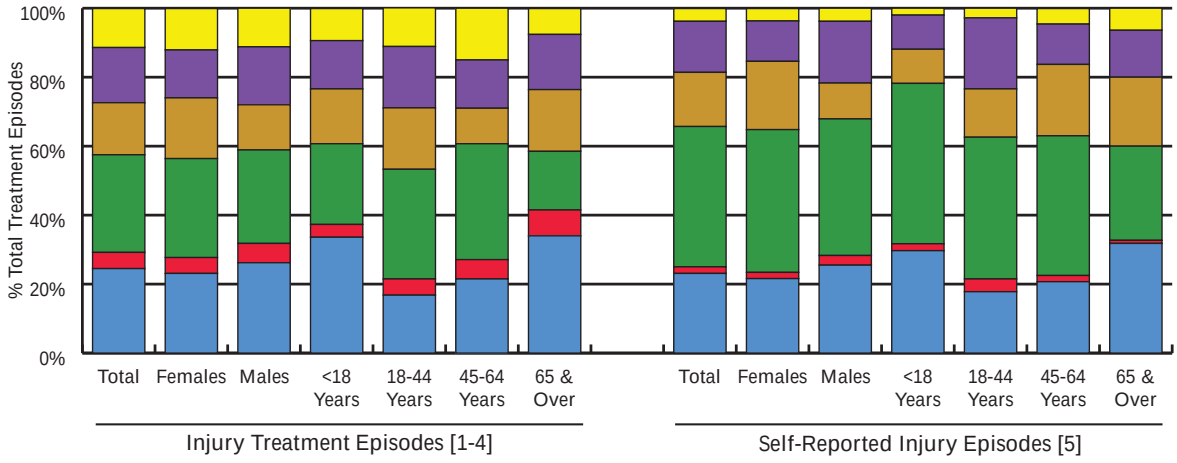
Nearly 16.2 million fractures were treated in physician offices, emergency and outpatient clinics, and hospitals in 2006/2007. (Table 6.4) Nearly 3.0 million of these occurred in young males under the age of 18, while another 2.5 million occurred in females aged 65 and over.

Sprains and strains accounted for nearly 18.4 million musculoskeletal injury treatment episodes in 2006/2007, with 7.5 million treated in persons aged 18 to 44, the most common age in which a sprain or strain is reported and treated.

Open wounds are the third most frequently treated musculoskeletal injury, accounting for more than 10.2 million injury treatment episodes in 2006/2007. Open wounds were treated in the highest number among persons aged 18 to 44 years, but the rate was highest among the persons aged 65 years and older. Open wounds are more commonly treated in males (6.0 million treatment episodes) than females (4.2 million treatment episodes).

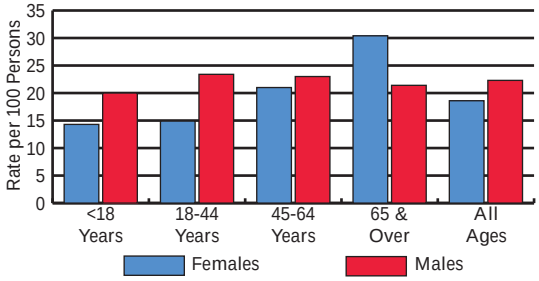
Nearly as many treatment episodes were for contusions (10.0 million) as for open wounds in 2006/2007. Treatment for contusions is highest among persons aged 65 and over, with females accounting for the bulk of this higher rate.

Graph 6.1.1: Distribution of Injury Treatment Episodes and Self-Reported Injuries by Type of Musculoskeletal Injury by Sex and Age, United States 2006/2007 and 2008



[1] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006
[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007
[5] National Center for Health Statistics. National Health Interview Survey, 2008

Graph 6.1.2: Rate of Musculoskeletal Injury Treatment Episodes by Sex and Age, United States 2006/2007



Sources: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006; Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Section 6.1.2: Rate of Musculoskeletal Injuries by Age and Sex

The 2006/2007 annual rate of all injury, and of musculoskeletal injury treatment episodes, was slightly higher for males than for females. (Table 6.4 and Graph 6.1.2) Overall in 2006/2007, persons aged 65 and over were more likely to sustain any type of injury (43.6 per 100 persons) or a musculoskeletal injury (26.6 per 100 persons) than were persons of any other age group.

In 2006/2007, musculoskeletal injury rates among males was similar between all age groups; a steady increase in the rate of injury was found among females as they aged. Injury rates by age group were fairly consistent among males, ranging from 20.0 per 100 males under the age of 18 to 23.4 per 100 males aged 18 to 44. Among females, the rate of injury by age group varied from 14.3 per 100 females under the age of 18 to 30.4 per 100 females aged 65 and over. Fractures are the most common musculoskeletal injury in both young males and older females, while sprains and strains are more common among males and females between the ages of 18 and 64.

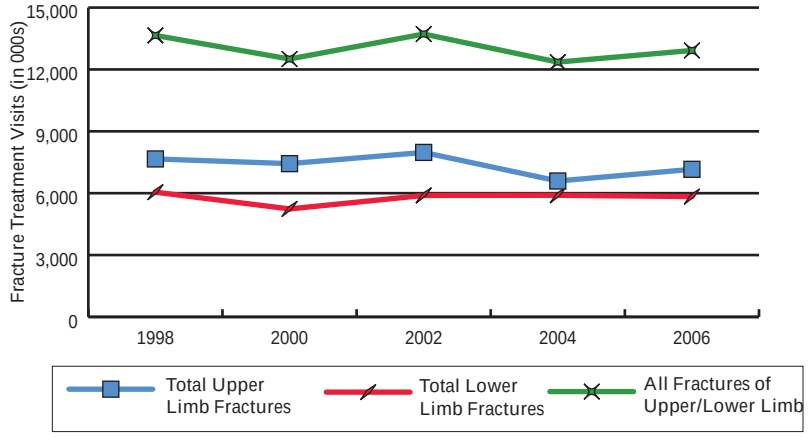
In 2006/2007, fractures accounted for 26% of the 61.2 million musculoskeletal injuries treated in physician offices, emergency and outpatient clinics, and hospitalizations. The overall fracture injury treatment rate in 2006/2007 was 5.4 per 100 persons. Among males under the age of 18, the fracture injury treatment rate was 7.9 per 100 persons, while females of this age were treated for fractures at a rate of 4.3 per 100 persons. Among females aged 65 and older, fracture injury treatment rates were 11.7 per 100, while men in this age group were treated for fractures at a much lower (6.8 per 100 persons) rate. (Table 6.4)

Females aged 65 and older were treated at higher rates than males of the same age for fractures, sprains and strains, and contusions. Males aged 65 and older were treated for dislocations, open wounds, and other musculoskeletal injuries at higher rates than females, although the differences were less pronounced. (Table 6.4)

Among the young, aged 18 and under, males had higher rates of injury treatment for all types of injury than did females with the exceptions of dislocations and other types of musculoskeletal injuries, which had similar rates. Overall, musculoskeletal treatment rates of 20.0 and 14.3 per 100 persons in males and females, respectively, occurred in this age group. (Table 6.4)

Males between the ages of 18 and 44 were treated for musculoskeletal injuries at substantially higher rates than females in this age group, 23.4 versus 14.9 per 100 persons, respectively. Rates of treatment in males were higher for all types of injuries, with the fractures, sprains and strains, and open wounds showing the greatest difference in treatment rate. Between the ages of 45 and 64, the musculoskeletal injury rate between females and males began to converge, but only contusions and open wounds were reported at a higher level among females than males. Overall in this age group, males show a higher rate of musculoskeletal injury treatment (23.0 per 100 persons) than females (21.0 per 100). (Table 6.4)

Graph 6.1.3: Total Fracture Treatment Episodes by Selected Anatomic Site , United States, 1998-2006



Sources: National Center for Health Statistics, National Hospital Discharge Survey, 1998-2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 1998-2006; National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Physician Visits, 1998-2006

Section 6.1.3: Fracture Trends

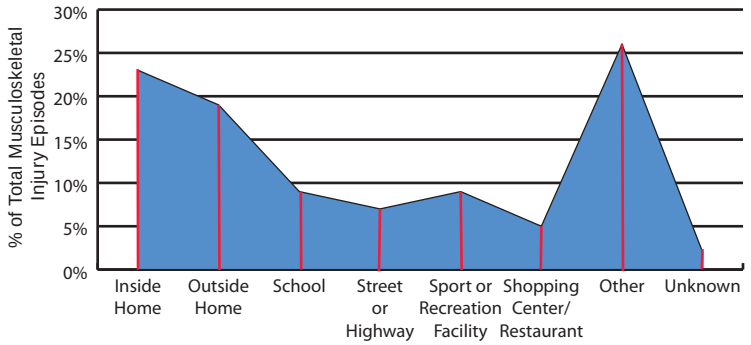
The total number of fractures of the upper and lower extremities treated in physician offices, emergency departments, and hospitals, while fluctuating year to year, has remained fairly constant since 1998. (Table 6.5 and Graph 6.1.3) In 1998, 13.65 million treatment episodes for fractures of the upper and lower limbs were reported; in 2004, 12.91 million were treated. Upper limb fractures account for 53% to 59% of the total fractures treated, while lower limb fractures accounted for 42% to 48% across the years. (Table 6.5a)

Wrist, hand, and finger fractures accounted for about one-half or more of upper limb fractures across the years, with forearm fractures accounting for more than 90% of the remaining upper limb fractures. Fractures to the upper arm, or humerus, accounted for 8% or less of all reported treatment episodes for upper limb fractures. Fractures of the ankle, foot or toes accounted for approximately three-fourths of treated lower limb fractures. The majority of fractures, 62% to 71%, were treated in a physician's office. Fewer than one in ten fractures (8% or less) were treated with inpatient hospitalization in any given year. (Table 6.5a)

Section 6.2: Location and Causes of Musculoskeletal Injuries

The most common location where musculoskeletal injury episodes occur is in the home. In 2008, nearly one in two of the 22.1 million self-reported injury episodes occurred in or around the home. Musculoskeletal injury episodes that occurred in automobile or pedestrian related incidents—injuries that occurred on the streets or highways—accounted for only 7% of the reported injury episodes. An additional 9% of musculoskeletal injury episodes occurred while participating in sport activities, while 9% occurred in schools. The remaining 26% occurred in other locations, including shopping centers and restaurants. (Table 6.6 and Graph 6.2.1)

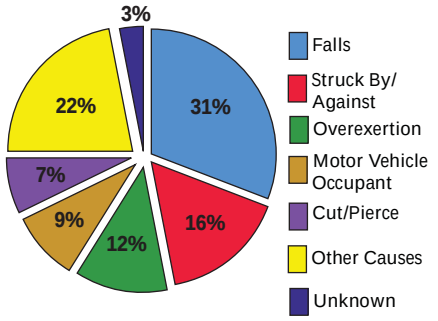
Graph 6.2.1: Location of Musculoskeletal Injury Episode Occurrence, United States 2008



Source: National Center for Health Statistics. National Health Interview Survey, Injury Database, 2008

Falls were the leading cause of nonfatal unintentional injuries treated in hospital emergency departments in 2008 for all age groups. (Table 6.7 and Graph 6.2.2) Falls occurred at a rate of 25.0 per 1,000 persons and accounted for 8.5 million of the 27.9 million nonfatal unintentional injuries reported by the Centers for Disease Control as treated in hospital emergency

Graph 6.2.2: Nonfatal Unintentional Injuries Treated in Hospital Emergency Departments, United States 2008



Source: Centers for Disease Control, National Center for Injury Prevention and Control, WISQARSTM (Web-based Injury Statistics Query and Reporting System), Nonfatal Unintentional Injury Reports treated in Emergency Department. Available at: http://webappa.cdc.gov/sasweb/ncipc/nfirates2001.html. Accessed on November 10, 2009.

departments in the United States in 2008. Falls accounted for 64% of the nonfatal injuries treated for persons aged 65 and older.[3] (Table 6.8)

Falls were also the leading cause of death in unintentional injuries for persons aged 75 and over in 2008,[3] accounting for nearly 14,258 of the 20,823 deaths due to unintentional injury in this age group. The rate of death from falls for persons aged 75 to 84 years was 47.7 per 100,000 persons; that rate jumped to 152.1 per 100,000 among persons aged 85 years and older. (Table 6.9) In 1984, 54% of falls resulting in death occurred in the home; by 2004, the proportion had risen to 63%. (Table 6.10)

The most frequently self-reported type of injury is a sprain, strain or twist, accounting for one-third (32%) of all self-reported injury episodes, including burns and bites, in 2008. (Table 6.11) Motor vehicle incidents were the cause of more sprain, strain or twist injuries than any other reported mechanism, with more than one-half (56%) of persons involved in a motor vehicle incident reporting a sprain/strain injury.

Fractures occurred in one-in-four (27%) of the 1.5 million accidents involving sports equipment (e.g., bikes, scooters, skate-boards, skis, skates) and in 29% of the 11.1 million falls. Fractures occurred in more than one-third (37%) of the reported 188,000 incidents in which a pedestrian was struck. (Table 6.11)

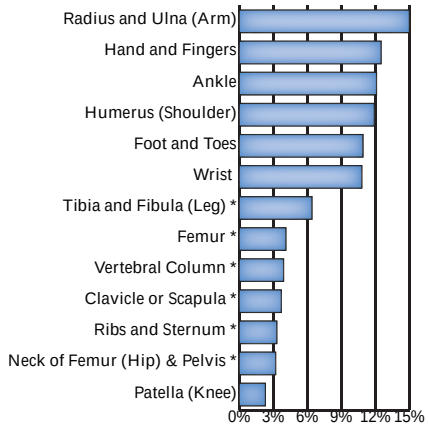
Contusion or bruising injuries were reported in 18% of all accidents, with a high level occurring in incidents that involved motor vehicles, either as a passenger or as a pedestrian struck by a motor vehicle.

Section 6.3: Musculoskeletal Injury Sites

The Centers for Disease Control estimates that more than 50 million injuries occurred in 2000.[4] Traumatic brain injuries, injuries to the torso, systemwide injuries, and unspecified injuries represented nearly all the fatal injuries; however, injuries to the upper and lower extremities accounted for the greatest number of hospitalized and non-hospitalized injury episodes. (Table 6.12)

Fractures occur most frequently in the upper limb, including the hand, fingers, wrist, and arm. Of the 10.4 million fractures (9.9 million fracture episodes) treated in physician offices in 2006, 38% were fractures of the upper limb. (Table 6.13 and Graph 6.3.1) Lower limb fractures treated in physician offices, including the leg, knee cap, ankle, and foot and toes, accounted for 36% of treated fractures. Fractures of the ankle and foot and toes accounted

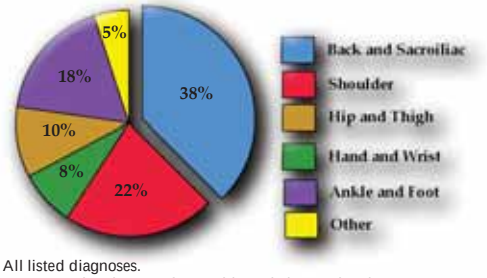
Graph 6.3.1: Visits to Physicians in Office-Based Practice for Fractures at Selected Anatomic Sites, United States 2006



All listed diagnoses.
* Data does not meet standards of reliability.
Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

for nearly two-thirds (64%) of lower limb fractures. The shoulder was the third most frequently fractured site, accounting for 12% of all fractures.

Graph 6.3.2: Visits to Physicians in Office-Based Practice for Sprains and Strains at Selected Anatomic Sites, United States 2006



All listed diagnoses.
Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

More than one-third (38%) of the 16.6 million sprain and strain injuries treated in physician offices in 2006 were to the back and sacroiliac. Shoulder (22%) and ankle and foot injuries (18%) represented the other two most common anatomic sites for sprains and strains treated in physician offices. (Table 6.13 and Graph 6.3.2)

A substantial majority of the 3.4 million dislocation injury episodes (74%) treated in 2006 were treated in physician offices. Dislocation of the knee or leg joint represented 77% of these injuries, with the shoulder (8%) the only other anatomic site to account for more than a very small fraction of dislocations. (Table 6.13) This finding is likely an artifact of an ICD-9 coding anomaly. Isolated acute ligamentous injuries of the knee, (i.e., anterior cruciate ligament [ACL], medial collateral ligament [MCL], posterior cruciate ligament [PCL], and lateral collateral ligament [LCL] disruptions) are coded as dislocations using ICD-9 methodology, whereas equivalent injuries in other joints are coded as sprains or strains rather than dislocations. True complete dislocations of the knee joint are actually quite rare, and associated with marked morbidity.

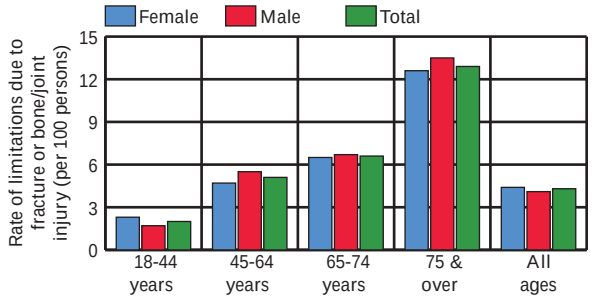
The annual National Health Interview Survey (NHIS) provides data on self-reported injuries. In the 2008 NHIS, injuries to the ankle, back and knee were reported by approximately 10% of persons, the most frequent of all anatomic sites. (Table 6.14) Among persons under the age of 18, injuries to the ankle and knee were the most commonly reported injury sites. Persons aged 18 to 44 years reported injury to their ankle and back about equally, accounting for about one-fourth of all reported musculoskeletal injuries. Persons aged 45 to 64 years reported back, knee, and foot/toe injuries the most frequently. Injuries among persons aged 65 and over were reported among all sites more evenly than for other age groups.

Section 6.4: Musculoskeletal Injury Limitations

Musculoskeletal injuries are often a cause of physical limitations in the ability to perform activities of daily living (e.g., eating, personal care, and dressing). In 2006, more than four out of every 100 persons (4.3) reported they were currently experiencing limitations in their ability to perform daily activities as a result of a fracture or bone/joint injury. (Table 6.15 and Graph 6.4.1) Among persons aged 65 and over, the rate with limitations was nearly 13 out of 100 due to fracture or bone/joint injury. With the exception of persons aged 18 to 44, males are more likely to report a limitation in ability to perform activities of daily living due to fracture or other bone/joint injury than are women.

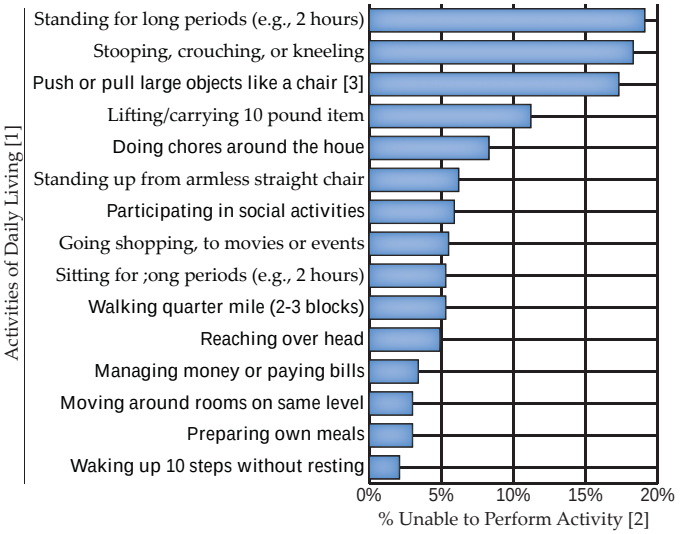
Many common chores around the house are reported as difficult to perform by persons with a musculoskeletal injury. As many as 82% of persons

Graph 6.4.1 : Rate of Activity Limitations due to Fracture or Bone/Joint Injury [1] by Gender and Age for Persons Aged 18 and Over, United States 2005-2006



[1] Responded "yes" to fracture or bone/joint injury when asked "What condition or health problem causes you to have difficulty with or need help with the following activities."
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2005-2006

Graph 6.4.2: Activities "Unable to Perform" due to Fracture of Bone/Joint Injury for Persons Aged 18 and Over, United States 2001-2006



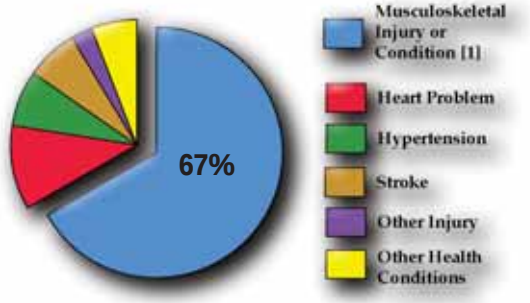
[1] "What condition or health problem causes you to have difficulty with or need help with the following activities"
[2] "By yourself and without using any special equipment, how much difficult do you have ..."
Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2001-2006.

reporting a musculoskeletal injury reported they are "some(what)" unable or "unable to do" twenty common tasks of daily living. (Table 6.16 and Graph 6.4.2) The most frequently mentioned limitation due to a fracture or bone/joint injury was "stooping, crouching or kneeling," with 82% reporting some degree of difficulty doing this. However, "standing on their feet for two hours or more" was reported by the highest percentage (19%) as "unable to perform."

In 2008, 6.8 million persons over the age of 18 reported spending a mean of 11.8 days in bed due to a fracture or bone/joint injury, resulting in a total of 76.4 million bed days. Bed days are defined as illness or injury that kept a person in bed more than one-half of a day, excluding hospitalization. An additional 18.7 million reported a mean of 15.4 bed days due to back or neck problems, for a total of 288.1 million bed days. Overall, musculoskeletal conditions, including arthritis and rheumatism, were responsible for 67% of all bed days reported for seven chronic or traumatic health conditions in the United States in 2008, with musculoskeletal injuries accounting for 10% of 2008 bed days. (Tables 6.17 and 6.19 and Graph 6.4.3)

Sixteen percent (16%) of persons reporting they had been in the paid workforce over the previous 12 months also reported missing a mean of 15.1 days from work due to fractures, bone, or joint injury, for a total of 64.4 million lost work days. A missed work day is defined as absence from work due to illness or injury in the past 12 months, excluding maternity or family leave. Although other types of injuries were reported by only 9% of

Graph 6.4.3: Proportion of Bed Days Resulting from Selected Health Conditions for Persons Aged 18 and Over, United States 2008



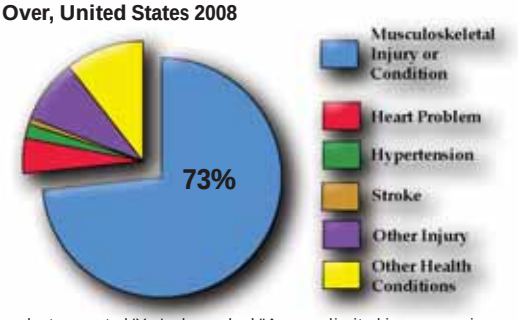
Respondents reported 'Yes' when asked "Are you limited in any way in any activities because of physical, mental or emotional problems."

Respondents reported the number of days illness or injury kept them in bed more than half of the day, including overnight hospitalization.

[1] Includes back/neck pain, arthritis/rheumatism, and fracture/bone/joint pain.

Source: National Center for Health Statistics. National Health Interview Survey, Adult Sample 2008

Graph 6.4.4: Proportion of Lost Work Days Resulting from Selected Health Conditions for Persons Aged 18 and Over, United States 2008



Respondents reported 'Yes' when asked "Are you limited in any way in any activities because of physical, mental or emotional problems."

Respondents reported the number of days absent from work due to illness or injury in the past 12 months, excluding maternity or family leave.

[1] Includes back/neck pain, arthritis/rheumatism, and fracture/bone/joint pain.

Source: National Center for Health Statistics. National Health Interview Survey, Adult Sample 2008

the workforce, mean lost work days were much higher at 28.7 days, for a total of 34.4 million lost work days due to non-musculoskeletal types of injuries. (Tables 6.18 and 6.19 and Graph 6.4.4)

Section 6.5: Workplace Injuries

Cumulative and repetitive motion injuries, also described as musculoskeletal disorders (MSDs), occur when the body reacts to strenuous motion (i.e., bending, climbing, crawling, reaching, twisting), overexertion, or repetitive motion. MSD injuries include sprains, strains, tears, back pain, soreness, carpal tunnel syndrome, hernia, and musculoskeletal system and connective diseases. MSD cases are more severe than the average nonfatal workplace injury or illness, typically involving an average of 2 additional days away from work.[5] In 2007, the median number of days away from work for all workplace injuries was 7 days; for MSD injuries, the median was 9 days.

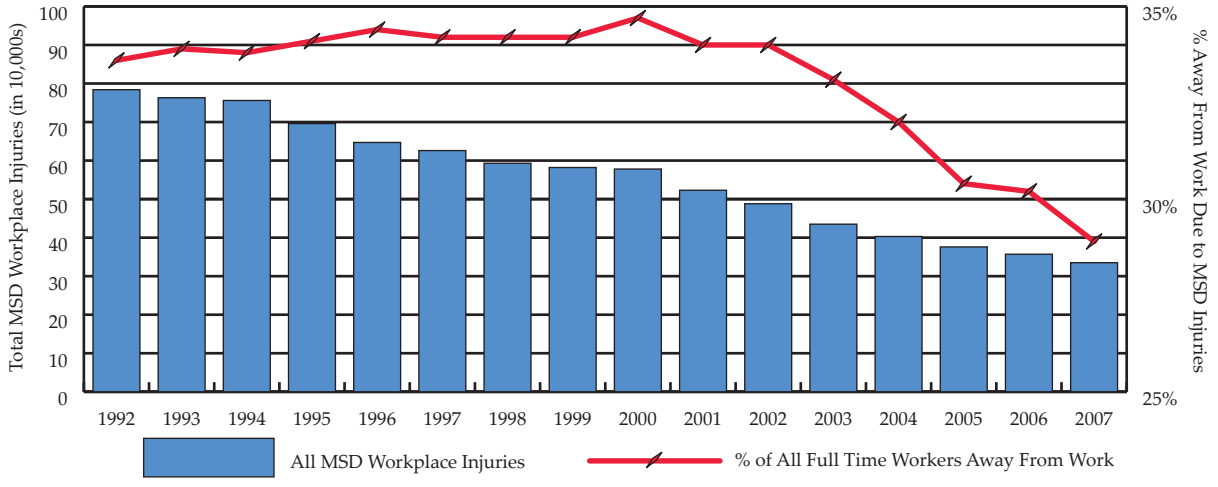
In addition to MSD injuries as defined above, musculoskeletal workplace injuries include fractures, bruises/contusions, and amputations.

Section 6.5.1: Trends in Workplace Musculoskeletal Disorders

Although the rate of nonfatal occupational injuries and illnesses has decreased over the past 15 years, the relative percentage of MSD cases fluctuated within a narrow range of 30% to 34% from 1992 to 2006. In 2007, the ratio dropped below 30% for the first time (29%). (Table 6.20 and Graph 6.5.1) During this same time frame, total cases of work-related injuries and illnesses dropped from 2.33 million in 1992 to 1.16 million in 2007, a change of 50%. At the same time, MSDs declined from 784,100 to 335,400, a change of 57%.

The distribution of MSD injuries by type of injury has remained essentially constant over the past six years, as has the distribution between males (62%-64%) and females (36%-38%). (Table 6.22) Slightly more than one-half (56%) of all sprain, strain, and tear injuries resulting in days away from work in 2007 were classified as an MSD injury. Although sprains, strains and tears represent about 40% of total workplace injuries and illnesses involving days away from work, they represent three-fourths (75.3%) of all MSD

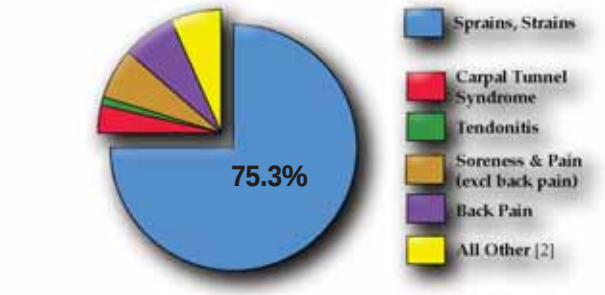
Graph 6.5.1: Trend in Number and Proportion of Nonfatal Musculoskeletal Disorders (MSD) Occupational Injuries and Illnesses Involving Days Away from Work, United States 1992-2007



Source (1992 to 1997): U.S. Department of Labor, Bureau of Labor Statistics: Worker Health Chartbook 2004. Available at: http://www2a.cdc.gov/niosh-Chartbook/imagedetail.asp?imgid=77. Accessed August 24, 2007.

Source (1998 to 2007): U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2006 and 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1790.pdf and http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Graph 6.5.2: Proportion of Musculoskeletal Disorders (MSD) by Type for Nonfatal Occupational Injuries [1] and Illnesses Involving Days Away from Work, United States 2007



[1] Multiple injuries per case possible; percentages based on total injuries, which may be > total cases.
[2] Includes MS system and connective diseases and disorders and hernia.
Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2006 and 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1790.pdf and http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

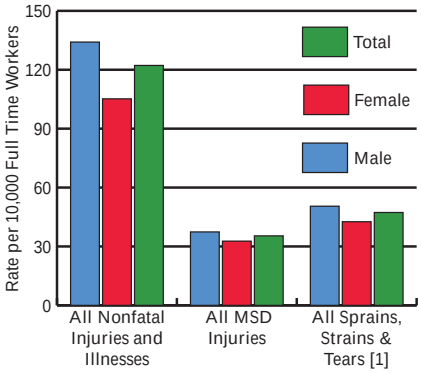
injuries. (Tables 6.21 and 6.23 and Graph 6.5.2) Back pain, carpal tunnel syndrome, tendonitis, soreness and pain (other than back pain), and a range of other conditions comprise the remaining MSD injuries.

Section 6.5.2: Demographic Characteristics of MSD Workplace Injuries

Workplace injuries resulting in days away from work, both overall and for MSD injuries, are far more likely to be sustained by males than by females (1.6:1 ratio). This is most likely due to the differences in work environments, with males more likely employed in workplace settings with different risks and exposures. However, the ratio of full-time workers sustaining a carpal tunnel syndrome injury severe enough to result in days away from work is 3:1 for females versus males; 61% of the 2007 tendonitis injuries were incurred by females. (Table 6.23 and Graph 6.5.3)

Two-thirds or more of all workplace injuries and MSD injuries resulting in days away from work in 2007 were sustained by white workers for those workers declaring a race. Carpal tunnel syndrome injuries occur almost exclusively to whites (78%). Hispanics or Latinos are most likely to sustain sprains/strains/tears, while Asians report tendonitis injuries in a higher proportion than overall injuries. (Table 6.24 and Graph 6.5.4)

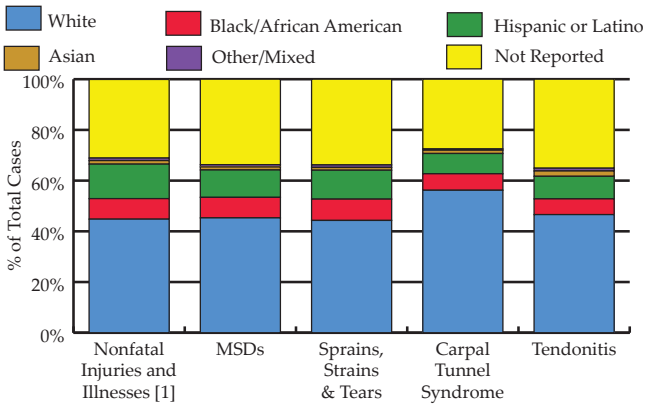
Graph 6.5.3: Rate of Nonfatal Occupational Injuries Involving Days Away from Work for Full Time Workers by Sex, United States 2007



[1] Totals are greater than shown in Table 6.21 for MDS sprains & strains due to inclusion of all sprains and strains.
Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

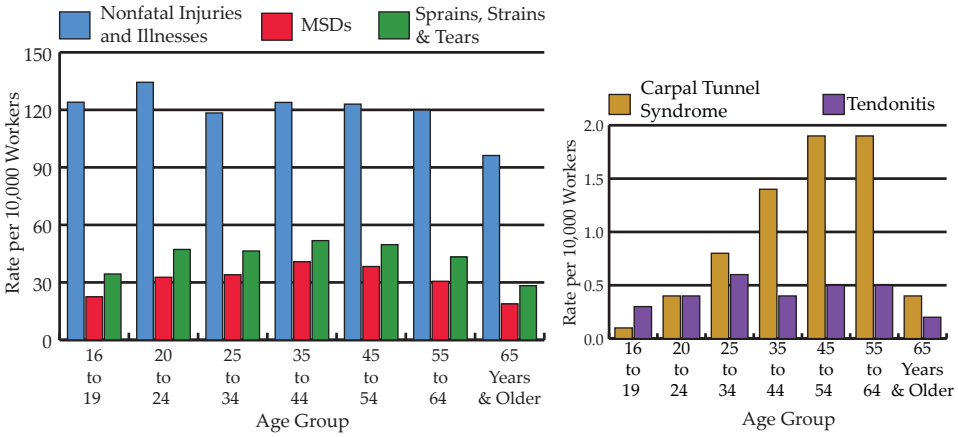
The rate per 10,000 full-time workers of non-fatal workplace injuries, MSD injuries and sprain/strain injuries peaks among workers between the ages of 35 and 44 years, tapering off both as workers are younger or older. Carpal tunnel syndrome injuries has the highest rate among workers aged 45 to 64, while

Graph 6.5.4: Proportion of Musculoskeletal Disorders (MSD) by Type for Nonfatal Occupational Injuries and Illnesses Involving Days Away from Work by Race, United States 2007



[1] Nonfatal injuries and illnesses include the total of all nonfatal injuries and illnesses involving days away from work
Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8b. Number and percent of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and nature of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1939.pdf. Accessed November 11, 2009.

Graph 6.5.5: Rate per 10,000 full Time Workers of Nonfatal Occupational Injuries and Illnesses Involving Days Away from Work by Age, United States 2007

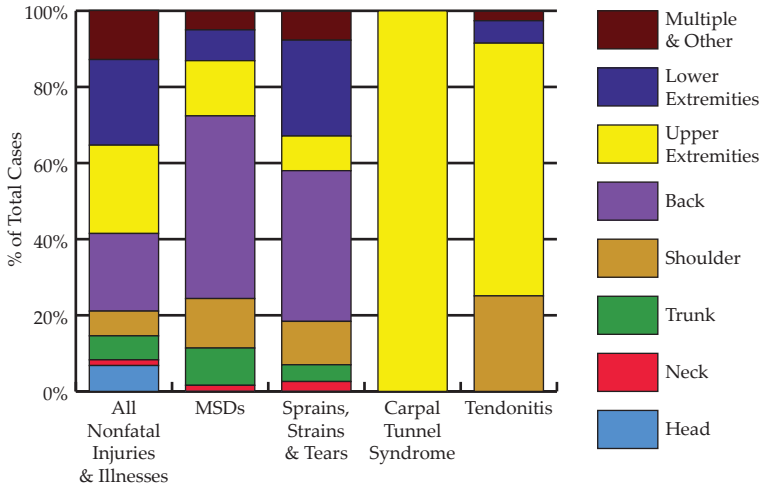


Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

tendonitis is reported at similar rates for all ages except the very young and oldest workers. (Table 6.25 and Graph 6.5.5)

Section 6.5.3: Incidence Rates for Workplace Injuries by Type of Injury and Body Part Affected

Graph 6.5.6: Proportion of Nonfatal Occupational Injuries and Illnesses Involving Days Away from Work by Body Part Affected, United States 2007



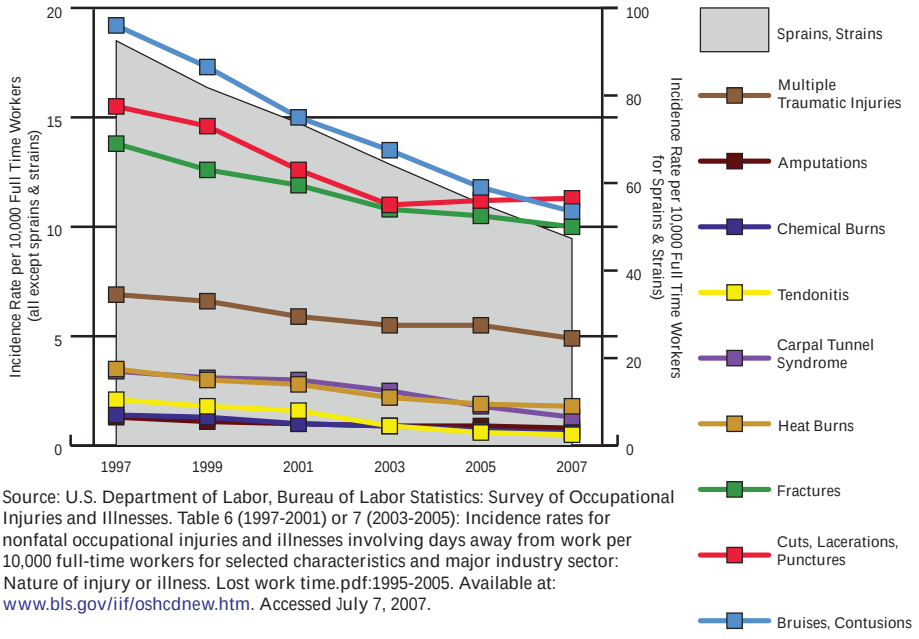
Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

While workplace injuries affect all parts of the anatomy, in 2007, both MSD workplace injuries and non-MSD injuries occurred most often to the back (rate of 17.0 injuries per 10,000 workers). Back injuries accounted for 48% of all MSD injuries. Carpal tunnel syndrome is an injury exclusively of the wrist, while tendonitis focuses primarily in the arm, wrist, hand, fingers, and shoulder. Sprains and strains also occur primarily in the back (40%), with the shoulder (11%), knee (12%), and ankle (9%) joints the other primary joints affected by sprains and strains. (Table 6.26 and Graph 6.5.6)

In the last decade, 1997 to 2007, the incidence rate for nonfatal occupational injuries involving days away from work has decreased by 42%. While the incidence of sprain, strain and tear injuries is much higher than any other type of injury, it has dropped by 49%, from a rate of 92.5 per 10,000 workers in 1997 to 47.3 per 10,000 in 2007.

The highest rates of decline in nonfatal occupational injuries over the past decade have been for tendonitis (76% decline) and carpal tunnel syndrome (62%). The result is very low rates of less than 2 injuries per 10,000 workers reported in 2007. This is likely due to awareness of how these injuries occur and safety measures to reduce their occurrence. The injury rates for bruises/contusions and fractures in the workplace were around 10 per 10,000 workers in 2007. (Table 6.27 and Graph 6.5.7)

Graph 6.5.7: Incidence Rates per 10,000 Full-time Workers for Nonfatal Occupational Injuries and Illnesses Involving Days Away from Work by Type of Injury , United States 1997-2007



Source: U.S. Department of Labor, Bureau of Labor Statistics: Survey of Occupational Injuries and Illnesses. Table 6 (1997-2001) or 7 (2003-2005): Incidence rates for nonfatal occupational injuries and illnesses involving days away from work per 10,000 full-time workers for selected characteristics and major industry sector: Nature of injury or illness. Lost work time.pdf:1995-2005. Available at: www.bls.gov/iif/oshcdnew.htm. Accessed July 7, 2007.

Source: (2007) U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

The incidence rate per 10,000 full-time workers in 2007 of injuries to the trunk (40.6, including the shoulder, 8.0, and back, 24.9), upper extremities (28.4), and lower extremities (27.5, including the knee, 10.0), were all high and accounted for a majority of nonfatal occupational injuries in all industries. The overall incidence of all nonfatal occupational injuries involving days away from work for all industries was 122.2 per 10,000 full-time workers. (Table 6.28)

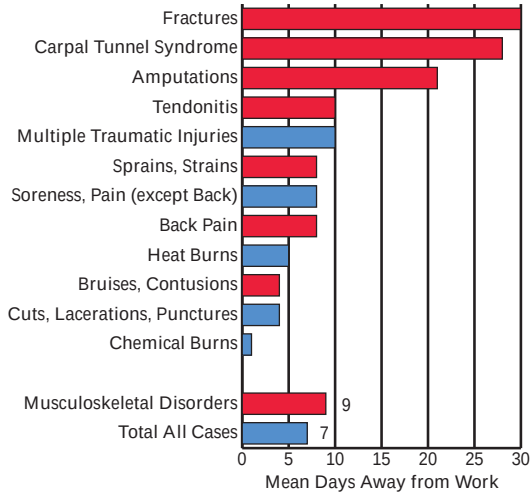
Section 6.5.4: MSD Injuries by Occupation

MSD injuries occur in relatively equal proportion to all nonfatal workplace injuries with respect to worker occupation, but occur at much higher rates in construction, maintenance, production and transportation industries than in service industries. (Table 6.29) However, carpal tunnel syndrome injuries are more likely to occur in production or office/administrative support occupations, which account for 55% of carpal tunnel syndrome injuries. (Table 6.29)

Section 6.5.5: Days Away from Work

In 2007, MSD injuries, as in most years since 1998, involved 2 additional days, 9 versus 7, away from work when compared to all nonfatal workplace injury cases. (Table 6.30 and Graph 6.5.8) Both carpal tunnel syndrome (median of 28 days) and tendonitis (10 days) contributed to the higher time away from work. The difference in median days away from work due to sprain/strain injuries that are classified as MSD injuries and those other than

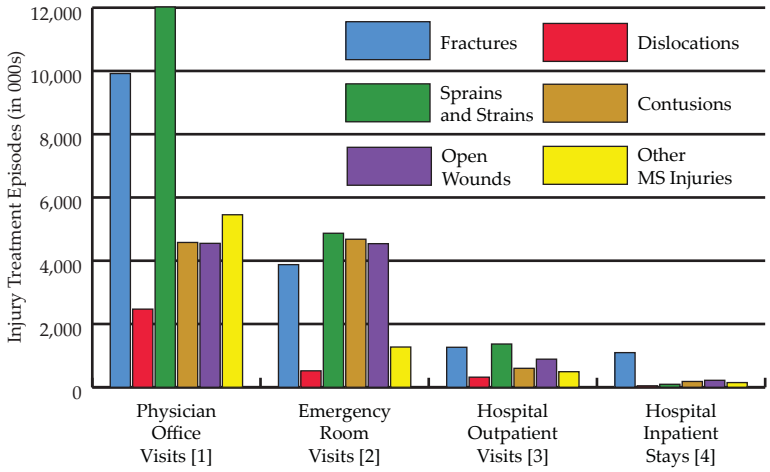
Graph 6.5.8: Median Days Away from Work for Nonfatal Occupational Injuries and Illnesses Involving Days Away from Work by Type of Injury, United States 2007



Source (2007): U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. 2007 nonfatal occupational injuries and illnesses: case and demographics. November 20, 2008, reissued March 2009. Available at: http://www.bls.gov/iif/oshwc/osh/case/osch0038.pdf. Accessed November 13, 2009.

MSD injuries is not available. Fractures (median of 30 days) and amputation injuries (median 21 days), which are not included in the MSD classification, add significantly to the nonfatal workplace musculoskeletal injury burden. Shoulder, wrist, and knee injuries involved the highest median number of days away from work (18, 14, and 15, respectively). (Table 6.31)

Graph 6.6.1: Resource Utilization for Traumatic Musculoskeletal Injuries by Treatment Location for All Diagnoses, United States 2006/2007



[1] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006
[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Overall, musculoskeletal workplace injuries are a major concern, accounting for a large proportion of all nonfatal injuries that result in days away from work. Even through long term trends show significant reductions in the total number of worker injuries each year, the proportion that are musculoskeletal related (MSD, fractures, bruises/ contusions, and amputations) continues to account for more than one-half of all worker nonfatal injury cases involving days away from work. In addition to the cost of medical care for these injuries, the cost of lost wages and the potential for long term impacts on worker productivity are enormous.

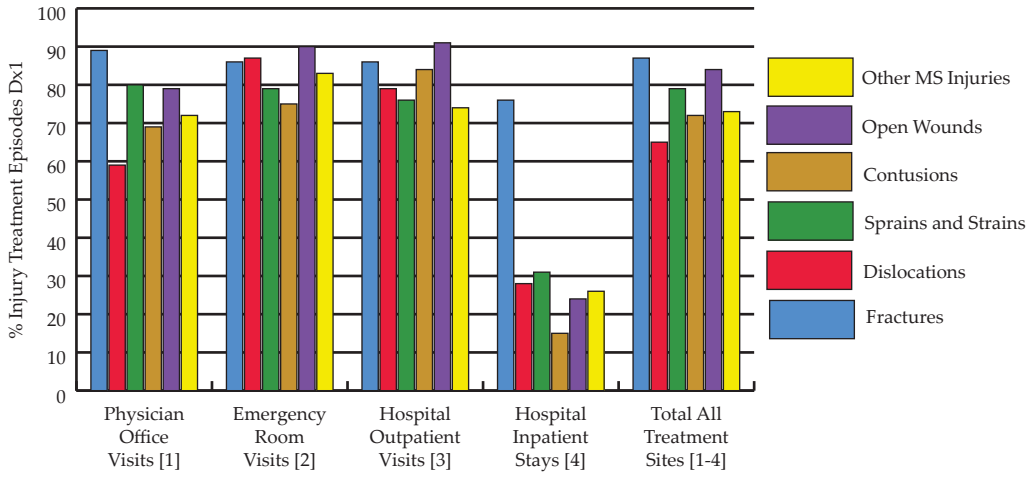
Section 6.6: Health Care Resource Utilization for Musculoskeletal Injuries

Injury treatment episodes for 2006/2007, for purposes of this study, have been defined as the accumulative total of cases for all injury diagnoses treated in 2006 in physician offices, emergency rooms, outpatient clinics, and in 2007 in hospitals, as identified in four major national health care databases. Of the 61.2 million musculoskeletal injury treatment episodes that occurred, 60% were treated in a physician's office. (Table 6.32 and Graph 6.6.1) Another one-third (30%) were treated in emergency rooms. Only 8% were treated in outpatient clinics, with 3% of persons with musculoskeletal injuries admitted to a hospital. Persons hospitalized for a musculoskeletal injury represented 29% of all hospitalizations for an injury; musculoskeletal injuries accounted for 61% of all injury treatment episodes.

Males and females show only slight differences in where they are treated for a musculoskeletal injury. However, males were slightly more likely to be treated in a physicians' office (61% of male injury visits), while females were slightly more likely to be treated in an emergency room (31% of female injury visits).

The age of a person seeking treatment for a musculoskeletal injury is a factor in where treatment is given. (Table 6.33) Persons aged 65 and over are the most likely to be hospitalized for a musculoskeletal injury of any type, accounting for 34% of hospitalized musculoskeletal injury treatment episodes in 2007, but representing only 16% of all musculoskeletal injuries. Persons under the age of 18 are the least likely to be hospitalized, representing only 6% of hospitalized episodes while accounting for 21% of all musculoskeletal injury treatment episodes. Persons aged 18 to 44 years are more likely to seek treatment in an

Graph 6.6.2: Percent of All Traumatic Musculoskeletal Injuries by Treatment Location that are First Diagnosis, United States 2006/2007



[1] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006
[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006
[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006
[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

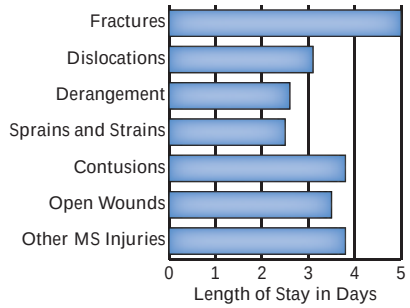
emergency room, while those aged 45 to 64 are more likely to seek treatment in a physician's office or outpatient clinic.

In 85% of the 2006/2007 musculoskeletal injury treatment episodes, or 51.9 million injury episodes, the primary (Dx1) diagnosis was a musculoskeletal injury. (Table 6.34 and Graph 6.6.2) Among the 1.6 million persons hospitalized for a musculoskeletal injury, 62% were hospitalized with a primary (Dx1) diagnosis of a musculoskeletal injury. Hospitalization for a fracture is usually the primary (Dx1) diagnosis (76%).

Fractures and open wounds are commonly the primary (Dx1) diagnosis (87% and 84%, respectively) regardless of the treatment site, while dislocations were less frequently a primary (Dx1) diagnosis (65%).

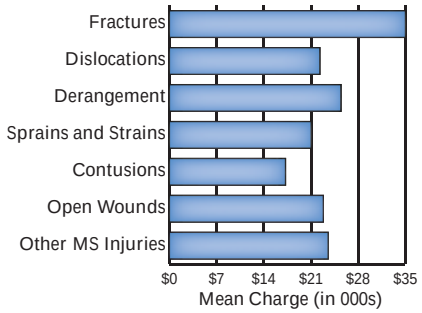
The 1.0 million persons hospitalized for a primary (Dx1) diagnosis of a musculoskeletal injury in 2007 spent an average of 4.8 days in the hospital, representing 4.7 million hospitalized days and total estimated hospital costs of $32.43 billion. (Table 6.35 and Graph 6.6.3) The mean hospital cost per patient for treatment of a musculoskeletal injury was $33,260. (Graph 6.6.4) Eighty-four percent (84%) of persons hospitalized with a primary (Dx1) diagnosis of a musculoskeletal injury were treated for a fracture, and fractures represented 90% of the estimated total cost of treatment. The average hospital length of stay for a fracture was 5.0 days, for a total of 4.2 million hospital days; the average hospital charge per patient was $35,000, for a total cost of $29.08 billion.

Graph 6.6.3: Mean Hospital Patient Stay for Dx1 [1] Musculoskeletal Injury Patients, United States 2007



[1] First listed diagnosis for inpatients discharged from short-stay hospitals
Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Graph 6.6.4: Mean Hospital Charge for Dx1 [1] Musculoskeletal Injury Patients, United States 2007



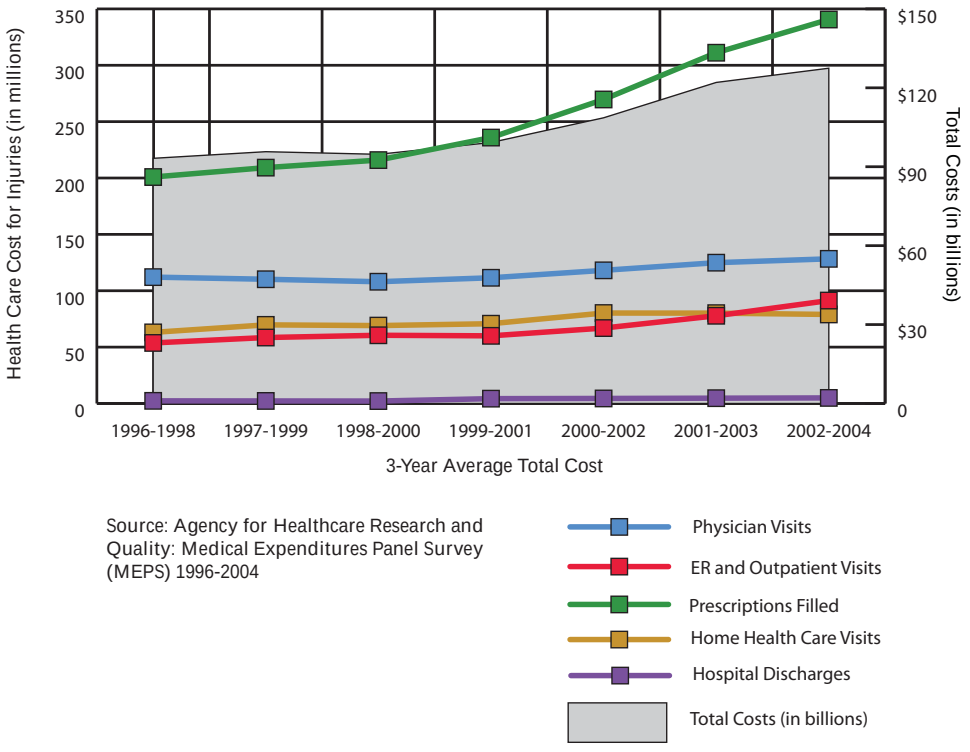
[1] First listed diagnosis for inpatients discharged from short-stay hospitals
Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Section 6.7: Economic Cost of Musculoskeletal Injuries

Chapter 9 (Health Care Utilization and Economic Costs of Musculoskeletal Diseases) summarizes the cost of musculoskeletal conditions based on analysis of the Medical Expenditures Panel Survey (MEPS) from 1996 to 2004. The MEPS, which began in 1996, is a set of large-scale surveys of families and individuals, their medical providers (doctors, hospitals, pharmacies, etc.), and employers across the United States. MEPS collects data on the specific health services that Americans use, how frequently they use them, the cost of these services, and how they are paid for, as well as data on the cost, scope, and breadth of health insurance held by and available to U.S. workers. Currently MEPS collects data from two major components: households and insurance companies. The Household Component (HC) provides data from individual households and their members, which is supplemented by data from their medical providers. The Insurance Component is a separate survey of employers that provides data on employer-based health insurance. MEPS also includes a Medical Provider Component (MPC), which covers hospitals, physicians, home health care providers, and pharmacies identified by MEPS-HC respondents. Its purpose is to supplement and/or replace information received from the MEPS-HC respondents.[6]

As with the National Health Interview Survey (NHIS), data in the household component is self-reported. As noted earlier, the NHIS is believed to underreport the incidence of injuries. Comparison of incidence between the two databases indicates injuries in the MEPS may also be under-reported. In 2008, the NHIS reported 22.1 million persons sustained a musculoskeletal injury. An annual average of 24.7 million persons reported a musculoskeletal injury between 2002 and 2004 in the MEPS, a relatively stable number since the 1996 to 1998 MEPS data. (Table 6.36) This compares to the 61.2 million injury treatment episodes reported in the four major health care databases for physician offices, emergency rooms, hospital outpatient clinics, and inpatient care for 2006/2007.

Graph 6.7.1: Total Visits for Musculoskeletal Injuries by Expenditure Type and Total Musculoskeletal Injury Costs, United States 1996-2004



The estimated annual cost for medical care of musculoskeletal injuries in 2004 utilizing the MEPS data was $127.4 billion or an average of $5,160 for each of the 24.7 million persons who sustained a musculoskeletal injury. A breakdown of the $127.4 billion cost due to musculoskeletal injuries shows 33% for ambulatory care, 31% for emergency room or inpatient care, 17% for prescription drugs, and

18% for other expenses. The cost of musculoskeletal injuries, in 2004 dollars, rose from $93 billion in 1996 to $127.4 billion in 2004, an increase of 37%. The increasing cost of prescription drugs accounts for the largest percentage of this total cost increase, rising from 11% of total cost to 17% over the 9-year period. (Graph 6.7.1)

1. Centers for Disease Control and Prevention (CDC): 2003 National Health Interview Survey (NHIS) Public Use Data Release. Available at: http://www.cdc.gov/nchs/about/major/nhis/quest_data_related_1997_forward.htm. Accessed May 10, 2007.

2. Praemer A, Furner S, Rice DP: *Musculoskeletal Conditions in the United States*, ed 2. Rosemont, IL: American Academy of Orthopaedic Surgeons, 1999, p 182.

3. Centers for Disease Control, National Center for Injury Prevention and Control, WISQARSTM (Web-based Injury Statistics Query and Reporting System), Leading Causes of Nonfatal Injuries Reports, 2008. Available at: http://webappa.cdc.gov/sasweb/ncipc/nfilead.html. Accessed on November 10, 2009.

4. Finkelstein EA, Corso PS, Miller TR: *The Incidence and Economic Burden of Injuries in the United States*. New York, NY: Oxford University Press, Inc., 2006, p 187.

5. National Institute for Occupational Safety and Health (NIOSH): Workers Health Chartbook. Cincinnati, OH: Department of Health and Human Services, Centers for Disease Control and Prevention, 2004, p 58.

6. Agency for Health Care Quality and Research: Medical Expenditure Panel Survey Background, 2007. Available at: http://www.meps.ahrq.gov/mepsweb/about_meps/survey_back.jsp. Accessed May 7, 2007.

Section 6.8: Musculoskeletal Injuries Data Tables

Table 6.1: Comparison of Incidence of Unintentional Injuries, United States 1985, 1992-1994, 2000, and 2006

	Incidence of Injuries (in 000s)							
	Rice, 1985 [1]		MSCUS, 1992-1994 [2]		Finkelstein, 2000 [3]		BMUS 2009	
	Incidence	% of Total	Incidence	% of Total	Incidence	% of Total	Incidence	% of Total
Total Injuries	56,443		57,885		50,127		100,561	
Fatal Unintentional Injuries	143	0.3%	NA		149	0.3%	122 [4]	0.1%
Hospitalized Injuries	2,300	4.1%	NA		1,870	3.7%	5,527 [5]	5.5%
Non-hospitalized, Medically Treated Injuries	54,000	95.7%	NA		48,108	96.0%	94,912 [6]	94.4%
Musculoskeletal Injuries	NA		36,901		33,460		61,210	
Fatal Unintentional Injuries	NA		NA		33 [7]	0.1%	21 [8]	0.0%
Hospitalized Injuries	NA		NA		1,273 [7]	3.8%	1,589 [5]	2.6%
Non-hospitalized, Medically Treated Injuries	NA		NA		32,154 [7]	96.1%	59,600 [9]	97.4%
Musculoskeletal as % of All Unintentional Injuries	NA		63.7%		66.8%		60.9%	

[1] Rice DP, MacKenzie EJ: *Cost of Injury in the United States: A Report to Congress* , 1989. San Francisco, CA: Institute for Health & Aging, University of California and Injury Prevention Center, The Johns Hopkins University, 1989.

[2] Praemer A, Furner S, Rice DP. *Musculoskeletal Conditions in the United States.* Rosemont, IL: American Academy of Orthopaedic Surgeons, 1999, p 83.

[3] Finkelstein EA, Corso PS, Miller TR. *The Incidence and Economic Burden of Injuries in the United States* . New York, NY: Oxford University Press, 2006, p 8.

[8] Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), 20 Leading Causes of Death, Unintentional Injuries, 2006. Available at: http://webappa.cdc.gov/cgi-bin/broker.exe. Accessed on November 10, 2009.

[5] Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[6] National Center for Health Statistics. National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

[7] Defined as spinal cord, vertebral column, torso, upper extremity, lower extremity injuries. Finkelstein EA, Corso PS, Miller TR. *The Incidence and Economic Burden of Injuries in the United States* . New York, NY: Oxford University Press,2006, p 13.

[8] Defined as falls. Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), Fatal Injuries Report, Unintentional Injuries Only, 2006. Available at: http://webappa.cdc.gov/cgi-bin/broker.exe; all ages percentages. Accessed on November 10, 2009.

[9] Defined as fracture, derangement, dislocation, sprain/strain, contusion, crushing injury, open wound, traumatic amputation, and late effects of injury. National Center for Health Statistics. National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

Table 6.2 : Resource Utilization for Traumatic Injuries by Treatment Location and Sex, United States 2006/2007

	Total Visits (in 000s) [1]					
	Physician Office Visits [2]	Emergency Room Visits [3]	Hospital Outpatient Visits [4]	Inpatient Stays [5]	Total All Treatment Sites	% All Diagnoses for All Treatment Locations
Fractures	9,919	3,877	1,264	1,095	16,155	26%
Dislocations	2,470	520	319	46	3,355	5%
Sprains and Strains	12,023	4,869	1,367	94	18,353	30%
Contusions	4,578	4,680	599	183	10,040	16%
Open Wounds	4,550	4,540	888	220	10,198	17%
All Other Musculoskeletal Injuries	5,454	1,272	492	148	7,366	12%
Total All Musculoskeletal Traumatic Injuries	36,617	18,264	4,719	1,589	61,189	
All Injury Treatment Episodes	57,162	30,940	6,810	5,527	100,439	
Proportion of Total Diagnoses That Are Musculoskeleta	64%	59%	69%	29%	61%	

[1] All listed diagnoses for inpatients discharged from short-stay hospitals.

[2] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

[5]Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 6.3 : Distribution of Injury Treatment Episodes, 2006/2007, and Self-Reported Injuries, 2008, by Type of Musculoskeletal Injury, United States

Injury Treatment Episodes [1]

	Proportion Injury Treatment Episodes						
	Total	Females	Males	<18 Years	18-44 Years	45-64 Years	65 & Over
Fractures	26%	25%	28%	36%	18%	23%	36%
Dislocations	5%	5%	6%	4%	5%	6%	8%
Sprains and Strains	30%	31%	29%	25%	34%	36%	18%
Contusions	16%	19%	14%	17%	19%	11%	19%
Open Wounds	17%	15%	18%	15%	19%	15%	17%
All Other Musculoskeletal Injuries	12%	13%	12%	10%	12%	16%	8%
	Total Injury Treatment Episodes (in 000s)						
Total All Musculoskeletal Traumatic Injuries	61,189	28,324	32,855	12,710	21,842	16,459	9,929

Self-Reported Injury Episodes [2]

	Proportion Self-Reported Injury Episodes						
Fractures	25%	24%	27%	30%	19%	23%	35%
Dislocations	2%	2%	3%	2%	4%	2%	1%
Sprains and Strains	44%	46%	42%	47%	44%	45%	30%
Contusions	17%	22%	11%	10%	15%	23%	22%
Open Wounds	16%	13%	19%	10%	22%	13%	15%
All Other Musculoskeletal Injuries	4%	4%	4%	2%	3%	5%	7%
	Self-Reported Injury Episodes (in 000s)						
Total All Musculoskeletal Traumatic Injuries	22,107	11,577	10,530	5,509	7,966	5,700	2,932

[1] Sources : National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006; Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] National Center for Health Statistics. National Health Interview Survey, Injury File, 2008

Table 6.4: Injury Treatment Episodes and Rate by Type of Musculoskeletal Injury by Sex and Age, United States 2006/2007

TOTAL POPULATION	Injury Treatment Episodes (in 000s) [1]									
	Total		Under 18 Years		18-44 Years		45-64 years		65 Years & Over	
	Injury Treatment Episodes	Rate per 100 Population	Injury Treatment Episodes	Rate per 100 Population	Injury Treatment Episodes	Rate per 100 Population	Injury Treatment Episodes	Rate per 100 Population	Injury Treatment Episodes	Rate per 100 Population
Fractures	16,155	5.4	4,528	6.1	4,015	3.5	3,815	5.1	3,603	9.7
Dislocations	3,355	1.1	566	0.8	985	0.9	1,057	1.4	746	2.0
Sprains and Strains	18,353	6.1	3,114	4.2	7,482	6.6	5,930	7.9	1,818	4.9
Contusions	10,040	3.4	2,173	2.9	4,160	3.7	1,795	2.4	1,878	5.0
Open Wounds	10,198	3.4	1,845	2.5	4,179	3.7	2,504	3.3	1,652	4.4
All Other Musculoskeletal Injuries	7,366	2.5	1,295	1.8	2,697	2.4	2,615	3.5	749	2.0
Total All Musculoskeletal Traumatic Injurie	61,189	20.4	12,710	17.2	21,842	19.2	16,459	22.0	9,929	26.6
All Injuries	100,439	33.5	21,468	29.1	35,430	31.2	26,752	35.7	16,243	43.6
Total Population (in 000s) [2]	299,398		73,736		113,538		74,865		37,260	
MALES	Injury Treatment Episodes Males (in 000s) [1]									
Fractures	9,061	6.1	2,987	7.9	2,800	4.9	2,168	5.9	1,065	6.8
Dislocations	1,877	1.3	291	0.8	626	1.1	628	1.7	333	2.1
Sprains and Strains	9,584	6.5	1,664	4.4	4,345	7.5	3,173	8.7	400	2.6
Contusions	4,601	3.1	1,202	3.2	2,256	3.9	520	1.4	513	3.3
Open Wounds	6,008	4.1	1,152	3.1	2,892	5.0	1,168	3.2	790	5.0
All Other Musculoskeletal Injuries	3,796	2.6	635	1.7	1,188	2.1	1,314	3.6	357	2.3
Total All Musculoskeletal Traumatic Injurie	32,855	22.3	7,543	20.0	13,501	23.4	8,404	23.0	3,355	21.4
All Injuries	52,394	35.5	12,345	32.7	20,192	35.1	13,699	37.5	5,982	38.2
Total Population (in 000s) [2]	147,512		37,735		57,607		36,514		15,657	
FEMALES	Injury Treatment Episodes Females (in 000s) [1]									
Fractures	7,087	4.7	1,539	4.3	1,212	2.2	1,647	4.3	2,537	11.7
Dislocations	1,478	1.0	274	0.8	361	0.6	429	1.1	412	1.9
Sprains and Strains	8,770	5.8	1,451	4.0	3,137	5.6	2,757	7.2	1,417	6.6
Contusions	5,438	3.6	971	2.7	1,802	3.2	1,273	3.3	1,364	6.3
Open Wounds	4,199	2.8	695	1.9	1,287	2.3	1,335	3.5	860	4.0
All Other Musculoskeletal Injuries	3,569	2.3	660	1.8	1,209	2.2	1,300	3.4	393	1.8
Total All Musculoskeletal Traumatic Injurie	28,324	18.6	5,165	14.3	8,339	14.9	8,054	21.0	6,577	30.4
All Injuries	48,045	31.6	9,120	25.3	15,234	27.2	13,051	34.0	10,262	47.5
Total Population (in 000s) [2]	151,886		36,001		55,931		38,351		21,603	

[1] Sources : National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006; National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006; National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006; Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

[2] Source: U.S. Census Bureau, National Population Estimates: National Sex and Age. Available at: http://www.census.gov/popest/national/asrh/NC-EST2006-sa.html. Accessed November 6, 2009.

Table 6.5: Trends in Fracture Treatment Episodes for Selected Anatomic Sites by Treatment Location, United States 1998-2004

Emergency Room Visits

ICD-9-CM	Description	Total Visits (rounded to nearest 000) [1]							
		1998	1999	2000	2001	2002	2003	2004	2006
Upper Limb									
812	Fracture of Upper Arm (Humerus)	261	346	417	297	329	398	342	270
813	Fracture of Lower Arm (Radius/Ulna)	647	628	588	745	583	563	763	505
814 - 817	Wrist/Hand/Fingers	832	1,007	1,033	1,079	970	895	1,093	974
Lower Limb									
820 - 821	Fracture of Hip/Upper Leg (Femur)	324	313	297	298	282	302	307	326
823	Fracture of Lower Leg (Tibia/Fibula)	244	234	209	292	212	197	264	195
824 - 826	Fracture of Ankle/Foot/Toes	787	697	836	968	740	816	783	944
All Anatomic Sites [2]									
812 - 817	Fracture of Upper Limb	1,726	1,965	2,009	2,097	1,853	1,841	2,163	1,743
820 - 821, 823 - 826	Fracture of Lower Limb	1,339	1,233	1,331	1,551	1,217	1,311	1,348	1,429
812 - 817, 820 - 821, 823 - 826	All Fracture of Upper/Lower Limb	3,041	3,190	3,308	3,624	3,058	3,148	3,495	3,135

Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 1998-2006

Physician Office Visits

ICD-9-CM	Description	Total Visits (rounded to nearest 000) [1]							
		1998	1999	2000	2001	2002	2003	2004	2006
Upper Limb									
812	Fracture of Upper Arm (Humerus)	*	*	*	*	*	*	*	*
813	Fracture of Lower Arm (Radius/Ulna)	2,429	1,437	1,852	1,685	2,710	1,116	1,485	1,567
814 - 817	Wrist/Hand/Fingers	2,691	1,846	2,450	2,675	2,740	2,464	1,988	2,423
Lower Limb									
820 - 821	Fracture of Hip/Upper Leg (Femur)	*	*	*	*	*	*	*	*
823	Fracture of Lower Leg (Tibia/Fibula)	*	*	*	*	*	*	*	*
824 - 826	Fracture of Ankle/Foot/Toes	2,170	1,804	1,883	2,210	2,555	2,228	2,100	2,355
All Anatomic Sites [2]									
812 - 817	Total Upper Limb Fractures	5,718	3,963	5,203	5,005	5,915	4,234	4,203	5,169
820 - 821, 823 - 826	Total Lower Limb Fractures	4,027	2,750	3,244	3,344	4,008	3,692	3,862	3,753
812 - 817, 820 - 821, 823 - 826	All Fracture of Upper/Lower Limb	9,746	6,644	8,349	8,184	9,816	7,731	7,976	8,923

Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Physician Visits, 1998-2006

Inpatient Hospitalization

ICD-9-CM	Description	Total Visits (rounded to nearest 000) [1]							
		1998	1999	2000	2001	2002	2003	2004	2006
Upper Limb									
812	Fracture of Upper Arm (Humerus)	90	98	91	105	89	102	102	108
813	Fracture of Forearm (Radius/Ulna)	96	98	98	106	92	108	94	111
814 - 817	Wrist/Hand/Fingers	42	43	41	38	37	35	39	43
Lower Limb									
820 - 821	Fracture of Hip/Upper Leg (Femur)	445	443	423	434	431	422	449	425
823	Fracture of Lower Leg (Tibia/Fibula)	91	99	94	95	86	91	88	85
824 - 826	Fracture of Ankle/Foot/Toes	164	172	169	176	166	170	173	159
All Anatomic Sites [2]									
812 - 817	Total Upper Limb Fractures	216	225	221	237	209	231	224	245
820 - 821, 823 - 826	Total Lower Limb Fractures	682	694	663	686	665	664	689	654
812 - 817, 820 - 821, 823 - 826	All Fracture of Upper/Lower Limb	863	887	850	889	843	867	885	863

* Estimate does not meet standards for reliability.

[1] All diagnoses [2] Totals may not add due to rounding and inclusion of additional anatomic sites.

Source: National Center for Health Statistics, National Hospital Discharge Survey,1998-2006

Table 6.5a: Fracture Treatment Episode Trends for Total Physician Office Visits, Emergency Room Visits, and Inpatient Hospitalization for Selected Anatomic Sites, United States 1998-2006

		Total Visits (rounded to nearest 0000) [1]							
ICD-9-CM	Description	1998	1999	2000	2001	2002	2003	2004	2006
Upper Limb									
812	Fracture of Upper Arm (Humerus)	351	444	509	401	418	500	444	378
813	Fracture of Forearm (Radius/Ulna)	3,172	2,164	2,539	2,536	3,385	1,786	2,342	2,183
814 - 817	Wrist/Hand/Fingers	3,564	2,896	3,524	3,793	3,746	3,394	3,120	3,440
Lower Limb									
820 - 821	Fracture of Hip/Upper Leg (Femur)	769	756	720	732	713	724	756	751
823	Fracture of Lower Leg (Tibia/Fibula)	334	333	303	387	298	288	352	280
824 - 826	Fracture of Ankle/Foot/Toes	3,121	2,673	2,888	3,354	3,461	3,213	3,057	3,458
All Anatomic Sites [2]									
812 - 817	Total Upper Limb Fractures	7,661	6,153	7,433	7,339	7,977	6,307	6,591	7,157
820-821, 823-826	Total Lower Limb Fractures	6,049	4,678	5,237	5,582	5,890	5,666	5,898	5,836
812-817, 820-821, 823-826	All Fracture of Upper/Lower Limb	13,650	10,722	12,507	12,696	13,718	11,746	12,356	12,921

		Proportion of Total Visits							
ICD-9-CM	Description	1998	1999	2000	2001	2002	2003	2004	2006
Upper Limb		**Proportion of Upper Limb Fractures**							
812	Fracture of Upper Arm (Humerus)	5.0%	8.1%	7.7%	6.0%	5.5%	8.8%	7.5%	6.3%
813	Fracture of Forearm (Radius/Ulna)	44.8%	39.3%	38.6%	37.7%	44.8%	31.4%	39.7%	36.4%
814 - 817	Wrist/Hand/Fingers	50.3%	52.6%	53.6%	56.4%	49.6%	59.8%	52.8%	57.3%
	% Upper/Lower Limb Fractures	56.1%	57.4%	59.4%	57.8%	58.2%	53.7%	53.3%	55.4%
Lower Limb		**Proportion of Upper Limb Fractures**							
820 - 821	Fracture of Hip/Upper Leg (Femur)	18.2%	20.1%	18.4%	16.4%	15.9%	17.1%	18.2%	16.7%
823	Fracture of Lower Leg (Tibia/Fibula)	7.9%	8.9%	7.7%	8.7%	6.7%	6.8%	8.5%	6.2%
824 - 826	Fracture of Ankle/Foot/Toes	73.9%	71.1%	73.8%	75.0%	77.4%	76.0%	73.4%	77.0%
	% Upper/Lower Limb Fractures	44.3%	46.6%	41.9%	44.0%	42.9%	48.2%	47.7%	45.2%
		Proportion of Fractures Treated by Site							
Location	Emergency Room Visits	22.3%	29.8%	26.5%	28.5%	22.3%	26.8%	28.3%	24.3%
	Physician Office Visits	71.4%	62.0%	66.8%	64.5%	71.6%	65.8%	64.6%	69.1%
	Inpatient Hospitalization	6.3%	8.3%	6.8%	7.0%	6.1%	7.4%	7.2%	6.7%

* Estimate does not meet standards for reliability.

[1] All diagnoses [2] Totals may not add due to rounding and inclusion of additional anatomic sites.

Sources: National Center for Health Statistics, National Hospital Discharge Survey, 1998-2006; National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 1998-2006; National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Physician Visits, 1998-2006

Table 6.6: Location of Musculoskeletal Injury Episode Occurrence, United States 2008

	Total Occurrences (in 000s) [1]	% of Total Occurrences
Inside Home	5,092	23.0%
Outside Home	4,219	19.1%
School	1,954	8.8%
Street or Highway	1,580	7.1%
Sport or Recreation Facility	2,079	9.4%
Shopping Center/Restaurant	1,048	4.7%
Other	5,743	26.0%
Unknown	392	1.8%
All Musculoskeletal Injuries	22,107	100.0%

* Totals may not add due to rounding

[1] All listed diagnoses for persons reporting a musculoskeletal injury in the 3-month period prior to the interview, weighted to annual occurrences.

Source: National Center for Health Statistics. National Health Interview Survey, Injury Database, 2008

Table 6.7: Nonfatal Unintentional Injuries Treated in Hospital Emergency Departments, United States 2008

Cause of Injury	Total Nonfatal Unintentional Injuries (in 000s)	% of Total Nonfatal Unintentional Injuries	Total Nonfatal Unintentional Injuries Treated and Released (in 000s)	% of Total Nonfatal Unintentional Injuries Treated and Released	Rate of Nonfatal Unintentional Injuries Treated and Released per 1,000 Persons
Falls	8,551	31%	7,615	89%	25.0
Struck By/Against	4,492	16%	4,374	97%	14.4
Overexertion	3,278	12%	3,229	99%	10.6
Motor Vehicle Occupant	2,582	9%	2,365	92%	7.8
Cut/Pierce	2,073	7%	2,024	98%	6.7
Other Causes	6,095	22%	5,233	86%	17.2
Unknown	807	3%	735	91%	2.4
Total All Causes	27,878	100%	25,575	92%	84.1

Source: Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), Nonfatal Unintentional Injury Reports treated in Emergency Department. Available at: http://webappa.cdc.gov/sasweb/ncipc/nfirates2001.html. Accessed on November 10, 2009.

Table 6.8: Nonfatal Unintentional Injuries Treated in Emergency Departments by Age, United States 2008

Age	Total Nonfatal Unintentional Injuries	Total Nonfatal Unintentional Falls	% of Total Nonfatal Unintentional Injuries that are Falls	Falls Rank as Leading Cause of Nonfatal Unintentional Injury
0-4 years	2,246,139	1,003,709	45%	1
5-9 years	1,693,564	639,091	38%	1
10-14 years	2,151,639	607,365	28%	1
15-24 years	5,170,713	918,574	18%	2
25-34 years	4,143,130	813,125	20%	1
35-44 years	3,680,896	798,775	22%	1
45-54 years	3,433,363	913,341	27%	1
55-64 years	2,070,337	742,735	36%	1
65 years & over	3,284,671	2,114,113	64%	1
Unknown age	3,297	208	6%	1
Total All Ages	27,877,748	8,551,037	31%	1

Source: Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), Leading Causes of Nonfatal Injuries Reports, 2008. Available at: http://webappa.cdc.gov/sasweb/ncipc/nfilead.html. Accessed on November 10, 2009.

Table 6.9: Deaths Due to Falls from Unintentional Injury Episodes by Age, United States 2006

Age	Total Population (in 000s)	Total Unintentional Injury Deaths	Total Deaths Due to Falls	Rate of Unintentional Injury Deaths Due to Falls (per 100,000 persons)	% of Total Unintentional Injury Deaths Due to Falls
<18 years	73,594	7,966	130	0.2	1.6%
18-24	29,236	13,278	211	0.7	1.6%
25-34 years	40,020	14,954	318	0.8	2.1%
35-44 years	43,481	17,534	628	1.4	3.6%
45-54 years	43,210	19,675	1,290	3.0	6.6%
55-64 years	31,558	11,446	1,592	5.0	13.9%
65-74 years	18,915	8,420	2,392	12.6	28.4%
75-84 years	13,068	13,708	6,227	47.7	45.4%
85 years & over	5,281	14,561	8,031	152.1	55.2%
Total All Ages	298,363	121,599	20,823	7.0	17.1%

Source: Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), Fatal Injuries Report, Injury Mortality Reports, 1999-2006. Available at: http://webappa.cdc.gov/sasweb/ncipc/mortrate10_sy.html. Accessed on November 10, 2009.

Table 6.10: Trends in Deaths Due to Falls, United States 1984-2006

Year	Total Unintentional Injury Deaths Occurring All Locations [1]			Total Unintentional Injury Deaths Occurring in the Home [2]			% All Deaths Due to Falls that Occurred in the Home
	Total Unintentional Injury Deaths	Death due to Falls	% of Deaths due to Falls	Total Home Injury Deaths	Death due to Falls	% of Deaths due to Falls	
1984	92,911	11,937	12.8%	21,200	6,400	30.2%	53.6%
1985	93,457	12,001	12.8%	21,600	6,500	30.1%	54.2%
1986	95,277	11,444	12.0%	21,700	6,100	28.1%	53.3%
1987	95,020	11,733	12.3%	21,400	6,300	29.4%	53.7%
1988	97,100	12,096	12.5%	22,700	6,600	29.1%	54.6%
1989	95,028	12,151	12.8%	22,500	6,600	29.3%	54.3%
1990	91,983	12,313	13.4%	21,500	6,700	31.2%	54.4%
1991	89,347	12,662	14.2%	22,100	6,900	31.2%	54.5%
1992	86,777	12,646	14.6%	24,000	7,700	32.1%	60.9%
1993	90,523	13,141	14.5%	26,100	7,900	30.3%	60.1%
1994	91,437	13,450	14.7%	26,300	8,100	30.8%	60.2%
1995	93,320	13,986	15.0%	27,200	8,400	30.9%	60.1%
1996	94,948	14,986	15.8%	27,500	9,000	32.7%	60.1%
1997	95,644	15,447	16.2%	27,700	9,100	32.9%	58.9%
1998	97,835	16,274	16.6%	29,000	9,500	32.8%	58.4%
1999	97,860	13,162	13.4%	30,500	7,600	24.9%	57.7%
2000	97,900	13,322	13.6%	29,200	7,100	24.3%	53.3%
2001	101,537	15,019	14.8%	33,200	8,600	25.9%	57.3%
2002	106,742	16,257	15.2%	36,200	9,700	26.8%	59.7%
2003	108,900	19,800	18.2%	37,600	11,900	31.6%	60.1%
2004	111,000	20,200	18.2%	37,400	12,800	34.2%	63.4%
2005 [3]	117,800	19,700	16.7%	NA	NA	NA	NA
2006 [3]	121,600	20,800	17.1%	NA	NA	NA	NA

[1] Source: National Safety Council. *Injury Facts, 2009* . Itasca, IL: National Safety Council, 2009, p 42.

[2] Source: National Safety Council. *Injury Facts, 2009* . Itasca, IL: National Safety Council, 2009, p 127.

[3] Centers for Disease Control, National Center for Injury Prevention and Control, **WISQARS™** (Web-based Injury Statistics Query and Reporting System), Fatal Injuries Report, Unintentional Injuries Only, 2005 & 2006. Available at: http://webappa.cdc.gov/cgi-bin/broker.exe; all ages percentages. Accessed on November 10, 2009.

Table 6.11: Proportion of Unintentional Injury Episodes by Type and Cause of Injury, United States 2008

		Proportion of Injury Episodes by Injury Type for Selected Causes [1]					
	Total Injury Episodes [2]	Motor Vehicle	Bike, Scooter, Skateboard, Skis, etc.	Pedestrian (Struck)	Boat, Train, Plane	Fall	Burn
Spain, Strain or Twist	31.9%	55.7%	41.9%	26.5%	51.5%	37.6%	3.1%
Cut or Scrape	16.0%	11.8%	15.1%	26.7%	32.9%	14.1%	0.0%
Fracture	19.9%	18.0%	27.3%	36.7%	0.0%	29.3%	0.0%
Bruise or Contusion	18.0%	32.9%	20.3%	74.0%	49.3%	23.8%	0.0%
Other	13.6%	18.6%	11.1%	15.6%	0.0%	10.0%	7.2%
Bite (Insect or Animal)	2.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Burn	1.3%	0.9%	1.6%	0.0%	0.0%	0.5%	89.7%
Total Injury Episodes (in 000s)	30,702	2,092	1,540	188	163	11,074	263

[1] Self-reported injury type in the 3-month period prior to the interview, weighted to annual episodes.

[2] Multiple injury types and body parts injured per injury episode possible. Totals may not equal 100%.

Source: National Center for Health Statistics. National Health Interview Survey, Injury Database, 2008

Table 6.12: Incidence and Rates of Injuries by Body Region, United States 2000

	Fatal		Hospitalized		Nonhospitalized		Total	
	Incidence (in 000s)	Rate/ 100,000	Incidence (in 000s)	Rate/ 100,000	Incidence (in 000s)	Rate/ 100,000	Incidence (in 000s)	Rate/ 100,000
Traumatic Brain Injury	40	15	156	56	1,147	415	1,343	486
Other Head /Neck Injury	5	2	144	52	6,392	2,312	6,541	2,366
Spinal Cord Injury	1	0	10	4	16	6	27	10
Vertebral Column Injury	1	0	86	31	4,619	1,671	4,706	1,702
Torso	23	8	245	89	3,888	1,406	4,155	1,503
Upper Extremity	1	0	275	100	13,047	4,720	13,324	4,820
Lower Extremity	7	3	656	237	10,584	3,829	11,247	4,069
Other/Unspecified	32	12	18	7	5,789	2,094	5,839	2,113
Systemwide Injuries	39	14	279	101	2,626	950	2,945	1,065
Total	149	54	1,870	676	48,108	17,405	50,127	18,135

Source: Finkelstein EA, Corso PS, Miller TR. *The Incidence and Economic Burden of Injuries in the United States* . New York, NY: Oxford University Press, 2006, p 12.

Table 6.13: Visits to Physicians in Office-Based Practice for Fractures, Sprains and Strains, and Dislocation Injuries at Selected Anatomic Sites by Gender, United States 2006

Visits for Fractures

	Total Visits (in 000s) [1]			% of Total Visits
	Male	Female	Total	
Hand and Fingers	581	717	1,298	12.5%
Radius and Ulna (Arm)	498	1,069	1,567	15.0%
Ankle	337	920	1,257	12.1%
Ribs and Sternum *	94	250	344	3.3%
Tibia and Fibula (Leg) *	193	475	668	6.4%
Foot and Toes	546	590	1,136	10.9%
Humerus (Shoulder)	734	508	1,242	11.9%
Vertebral Column *	227	179	406	3.9%
Neck of Femur (Hip) *	161	144	305	2.9%
Wrist	468	657	1,124	10.8%
Femur *	235	190	425	4.1%
Pelvis *	27	-	27	0.3%
Clavicle or Scapula *	87	301	388	3.7%
Patella (Knee)	199	39	238	2.3%
All Fractures [2]			10,425	100.0%
Total Fracture Episodes Treated in Physician's Office			9,919	

Visits for Sprains and Strains

	Total Visits (in 000s) [1]			% of Total Visits
	Male	Female	Total	
Back and Sacroiliac	2,803	3,503	6,307	38.0%
Shoulder	1,324	2,254	3,578	21.6%
Elbow and Arm *	-	134	134	0.8%
Hand and Wrist	534	781	1,315	7.9%
Hip and Thigh	905	680	1,585	9.6%
Knee and Leg *	214	427	642	3.9%
Ankle and Foot	1,597	1,422	3,019	18.2%
All Sprains and Strains [2]			16,580	100.0%
Total Sprain and Strain Episodes Treated in Physician's Office			12,023	

Visits for Dislocation Injuries

	Total Visits (in 000s) [1]			% of Total Visits
	Male	Female	Total	
Knee and Leg Joint [3]	708	1,137	1,845	76.8%
Shoulder*	117	165	182	7.6%
All Other Sites	210	167	377	15.7%
All Dislocations [2]			2,404	100.0%
Total Dislocation Episodes Treated in Physician's Office			2,470	

* Estimate does not meet standards for reliability

[1] All listed diagnoses

[2] Multiple anatomic sites per injury episode possible

[3] The high proportion of dislocation injuries attributed to the knee is due to an ICD-9 coding anomaly. Isolated acute ligamentous injuries of the knee (ACL, MCL, PCL, LCL disruptions) are coded as dislocations using ICD-9 methodology, whereas equivalent injuries in other joints are coded as sprains/strains. True complete dislocations of the knee joint are actually quite rare, and associated with marked morbidity.

Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

Table 6.14: Prevalence of Self-Reported Musculoskeletal Injury Episodes by Anatomic Site by Age, United St

	Total Identified Anatomic Site Injuries (in 000s) [1]	% of Total Injuries by Anatomic Site	Prevalence of Self-Reported Injury Sites for All Musculoskeletal Injury Episodes (in 000s) [2]				Proportion of All Injury Sites for All Musculoskeletal Injury Episodes [2]			
			< 18	18 to 44	45 to 64	65 & older	< 18	18 to 44	45 to 64	65 & older
Ankle	3,600	10.1%	1,047	1,511	756	286	12.7%	12.1%	7.9%	5.4%
Back	3,429	9.6%	318	1,564	1,035	515	3.8%	12.5%	10.8%	9.8%
Knee	3,408	9.6%	754	1,097	1,088	468	9.1%	8.8%	11.4%	8.9%
Finger/Thumb	2,689	7.6%	598	1,211	660	220	7.2%	9.7%	6.9%	4.2%
Foot or toe	2,654	7.5%	532	911	946	265	6.4%	7.3%	9.9%	5.0%
Shoulder	2,253	6.3%	292	769	830	362	3.5%	6.2%	8.7%	6.9%
Hand	1,772	5.0%	389	767	466	151	4.7%	6.1%	4.9%	2.9%
Wrist	1,659	4.7%	545	531	226	357	6.6%	4.3%	2.4%	6.8%
Lower leg	1,630	4.6%	196	435	549	450	2.4%	3.5%	5.7%	8.6%
Forearm	1,503	4.2%	449	444	263	348	5.4%	3.6%	2.7%	6.6%
Elbow	1,074	3.0%	518	188	290	79	6.3%	1.5%	3.0%	1.5%
Hip	919	2.6%	96	154	325	344	1.2%	1.2%	3.4%	6.5%
Thigh	632	1.8%	86	234	150	162	1.0%	1.9%	1.6%	3.1%
Upper Arm	458	1.3%	95	118	118	127	1.1%	0.9%	1.2%	2.4%
Other	7,901	22.2%	2,358	2,544	1,871	1,128	28.5%	20.4%	19.5%	21.4%
All MS Injury Episodes by Anatomic Sites*	35,581	100.0%	8,273	12,478	9,573	5,262	100.0%	100.0%	100.0%	100.0%
Total Population Reporting an Injury	30,702		7,998	10,931	7,804	3,968				

* Totals may not add due to rounding

[1] All listed diagnoses for persons reporting a musculoskeletal injury in the 3 month period prior to the interview, weighted to annual episodes.

[2] Multiple anatomic sites per injury episode possible.

Source: National Center for Health Statistics. National Health Interview Survey, Injury Database, 2008

Table 6.15: Activity Limitations due to Fracture or Bone/Joint Injury by Gender and Aged for Persons Age 18 and Over, United States 2005-2006

	Rate of Reported Limitations due to Fracture or Bone/Joint Injury [1] (per 100 persons)		
	Male	Female	Total
18-44 years	1.7	2.3	2.0
45-64 years	5.5	4.7	5.1
65-74 years	6.7	6.5	6.6
75 & over	13.5	12.6	12.9
All ages	4.1	4.4	4.3

[1] "What condition or health problem causes you to have difficulty with or need help with the following activities?" Response: "Fractures, bone/joint injury."

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2005-2006

Table 6.16: Activity Limitations Due to Fracture or Bone/Joint Injury for Persons Aged 18 and Over, United States 2005-2006

	Degree of Limitation for Persons Reporting Limitation [1]			
Activity Limitation Reported [2]	Some Difficulty	Much Difficulty	Unable to Do	Total % With Difficulty
Stooping, crouching, or kneeling	41.2%	22.8%	18.3%	82.3%
Standing for long periods (e.g., 2 hours)	26.4%	19.1%	19.1%	64.6%
Push or pull large objects like a chair [3]	29.9%	11.6%	17.3%	58.7%
Sitting for long periods (e.g., 2 hours)	31.6%	11.9%	5.3%	48.8%
Doing chores around the house	28.3%	9.5%	8.3%	46.1%
Lifting/carrying 10 pound item	23.7%	10.6%	11.2%	45.5%
Standing up from armless straight chair	29.0%	8.0%	6.2%	43.2%
Getting in and out of bed	29.4%	9.8%	1.5%	40.7%
Reaching over head	25.8%	9.8%	4.9%	40.5%
Going shopping, to movies or events	24.5%	9.6%	5.5%	39.6%
Participating in social activities	17.2%	7.9%	5.9%	45.5%
Walking quarter mile (2-3 blocks)	26.1%	7.4%	5.3%	38.8%
Dressing self (tying shoes, zippers, buttons)	26.1%	5.1%	0.8%	32.0%
Using fingers to grasp small objects	22.3%	7.2%	0.9%	30.4%
Waking up 10 steps without resting	20.4%	6.7%	2.1%	29.2%
Moving around rooms on same level	16.0%	2.9%	3.0%	21.9%
Managing money or paying bills	13.0%	3.2%	3.4%	19.6%
Preparing own meals	12.8%	3.4%	3.0%	19.2%
Relaxing at home, watching TV, sewing	12.6%	3.0%	1.5%	17.1%
Eating with utensils or drinking from a glass	9.6%	2.3%	0.1%	12.0%

[1] Responded "yes" to fracture or bone/joint injury when asked "What condition or health problem causes you to have difficulty with or need help with the following activities . . . ?"

[2] "By yourself and without using any special equipment, how much difficulty do you have . . .?"

[3] Not included in 2001-2002 survey; available only for 4 year period 2003-2006.

Source: National Center for Health Statistics. National Health and Nutrition Examination Survey, 2001-2006

Table 6.17: Bed Days Due to Major Health Conditions by Gender for Persons Aged 18 and Over, United States 2008

	Bed Days [1]				Bed Days		
	Persons Reporting Bed Days (in 000s)	Mean Bed Days	Total Bed Days (in 000s)		Persons Reporting Bed Days (in 000s)	Mean Bed Days	Total Bed Days (in 000s)
All Causes [2]				**Other Major Health Conditions**			
				Heart Problem [7]			
Total Population	71,338	11.0	784,718	Total Population	3,703	22.9	84,799
Male	28,947	11.0	318,417	Male	1,901	21.7	41,252
Female	42,390	10.9	462,051	Female	1,802	24.0	43,248
18 to 44 Years	19,554	11.9	232,693	18 to 44 Years	361	17.1	6,173
45 to 64 Years	29,339	12.2	357,936	45 to 64 Years	1,384	31.7	43,873
65 Years & Over	22,445	8.4	188,538	65 Years & Over	1,958	17.6	34,461
Musculoskeletal Conditions							
All Musculoskeletal Injuries or Conditions [3]				**Stroke** [8]			
Total Population	51,334	10.2	523,607	Total Population	1,540	34.1	52,514
Male	20,682	10.0	206,820	Male	769	30.3	23,301
Female	30,652	10.2	312,650	Female	770	37.9	29,183
18 to 44 Years	12,786	11.6	148,318	18 to 44 Years	77	49.4	3,804
45 to 64 Years	22,258	11.1	247,064	45 to 64 Years	650	33.9	22,035
65 Years & Over	16,200	7.6	123,120	65 Years & Over	813	32.8	26,666
Fracture/Bone/Joint Injury[4]				**Hypertension [**9]			
Total Population	6,821	11.2	76,395	Total Population	2,314	24.9	57,619
Male	3,500	12.3	43,050	Male	892	16.4	14,629
Female	3,320	10.0	33,200	Female	1,422	30.2	42,944
18 to 44 Years	2,317	8.1	18,768	18 to 44 Years	149	26.5	3,949
45 to 64 Years	2,920	15.0	43,800	45 to 64 Years	1,309	28.8	37,699
65 Years & Over	1,584	8.7	13,781	65 Years & Over	857	18.5	15,855
Back/Neck Problem [5]				**Other Injury** [10]			
Total Population	18,705	15.4	288,057	Total Population	2,139	10.1	21,604
Male	8,256	16.7	137,875	Male	1,165	8.7	10,136
Female	10,449	14.3	149,421	Female	974	11.8	11,493
18 to 44 Years	6,094	14.1	85,925	18 to 44 Years	919	11.0	10,109
45 to 64 Years	8,326	17.0	141,542	45 to 64 Years	865	6.2	5,363
65 Years & Over	4,285	14.0	59,990	65 Years & Over	358	17.1	6,122
Arthritis/Rheumatism [6]							
Total Population	23,517	10.4	244,577				
Male	7,893	7.9	62,355				
Female	15,624	12.7	198,425				
18 to 44 Years	2,645	16.6	43,907				
45 to 64 Years	10,645	12.6	134,127				
65 Years & Over	10,227	10.4	106,361				

[1] A bed day is defined as 1/2 or more days in bed due to injury or illness in past 12 months, excluding hospitalization.

[2] Respondents reported "Yes" when asked "Are you limited in any way in any activities because of physical, mental or emotional problems." AND respondents reporting a limitation reported "Yes" when asked if limitation was caused by "arthritis/rheumatism, back/neck problem, fracture/bone/joint injury, other injury, heart problem, stroke, hypertension."

[3] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Fracture/bone/joint injury; Back/neck problem; Arthritis/Rheumatism; Amputated limb/finger/digit; or Musculoskeletal/connective tissue problem."

[4] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Fracture/bone/joint injury."

[5] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Back/neck problem."

[6] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Arthritis/rheumatism."

[7] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Heart problem."

[8] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Stroke."

[9] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Hypertension."

[10] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Other injury."

Source: National Center for Health Statistics. National Health Interview Survey, 2008

Table 6.18: Lost Work Days Due to Major Health Conditions by Gender for Persons Aged 18 and Over, United States 2008

	Work Days Lost [1]				Work Days Lost		
	Persons Reporting Lost Work Days (in 000s)	Mean Work Days Lost	Total Work Days Lost (in 000s)		Persons Reporting Lost Work Days (in 000s)	Mean Work Days Lost	Total Work Days Lost (in 000s)
All Causes [2]				**Other Major Health Conditions**			
				Heart Problem [7]			
Total Population	36,408	10.8	393,206	Total Population	745	24.6	18,327
Male	16,182	9.9	160,202	Male	317	21.5	6,816
Female	20,226	11.4	230,576	Female	427	26.9	11,486
18 to 44 Years	15,072	11.8	177,850	18 to 44 Years	180	14.2	2,556
45 to 64 Years	18,494	11.0	203,434	45 to 64 Years	373	35.4	13,204
65 Years & Over	2,842	3.8	10,800	65 Years & Over	192	13.6	2,611
Musculoskeletal Conditions							
All Musculoskeletal Injuries or Conditions [3]				**Stroke** [8]			
Total Population	27,227	10.6	288,606	Total Population	120	27.2	3,264
Male	12,537	9.3	116,594	Male	79	3.2	253
Female	14,690	11.6	170,404	Female	41	73.2	3,001
18 to 44 Years	10,312	12.0	123,744	18 to 44 Years	-	-	-
45 to 64 Years	14,645	10.6	155,237	45 to 64 Years	116	28.3	3,283
65 Years & Over	2,270	3.6	8,172	65 Years & Over	5	-	-
Fracture/Bone/Joint Injury [4]				**Hypertension** [9]			
Total Population	4,263	15.1	64,371	Total Population	496	15.2	7,539
Male	2,524	13.2	33,317	Male	177	8.7	1,540
Female	1,739	17.8	30,954	Female	318	18.9	6,010
18 to 44 Years	1,928	10.7	20,630	18 to 44 Years	40	11.0	440
45 to 64 Years	2,059	19.0	39,121	45 to 64 Years	395	17.2	6,794
65 Years & Over	275	17.4	4,785	65 Years & Over	61	5.4	329
Back/Neck Problem [5]				**Other Injury** [10]			
Total Population	10,127	14.8	149,880	Total Population	1,198	28.7	34,383
Male	5,016	13.1	65,710	Male	680	43.7	29,716
Female	5,110	16.4	83,804	Female	518	9.1	4,714
18 to 44 Years	4,570	17.9	81,803	18 to 44 Years	651	31.2	20,311
45 to 64 Years	5,030	12.9	64,887	45 to 64 Years	535	26.3	14,071
65 Years & Over	527	5.4	2,846	65 Years & Over	11	2.6	29
Arthritis/Rheumatism [6]							
Total Population	9,422	10.4	97,989				
Male	3,672	6.8	24,970				
Female	5,750	12.7	73,025				
18 to 44 Years	1,823	9.4	17,136				
45 to 64 Years	6,420	12.2	78,324				
65 Years & Over	1,178	2.2	2,592				

[1] A bed day is defined as 1/2 or more days in bed due to injury or illness in past 12 months, excluding hospitalization.

[2] Respondents reported "Yes" when asked "Are you limited in any way in any activities because of physical, mental or emotional problems." AND respondents reporting a limitation reported "Yes" when asked if limitation was caused by "arthritis/rheumatism, back/neck problem, fracture/bone/joint injury, other injury, heart problem, stroke, hypertension."

[3] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Fracture/bone/joint injury; Back/neck problem; Arthritis/Rheumatism; Amputated limb/finger/digit; or Musculoskeletal/connective tissue problem."

[4] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Fracture/bone/joint injury."

[5] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Back/neck problem."

[6] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Arthritis/rheumatism."

[7] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Heart problem."

[8] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Stroke."

[9] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Hypertension."

[10] Respondents reporting a limitation reported "Yes" when asked if limitation was caused by "Other injury."

Source: National Center for Health Statistics. National Health Interview Survey, 2008

Table 6.19: Summary of Bed and Lost Work Days Due to Health Problems for Persons Age 18 and Over, United States 2008

Cause of Bed/Lost Work Days [1]	Bed Days [2] Total (in 000s)	Bed Days [2] % of Total	Lost Work Days [3] Total (in 000s)	Lost Work Days [3] % of Total
Musculoskeletal Injury or Condition	523,607	67%	288,606	73%
Heart Problem	84,799	11%	18,327	5%
Hypertension	57,619	7%	7,539	2%
Stroke	52,514	7%	3,264	1%
Other Injury	21,604	3%	34,383	9%
Other Health Conditions	44,576	6%	41,087	10%
All Causes	784,718	100%	393,206	100%
MUSCULOSKELETAL INJURY OR CONDITION				
Back/Neck Pain	288,057	37%	149,880	38%
Arthritis/Rheumatism	244,577	31%	97,989	25%
Fracture/Bone/Joint Pain	76,395	10%	64,371	16%

[1] Respondents reported "Yes" when asked "Are you limited in any way in any activities because of physical, mental or emotional problems."

[2] A bed day is defined as 1/2 or more days in bed due to injury or illness in past 12 months, excluding hospitalization.

[3] A missed work day is defined as absence from work due to illness or injury in the past 12 months, excluding maternity or family leave.

Source: National Center for Health Statistics. National Health Interview Survey, 2008

Table 6.20: Musculoskeletal Disorders (MSDs) for Work-Related Injuries and Illnesses Involving Days Away from Work, United States 1992-2007

	All Cases of Work-related Injuries and Illnesses	MSDs	% of MSD Cases to All Cases
1992	2,331,098	784,145	33.6%
1993	2,252,591	762,727	33.9%
1994	2,236,639	755,594	33.8%
1995	2,040,929	695,789	34.1%
1996	1,880,525	647,355	34.4%
1997	1,833,380	626,352	34.2%
1998	1,730,534	592,544	34.2%
1999	1,702,420	582,340	34.2%
2000	1,664,018	577,814	34.7%
2001	1,537,567	522,528	34.0%
2002	1,436,194	487,915	34.0%
2003	1,315,920	435,180	33.1%
2004	1,259,320	402,700	32.0%
2005	1,234,860	375,540	30.4%
2006	1,183,500	357,160	30.2%
2007	1,158,870	335,390	28.9%

Source (1992 to 1997): U.S. Department of Labor, Bureau of Labor Statistics: Worker Health Chartbook 2004. Available at: http://www2a.cdc.gov/niosh-Chartbook/imagedetail.asp?imgid=77. Accessed August 24, 2007.

Source (1998 to 2007): U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2006 and 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1790.pdf and http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Table 6.21: Musculoskeletal Disorders for Work-Related Injuries and Illnesses Involving Days Away from Work by Nature of Injury, United States 2000-2007

Nature of Injury [1]		Sprains, Strains	Carpal Tunnel Syndrome	Tendonitis	Soreness & Pain (excl back pain)	Back Pain	All Other [2]	Total Cases
2000	Number	442,839	27,571	12,577	25,454	31,685	50,265	577,814
	Percent	75.0%	4.7%	2.1%	4.3%	5.4%	8.5%	100.0%
2001	Number	399,722	26,522	12,131	22,346	27,894	33,913	522,528
	Percent	76.5%	5.1%	2.3%	4.3%	5.3%	6.5%	100.0%
2002	Number	369,785	22,583	8,105	25,934	30,953	38,660	487,915
	Percent	74.6%	4.6%	1.6%	5.2%	6.2%	7.8%	100.0%
2003	Number	331,020	22,110	6,740	21,930	23,650	29,740	435,180
	Percent	76.1%	5.1%	1.5%	5.0%	5.4%	6.8%	100.0%
2004	Number	306,210	18,760	5,940	22,460	23,770	1,790	378,930
	Percent	80.8%	5.0%	1.6%	5.9%	6.3%	0.5%	100.0%
2005	Number	287,970	16,440	5,040	19,880	22,050	24,170	375,540
	Percent*	76.7%	4.4%	1.3%	5.3%	5.9%	6.4%	100.0%
2006	Number	274,730	12,990	4,020	21,810	21,950	21,660	357,160
	Percent*	76.9%	3.6%	1.1%	6.1%	6.1%	6.1%	100.0%
2007	Number	252,590	11,920	3,530	22,520	23,430	21,400	335,390
	Percent*	75.3%	3.6%	1.1%	6.7%	7.0%	6.4%	100.0%

[1] Multiple injuries per case possible; percentages based on total injuries, which may be > total cases.

[2] Includes MS system and connective diseases and disorders and hernia.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2006 and 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1790.pdf and http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Table 6.22: Trends in MSD Injuries Involving Days Away from Work in Private Industry by Sex, United States 2000 to 2007

		All MSD Injuries		
		Male	Female	Total
2000	Number	358,949	216,014	574,963
	Percent	62.4%	37.6%	
2001	Number	324,935	194,910	519,845
	Percent	62.5%	37.5%	
2002	Number	300,128	186,966	487,915
	Percent	61.6%	38.4%	
2003	Number	267,530	166,780	435,180
	Percent	61.6%	38.4%	
2004	Number	254,220	147,750	402,700
	Percent	63.2%	36.8%	
2005	Number	238,630	136,340	375,540
	Percent	63.5%	36.3%	
2006	Number	222,880	133,710	357,160
	Percent	62.4%	37.4%	
2007	Number	207,770	127,010	335,390
	Percent	61.9%	37.9%	

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2006 and 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1790.pdf and http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Table 6.23: Distribution of Nonfatal Injury and Illness Cases Involving Days Away from Work in Private Industry for Musculoskeletal Disorders by Sex, United States 2007

		Nonfatal Injuries by Injury Type, 2007		
		Male	Female	Total
All Nonfatal Injuries and Illnesses	Number	744,860	409,040	1,158,870
	Rate per 10,000	134.1	105.2	122.2
All MSD Injuries	Number	207,770	127,010	335,390
	Rate per 10,000	37.4	32.7	35.4
All Sprains, Strains & Tears [1]	Number	280,670	165,550	448,380
	Rate per 10,000	50.5	42.6	47.3
Carpal Tunnel Syndrome	Number	3,750	8,180	11,940
	Rate per 10,000	0.7	2.1	1.3
Tendonitis	Number	1,693	2,680	4,380
	Rate per 10,000	0.3	0.7	0.5

[1] Totals are greater than shown in Table 6.21 for MDS sprains & strains due to inclusion of all sprains and strains.

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

Table 6.24: Musculoskeletal Disorders (MSDs) for Work-Related Injuries and Illnesses Involving Days Away from Work by Race, United States 2007

	Nonfatal Injuries and Illnesses [1]		MSDs		Sprains, Strains & Tears		Carpal Tunnel Syndrome		Tendonitis	
Race or Ethnicity	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
White	519,330	65.0%	151,850	68.3%	198,820	67.0%	6,710	77.6%	2,030	71.7%
Black/African American	94,200	11.8%	27,050	12.2%	37,670	12.7%	780	9.0%	270	9.5%
Hispanic or Latino	157,320	19.7%	36,250	16.3%	51,010	17.2%	960	11.1%	390	13.8%
Asian	16,220	2.0%	4,090	1.8%	4,820	1.6%	150	1.7%	90	3.2%
Other/Mixed	12,110	1.5%	3,140	1.4%	4,450	1.5%	50	0.6%	50	1.8%
Not Reported	359,690		113,010		151,620		3,280		1,530	
Total	1,158,870	100.0%	335,390	100.0%	448,380	100.0%	11,940	100.0%	4,380	100.0%

[1] Nonfatal injuries and illnesses include the total of all nonfatal injuries and illnesses involving days away from work

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8b. Number and percent of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and nature of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1939.pdf. Accessed November 11, 2009.

Table 6.25: Musculoskeletal Disorders (MSDs) for Work-Related Injuries and Illnesses Involving Days Away from Work by Age, United States 2007

	Nonfatal Injuries and Illnesses		MSDs		Sprains, Strains & Tears		Carpal Tunnel Syndrome		Tendonitis	
	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers
Under 14 Years	20	*	*	*	*	*	*	*	*	*
14 to 15	400	*	30	*	30	*	*	*	*	*
16 to 19	35,250	124.0	6,400	22.5	9,790	34.4	30	0.1	80	0.3
20 to 24	124,550	134.4	30,320	32.7	43,740	47.2	380	0.4	340	0.4
25 to 34	260,080	118.4	74,780	34.0	101,840	46.4	1,710	0.8	1,320	0.6
35 to 44	283,660	123.9	93,440	40.8	118,550	51.8	3,300	1.4	890	0.4
45 to 54	271,300	123.0	84,410	38.3	109,730	49.7	4,170	1.9	1,010	0.5
55 to 64	138,960	119.9	35,470	30.6	50,220	43.3	2,170	1.9	570	0.5
65 Years & Older	25,140	96.2	4,900	18.8	7,400	28.3	90	0.4	60	0.2
Total	1,158,870	122.2	335,390	35.4	448,380	47.3	11,940	1.3	4,380	0.5

* Data does not meet publication guidelines

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

Table 6.26: Musculoskeletal Disorders (MSD) for Work-Related Injuries and Illnesses Involving Days Away from Work by Body Part Affected, United States 2007

	All Natures		Musculoskeletal Disorders		Sprains, Strains & Tears		Carpal Tunnel Syndrome		Tendonitis	
Body Part Affected	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers
Head (total)	78,370	8.3	90	*	220	*	*	*	*	*
Eye	33,010	3.5	50	*	110	*	*	*	*	*
Head (except eye) [1]	45,360	4.8	40	*	110	*	*	*	*	*
Neck	17,050	1.8	5,420	0.6	11,730	1.2	*	*	*	*
Trunk (total)	384,650	40.6	237,330	25.0	248,480	26.2	*	*	1,100	0.1
Shoulder	75,580	8.0	43,620	4.6	51,180	5.4	*	*	1,100	0.1
Back	235,960	24.9	160,880	17.0	177,480	18.7	*	*	*	*
Trunk (except shoulder and back) [1]	73,110	7.7	32,830	3.4	19,820	2.1	*	*	*	*
Upper Extremities (total)	269,240	28.4	48,650	5.1	40,740	4.3	11,940	1.3	2,910	0.3
Arm	54,260	5.7	14,020	1.5	13,590	1.4	*	*	840	0.1
Wrist	51,620	5.4	25,270	2.7	15,710	1.7	11,940	1.3	1,460	0.2
Hand (except finger)	47,920	5.1	3,010	0.3	3,680	0.4	*	*	170	*
Finger	101,650	10.7	3,090	0.3	4,510	0.5	*	*	170	*
Upper Extremities (except arm, wrist, hand & finger) [1]	13,790	1.5	3,260	0.3	3,250	0.3	*	*	270	*
Lower Extremities (total)	260,580	27.5	27,260	2.9	112,980	11.9	*	*	260	*
Knee	94,500	10.0	17,630	1.9	52,340	5.5	*	*	80	*
Ankle	62,660	6.6	3,930	0.4	41,730	4.4	*	*	60	*
Foot, Toe	55,600	5.9	1,520	0.2	7,160	0.8	*	*	90	*
Lower Extremities (except knee, foot & toe) [1]	47,820	5.0	4,180	0.4	11,750	1.2	*	*	30	*
Body Systems	17,710	1.9	*	*	*	*	*	*	*	*
Multiple Parts	120,950	12.8	15,780	1.7	33,050	3.5	*	*	80	*
All Other	10,330	1.1	850	0.1	1,170	0.1	*	*	20	*
Total Cases	1,158,870	122.2	335,390	35.4	448,380	47.3	11,940	1.3	4,380	0.5

[1] Computed value

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 8a. Number and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and selected natures of injury or illness, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1938.pdf. Accessed November 11, 2009.

Table 6.27: Incidence Rates per 10,000 Full-time Workers for Injuries and Illnesses by Nature of Injury or Illness for Nonfatal Occupational Injuries Involving Days Away from Work, United States 1997-2007

	Incidence per 10,000 Full-Time Workers						Incidence Rate Change
	1997	1999	2001	2003	2005	2007	1997-2007
Sprains, Strains	92.5	81.8	73.7	64.3	55.3	47.3	-48.9%
Bruises, Contusions	19.2	17.3	15.0	13.5	11.8	10.7	-44.3%
Cuts, Lacerations, Punctures	15.5	14.6	12.6	11.0	11.2	11.3	-27.1%
Fractures	13.8	12.6	11.9	10.8	10.5	10.0	-27.5%
Heat Burns	3.5	3.0	2.8	2.2	1.9	1.8	-48.6%
Carpal Tunnel Syndrome	3.4	3.1	3.0	2.5	1.8	1.3	-61.8%
Tendonitis	2.1	1.8	1.6	0.9	0.6	0.5	-76.2%
Chemical Burns	1.4	1.3	1.0	0.9	0.7	0.6	-57.1%
Amputations	1.3	1.1	1.0	0.9	0.9	0.8	-38.5%
Multiple Traumatic Injuries	6.9	6.6	5.9	5.5	5.5	4.9	-29.0%
Soreness, Pain						12.2	NA
All Other						20.8	NA
MSD Injuries All Cases	212.3	188.3	169.1	150.0	135.7	122.2	-42.4%

Source: U.S. Department of Labor, Bureau of Labor Statistics: Survey of Occupational Injuries and Illnesses. Table 6 (1997-2001) or 7 (2003-2005): Incidence rates for nonfatal occupational injuries and illnesses involving days away from work per 10,000 full-time workers for selected characteristics and major industry sector: Nature of injury or illness. Lost work time.pdf:1995-2005. Available at: www.bls.gov/iif/oshcdnew.htm. Accessed July 7, 2007.

Source: (2007) U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Table 6.28: Incidence Rates for Injuries and Illnesses by Industry for Nonfatal Occupational Injuries Involving Days Away from Work by Body Part Affected, United States 2007

		Goods Producing				Service Providing							
	Total Private Industry	Total Goods Producing	Natural Resource and Mining	Con-struction	Manu-facturing	Total Service	Trade, Transport and Utilities	Infor-mation	Financial Activities	Professional and Business Services	Education and Health Services	Leisure and Hospitality	Other Services
Head (total)	8.3	11.8	14.5	14.9	9.9	7.1	10.3	4.1	3.5	4.4	6.3	8.2	8.7
Eye	3.5	6.4	7.3	7.3	5.8	2.6	3.7	1.0	1.6	1.4	1.7	3.1	5.7
Neck	1.8	1.8	1.8	2.6	1.4	1.8	2.6	0.6	1.0	1.1	2.5	0.8	1.8
Trunk (total)	40.6	46.9	48.3	58.0	41.2	38.5	56.5	20.6	14.1	19.8	54.9	27.0	25.6
Shoulder	8.0	10.2	8.5	11.6	9.7	7.3	11.9	3.9	1.9	3.6	9.1	4.8	4.4
Back	24.9	25.4	26.3	31.8	22.1	24.7	34.4	12.6	9.3	12.5	38.9	16.5	16.9
Upper Extremities (total)	28.4	43.5	33.9	44.8	43.9	23.6	31.9	12.8	10.2	14.9	21.5	31.8	28.8
Arm	5.7	7.8	7.0	9.7	6.9	5.1	7.3	2.6	2.2	2.6	5.0	5.0	9.5
Wrist	5.4	6.5	3.2	5.3	7.5	5.1	6.5	3.7	2.9	4.0	5.7	5.0	3.6
Hand (except finger)	5.1	8.1	6.1	10.5	7.1	4.1	5.4	2.1	1.5	2.6	3.1	7.0	4.9
Finger	10.7	19.1	15.8	17.6	20.3	8.0	11.2	3.5	3.0	4.8	6.0	13.4	9.5
Lower Extremities (total)	27.5	33.6	45.5	48.3	24.7	25.5	37.6	16.4	10.6	14.6	27.0	25.8	22.1
Knee	10.0	11.7	15.3	16.8	8.7	9.4	12.9	6.0	3.8	4.9	11.5	9.9	9.7
Ankle	6.6	7.3	9.2	11.9	4.7	6.4	9.1	4.0	2.3	4.2	6.7	6.9	5.1
Foot (except toe)	4.6	6.4	9.2	8.3	5.1	4.1	6.6	2.5	2.2	2.2	3.6	3.9	2.7
Toe	1.2	1.6	1.4	2.2	1.3	1.1	2.2	1.0	0.2	0.3	0.9	0.6	1.1
Body Systems	1.9	1.8	1.6	2.3	1.6	1.9	2.2	2.6	0.9	1.6	2.1	1.4	3.1
Multiple Parts	12.8	12.6	16.0	18.1	9.3	12.8	15.8	11.7	5.9	8.1	18.8	10.4	10.7
Rate All Cases	122.2	152.9	163.3	190.3	132.8	112.4	158.4	69.3	47.0	64.9	134.2	106.5	102.3

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. TABLE 7. Incidence rates(1) for nonfatal occupational injuries and illnesses involving days away from work(2) per 10,000 full-time workers for selected characteristics and major industry sector, 2007. Available at: http://www.bls.gov/news.release/osh2.t07.htm. Accessed November 13, 2009.

Table 6.29: Musculoskeletal Disorders (MSDs) for Work-Related Injuries and Illnesses Involving Days Away from Work by Occupation, United States 2007

	All Natures Private Industry		MSDs		Sprains, Strains and Tears		Carpal Tunnel Syndrome		Tendonitis	
Industry	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers	Number	Rate per 10,000 Workers
Management, Business, Financial	29,600	30.5	7,020	7.2	9,770	10.1	890	0.9	260	0.3
Professional and Related	79,260	54.7	26,140	18.0	38,240	26.4	650	0.5	330	0.2
Service	251,490	162.9	73,060	47.3	102,060	66.1	980	0.6	520	0.3
Sales and Related	78,070	70.1	23,300	20.9	30,610	27.5	560	0.5	290	0.3
Office and Administrative Support	85,190	54.2	27,430	17.4	33,760	21.5	2,860	1.8	430	0.3
Farming, Fishing, and Forestry	13,950	149.8	2,190	23.5	4,390	47.2	20	0.3	40	0.4
Construction and Extractive	134,010	238.7	30,050	53.5	44,150	78.6	420	0.7	330	0.6
Installation, Maintenance and Repair	98,390	217.5	26,950	59.6	35,590	78.7	670	1.5	120	0.3
Production	160,350	175.7	49,020	53.7	51,860	56.8	3,700	4.1	1,340	1.5
Transportation and Material Moving	225,780	285.0	69,900	88.2	97,240	122.7	1,170	1.5	720	0.9
Total	1,158,870	122.2	335,390	35.4	448,380	47.3	11,940	1.3	4,380	0.5

Industry	Proportion of Total Injuries within Occupation				
Management, Business, Financial	2.6%	2.1%	2.2%	7.5%	5.9%
Professional and Related	6.9%	7.8%	8.5%	5.5%	7.5%
Service	21.8%	21.8%	22.8%	8.2%	11.9%
Sales and Related	6.8%	7.0%	6.8%	4.7%	6.6%
Office and Administrative Support	7.4%	8.2%	7.5%	24.0%	9.8%
Farming, Fishing, and Forestry	1.2%	0.7%	1.0%	0.2%	0.9%
Construction and Extractive	11.6%	9.0%	9.9%	3.5%	7.5%
Installation, Maintenance and Repair	8.5%	8.0%	8.0%	5.6%	2.7%
Production	13.9%	14.6%	11.6%	31.0%	30.6%
Transportation and Material Moving	19.5%	20.9%	21.7%	9.8%	16.4%

Source: U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. Table 10. Number, percent, and incidence rate of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and musculoskeletal disorders, All United States, private industry, 2007. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb1941.pdf. Accessed November 11, 2009.

Table 6.30: Median Days Away from Work for Nonfatal Injuries and Illnesses by Nature of Injury or Illnesses, United States 1997-2007

	Median Days Away from Work					
	1997	1999	2001	2003	2005	2007
Fractures	21	20	21	30	27	30
Carpal Tunnel Syndrome (MSD & Other)	25	27	25	32	27	28
Amputations	18	18	18	30	22	21
Tendonitis (MSD & Other)	11	9	10	11	12	10
Multiple Traumatic Injuries	7	7	8	9	8	10
Sprains, Strains (MSD & Other)	6	6	6	8	8	8
Soreness, Pain (except Back)	NA	NA	NA	NA	NA	8
Back Pain	NA	NA	NA	NA	NA	8
Heat Burns	4	4	5	5	5	5
Bruises, Contusions	3	3	3	4	4	4
Cuts, Lacerations, Punctures	3	3	3	4	4	4
Chemical Burns	2	3	2	2	3	1
Musculoskeletal Disorders	*	7	8	10	9	9
Total All Cases	5	6	6	8	7	7
Musculoskeletal Disorder Cases	*	582.3	522.5	435.2	375.5	335.4
All Cases	1,833.3	1,702.5	1,537.6	1,315.9	1,234.7	1158.9

* Data not available

Source (1997 to 2005): U.S. Department of Labor, Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses. Table 9 (1997-2001) or 11 (2003-2005): Percent distribution of nonfatal occupational injuries and illnesses involving days away from work by selected injury or illness characteristics and number of days away from work: Nature of injury or illness. Lost work time:1996-2005. Available at: www.bls.gov/iif/oshcdnew.htm. Accessed July 7, 2007.

Source (2007): U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. 2007 nonfatal occupational injuries and illnesses: case and demographics. November 20, 2008, reissued March 2009. Available at: http://www.bls.gov/iif/oshwc/osh/case/osch0038.pdf. Accessed November 13, 2009.

Table 6.31: Median Days Away from Work for Nonfatal Injuries and Illnesses by Part of Body Affected, United States 1997-2007

	1997	1999	2001	2003	2005	2007
Neck	5	6	5	8	7	6
Trunk	7	7	7	9	8	8
Shoulder	9	10	12	18	15	18
Back	6	6	6	7	7	7
Upper Extremities	6	6	6	7	7	7
Arm	NA	NA	NA	NA	NA	9
Wrist	12	12	13	17	14	14
Hand (except finger)	5	5	4	5	5	5
Finger	5	4	5	5	5	5
Lower Extremities	6	7	7	9	9	10
Knee	9	10	11	14	12	15
Ankle	NA	NA	NA	NA	NA	8
Foot (except toe)	5	5	6	7	7	7
Toe	5	5	5	6	5	7
Multiple Parts	8	8	8	10	8	9
Total All Cases	5	6	6	8	7	7
Total Cases (in 000s)	1,833	1,703	1,538	1,316	1,235	1,159

Source (1997 to 2005): U.S. Department of Labor, Bureau of Labor Statistics, Survey of Occupational Injuries and Illnesses. Table 11: Percent distribution of nonfatal occupational injuries and illnesses involving days away from work by selected injury or illness characteristics and number of days away from work: Part of body affected by the injury or illness. Lost work time:1996-2005. Available at: www.bls.gov/iif/oshcdnew.htm. Accessed July 7, 2007.

Source (2007): U.S. Department of Labor, Bureau of Labor Statistics, Injuries, Illnesses and Fatalities Program: Case and Demographic Characteristics for Work-related Injuries and Illnesses Involving Days Away from Work. TABLE R67. Number and percent distribution of nonfatal occupational injuries and illnesses involving days away from work1 by nature of injury or illness and number of days away from work, 2007. Reissued March 2009. Available at: http://www.bls.gov/iif/oshwc/osh/case/ostb2009.pdf. Accessed November 13, 2009.

Table 6.32: Resource Utilization for Traumatic Musculoskeletal (MS) Injuries by Treatment Location and Sex, United States 2006/2007

	Total Visits (in 000s) [1]						% Total Diagnoses by Treatment Location			
	Physician Office Visits [2]	Emergency Room Visits [3]	Hospital Outpatient Visits [4]	Inpatient Stays [5]	Total All Treatment Sites	% All MS Injuries All Locations	Physician Office Visits [2]	Emergency Room Visits [3]	Hospital Outpatient Visits [4]	Inpatient Stays [5]
Fractures										
All Fractures	9,919	3,877	1,264	1,095	16,155	26.4%	61%	24%	8%	7%
Males	5,769	2,106	719	467	9,061	27.6%	64%	23%	8%	5%
Females	4,151	1,771	545	620	7,087	25.0%	59%	25%	8%	9%
Dislocations										
All Dislocations	2,470	520	319	46	3,355	5.5%	74%	15%	10%	1%
Males	1,369	309	172	27	1,877	5.7%	73%	16%	9%	1%
Females	1,101	212	146	19	1,478	5.2%	74%	14%	10%	1%
Sprains and Strains										
All Sprains and Strains	12,023	4,869	1,367	94	18,353	30.0%	66%	27%	7%	1%
Males	6,659	2,279	600	46	9,584	29.2%	69%	24%	6%	0%
Females	5,365	2,590	767	48	8,770	31.0%	61%	30%	9%	1%
Contusions										
All Contusions	4,578	4,680	599	183	10,040	16.4%	46%	47%	6%	2%
Males	2,003	2,178	346	74	4,601	14.0%	44%	47%	8%	2%
Females	2,575	2,502	253	108	5,438	19.2%	47%	46%	5%	2%
Open Wounds										
All Open Wounds	4,550	4,540	888	220	10,198	16.7%	45%	45%	9%	2%
Males	2,597	2,829	444	138	6,008	18.3%	43%	47%	7%	2%
Females	1,953	1,711	444	81	4,189	14.8%	47%	41%	11%	2%
Other Musculoskeletal Injuries										
All Other MS Injuries	5,454	1,272	492	148	7,366	12.0%	74%	17%	7%	2%
Males	2,777	617	323	79	3,796	11.6%	73%	16%	9%	2%
Females	2,677	655	169	68	3,569	12.6%	75%	18%	5%	2%
Total Musculoskeletal Traumatic Injuries										
All MS Traumatic Injuries	36,617	18,264	4,719	1,589	61,189		60%	30%	8%	3%
Males	20,100	9,541	2,499	715	32,855		61%	29%	8%	2%
Females	16,517	8,723	2,220	864	28,324		58%	31%	8%	3%
All Injury Treatment Episodes										
All Injuries	57,162	30,940	6,810	5,527	100,439		57%	31%	7%	6%
Males	30,095	16,197	3,418	2,710	52,420		57%	31%	7%	5%
Females	27,067	14,743	3,392	2,817	48,019		56%	31%	7%	6%

[1] All listed diagnoses for inpatients discharged from short-stay hospitals. Multiple diagnoses per case possible; percentages based on total diagnoses.

[2] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

[5]Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 6.33: Resource Utilization for Traumatic Musculoskeletal (MS) Injuries by Treatment Location and Age, United States 2006/2007

	Total Visits (in 000s) [1]						% Total Visits at Treatment Location			
	Physician Office Visits [2]	Emergency Room Visits [3]	Hospital Outpatient Visits [4]	Inpatient Stays [5]*	Total All Treatment Sites	% All MS Injuries All Locations	Physician Office Visits [2]	Emergency Room Visits [3]	Hospital Outpatient Visits [4]	Inpatient Stays [5]
Fractures										
All Fractures	9,919	3,877	1,264	1,095	16,155	26.4%	61%	24%	8%	7%
Under 18 Years	2,824	1,204	433	67	4,528	35.6%	62%	27%	10%	1%
18 to 44 Years	2,328	1,092	387	208	4,015	18.4%	58%	27%	10%	5%
45 to 64 Years	2,519	777	289	230	3,815	23.2%	66%	20%	8%	6%
65 Years and Over	2,249	804	155	395	3,603	36.3%	62%	22%	4%	11%
Dislocations										
All Dislocations	2,470	520	319	46	3,355	5.5%	74%	15%	10%	1%
Under 18 Years	347	140	76	3	566	4.5%	61%	25%	13%	1%
18 to 44 Years	589	250	128	18	985	4.5%	60%	25%	13%	2%
45 to 64 Years	852	104	88	13	1,057	6.4%	81%	10%	8%	1%
65 Years and Over	682	27	27	10	746	7.5%	91%	4%	4%	1%
Sprains and Strains										
All Sprains and Strains	12,023	4,869	1,367	94	18,353	30.0%	66%	27%	7%	1%
Under 18 Years	1,815	1,036	260	3	3,114	24.5%	58%	33%	8%	0%
18 to 44 Years	4,392	2,553	513	24	7,482	34.3%	59%	34%	7%	0%
45 to 64 Years	4,551	916	435	28	5,930	36.0%	77%	15%	7%	0%
65 Years and Over	1,265	363	159	31	1,818	18.3%	70%	20%	9%	2%
Contusions										
All Contusions	4,578	4,680	599	183	10,040	16.4%	46%	47%	6%	2%
Under 18 Years	864	1,094	207	8	2,173	17.1%	40%	50%	10%	0%
18 to 44 Years	1,786	2,120	220	34	4,160	19.0%	43%	51%	5%	1%
45 to 64 Years	793	867	129	36	1,825	11.1%	43%	48%	7%	2%
65 Years and Over	1,136	628	44	70	1,878	18.9%	60%	33%	2%	4%
Open Wounds										
All Open Wounds	4,550	4,540	888	220	10,198	16.7%	45%	45%	9%	2%
Under 18 Years	718	918	189	20	1,845	14.5%	39%	50%	10%	1%
18 to 44 Years	1,512	2,212	355	100	4,179	19.1%	36%	53%	8%	2%
45 to 64 Years	1,306	923	228	47	2,504	15.2%	52%	37%	9%	2%
65 Years and Over	1,104	486	116	36	1,742	17.5%	63%	28%	7%	2%
Other Musculoskeletal Injuries										
All Other MS Injuries	5,454	1,272	492	148	7,366	12.0%	74%	17%	7%	2%
Under 18 Years	867	320	98	10	1,295	10.2%	67%	25%	8%	1%
18 to 44 Years	1,756	659	238	44	2,697	12.3%	65%	24%	9%	2%
45 to 64 Years	2,239	212	120	46	2,617	15.9%	86%	8%	5%	2%
65 Years and Over	593	81	36	39	749	7.5%	79%	11%	5%	5%
Total Musculoskeletal Traumatic Injuries										
All MS Traumatic Injuries	36,617	18,264	4,719	1,589	61,189		60%	30%	8%	3%
Under 18 Years	7,027	4,382	1,202	99	12,710		55%	34%	9%	1%
18 to 44 Years	11,560	8,156	1,777	349	21,842		53%	37%	8%	2%
45 to 64 Years	11,388	3,503	1,216	352	16,459		69%	21%	7%	2%
65 Years and Over	6,643	2,223	524	539	9,929		67%	22%	5%	5%
All Injury Treatment Episode										
All Injuries	57,162	30,940	6,810	5,527	100,439		57%	31%	7%	6%
Under 18 Years	11,279	8,057	1,822	310	21,468		53%	38%	8%	1%
18 to 44 Years	18,557	13,263	2,474	1,136	35,430		52%	37%	7%	3%
45 to 64 Years	17,491	5,942	1,763	1,556	26,752		65%	22%	7%	6%
65 Years and Over	9,835	3,678	750	1,980	16,243		61%	23%	5%	12%

* Distribution by age group does not meet standards of reliability. Included to information purposes only.

[1] All listed diagnoses for inpatients discharged from short-stay hospitals. Multiple diagnoses per case possible; percentages based on total diagnoses.

[2] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006

[4] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

[5]Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 6.34: Percent Resource Utilization for Traumatic Musculoskeletal (MS) Injuries by Treatment Location for All Injury Diagnoses versus Primary (Dx1) Diagnosis, United States 2006/2007

	Percent of All Injury Diagnoses that are Primary (1st) Diagnosis				
	Physician Office Visits [1]	Emergency Room Visits [2]	Hospital Outpatient Visits [3]	Inpatient Stays [4]	Total All Treatment Sites
Fractures	89%	86%	86%	76%	87%
Dislocations	59%	87%	79%	28%	65%
Sprains and Strains	80%	79%	76%	31%	79%
Contusions	69%	75%	84%	15%	72%
Open Wounds	79%	90%	91%	24%	84%
All Other MS Injuries	72%	83%	74%	26%	73%
Total All MS Traumatic Injuries	84%	89%	86%	62%	85%

[1] Source: National Center for Health Statistics, National Ambulatory Medical Care Survey, 2006

[2] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Care Survey, Emergency Room Visits, 2006

[3] Source: National Center for Health Statistics, National Hospital Ambulatory Medical Visits, Outpatient Department Visits, 2006

[4] Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 6.35 : Patient Days and Estimated Total Cost for Hospital Care for Primary (Dx1) Traumatic Musculoskeletal (MS) Injury Patients, United States 2007

		Hospital Stay			Hospital Cost		
	Total Patients (in 000s) [1]	Mean Length of Stay (in days)	Total Patient Days (in 000s)	% of Total Patient Days [2]	Mean Charge per Patient [3]	Estimated Total Cost (in billions)	% of Total Cost [2]
Fractures							
Fracture of Upper Limb	100	5.2	520	11.1%	$ 28,970	$ 2.897	8.9%
Fracture of Lower Limb	158	3.2	506	10.8%	$ 37,300	$ 5.893	18.1%
Fracture of Trunk and Multiple Sites	573	5.4	3,094	66.2%	$ 38,180	$ 21.877	67.1%
All Fractures	831	5.0	4,155	89.0%	$ 35,000	$ 29.085	89.1%
Derangement Injuries							
Derangement of Knee	5	2.2	11	0.2%	$ 24,420	$ 0.122	0.4%
Other Joint Derangement	13	2.7	35	0.8%	$ 25,850	$ 0.336	1.0%
All Derangement Injuries	17	2.6	44	0.9%	$ 25,450	$ 0.433	1.3%
Dislocation Injuries							
Dislocations of Upper Limb	5	2.9	15	0.3%	$ 19,470	$ 0.097	0.3%
Dislocations of Lower Limb	8	3.3	26	0.6%	$ 23,710	$ 0.190	0.6%
All Dislocation Injuries	13	3.1	40	0.9%	$ 22,310	$ 0.290	0.9%
Sprain and Strain Injuries							
Sprains of Upper Limb	11	2.0	22	0.5%	$ 20,570	$ 0.226	0.7%
Sprains of Lower Limb	8	3.3	26	0.6%	$ 23,710	$ 0.190	0.6%
All Sprains and Strain Injuries	21	2.5	53	1.1%	$ 21,020	$ 0.441	1.4%
Contusions	27	3.8	103	2.2%	$ 17,210	$ 0.465	1.4%
Crushing Injuries	6	5.5	33	0.7%	$ 42,520	$ 0.255	0.8%
Open Wounds	53	3.5	186	4.0%	$ 22,820	$ 1.209	3.7%
Traumatic Amputation	8	4.6	37	0.8%	$ 39,520	$ 0.316	1.0%
Other Musculoskeletal Injuries]4\	7	3.0	21	0.4%	$ 18,830	$ 0.132	0.4%
All Other MS Injuries	101	3.8	379	8.1%	$ 23,540	$ 2.378	7.3%
Total All MS Traumatic Injuries	975	4.8	4,680	100.0%	$ 33,260	$ 32.429	100.0%
All Traumatic Injuries	2,735	5.3	14,496		$ 36,650	$ 100.238	
% MS Traumatic Injuries of All Traumatic Injuries	36%		32%			32%	

[1] First listed diagnoses for inpatients discharged from short-stay hospitals

[2] Due to rounding, totals may not equal sum of the individual components

[3] Rounded to nearest ten

[4] Includes late effects and consequences of traumatic musculoskeletal injuries

Source: Agency for Healthcare Research and Quality, Healthcare Cost and Utilization Project, Nationwide Inpatient Sample, 2007

Table 6.36: Number and Percent of Population with Musculoskeletal Injuries and Distribution of Persons with Such Conditions by Age and Expenditure Type, United States 1996-2004

		Persons with MS Injury		Age Distribution of Persons with MS Injuries			
Year	Total Population (in millions)	#Individuals (in millions)	% Total Population	< 18	18-44	45-64	65 & Over
1996-1998	271.2	23.4	8.6%	24.2%	43.4%	19.4%	13.0%
1997-1999	273.7	22.5	8.2%	24.8%	41.8%	20.0%	13.3%
1998-2000	276.1	21.6	7.8%	24.5%	41.8%	21.0%	12.7%
1999-2001	279.7	21.4	7.7%	23.0%	41.8%	22.4%	12.8%
2000-2002	283.6	22.3	7.9%	21.4%	41.8%	23.4%	13.4%
2001-2003	287.7	23.6	8.2%	21.0%	41.1%	24.1%	13.8%
2002-2004	290.8	24.7	8.5%	21.2%	40.2%	24.6%	14.0%

	Total Visits for Musculoskeletal Injuries by Expenditure Type (in millions)					
	Physician Visits	ER and Outpatient Visits	Prescrip-tions Filled	Home Health Care Visits	Hospital Disharges	Total Costs (in billions)
1996-1998	112.1	53.7	200.9	63.1	2.3	$ 93.20
1997-1999	110.2	58.5	209.2	69.7	2.3	$ 95.72
1998-2000	108.0	60.5	215.9	69.1	2.2	$ 94.72
1999-2001	111.5	60.0	235.9	70.8	4.3	$ 99.21
2000-2002	118.1	66.9	269.7	80.2	4.5	$ 108.60
2001-2003	124.9	77.8	311.1	80.1	4.7	$ 122.04
2002-2004	128.3	91.3	340.6	79.0	4.9	$ 127.45

Source: Agency for Healthcare Research and Quality: Medical Expenditures Panel Survey (MEPS) 1996-2004

Chapter 7

Congenital and Infantile Developmental Conditions of the Musculoskeletal System

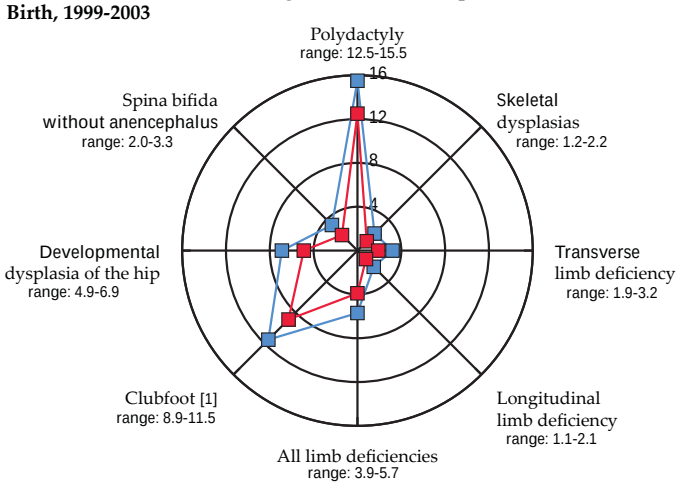
Congenital and infantile developmental conditions of the musculoskeletal system include a variety of defects and range from clinically minor anomalies, such as extra fingers or toes, to more serious and disabling conditions, such as spina bifida. This chapter focuses on musculoskeletal conditions among infants for which population-based surveillance data are available. Although the overall birth prevalence of these conditions is relatively low in comparison to other types of musculoskeletal conditions, due to the seriousness of some of these conditions (e.g., spina bifida, limb deficiencies, skeletal dysplasias, and cerebral palsy), they place a lifetime burden on patients, their families, and the medical community. Further surveillance and research efforts are needed: (1) to gain a better understanding of the magnitude of the public health impact of these conditions, including morbidity, mortality, and health services needs, and of possible disparities in prevalence and outcomes by race/ethnicity, socioeconomic status, and geography; (2) to identify possible causes and factors that may influence health status, development, and level of functioning; and (3) to develop and evaluate potential interventions for prevention.

The primary data sources available on congenital and developmental conditions are the National Birth Defects Prevention Network (NBDPN), from which estimates of prevalence for selected defects are drawn based on state birth defects surveillance programs; the Centers for Disease Control and Prevention (CDC) Metropolitan Atlanta Congenital Defects Program (MACDP), which collects data on birth defects; and the CDC Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP), which monitors the occurrence of selected developmental disabilities in school-age children. Data were analyzed and prepared by the Division of Birth Defects and Developmental Disabilities, Centers for Disease Control and Prevention, Atlanta, Georgia.

Section 7.1: Prevalence of Congenital and Infantile Developmental Conditions of the Musculoskeletal System

Estimated prevalence of selected musculoskeletal conditions at birth using a 95% confidence interval ranges from a low of 1.2 cases per 10,000 births for skeletal dysplasias to 15.5 cases per 10,000 births for polydactyly. (Table 7.1 and Graph 7.1.1) For the few conditions reported by both the national NBDPN and Atlanta based MACDP studies, prevalence is slightly higher in the NBDPN study than found in the MACDP.

Graph 7.1.1: 95% Confidence Intervals around the Estimated Prevalence of Selected Musculoskeletal Congenital and Development Conditions at Birth, 1999-2003

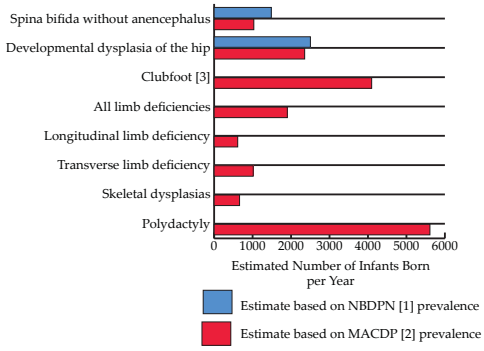


95% CI [2] for Prevalence per 10,000 Total Births

[1] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect
[2] 95% confidence interval based on Metropolitan Atlanta Congenital Defects Program data, 1999-2003
Source: Correa A, Cragan JD, Kucik JE, et al.: Reporting birth defects surveillance data 1968–2003. Birth Defects Research *A Clin Mol Teratol* 2007;79(2):65–186.

Utilizing data from the NBDPN or MACDP and the average number of births in the United States of 4.05 million for the years 1999 to 2003, the estimated number of infants born each year with a congenital musculoskeletal or developmental condition is greater than 17,000 identified for the conditions presented. (Table 7.2) During this time period, there were between 1,030 and 1,500 births with spina bifida without anencephalus, 2,300 and 2,500 with development dysplasia of the hip (DDH), 4,100 with clubfoot without neural tube defect (NTD), 1,900 with limb deficiencies, 600 with skeletal dysplasias, and 5,600 with polydactyly each year. (Graph 7.1.2)

Graph 7.1.2: Estimated Number of Infants Born per Year in the United States with Selected Congenital Musculoskeletal Defects, 1999 -2003



[1] National Birth Defects Prevention Network
[2] Metropolitan Atlanta Congenital Defects Program
[3] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect
Sources : (1) National Birth Defects Prevention Network. Birth defects surveillance data from selected states, 1999-2003. Birth Defects Research *A ClinMol Teratol* 2006;76(12):894-960.
(2) Correa A, Cragan JD, Kucik JE, et al.: Reporting birth defects surveillance data 1968–2003. Birth Defects Research *A Clin Mol Teratol* 2007;79(2):65–186.

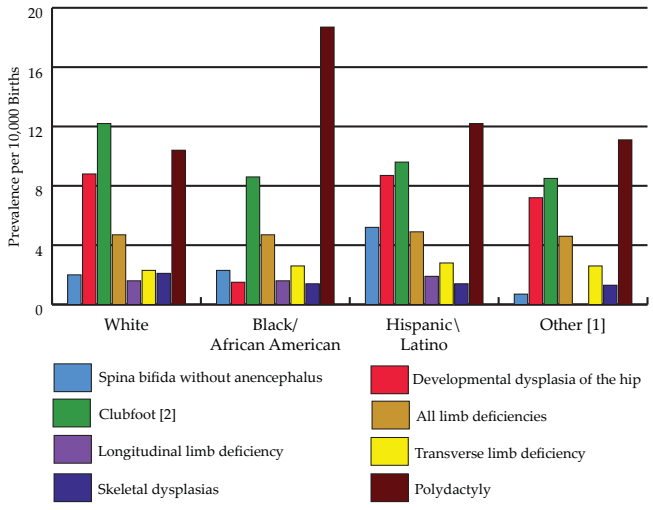
Congenital musculoskeletal defects show some variation by race and ethnicity. (Table 7.3) Based on NBDPN data, the prevalence of spina bifida without anencephalus was highest among Hispanics/Latinos (4.3 per 10,000 total births) and lowest among births of "other" race or ethnicity (3.2 per 10,000). The prevalence of developmental dysplasia of the hip, or developmental hip dislocation, was highest among whites (7.5 per 10,000) and lowest among blacks/African Americans (3.0 per 10,000).

Based on MACDP data, the prevalence of spina bifida without anencephalus was also highest among Hispanics/Latinos (5.2 per 10,000 total births) and lowest among others (0.7 per 10,000). (Table 7.4 and Graph 7.1.3) For developmental dysplasia of the hip, the prevalence was again highest among whites (8.8 per 10,000) and lowest among blacks/African Americans (1.5 per 10,000).

Among those conditions presented only in the MACDP data, the prevalence of clubfoot without NTD and skeletal dysplasia was highest among whites (12.2 per 10,000 and 2.1 per 10,000, respectively), while both were lowest among others (8.5 per 10,000 total births and 1.3 per 10,000, respectively.) Polydactyly shows the highest prevalence among blacks/African Americans (18.7 per 10,000) and lowest among whites (10.4 per 10,000). The prevalence of all limb deficiencies varied little by race and ethnicity.

Cerebral palsy (CP), which is reported only in the MADDSP, had a prevalence of 3.1 per 1000 among children aged 8 years in 2000. (Table 7.4) The prevalence of cerebral palsy is slightly higher among blacks/African Americans than among whites (3.6/1000 versus 2.9/1000), and among males than females (3.6 per 1000 versus 2.6 per 1000). The majority of children in the study had spastic cerebral palsy (61%) compared with nonspastic CP (5%) and CP not otherwise specified (33%).[1]

Graph 7.1.3: Prevalence of Selected Congenital Musculoskeletal Defects per 10,000 Total Births, by Race and Ethnicity, Metropolitan Atlanta Congenital Defects Program, Atlanta, Georgia, 1999 - 2003



[1] Data for races other than White, Black or African American, Hispanic or Latino, or race not specified were combined because the data, when analyzed separately, were too small for meaningful analysis.
[2] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect.
Source: Correa A, Cragan JD, Kucik JE et al.: Reporting birth defects surveillance data 1968–2003. Birth Defects Research *A Clin Mol Teratol* 2007;79(2):65–186.

Section 7.2: Selected Congenital and Infantile Development Conditions of the Musculoskeletal System

Section 7.2.1: Spina Bifida

Spina bifida consists of a bony defect in the spine through which the cerebrospinal fluid, meninges, nerves, spinal cord, or a combination thereof can herniate. It results from failure of the neural tube to close during the first 28 days after conception and is classified embryologically as a congenital anomaly of the central nervous system. The most common types of spina bifida are meningocele and myelomeningocele. In meningocele, only the meninges and cerebrospinal fluid herniate through the spinal defect. In myelomeningocele, the nerves, the spinal cord, or both also herniate. The spinal defect in spina bifida can be either covered by normal skin (closed) or in communication with the environment (open). Additional defects of other organs are present in about 20% of infants with spina bifida.[2]

Spina bifida can be diagnosed prenatally through screening for elevated alpha-fetoprotein in maternal serum and prenatal ultrasonography. While many spina bifida defects can be repaired surgically, affected children have lifelong complications such as hydrocephalus, neurologic deficit, bowel and bladder incontinence, and decreased long-term survival.[2,3] A decline in the prevalence of spina bifida since the mid-1970s has been reported in the United States, Europe, Australia, and New Zealand.[4,5] Spina bifida is seen more frequently at birth among females than males, and most frequently among infants of Hispanic or Latino ethnicity, particularly those born in Mexico.[6-10]

In the early 1990s, randomized clinical trials in Great Britain and Hungary demonstrated that consumption of the vitamin folic acid during the periconceptional period (before and during the early weeks of pregnancy) could prevent the recurrence[11] and occurrence[12] of anencephaly and spina bifida. As a result, in 1992, the U.S. Public Health Service recommended that all women of childbearing age who are capable of becoming pregnant consume 4.0 mg of folic acid daily to reduce their risk of having a baby with anencephaly or spina bifida.[13] Subsequently, in 1996, the U.S. Food and Drug Administration established regulations requiring that flour and other enriched grain products be fortified with 140 micrograms of folic acid per 100 grams of grain by January 1, 1998.[14] Since these regulations were implemented, serum and red blood cell folate levels have increased among women of reproductive age in the United States, and declines in the prevalence of anencephaly and spina bifida have been observed.[9,15-18]

Section 7.2.2: Developmental Dysplasia of the Hip

Developmental dysplasia of the hip (DDH) refers to a spectrum of abnormalities that includes an unstable, subluxed, or dislocated hip, or malformed acetabulum. DDH can originate early in gestation as the lower limbs develop, during the second trimester as the hip muscles develop, or late in the third trimester as a result of mechanical forces associated with oligohydramnios or breech presentation. It also can develop in the weeks following delivery or during infancy and childhood. The clinical symptoms of DDH can change and evolve over time. If untreated, persistent subluxation or dislocation can lead to permanent changes in the hip, including a shallow acetabulum, muscle contractures, and constriction of the hip capsule. Newborns and young infants can be treated effectively with a Pavlik harness, while older infants and children can require closed or open surgical reduction.

Diagnosing DDH can be difficult, particularly among newborns. It is usually detected by physical examination, radiography, or ultrasound, although false positives and false negatives occur with all of these methods. Among older infants, limited abduction of the hip is usually the most consistent finding. The Committee on Quality Improvement,

Subcommittee on Developmental Dysplasia of the Hip, American Academy of Pediatrics has developed clinical practice guidelines for pediatric health care providers on the early detection of DDH.[19]

DDH can occur unilaterally or bilaterally. When unilateral, the left side is involved approximately three times more often than the right. DDH is more common among girls, first-born children, and those with a positive family history in a parent or sibling. It can occur as part of a more general neuromuscular disorder or clinical syndrome. However, "typical" hip dislocation occurs among otherwise healthy infants.[19] The prevalence of DDH can differ depending on the age of the child at diagnosis, the type of examination used for screening, the experience of the examiner, and the diagnostic criteria and terminology used.

Section 7.2.3: Clubfoot

Congenital talipes equinovarus (TEV), more commonly referred to as clubfoot, is a common congenital disorder of the lower limb. A clubfoot is fixed in adduction, supination, and varus, that is, the forefoot turned in, the ankle turned inward, and the foot pointed down.[20] True TEV requires active treatment, including casting, manipulation, and sometimes surgery to place the foot in the correct anatomical position.[21] Clubfoot can occur as an isolated finding, as a result of another abnormality such as spina bifida, or as part of a clinical syndrome. The treatment of clubfoot can be particularly challenging if an infant has associated abnormalities.[22]

Isolated TEV occurs almost twice as often among males as in females, regardless of ethnicity.[23] It is bilateral in 50% or more of cases. When unilateral, the right side is involved more frequently than the left.[24] In metropolitan Atlanta, the prevalence of clubfoot not associated with an NTD declined remarkably from 1968 through 2003.[25] Studies have suggested that maternal smoking might be a risk factor for clubfoot, particularly among those with a family history of clubfoot.[26] However, the corresponding decline in smoking over this period probably was not sufficient to fully explain the decline in clubfoot.

Section 7.2.4: Limb Deficiencies

Limb deficiencies, also known as limb reduction defects, are defined by the absence (or severe hypoplasia) of part or all of bony structures of the extremities. The most common type of this defect is a transverse terminal limb deficiency, characterized by the absence of the distal segments of any limb while the proximal segments remain intact. People with transverse digital deficiencies are missing part or all of any phalanx with intact metacarpal or metatarsal bones and proximal segments. The functional consequences of these defects can be considerable when the thumb and multiple fingers are involved. Other categories include preaxial and postaxial deficiencies, often grouped together as longitudinal limb deficiencies, as well as split hand or split foot malformations. The least common category of deficiency is the intercalary type (classic phocomelia), defined by the absence of proximal parts of limbs with distal structures totally or partially present.

Although specific genetic loci for several limb defect syndromes have been identified in recent years, the causes of limb deficiencies currently cannot be easily identified for many affected infants.[27] Certain phenotypes, particularly those involving split hand or split foot, intercalary, radial ray, or postaxial deficiencies, have been associated with single-gene mutations (e.g., the Holt-Oram "heart/hand" syndrome or familial split hand or split foot malformation). Other rare causes include chromosome abnormalities such as aneuploidies or exposure to known teratogens such as thalidomide and valproic acid. Because chromosomal abnormalities account for a small proportion of limb deficiencies overall, advancing maternal age has not been shown to be a risk factor for these defects.[28] The hypothesis of a vascular pathogenesis for transverse terminal limb deficiencies is

supported by animal, epidemiologic, autopsy, and family studies, but often specific vasoactive exposures cannot be identified for individual infants. However, even for the distinctive amniotic band phenotype, there is controversy regarding the intrinsic versus extrinsic nature of limb disruption.[29]

Prenatal ultrasonography has resulted in early identification of a significant proportion of limb deficiencies among countries where this procedure has become routine, but primary prevention of most of these defects has remained elusive.[30] There is some suggestion from limb deficiency case-control studies that periconceptional multivitamin use might be protective for longitudinal or transverse terminal deficiencies,[31,32] and this hypothesis is being further investigated along with studies of gene-environment interactions that might shed light on mechanisms of nutritional protective factors or vasoactive risk factors.

Section 7.2.5: Skeletal Dysplasias

Skeletal dysplasias belong to a heterogeneous group of birth defects. They include over 200 disorders (e.g., chondrodystrophies, osteodystrophies, dwarfisms, and generalized skeletal dysplasias) characterized by abnormalities of cartilage and bone growth resulting in an abnormal shape and size of the skeleton and a disproportion of the long bones, spine, and head.[33] Most of them are genetic conditions. Most fetuses with skeletal dysplasia now can be diagnosed prenatally.[34] However, some skeletal dysplasias do not manifest until short stature and other complications arise during childhood. Skeletal dysplasias differ in inheritance patterns, severity, natural histories, and prognoses. Modes of inheritance include both autosomal and X-linked dominant and recessive forms. Several genetic mutations have been described and associated with skeletal dysplasias.[35,36] Males are primarily affected in X-linked recessive disorders; X-linked dominant disorders can be lethal in males.

Severity of skeletal dysplasias ranges from mild forms (nonlethal) to severe (lethal) forms.[37] The most common lethal skeletal dysplasias include thanatophoric dysplasia, achondrogenesis, and osteogenesis imperfecta.[38] Achondroplasia is the most common nonlethal skeletal dysplasia. Prognosis and life expectancy of children with nonlethal skeletal dysplasias depend on the degree of skeletal abnormalities and other associated anomalies.

Treatment is usually supportive. With early intervention from specialists, patients with nonlethal skeletal dysplasias can avoid or minimize the many complications associated with these disorders.[39] Orthopaedic surgery is one of the pillars of treatment to prevent neurologic and orthopaedic complications due to spinal cord compression, joint instability, and long bone deformity. The International Skeletal Dysplasia Registry is a referral center for the diagnosis, management, and the etiology of skeletal dysplasia.[40]

Section 7.2.6: Polydactyly

Polydactyly is a heterogeneous group of anomalies described by excessive partition of the digital rays of the hands and feet that can appear in isolation or in association with other birth defects. Clinically, it generally manifests as an extra digit. It is the most common congenital digital anomaly of the hand and foot. Isolated polydactyly is often autosomal dominant or occasionally sporadic, while polydactyly associated with other major defects can be autosomal recessive.[41] Polydactyly is classified into postaxial and preaxial types. Postaxial polydactyly, the most common type in the United States, typically involves an extra digit on the ulnar or fibular side of the limb. Preaxial polydactyly refers to duplication on the radial or tibial side. Central polydactyly is a term used primarily in clinical settings, usually in the rare situation when syndactyly is associated with duplication of the second, third, or fourth digit.

In general, there is a significant racial predilection for polydactyly. Postaxial polydactyly is more frequent among blacks/African Americans than among whites, and is more frequent among male children.[42] This higher prevalence among African Americans is largely due to a higher prevalence of postaxial skin tags, which generally are not considered to be a major abnormality. Postaxial skin tags in African Americans are not included in the data from MACDP on polydactyly presented in the tables and graphs. Other factors associated with postaxial hand polydactyly in one study included twinning, low maternal education, parental consanguinity, and recurrence in first-degree relatives.[43]

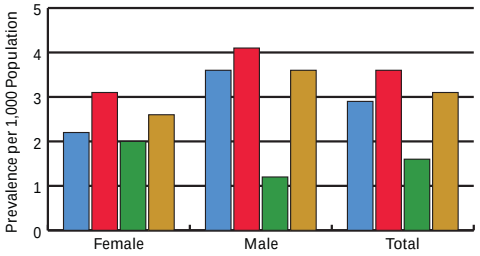
All types of polydactylies are rarely associated with other congenital anomalies. In a recent study, trisomy [13], Meckel syndrome, and Down syndrome accounted for most cases of syndromic polydactyly.[44] Treatment of polydactyly depends greatly on the complexity of the malformation and varies from tying the base of the finger with a suture to complex surgical correction.

Section 7.2.7: Cerebral Palsy

Cerebral palsy (CP) describes a group of permanent disorders of movement and posture that are attributed to nonprogressive disturbances in the developing brain of the fetus or infant. The motor disorders of CP are often accompanied by: (1) disturbances of sensation, perception, cognition, communication, and behavior; (2) epilepsy; and (3) secondary musculoskeletal problems.[45] This definition of CP covers a wide array of clinical presentations and degrees of activity limitation. Traditional classification schemes have focused principally on the distributional patterns of affected limbs (e.g., hemiplegia or diplegia), with an added modifier describing the predominant type of tone or movement abnormality (e.g., spastic or dyskinetic).[45] The etiology of CP is not fully understood. Factors associated with an increased risk for CP include low birth weight, intrauterine infections, and multiple gestation.[46,47] However, anywhere from 17% to 60% of cases of CP have no known perinatal or neonatal complications.[46]

The prevalence of CP, estimated to occur in slightly over 3 persons in 1,000, has been generally stable for several decades except for a modest increase in recent years. This recent increase in prevalence has been attributed to an increase among very low birth weight infants, which, in turn, has been attributed to their increased survival resulting from newborn intensive care.[48] CP occurs more frequently in males than in females, and is higher among blacks/African Americans than found in other race or ethnic groups. (Table 7.5 and Graph 7.2.1)

Graph 7.2.1: Prevalence of Cerebral Palsy Among Children Aged 8 Years per 1,000 Population, by Sex and Race, Metropolitan Atlanta Developmental Disabilities Surveillance Program, Atlanta, Georgia, 2000



[1] Data for races other than black /African American and white were combined due to small sample size.
Source: Centers for Disease Control and Prevention. Prevalence of four developmental disabilities among children aged 8 years, Metropolitan Atlanta Developmental Disabilities Surveillance Program, 1996 and 2000. In: Surveillance Summaries, January 27, 2006. *MMWR Surveill Summ* 2006:55;1-9.

Section 7.3: Birth Defects Surveillance Programs

The National Birth Defects Prevention Network (NBDPN) is composed of state-based birth defects surveillance programs and individuals working in birth defects surveillance, research, and prevention at the local, state, and national levels. NBDPN publishes an annual report of surveillance data from participating programs. In 2006, prevalence data for selected birth defects from 11 states with active case-finding for births in 1999-2003 were published, from which data

were pooled to calculate prevalence estimates for spina bifida without anencephaly and developmental dysplasia of the hip (developmental hip dislocation) used in this chapter.[49]

The CDC's Metropolitan Atlanta Congenital Defects Program (MACDP) is a population-based surveillance system for birth defects that was established in 1967. Since that time, the program has conducted ongoing surveillance for birth defects among infants, fetuses, and children born to residents of the five central counties of metropolitan Atlanta through the use of active case-finding methods and multi-source ascertainment.[36] Prevalence data from MACDP are presented for the period 1999-2003 for comparison with prevalence estimates from the NBDPN for the same period. In 2003, there were 51,676 live births to residents of the five counties.

The CDC's Metropolitan Atlanta Developmental Disabilities Program (MADDSP) is a population-based surveillance system that has been monitoring the occurrence of selected developmental disabilities, including cerebral palsy, among school-aged children since 1991 in the same population as MACDP. Prevalence data on CP are presented for children aged 8 years during 2000.[1] In 2000, the population in Metropolitan Atlanta included 43,593 children aged 8 years.

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Section 7.4: Congenital and Infantile Developmental Conditions of the Musculoskeletal System Data Tables

Table 7.1: Estimated Prevalence of Selected Congenital Musculoskeletal Defects, National Birth Defects Prevention Network and Metropolitan Atlanta Congenital Defects Program, 1999-2003

	NBDPN [1], 1999-2003		MACDP [2], 1999-2003	
Musculoskeletal Defect	Prevalence per 10,000 Total Births	95% CI [3]	Prevalence per 10,000 Total Births	95% CI [3]
Spina Bifida without Anencephalus	3.7	3.5 – 3.9	2.6	2.0 - 3.3
Developmental Dysplasia of the Hip	6.2	5.9 – 6.4	5.8	4.9 - 6.9
Clubfoot [4]			10.2	8.9 - 11.5
All Limb Deficiencies			4.7	3.9 - 5.7
Longitudinal Limb Deficiency			1.5	1.1 -2.1
Transverse Limb Deficiency			2.5	1.9 -3.2
Skeletal Dysplasias			1.6	1.2 -2.2
Polydactyly			13.9	12.5 -15.5

[1] National Birth Defects Prevention Network

[2] Metropolitan Atlanta Congenital Defects Program

[3] Confidence interval

[4] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect

Source 1: National Birth Defects Prevention Network. Birth defects surveillance data from selected states, 1999-2003. *Birth Defects Research A Clin Mol Teratol* 2006;76(12):894-960.

Source 2: Correa A, Cragan JD, Kucik JE, et al: Reporting birth defects surveillance data 1968–2003. *Birth Defects Research A Clin Mol Teratol* 2007;79(2):65–186.

Table 7.2: Estimated Number of Infants Born per Year in the United States with Selected Congenital Musculoskeletal Defects, 1999 -2003

Musculoskeletal Defect	Estimate Based on NBDPN [1] Prevalence	95% CI [2]	Estimate Based on MACDP [3] Prevalence	95% CI [2]
Spina Bifida without Anencephalus	1,486	1,411 – 1,564	1,032	970 – 1,097
Developmental Dysplasia of the Hip	2,503	2,406 – 2,603	2,354	2,260 – 2,451
Clubfoot [4]			4,096	3,971 – 4,223
All Limb Deficiencies			1,903	1,818 – 1,990
Longitudinal Limb Deficiency			613	565 – 663
Transverse Limb Deficiency			1,016	954 – 1,080
Skeletal Dysplasias			661	612 – 713
Polydactyly			5,611	5,466 – 5,760

[1] National Birth Defects Prevention Network

[2] Confidence interval

[3] Metropolitan Atlanta Congenital Defects Program

[4] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect

Source 1: National Birth Defects Prevention Network. Birth defects surveillance data from selected states, 1999-2003. *Birth Defects Research A Clin Mol Teratol* 2006;76(12):894-960.

Source 2: Correa A, Cragan JD, Kucik JE, et al: Reporting birth defects surveillance data 1968–2003. *Birth Defects Research A Clin Mol Teratol* 2007;79(2):65–186.

Table 7.3: Prevalence of Selected Congenital and Infantile Developmental Musculoskeletal Defects per 10,000 Total Births by Race and Ethnicity, National Birth Defects Prevention Network, 11 States With Active Surveillance Systems, 1999-2003

	White		Black/African American		Hispanic or Latino		Other [1]	
Musculoskeletal Defect	Prevalence	95% CI [2]	Prevalence	95% CI [2]	Prevalence	95% CI [2]	Prevalence	95% CI [2]
Spina Bifida without Anencephalus [3]	3.4	3.2 - 3.7	3.4	2.9 - 3.9	4.3	4.0 - 4.7	3.2	2.6 -4.0
Developmental Dysplasia of the Hip (developmental hip dislocation) [4]	7.5	7.1 - 7.9	3.0	2.6 - 3.5	5.9	5.4 - 6.4	5.5	4.5 -6.6

[1] Data for races other than white, black or African American, Hispanic or Latino were combined due to small sample size.

[2] Confidence interval

[3] Prevalence estimates based on pooled data from 11 states with active case finding during this time period: Alabama, Arkansas, California, Georgia, Hawaii, Iowa, Massachusetts, North Carolina, Oklahoma, Texas, and Utah.

[4] Prevalence estimates based on pooled data from 8 states with active case finding during this time period: Alabama, Arkansas, Georgia, Hawaii, Iowa, North Carolina, Oklahoma, and Texas.

Source: National Birth Defects Prevention Network: Birth defects surveillance data from selected states, 1999-2003. *Birth Defects Research A Clin Mol Teratol* 2006;76(12):894-960.

Table 7.4: Prevalence of Selected Congenital and Infantile Developmental Musculoskeletal Defects per 10,000 Total Births by Race and Ethnicity, Metropolitan Atlanta Congenital Defects Program, Atlanta, Georgia, 1999 - 2003

	White		Black/African American		Hispanic or Latino		Other [1]	
Musculoskeletal Defect	Prevalence	95% CI [2]	Prevalence	95% CI [2]	Prevalence	95% CI [2]	Prevalence	95% CI [2]
Spina Bifida without Anencephalus	2.0	1.2 – 3.1	2.3	1.4 – 3.5	5.2	3.2 – 7.8	0.7	0.0 – 3.6
Developmental Dysplasia of the Hip	8.8	7.0 – 10.9	1.5	0.8 – 2.4	8.7	6.1 – 12.0	7.2	3.6 – 12.9
Clubfoot [3]	12.2	10.1 – 14.7	8.6	6.9 – 10.7	9.6	6.9 – 13.1	8.5	4.5 – 14.6
All Limb Defiencies	4.7	3.4 – 6.3	4.7	3.4 – 6.3	4.9	3.1 – 7.6	4.6	1.8 – 9.4
Longitudinal Limb Deficiency	1.6	0.9 – 2.6	1.6	0.9 – 2.6	1.9	0.8 – 3.7	-	-
Transverse Limb Deficiency	2.3	1.4 – 3.5	2.6	1.7 – 3.8	2.8	1.5 – 4.9	2.6	0.7 – 6.7
Skeletal Dysplasias	2.1	1.3 – 3.2	1.4	0.7 – 2.3	1.4	0.5 – 3.1	1.3	0.2 – 4.7
Polydactyly	10.4	8.4 – 12.6	18.7	16.1 – 21.6	12.2	9.1 – 16.0	11.1	6.5 – 17.8

[1] Data for races other than white, black or African American, Hispanic or Latino were combined due to small sample size.

[2] Confidence interval

[3] Talipes equinovarus and clubfoot of unspecified type without a neural tube defect.

Source: Correa A, Cragan JD, Kucik JE et al: Reporting birth defects surveillance data 1968–2003. *Birth Defects Research A Clin Mol Teratol* 2007;79(2):65–186.

Table 7.5: Prevalence of Cerebral Palsy Among Children Aged 8 Years per 1,000 Population by Sex and Race, Metropolitan Atlanta Developmental Disabilities Surveillance Program, Atlanta, Georgia, 2000

	Number	Prevalence	95% CI [1]
Male			
White	33	3.6	2.6 – 5.1
Black/African American	40	4.1	3.0 – 5.6
Other [2]	4	1.2	0.5 – 3.3
Total	79	3.6	2.9 – 4.5
Female			
White	20	2.2	1.4 – 3.5
Black/African American	30	3.1	2.2 – 4.5
Other [2]	6	2.0	0.9 – 4.4
Total	56	2.6	2.0 – 3.4
Total			
White	53	2.9	2.2 – 3.8
Black/African American	70	3.6	2.9 – 4.6
Other [2]	10	1.6	0.9 – 3.0
TOTAL [3]	135	3.1	2.6 – 3.7

[1] Confidence interval.

[2] Data for races other than white or black/African American were combined due to small sample size.

[3] Total includes two children whose race was not indicated.

Source: Centers for Disease Control and Prevention. Prevalence of four developmental disabilities among children aged 8 years, Metropolitan Atlanta Developmental Disabilities Surveillance Program, 1996 and 2000. *MMWR Surveill Summ* 2006;55:1-9.

Chapter 8
Neoplasms of Bone and Connective Tissue

Bone and connective tissue neoplasms, which include bones and joints, myeloma, and soft tissues, are rare when compared with other cancers and with other musculoskeletal conditions, accounting for about 1.9% of annual cancer cases between 2002 and 2006. However, it is estimated that in 2009, 2,570 persons will be diagnosed with cancer of the bones and joints, with more than one in four diagnoses for children and youth under the age of 20. Myeloma, a malignant tumor of the bone marrow, will be diagnosed in 20,580 persons, while 10,660 men and women will be diagnosed with soft tissue cancers, including the heart. In addition, 1,470 persons will die of cancer of the bone and joints, 10,580 will die of myeloma, and 3,820 of soft tissue cancers in 2009. [1]

Data from the Surveillance Epidemiology and End Results (SEER) program of the National Cancer Institute, used to present the burden of bone and connective tissue neoplasms, is the most comprehensive source of information on cancer incidence, prevalence, mortality, survival, and lifetime risks. Data is currently available from 1974 to 2006. The SEER program is one of the most comprehensive sources of neoplasm data; it is based on data representing approximately 10% of the U.S. population. In addition, data from the American College of Surgeons' Commission on Cancer National Cancer Data Base (NCDB) was utilized in the analysis of the three main bone sarcomas: osteosarcoma, chondrosarcoma and Ewing's sarcoma. This database is maintained by the American College of Surgeons and contains the same standardized data as that collected by the SEER database. Data are collected from all institutions wishing to be accredited by the American College of Surgeons Commission on Cancer. Each accredited institution is required to report all patients with cancer treated at their institution, including annual follow-up data. Site visits and interaction between American College of Surgeons cancer database personnel and the local reporting institutions verifies a minimum of 90% case capture and reporting for each institution. Multiple internal checks verify the data accuracy. It is estimated the approximately 1,700 reporting institutions each year treat approximately 75% of all patients with malignancies in the United States.

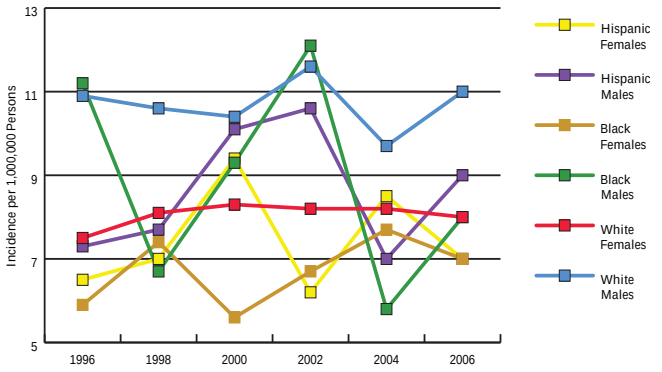
Section 8.1: Incidence of Neoplasms of Bone and Connective Tissue

Musculoskeletal cancers are classified into bone and joint cancers and myeloma. The three most common classifications of cancers of bones and joints are osteosarcoma, Ewing's sarcoma, and chondrosarcoma. The ages at which these cancers are most prevalent vary. Osteosarcoma, a malignant bone tissue tumor, is the most common, occurring most frequently in teens and young adults. Ewing's sarcoma, a tumor often located in the shaft of long bones and in the pelvic bones, occurs most frequently in children and youth. Chondrosarcoma, a sarcoma of malignant cartilage cells, often occurs as a secondary cancer by malignant degeneration of pre-existing cartilage cells within bone, including chondromas (a benign tumor), and is primarily found among older adults. However, the vast majority of chondromas never undergo malignant change and, therefore, the routine resection of benign chondromas is unwarranted. Of these three, Ewing's sarcoma is generally considered to have the worst prognosis. By definition, all cases of Ewing's sarcoma are high grade, the most aggressive category of cancer, with full potential to metastasize and bring about death. Approximately 6% to 20% of osteosarcomas

are of lower grade; chondrosarcoma has a higher proportion of low grade cases than the other two bone and joint cancers.

Bone cancers are found more frequently in males than females, and more frequently among whites than those of any other race. However, rates have varied for both genders and by race for the past decade. (Table 8.1 and Graph 8.1.1) The average annual incidence of bone cancers between 2002 and 2006 was 9 in one million persons; the rate among all males was 10 in one million, while among all females it was 8 in one million. Among white males, the overall incidence jumped to 11 in one million persons. The incidence of cancer of the bones and joints in the United States is comparable to several site-specific oral cancers (i.e., lip, salivary gland, floor of the mouth), cancers of the bile duct, cancers of the eye, and Kaposi's sarcoma, which affects the skin and mucous membranes and is often associated with immunodeficient individuals with AIDS.

Graph 8.1.1: Incidence of Cancers of Bones and Joints, by Sex and Race, United States 1996-2006



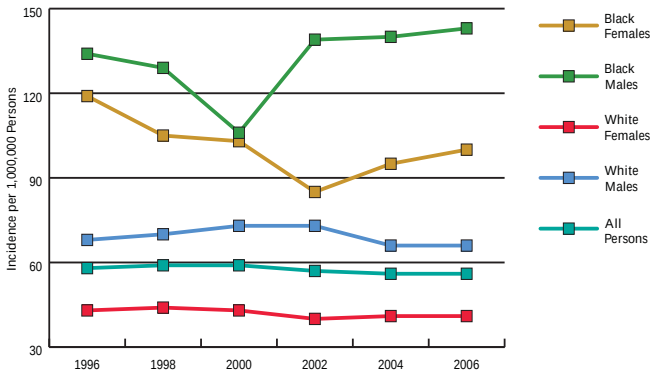
Source 1995 to 2004 data: Ries LAG, Harkins D, Krapcho M, et. al. (eds): SEER Cancer Statistics Review, 1975-2004, Overview. Bethesda, MD: National Cancer Institute, 2007. Available at: http://seer.cancer.gov/csr/1975_2004/. Accessed June 19, 2007.

Source 2005 data: Ries LAG, Melbert D, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2005, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2005/, based on November 2007 SEER data submission, posted to the SEER web site, 2008. Accessed December 8, 2009.

Source 2006 data: Horner MJ, Ries LAG, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Myeloma, a malignant primary tumor of the bone marrow that can form in any of the bone-marrow cells and usually involves multiple bones at the same time, occurs five to six times as frequently as bone cancers. It occurs most frequently in adults between the ages of 50 and 70. The average annual incidence of myeloma between 2002 and 2006

Graph 8.1.2: Incidence of Myeloma, by Sex and Race, United States 1996-2006



Source: Ries LAG, Harkins D, Krapcho M, et. al. (eds): SEER Cancer Statistics Review, 1975-2004, Overview. Bethesda, MD: National Cancer Institute, 2007. Available at: http://seer.cancer.gov/csr/1975_2004/. Accessed June 19, 2007.

Source 2005 data: Ries LAG, Melbert D, Krapcho M, Stinchcomb DG, et. al. (eds). SEER Cancer Statistics Review, 1975-2005, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2005/, based on November 2007 SEER data submission, posted to the SEER web site, 2008. Accessed December 8, 2009.

Source 2006 data: Horner MJ, Ries LAG, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

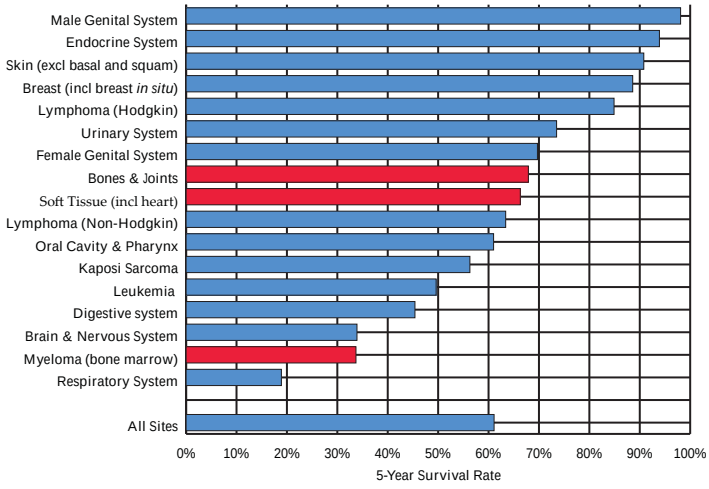
was 56 cases in one million persons, an annual averaged rate that has been relatively constant for the past decade. (Table 8.2 and Graph 8.1.2) Again, males have a higher incidence of myeloma than do females, with an average of 71 cases in one million males to 46 cases in one million females. Blacks have a much higher incidence rate of myeloma than whites. The incidence of myeloma in the United States is comparable to esophageal, liver, cervical, ovarian, brain, and lymphocytic leukemia cancers.

The isolated single bone version of myeloma is called plasmacytoma, but virtually all cases of isolated plasmacytoma develop into full-fledged multiple myeloma over the subsequent 5 to 10 years after diagnosis.

Although annual rates of cancers of the bones and joints and myeloma vary somewhat, the overall incidence has remained relatively constant since the mid-1970s.[2]

With a median age of 39 years at time of diagnosis, cancers of the bones and joints attack younger patients than most other broad categories of cancer. (Table 8.3) Males are typically diagnosed with bone cancers several years younger than females. Myeloma, on the other hand, is primarily a cancer

Graph 8.2.1: Age-Adjusted 5-Year Relative Cancer Survival Rates by Sex, United States 1999-2005



[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD. Table I-4 - continuedAGE-ADJUSTED SEER INCIDENCE AND U.S. DEATH RATES AND 5-YEAR RELATIVE SURVIVAL RATES By Primary Cancer Site, Sex and Time Period. Available at: http://seer.cancer.gov/csr/1975_2006/results_merged/ topic_survival.pdf, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

found among elderly persons, with a median age of 70 at the time of diagnosis. Again, males are typically diagnosed with myeloma at ages several years younger than females.

Section 8.2: Mortality and Survival Rates for Neoplasms of Bones and Connective Tissue

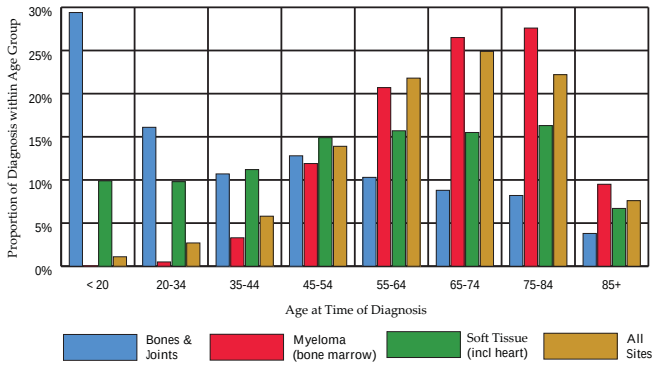
Annual population-based mortality rates due to cancers of bones and joints are low, averaging four deaths per one million persons per year between 2002 and 2006.[1] Over the past 35 years, the mortality rate from bone and joint cancer dropped by approximately 50% from that of the late 1970s.[1] However, there has been no significant improvement over the past 20 years.[3] Males have a higher mortality rate than females for all races. The overall 5-year survival rate is 54% for osteosarcoma, 75% for chondrosarcoma, and 51% for Ewing's sarcoma. The osteosarcoma survival rate varies with age: 5-year survival was 60% for persons under 30 years of age, 50% for those aged 30 to 49, and 30% for those 50 years old and older.[3]

The overall 5-year relative survival rate for bones and joints cancers has been 68% for the last few years, and is comparable to a number of more common cancers such as lymphoma, urinary, cervical/ovarian, and soft tissue cancers. (Table 8.4 and Graph 8.2.1) The annual population-based mortality rate of myeloma was an average of 36 persons per one million population between 2002 and 2006.[1] The mortality rate from myeloma has remained relatively constant since the mid-1970s.[1] The 5-year survival rate for myeloma, 34%, is one of the lowest for all cancers.

Section 8.3: Bone and Joint Cancer Among Children and Young Adults

While myeloma is primarily a cancer of middle aged to older adults, cancers of bones and joints are found among persons under the age of 30 in higher proportion than expected for the overall incidence. In 2002-2006, 45% of bone and joint cancers were diagnosed in persons under the age of 35, with more than 29% occurring among children and adolescents under the age of 20. This compares to less than 4% of all cancer sites in persons aged 35 and younger, and only 1% in those younger than 20 years. (Table 8.5 and Graph 8.3.1)

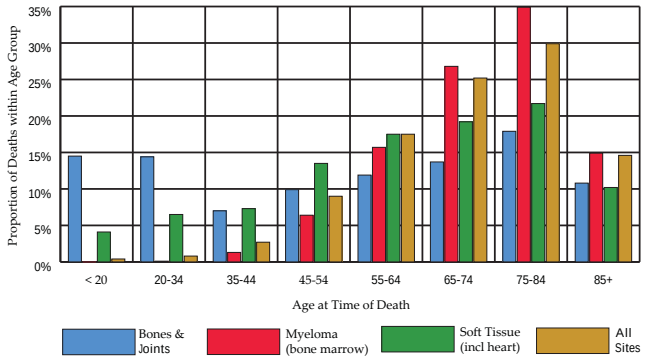
Graph 8.3.1: Age Distribution for Musculoskeletal Neoplasms at Time of Diagnosis, United States 2002-2006



[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Graph 8.3.2: Age Distribution for Musculoskeletal Neoplasms at Time of Death, United States 2002-2006

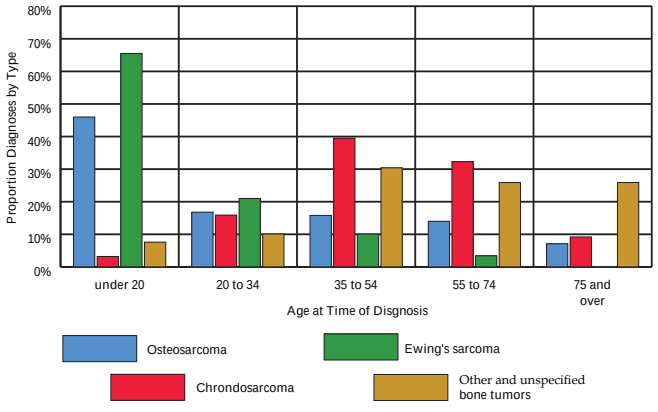


[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Deaths from bone and joint cancer follow a similar pattern. (Table 8.6 and Graph 8.3.2) Between 2002 and 2006, 15% of deaths from bone and joint cancer occurred in children and youth under the age of 20, and an additional 14% among young adults aged 20 to 34. The mortality rate among younger persons from bone and joint cancer comprises only 0.12% of deaths from all types of cancer, but is 9% of cancer deaths in persons under the age of 20 and 2.5% of deaths among young persons aged 20 to 34 years. The relative proportion of deaths from bones and joints cancer was higher in children, youth, and young adults than all other cancer types that disproportionately affect younger people, including brain and nervous system, leukemia and soft tissue cancers.

Graph 8.3.3: Distribution of Malignant Bone Tumors by Type and Age, United States 2000-2003

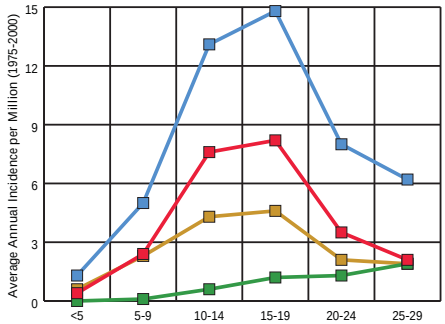


Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov): Public-Use Data (1973-2003). National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2006, based on the November 2005 submission. Accessed: March 19, 2007.

During the time period 2000-2003, osteosarcoma accounted for 59% of the malignant bone tumors diagnosed in persons under the age of 20, with 46% of osteosarcoma diagnoses occurring in persons younger than 20 years of age. The majority of the remaining tumors in the age 20 and under group were Ewing's sarcoma (31%, accounting for 66% of Ewing's sarcoma diagnoses.) In the young adult population (aged 20 to 34 years) diagnosed with malignant bone tumors, chondrosarcoma accounted for 37% and osteosarcoma for 36%, Ewing's sarcoma was diagnosed 17% of the time; this represented 16%, 17%, and 21% of all diagnoses for these tumors, respectively. (Table 8.7 and Graph 8.3.3)

The overall incidence of malignant bone tumors from 1975 to 2000 in persons under the age of 30 peaked between the ages of 15-19 years and 10-14 years at 14.8 and 13.1 per million persons, respectively. The incidence of osteosarcoma peaks in these ages at 8.2 and 7.6 per million, respectively, while Ewing's sarcoma peaks at 4.6 and 4.3, respectively. (Graph 8.3.4)

Graph 8.3.4: Malignant Bone Tumors in Persons Younger than 30 Years of Age, United States, 1975-2000



Source: Mascarenhas L, Siegel S, Spector L, et. al.: Malignant Bone Tumors, in Bleyer A, O'Leary M, Barr R, Ries LAG (eds.): *Cancer Epidemiology in Older Adolescents and Young Adults 15 to 29 Years of Age, Including SEER Incidence and Survival: 1975-2000*. Bethesda, MD: National Cancer Institute, NIH Pub. No. 06-5767, p 101.

The high incidence and mortality rate of bone cancers among children, youth, and young adults creates a significant burden on the productivity and life of future generations. Apart from the financial costs, emotional toil, and lost lives from the initial treatments, survivors carry significant functional burdens and continuing care costs. At least 75% of surviving bone and joint cancer patients are treated with limb salvaging surgery.

These surgeries most often require implantation of massive bone-replacing endoprostheses that have limited life span and compromised function, requiring periodic surveillance and revision surgery to repair or replace worn parts. The amputated survivors will require prosthetic limbs, the function of which is clearly limiting in comparison to normal activity. Both procedures are expensive, with cost estimates of $25,000 per year for replacement of an amputated limb in an active 20 to 30 year old man in 1997 dollars, and estimates of $23,500 for implant, rehabilitation, monitoring, and replacement with limb salvaging endoprothesis.[4] Due to chronic pain and overall dysfunction, a large number of such survivors will end up on disability, requiring public support for the majority of their adult lifetime.

Section 8.4: Economic Cost of Malignant Bone Tumors

Information on insurance coverage at time of treatment was only available for roughly one-third of patients (8,342) and the patterns of coverage were similar between osteosarcoma and Ewing's sarcoma. For chondrosarcoma, due to the older mean age of the patients, relatively more patients were covered by Medicare (8.6%) or Medicare with supplement (16.7%). At the time of diagnosis, insurance coverage was most commonly through managed care (38.5%) for all groups. Private insurance was the next most common recorded insurance coverage (27.4%), followed by Medicare with supplement (10%), although the majority of those patients had chondrosarcoma. Only 0.3% of patients overall were covered by Medicaid.

Section 8.5: Soft Tissue Sarcomas

Soft tissue sarcomas are malignant (cancerous) tumors that develop in any part of the body, including fat, muscle, nerve, fibrous tissues surrounding joints, blood vessel, or deep skin tissues. Approximately 55% to 60% of sarcomas develop in the arms or legs; the rest begin in the trunk (15% to 20%), head and neck area (8% to 10%), internal organs, or the retroperitoneum or back of the abdominal cavity (15%).[5]

In terms of case numbers, the musculoskeletal health burden in the United States from soft tissue sarcomas is two to three times greater than that of bone and joint sarcomas. For the period 2002-2006, the annual average number of soft tissue neoplasms, including the heart, approximately 11,700 cases were reported in the SEER database.[6] Soft tissue sarcomas come in a wide variety of forms which affect different age groups, but the most frequently encountered soft tissue sarcomas affect older adults.

As previously noted, the National Cancer Data Base (NCDB), a joint program of the Commission on Cancer and the American College of Surgeons, maintains the most thorough database on the prevalence of soft tissue sarcomas. Although the NCDB was not created to serve as an incidence-based registry, it currently gathers data on approximately 75% of the cancers treated in the United States. It should be noted this percentage varies from year to year based on the participation and reporting by hospitals to this voluntary database.

Over the past 20 years, 86,355 soft tissue sarcomas of the extremities, shoulders and pelvic girdles and trunk have been treated. This number excludes approximately 32,250 soft tissue sarcomas of the head and neck, thoracic, and abdominal areas; these patients are generally cared for by non-musculoskeletal specialists. Using a 20-year average and assuming 75% of annual cases are included in NCDB, over 5,700 cases of soft tissue sarcoma have been reported annually.

In 2006, soft tissue sarcomas, including those of the head, neck, thoracic, and abdominal areas, reported by NCDB was 7,200 cases, representing approximately 0.7% of all cancer cases. These numbers are comparable to the annual average reported for the years 2000 to 2004.[7] This compares to 2,070 cases reported for 2006 by NCDB and an

average of 2,700 cases of bone and joint sarcomas between 2000 and 2004, representing 0.2% of all cancer cases. (Table 8.8)

In 2009, it is expected about 10,660 new soft tissue sarcomas will have been diagnosed in the United States. Of these, 5,780 cases will be diagnosed in males, and 4,880 cases will be diagnosed in females. During 2009, it is expected 3,8200 Americans will die of soft tissue sarcomas. These statistics include both adults and children.[8]

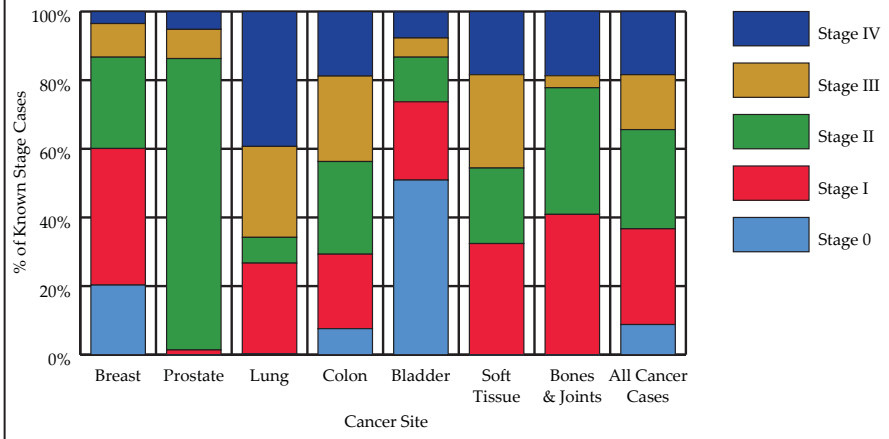
Section 8.5.1: Soft Tissue Sarcoma Survival Rates

For high-grade soft tissue sarcomas, the most important prognostic factor is the stage at which the tumor is identified. Staging criteria for soft tissue sarcomas are primarily determined by whether the tumor has metastasized or spread elsewhere in the body. Size is highly correlated with risk of metastasis and survival. In general, the prognosis for a soft tissue sarcoma is poorer if the sarcoma is large. As a general rule, high-grade soft tissue sarcomas over 10 centimeters in diameter have an approximate 50% mortality rate and those over 15 centimeters in diameter have an approximate 75% mortality rate.

The National Cancer Institute (NCI) has reported the overall 5-year relative survival of people with sarcomas is approximately 66%. The NCI statistics staging classification of sarcomas is (1) confined to the primary site (localized—54% of sarcomas are diagnosed at this stage), (2) spread to regional lymph nodes or directly beyond the primary site (regional—22%), or (3) metastasized (distant—15%). For the remaining cases, the staging information was unknown. The corresponding 5-year relative survival rates reported are 84% for localized sarcomas; 62% for regional stage sarcomas; 16% for sarcomas with distant spread; and 54% for unstaged sarcomas. The 10-year relative survival rate is only slightly worse for these stages, meaning that most people who survive 5 years are cured.[9]

Using the staging criteria of soft tissue sarcomas of the American Joint Committee on Cancer (AJCC) produces similar results for sarcomas found in the limbs (arms or legs): 90% 5-year survival rate for stage 1 sarcomas; 81% for stage 2; and 56% for stage 3. Sarcomas identified as stage 4 have a very low 5-year survival rate. Sarcomas located in other than a limb also have lower survival rates.[9]

Graph 8.5.1: Site by Stage Distribution of Cases Reported to the National Cancer Data Base for Top 5 Cancer Sites, Soft Tissue Cancers and Bone and Joint Cancers, Diagnosis Year 2006



Source: National Cancer Data Base (NCDB): Site by Stage Distribution of Cases Reported to the NCDB: Diagnosis Year 2006. American College of Surgeons Commission on Cancer. Available at: http://www.facs.org/cancer/ncdb/site_stage_2006.htm. Accessed December 10, 2009.

Comparing soft tissue sarcomas by stage to the most common types of cancer shows a relatively high proportion of cases that are not identified until stage 3 or stage 4. (Table 8.8 and Graph 8.5.1)

Section 8.5.2: Types of Soft Tissue Sarcoma

There are multiple soft tissue sarcomas with varying degrees of aggressive behavior (Table 8.9), but virtually all have the capacity to metastasize and cause death. Treatment for high-grade soft tissue sarcomas is typically resection (removal) and radiation. Chemotherapy is playing an ever-increasing role, especially in high-grade and metastatic cases.

The most commonly encountered soft tissue sarcoma is malignant fibrous histiocytoma, a tumor of the fibrous tissue most often occurring in the arms or legs. The least differentiated of the sarcomas, in many cases it represents a poorly defined, high-grade soft tissue sarcoma that cannot be further defined pathologically (histologically). A recent trend is to classify these poorly differentiated sarcomas as pleomorphic sarcomas or spindle cell sarcomas "not otherwise specified, (NOS)." Poorly differentiated sarcomas typically affect older individuals.

The next most commonly reported soft tissue sarcoma is liposarcoma, malignant tumors of the fat tissues. This sarcoma also is more common in older persons. There are several subtypes ranging from the low-grade lipoma-like liposarcoma that rarely metastasizes to the high-grade pleomorphic liposarcoma and round cell liposarcoma, which have a prognosis similar to malignant fibrous histiocytoma.

The third most commonly encountered soft tissue sarcoma is synovial sarcoma, which is more likely to affect younger adults than previously mentioned sarcomas. Many of these cases respond very favorably to chemotherapy with significant shrinkage of the tumor, although resection and radiation remain the cornerstones of current therapy. The prognosis is similar to malignant fibrous histiocytoma and the other high-grade soft tissue sarcomas mentioned above.

Rhabdomyosarcomas are primarily tumors of children. Clinically and behaviorally they are in a class by themselves. These are treated with aggressive chemotherapy, as well as surgery and/or radiation in many cases. The aggressive treatments often cause permanent life-altering disability, even in survivors.

Section 8.6: Benign Bone Tumors

In addition to the burden of malignant bone and soft tissue tumors, a plethora of benign tumors and tumor-like conditions disable thousands of Americans annually. (Table 8.10) No national databases on which to base estimates of the prevalence or incidence of such tumors exist. The relative frequency of more common benign bone tumors can be discerned from prior publications and extrapolation from the primary contributor's ongoing case registry of consecutive surgical cases treated between 1991 through 2004. Table 8.11 reflects the collected experience reported in the Mayo Clinic publication of 1986, the University of Florida publication from 1983, the J. Mirra experience reported in 1989, and the most recent updated case series reflecting the practice of William G. Ward, a full-time orthopaedic oncologist in practice from 1991 to 2004 at Wake Forest University Health Sciences in Winston-Salem, NC.

It is believed that the experience of Dr. Ward, one of few orthopaedic oncologists in the state of North Carolina, is reflective of the current general prevalence of bone and soft tissue tumors as he treats a wide variety of benign and malignant bone tumors in a broad referral practice. All cases in his case registry reflect recently treated patients, i.e., none were "consult cases" in which only radiographs or pathology slides were reviewed for outside consulting physicians, such as the Mayo and Mirra series included. The earlier data sets were accumulated during time periods prior to the full development of the subspecialty of orthopaedic oncology; thus, only the more unusual cases of bone tumors were referred to major medical centers, making estimates of their incidence less reliable. It is believed that, except for bone cysts, few bone tumors have been treated by general orthopaedic surgeons or other musculoskeletal specialists in North Carolina over the past 15 years, as most are referred to orthopaedic oncologists. Practical experience has confirmed that osteosarcoma is the least likely

sarcoma to be treated by anyone other than an orthopaedic oncologist. Dr. Ward and a few other orthopaedic oncologists have treated nearly all patients with an osteosarcoma in North Carolina for the past 15 years. Very few benign bone tumors have been treated by general orthopaedic surgeons. Thus, comparing the cases of benign bone tumors relative to the cases of osteosarcoma treated by Dr. Ward provides a relative index useful in generating a broad estimate of the prevalence of these tumors. By comparing this estimate with the national estimate for the annual occurrence of osteosarcoma, the most commonly encountered primary sarcoma of bone, a rough estimate of the prevalence of these benign bone tumor diseases can be calculated.

The most commonly encountered benign tumor of bone is osteochondroma, estimated to have an annual prevalence of >1,500 cases. Osteochondroma typically arises near the long ends of bones. Osteochondromas are often painful due to formation of bursa overlying the lesion, interference with neurovascular function due to tenting of such structures over the osteochondroma surface, and the potential for deformity in the involved and/or adjacent bones. Long-term complications are uncommon except for rare cases of dedifferentiation into a chondrosarcoma. There is no estimate of the number of patients seen with non-operatively managed osteochondroma, as records are kept only for surgically treated cases managed by Dr. Ward. The prevalence of osteochondroma, thus, is an estimate of only those cases requiring surgery. The estimate is further underestimated due to the fact that some general orthopaedic surgeons provide surgical treatment of osteochondromas.

The second most commonly encountered benign bone lesions are unicameral bone cysts, with an estimated annual prevalence of >1,250 cases. The etiology of these fluid-filled bone cysts, usually found in the growing ends of children's long bones such as the proximal humerus or femur, is unclear. Because they never metastasize and are usually quite characteristic on radiographs, many of these are treated by other orthopaedic surgeons. The true incidence, therefore, is probably significantly higher than that estimated by extrapolation from Dr. Ward's practice experience. These cystic lesions cause weakening of the bone and often require multiple surgeries to rebuild the bone with bone grafts, injections, and other techniques. They occur in children and typically recur multiple times until skeletal maturity is achieved.

Giant cell tumor of bone, with an estimated annual prevalence of >750 cases, is the third most commonly encountered benign bone neoplasm, and accounts for significant disability and dysfunction. This bone-destroying tumor typically occurs near the end of the long bones, most commonly the lower femur or upper tibia, and causes destruction of the bone. The tumor may extend through the cortex of the bone into the soft tissues and, if large enough, prior to treatment can be associated with pathologic fracture of the involved bone. Smaller tumors can be treated with resection and reconstruction of the bone with bone graft or cement filler. More complicated cases require sophisticated reconstruction with massive joint replacements and/or massive allografts and can cause severe long-term disability. On rare occasions, giant cell tumors can metastasize to the lungs. In such cases, they typically respond poorly to chemotherapy and may cause death. These tumors are infrequently treated by general orthopaedic surgeons.

A fourth commonly encountered tumor that requires surgery is enchondroma, estimated at more than 725 annual cases. Bones typically form as cartilage models in embryos that ultimately convert into bone structure. The cartilage-based growth plates add length to the bones from bone growth. Enchondromas are basically tumors derived from these cartilaginous tissues that abnormally remain in the skeleton as remnants from the normal pattern of maturation and development. If these achieve sufficient size, they can cause pain or bony erosion and may present diagnostic challenges requiring biopsy. They often require treatment by curettage and bone grafting.

These lesions can dedifferentiate into malignant cartilage tumors, called chondrosarcomas. Many small enchondromas are seen incidentally, cause no symptoms, and are treated with simple observation. Only the surgically treated cases were recorded in Dr. Ward's series, so the total incidence of enchondromas is much higher than that shown. The burden of enchondromas requiring surgical treatment is fairly accurately and conservatively estimated.

There are multiple other benign tumors that are even less commonly encountered. Aneurysmal bone cysts (ABCs) are more aggressive forms of cystic lesions similar to unicameral bone cysts. However, ABCs are more destructive, expanding the weakened bone and causing greater bone destruction. They tend to be filled with blood and tissue, not simple fluid. They usually respond favorably to curettage and bone grafting, but recur in at least 20% of cases. Metaphyseal fibrous defects are deficiencies in normal bone formation within the various bones that occur in 2% to 3% of children. Most resolve without ever causing symptoms and may never even be detected, but many require surgery, such as bone grafting, to prevent fracture and/or surgery to treat completed fractures that have occurred. Osteoid osteoma is a small tumor typically occurring in children that is associated with severe unrelenting night pain. It usually requires resection and may require bone grafting. When located in the spine it can cause a painful scoliosis. More recently, successful treatment with radio-frequency ablation procedures under radiographic guidance has become the treatment of choice for accessible lesions. Chondroblastoma is an unusual neoplasm that occurs in the ends of growing bones in teenagers and young adults. This requires resection of the lesion and bone grafting. If untreated, it can cause collapse and degenerative arthritis in the associated joint and on rare occasion can metastasize to the lung. These usually are referred to orthopaedic oncologists. Numerous other less common benign bone tumors often are treated similar to giant cell tumors, ABCs, or chondroblastomas with curettage, resection and bone grafting. Most cause some degree of disability and dysfunction of the involved extremity.

Section 8.7: Benign Soft Tissue Tumors

As with the benign bone tumors, there is no national registry of benign soft tissue tumors. By comparing Dr. Ward's 13 years of practice history from 1991 to 2004, and computing an incidence index relative to that of osteosarcoma, some estimate of the prevalence of surgically treated lesions may be obtained. (Table 8.12) From this index estimate, a baseline estimate of the national incidence can be calculated. However, benign soft tissue tumors are the most likely category of tumors to be treated by other surgeons, such as general orthopaedic surgeons and general surgeons; therefore, this national estimate is extremely conservative. The prevalence and burden in the United States from benign soft tissue tumors is significantly higher than estimated herein.

The majority of benign soft tissue tumors cause local growth and may require resection. Benign lesions rarely cause death, and it is quite infrequent that an amputation is required. However, depending on the site of involvement and size of the lesion, significant disability of the involved extremity and/or joint can occur. The true cost of these otherwise benign neoplasms can be quite high in terms of healthcare costs, lost work time, morbidity, emotional cost, and disability expenses.

A summary of "Neoplasms of the Bones & Joints and Soft Tissues, 20-Year Cumulative Case Counts, 1985-2004, National Cancer Data Base of the American College of Surgeons Commission on Cancer" is shown in Table 8.13.

1. Horner MJ, Ries LAG, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

2. Praemer A Furner S, Rice DP: *Musculoskeletal Conditions in the United States*. ed 2. Rosemont, IL: American Academy of Orthopaedic Surgeons, 1999, p 182.

3. Damron TA, Ward WG, Stewart A: Osteosarcoma, chondrosarcoma and Ewing's sarcoma: National Cancer Center Data Base Report. *Clin Orthop Relat Res* 2007;459:40-47.

4. Grimer RJ, Carter SR, Pynsent PB: The cost-effectiveness of limb salvage bone tumors. *J Bone Joint Surg Br* 1997;79:558-561.

5. National Cancer Society (NCS): *What Is a Soft Tissue Sarcoma?* Available at: http://www.cancer.org/docroot/cri/content/cri_2_4_1x_what_is_sarcoma_38.asp?sitearea=cri. Accessed October 10, 2007.

6. Horner MJ, Ries LAG, Krapcho M, et. al. (eds). *SEER Cancer Statistics Review, 1975-2006*, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

7. National Cancer Data Base (NCDB): *Site by Stage Distribution of Cases Reported to the NCDB: Diagnosis Year 2000 to 2004*. Chicago, IL: American College of Surgeons Commission on Cancer. Available at: http://www.facs.org/cancer/ncdb/publicaccess.html. Accessed October 10, 2007.

8. Horner MJ, Ries LAG, Krapcho M, et. al. (eds). *SEER Cancer Statistics Review, 1975-2006*, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

9. National Cancer Society (NCS): *How Are Soft Tissue Sarcomas Staged?* Available at: http://www.cancer.org/docroot/CRI/content/CRI_2_4_3X_How_is_sarcoma_staged_38.asp?rnav=cri. Accessed October 10, 2007.

Section 8.8: Neoplasms of Bone and Connective Tissue Data Tables

Table 8.1: Incidence of Cancer of Bones and Joints by Sex and Race, United States 1995-2006

	Incidence per 1,000,000 Persons										
		White		Black		Hispanic		American Indian/ Alaska Native		Asian or Pacific Islander	
Year	All Persons	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
1995		11.6	7.8	10.2	6.8	9.6	8.9	-	-	9.5	4.1
1996		10.9	7.5	11.2	5.9	7.3	6.5	5.0	30.7	6.3	4.1
1997		11.5	9.3	9.9	5.6	7.5	7.3	-	20.0	8.4	4.2
1998		10.6	8.1	6.7	7.4	7.7	7.0	4.8	3.6	5.9	5.8
1999		10.4	8.2	5.9	5.5	8.7	7.3	-	-	6.8	2.8
2000		10.4	8.3	9.3	5.6	10.1	9.4	27.1	6.7	8.5	7.7
2001		11.8	8.3	7.3	5.9	10.0	7.9	4.1	13.4	6.8	2.5
2002		11.6	8.2	12.1	6.7	10.6	6.2	15.6	6.6	6.4	7.5
2003	9.0	10.6	8.1	7.9	6.6	10.1	8.0	15.7	2.6	6.9	7.1
2004	9.0	9.7	8.2	5.8	7.7	7.0	8.5	2.3	2.3	6.4	2.7
(based on 5-year average for 2005 & 2006)											
2005	9.0	11.0	8.0	8.0	7.0	NA	NA	NA	NA	NA	NA
2006	9.0	11.0	8.0	8.0	7.0	9.0	7.0	NA	NA	6.0	6.0

Source 1995 to 2004 data: Ries LAG, Harkins D, Krapcho M, et. al. (eds): *SEER Cancer Statistics Review, 1975-2004, Overvie* w. Bethesda, MD: National Cancer Institute, 2007. Available at: http://seer.cancer.gov/csr/1975_2004/. Accessed June 19, 2007.

Source 2005 data: Ries LAG, Melbert D, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2005, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2005/, based on November 2007 SEER data submission, posted to the SEER web site, 2008. Accessed December 8, 2009.

Source 2006 data: Horner MJ, Ries LAG, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.2: Incidence of Myeloma by Sex and Race, United States 1995-2006

	Incidence per 1,000,000 Persons				
		White		Black	
Year	All Persons	Males	Females	Males	Females
1995	57.0	67.0	43.0	150.0	101.0
1996	58.0	68.0	43.0	134.0	119.0
1997	61.0	70.0	47.0	142.0	118.0
1998	59.0	70.0	44.0	129.0	105.0
1999	55.0	66.0	40.0	149.0	99.0
2000	59.0	73.0	43.0	106.0	103.0
2001	57.0	67.0	43.0	137.0	99.0
2002	57.0	73.0	40.0	139.0	85.0
2003	53.0	65.0	40.0	132.0	80.0
(based on 5-year average for 2004 to 2006)					
2004	56.0	66.0	41.0	140.0	95.0
2005	56.0	66.0	41.0	144.0	98.0
2006	56.0	66.0	41.0	143.0	100.0

Source: Ries LAG, Harkins D, Krapcho M, et. al. (eds): *SEER Cancer Statistics Review, 1975-2004, Overview* . Bethesda, MD: National Cancer Institute, 2007. Available at: http://seer.cancer.gov/csr/1975_2004/. Accessed June 19, 2007.

Source 2005 data: Ries LAG, Melbert D, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2005, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2005/, based on November 2007 SEER data submission, posted to the SEER web site, 2008. Accessed December 8, 2009.

Source 2006 data: Horner MJ, Ries LAG, Krapcho M, et. al. (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.3: Median Age of Patients at Diagnosis by Primary Cancer Site by Sex and Race, United States 2002-2006

Site	Median Age at Diagnosis, All Races			Median Age at Diagnosis, Whites			Median Age at Diagnosis, Blacks		
	Total	Males	Females	Total	Males	Females	Total	Males	Females
Lymphoma (Hodgkin)	38.0	40.0	36.0	39.0	40.0	37.0	37.0	39.0	34.5
Bones & Joints	**39.0**	**38.0**	**41.0**	**40.0**	**40.0**	**42.0**	**31.0**	**28.0**	**33.0**
Kaposi's Sarcoma	43.0	42.0	79.0	45.0	44.0	80.0	39.0	38.0	44.5
Endocrine System	48.0	53.0	47.0	48.0	53.0	47.0	49.0	52.0	49.0
Brain & Nervous System	56.0	55.0	57.0	57.0	56.0	58.0	50.0	50.0	50.0
Soft Tissue (incl heart)	**57.0**	**57.0**	**57.0**	**59.0**	**59.0**	**58.0**	**48.0**	**46.0**	**50.0**
Skin	60.0	63.0	55.0	60.0	63.0	56.0	53.5	55.0	51.0
Breast (incl breast in situ)	61.0	68.0	61.0	62.0	68.0	62.0	57.0	63.0	57.0
Female Genital System	61.0		61.0	61.0		61.0	60.0		60.0
Oral Cavity & Pharynx	62.0	60.0	65.0	63.0	61.0	67.0	58.0	58.0	57.0
Leukemia	66.0	66.0	68.0	68.0	67.0	69.0	60.0	59.0	62.0
Lymphoma (Non-Hodgkin)	67.0	65.0	69.0	68.0	66.0	70.0	56.0	54.0	58.0
Male Genital System	67.0	67.0		67.0	67.0		65.0	65.0	
Myeloma (bone marrow)	**70.0**	**69.0**	**71.0**	**71.0**	**70.0**	**72.0**	**66.0**	**65.5**	**67.0**
Respiratory System	70.0	70.0	71.0	71.0	70.0	71.0	66.0	65.0	67.0
Urinary System	70.0	70.0	70.0	70.0	70.0	71.0	65.0	64.0	67.0
Digestive system	70.0	68.0	73.0	71.0	69.0	73.0	66.0	64.0	68.0
All Sites	66.0	67.0	65.0	67.0	68.0	66.0	63.0	64.0	62.0

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). *SEER Cancer Statistics Review, 1975-2006* , National Cancer Institute. Bethesda, MD. Table 1.11: Median Age of Cancer Patients at Diagnosis, 2002-2006, By Primary Cancer Site, Race and Sex. Available at: http://seer.cancer.gov/csr/1975_2006/results_merged/topic_med_age.pdf, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.4: Age-Adjusted [1] 5-Year Relative Cancer Survival Rates by Sex, United States 1999-2005

	5-Year Relative Survival Rate (%, 1999-2005)		
Site	Total	Males	Females
Male Genital System	98.1	98.1	
Endocrine System	93.9	88.3	95.8
Skin (excl basal and squam)	90.8	88.8	93.3
Breast (incl breast *in situ*)	88.6	85.0	88.6
Lymphoma (Hodgkin)	84.9	83.0	87.0
Urinary System	73.5	75.0	70.2
Female Genital System	69.7		69.7
Bones & Joints	**67.9**	**64.4**	**58.3**
Soft Tissue (incl heart)	**66.3**	**66.6**	**66.0**
Lymphoma (Non-Hodgkin)	63.4	60.8	66.4
Oral Cavity & Pharynx	61.0	59.9	63.3
Kaposi Sarcoma	56.3	55.8	63.7
Leukemia	49.6	49.7	49.4
Digestive system	45.4	43.5	47.5
Brain & Nervous System	33.9	35.5	36.0
Myeloma (bone marrow)	**33.7**	**35.5**	**31.7**
Respiratory System	18.9	18.3	19.7
All Sites	61.1	66.2	66.0

[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). *SEER Cancer Statistics Review, 1975-2006* , National Cancer Institute. Bethesda, MD. Table I-4 - continued AGE-ADJUSTED SEER INCIDENCE AND U.S. DEATH RATES AND 5-YEAR RELATIVE SURVIVAL RATES By Primary Cancer Site, Sex and Time Period. Available at: http://seer.cancer.gov/csr/1975_2006/results_merged/topic_survival.pdf, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.5: Age Distribution [1] of Primary Cancer Site at Time of Diagnosis, United States 2002-2006

Site	Age Distribution (%) of Incidence Cases by Site, 2002-2006								Total Cases, All Ages
	< 20	20-34	35-44	45-54	55-64	65-74	75-84	85+	
Bones & Joints	**29.4**	**16.1**	**10.7**	**12.8**	**10.3**	**8.8**	**8.2**	**3.8**	**3,396**
Brain & Nervous System	13.2	9.3	10.1	15.0	17.6	16.4	14.2	4.2	23,973
Lymphoma (Hodgkin)	11.9	32.1	16.9	12.3	9.2	8.5	7.0	2.1	10,522
Leukemia	11.1	4.7	5.5	10.1	15.0	19.8	23.3	10.5	44,690
Soft Tissue (incl heart)	**9.9**	**9.8**	**11.2**	**14.9**	**15.7**	**15.5**	**16.3**	**6.7**	**11,687**
Endocrine System	3.2	16.2	21.3	23.1	16.9	11.3	6.4	1.5	39,088
Lymphoma (Non-Hodgkin)	1.7	3.9	7.2	13.9	19.0	22.2	23.6	8.6	71,464
Skin (excl basal & squamous)	0.9	7.7	12.0	18.3	19.4	17.8	17.6	6.3	79,398
Urinary System	0.6	0.9	3.6	11.0	20.4	26.3	27.5	9.9	128,472
Oral Cavity & Pharynx	0.6	2.4	6.8	20.9	26.2	21.3	16.1	5.8	38,632
Female Genital System	0.4	4.4	10.1	19.5	24.6	19.4	15.6	5.9	96,539
Digestive System	0.2	1.0	3.8	12.5	19.5	24.9	26.9	11.3	319,364
Male Genital System	0.2	1.8	1.7	8.9	27.9	34.2	20.7	4.5	267,411
Kaposi's Sarcoma	0.1	17.9	35.6	18.2	7.2	6.2	9.2	5.6	2,357
Respiratory System	0.1	0.4	2.0	9.2	21.3	31.1	28.3	7.5	242,400
Breast (incl breast in situ)	0.0	1.9	10.5	22.5	23.7	19.6	16.2	5.5	247,782
Myeloma (bone marrow)	**0.0**	**0.5**	**3.3**	**11.9**	**20.7**	**26.5**	**27.6**	**9.5**	**20,399**
All Sites	1.1	2.7	5.8	13.9	21.8	24.9	22.2	7.6	1,692,617

[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.6: Age Distribution [1] of Primary Cancer Site at Time of Death, United States 2002-2006

	Age Distribution (%) of Deaths by Cancer Site, 2002-2006								Total Cases,
Site	< 20	20-34	35-44	45-54	55-64	65-74	75-84	85+	All Ages
Bones & Joints	**14.5**	**14.4**	**7.0**	**9.9**	**11.9**	**13.7**	**17.9**	**10.8**	**6,488**
Endocrine System	8.2	2.6	4.4	10.5	16.3	21.2	24.3	12.5	11,416
Brain & Nervous System	4.3	3.8	7.4	15.2	21.3	22.3	19.5	6.1	64,598
Soft Tissue (incl heart)	**4.1**	**6.5**	**7.3**	**13.5**	**17.5**	**19.2**	**21.7**	**10.2**	**18,749**
Leukemia	3.0	3.2	3.4	6.5	12.4	21.9	31.6	17.9	108,393
Lymphoma (Hodgkin)	1.9	14.6	10.7	12.4	14.3	16.4	20.8	8.9	6,574
Lymphoma (Non-Hodgkin)	0.5	1.6	2.8	7.1	13.9	22.8	33.7	17.6	105,789
Oral Cavity & Pharynx	0.2	0.8	3.4	14.6	23.6	23.9	22.2	11.2	38,833
Urinary System	0.2	0.3	1.6	7.0	15.4	23.4	32.7	19.5	129,846
Skin (excl basal & squamous)	0.1	2.3	5.7	13.0	18.3	20.7	25.1	14.8	52,530
Digestive System	0.1	0.5	2.4	9.3	17.3	24.2	29.8	16.4	666,908
Female Genital System	0.0	1.3	4.7	12.0	19.3	23.3	26.0	13.4	136,258
Breast (incl breast in situ)	0.0	1.0	6.2	15.1	20.3	19.8	22.8	14.9	206,023
Male Genital System	0.0	0.4	0.4	1.7	7.3	20.0	40.3	29.8	149,423
Respiratory System	0.0	0.1	1.5	8.0	19.7	30.9	30.5	9.3	814,945
Myeloma (bone marrow)	**0.0**	**0.1**	**1.3**	**6.4**	**15.7**	**26.8**	**34.9**	**14.9**	**53,770**
All Sites	0.4	0.8	2.7	9.0	17.5	25.2	29.9	14.6	2,787,217

[1] Age-adjusted to the U.S. Standard Population (19 age groups - Census P25-1130)

Source: Horner MJ, Ries LAG, Krapcho M, et al (eds). SEER Cancer Statistics Review, 1975-2006, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2006/, based on November 2008 SEER data submission, posted to the SEER web site, 2009. Accessed December 8, 2009.

Table 8.7: Annual Distribution of Malignant Bone Tumors and Myeloma by Type and Age, United States, 2000-2003

	Annual Prevalence Bone Tumor Cases, 2000-2003					Total Malignant Cases, All Ages
	< 20	20-34	35-44	55-64	75+	
Malignant Bone Tumors						
Osteosarcoma	421	154	145	131	65	916
Chrondosarcoma	31	156	390	319	91	987
Ewing's Sarcoma	222	71	34	11	0	339
Other and Unspecified Bone Tumors	34	46	137	117	117	449
Total Malignant Bone Tumors	708	427	705	577	273	2691
Myeloma	0	92	2288	7217	5743	15,341

	Proportion (%) of Total Bone Tumor Cases by Type, 2000-2003					Malignant Cases, All Ages
	< 20	20-34	35-44	55-64	75+	
Malignant Bone Tumors						
Osteosarcoma	46.0%	16.8%	15.8%	14.3%	7.1%	100%
Chrondosarcoma	3.2%	15.9%	39.5%	32.3%	9.2%	100%
Ewing's Sarcoma	65.5%	21.0%	10.1%	3.4%	0.0%	100%
Other and Unspecified Bone Tumors	7.6%	10.1%	30.4%	25.9%	25.9%	100%
Total Malignant Bone Tumors	26.3%	15.9%	26.2%	21.5%	10.1%	100%
Myeloma	0.0%	0.6%	14.9%	47.0%	37.4%	100%

	Distribution (%) of Total Bone Tumor Cases by Age, 2000-2003					Malignant Cases, All Ages
	< 20	20-34	35-44	55-64	75+	
Malignant Bone Tumors						
Osteosarcoma	59.4%	36.0%	20.6%	22.7%	24%	916
Chrondosarcoma	4.4%	36.7%	55.2%	55.2%	33%	987
Ewing's Sarcoma	31.3%	16.7%	4.8%	2.0%	0%	339
Other and Unspecified Bone Tumors	4.8%	10.7%	19.4%	20.2%	43%	449
Total Malignant Bone Tumors	100.0%	100.0%	100.0%	100.0%	100.0%	2691

Source: Surveillance, Epidemiology, and End Results (SEER) Program (www.seer.cancer.gov): Public-Use Data (1973-2003). National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, released April 2006, based on the November 2005 submission. Accessed: March 19, 2007.

Table 8.8: Site by Stage Distribution of Cases for Top 12 Cancer Sites, Soft Tissue Cancers and Bone and Joint Cancers, Diagnosis Years 2000-2004 and 2006

National Cancer Data Base, Diagnosis Years 2006

	Proportion of Total Cases with Known Stage, 2006							
Primary Site	Stage 0	Stage I	Stage II	Stage III	Stage IV	Stage Unknown Cases	Total Cases	% of Total Cases
Breast	20.3%	39.8%	26.6%	9.8%	3.5%	13,083	178,764	17.3%
Prostate	0.0%	1.4%	84.9%	8.5%	5.2%	12,812	126,058	12.2%
Lung, Bronchus - NSCC	0.3%	26.4%	7.5%	26.5%	39.3%	13,878	112,095	10.8%
Colon	7.6%	21.7%	27.0%	24.9%	18.8%	7,278	70,537	6.8%
Bladder	50.9%	22.8%	13.0%	5.6%	7.6%	5,202	40,507	3.9%
Non-Hodgkins Lymphoma	0.0%	29.3%	16.3%	17.8%	36.5%	7,319	38,280	3.7%
Melanoma - Skin	25.1%	48.5%	13.4%	8.8%	4.3%	5,413	37,314	3.6%
Kidney and Renal Pelvis	0.0%	58.4%	9.8%	14.5%	17.4%	5,746	33,927	3.3%
Uterus	1.3%	69.7%	8.7%	13.6%	6.6%	4,840	31,876	3.1%
Thyroid	0.0%	68.8%	10.2%	12.6%	8.5%	3,572	25,210	2.4%
Pancreas	0.6%	8.7%	25.7%	13.9%	51.1%	5,560	24,956	2.4%
Rectum	8.4%	29.1%	23.0%	24.4%	15.1%	4,030	22,202	2.1%
Soft Tissue	**0.0%**	**32.4%**	**22.0%**	**27.2%**	**18.4%**	**2,657**	**7,167**	**0.7%**
Bones and Joints	**0.0%**	**40.9%**	**36.9%**	**3.5%**	**18.8%**	**945**	**2,070**	**0.2%**
All Cancer Cases	8.8%	27.9%	28.9%	16.0%	18.4%	858,270	1,035,937	72.5%

National Cancer Data Base, Diagnosis Years 2000 to 2004

	Proportion of Total Cases with Known Stage, 2000-2004							
Primary Site	Stage 0	Stage I	Stage II	Stage III	Stage IV	Stage Unknown Cases	Total Cases	% of Total Cases
Breast	18.0%	40.7%	29.9%	7.9%	3.5%	35,762	839,265	17.8%
Prostate	0.0%	2.1%	84.1%	8.5%	5.3%	38,727	612,414	13.0%
Lung, Bronchus - NSCC	0.3%	25.2%	8.1%	27.7%	38.7%	38,309	490,609	10.4%
Colon	7.9%	22.1%	27.5%	24.2%	18.3%	25,862	353,444	7.5%
Bladder	50.6%	23.7%	12.7%	6.0%	7.0%	15,466	190,144	4.0%
Non-Hodgkins Lymphoma	0.0%	32.0%	17.5%	15.9%	34.6%	35,954	172,269	3.7%
Melanoma - Skin	25.8%	43.2%	15.9%	11.0%	4.1%	20,605	158,558	3.4%
Uterus	1.4%	70.3%	8.9%	12.5%	6.9%	17,235	139,009	3.0%
Kidney and Renal Pelvis	0.0%	52.9%	11.3%	15.0%	20.8%	15,380	132,380	2.8%
Rectum	9.1%	31.0%	22.3%	23.3%	14.3%	17,304	109,971	2.3%
Pancreas	0.5%	9.0%	15.1%	14.3%	61.1%	17,105	102,399	2.2%
Lung, Bronchus - SCC	0.3%	6.7%	4.0%	30.3%	58.7%	9,779	96,167	2.0%
Soft Tissue	**0.0%**	**28.3%**	**30.4%**	**24.8%**	**16.6%**	**12,310**	**32,622**	**0.7%**
Bones and Joints	**0.0%**	**43.7%**	**34.6%**	**2.9%**	**18.8%**	**4,339**	**10,002**	**0.2%**
All Cancer Cases	8.8%	27.9%	28.9%	16.0%	18.4%	858,270	4,708,118	

Source: National Cancer Data Base (NCDB): Site by Stage Distribution of Cases Reported to the NCDB: Diagnosis Year 2006. American College of Surgeons Commission on Cancer. Available at: http://www.facs.org/cancer/ncdb/site_stage_2006.htm. Accessed December 10, 2009.

Table 8.9: Malignant Soft Tissue Tumors (Sarcomas)

Tumors of Fat Tissue	
Liposarcomase	Malignant tumors of fat tissue. They can develop anywhere in the body, but they most often develop in the thigh, behind the knee, and inside the back of the abdomen. They occur mostly in adults between 50 and 65 years old. Some liposarcomas grow very slowly, whereas others can grow quickly. Your doctor can tell you which kind you have.
Tumors of Muscle Tissue	
Smooth muscle sarcomas (Found in internal organs such as stomach, intestines, blood vessels, or uterus (womb) and causes them to contract. These muscles are involuntary.)	
Leiomyosarcomas	Malignant tumors of involuntary muscle tissue. They can grow almost anywhere in the body but are most often found in the retroperitoneum and the internal organs and blood vessels where leiomyomas also arise. Less often, they develop in the deep soft tissues of the legs or arms. They tend to occur in adults, particularly the elderly.
Skeletal muscle sarcomas (Muscle that allows movement of arms and legs and other body parts; voluntary movement.)	
Rhabdomyosarcomas	Malignant tumors of skeletal muscle. These tumors commonly grow in the arms or legs, but they can also begin in the head and neck area and in reproductive and urinary organs such as the vagina or bladder. Children are affected much more often than adults. For more information, see the American Cancer Society document, "Rhabdomyosarcoma."
Tumors of Peripheral Nerve Tissue	
Malignant schwannomas, neurofibrosarcomas, or neurogenic sarcomas	Malignant tumors of the cells that surround a nerve. A new name for these is malignant peripheral nerve sheath tumors
Tumors of Joint Tissue	
Joints are surrounded by tough tissue called synovium, which produces the fluid that lubricates the joint surfaces so that they move smoothly. Tumors of joints start in the synovium.	
Synovial sarcoma	Malignant tumor of the tissue around joints. The most common location is the thigh. Despite the name Synovial Sarcoma, most do not occur in joints. It tends to occur mostly in young adults, but can also occur in children and in older people.
Tumors of Blood Vessels and Lymph Vessels	
Hemangiopericytoma	A tumor of perivascular tissue. It most often develops in the legs, pelvis, and retroperitoneum (the back of the abdominal cavity). It is most common in adults. These can be either benign or malignant. They don't often spread to distant sites, but tend to come back where they started, even after surgery, unless widely excised.
Hemangioendothelioma	A blood vessel tumor that is less aggressive than hemangiosarcoma but still considered a low-grade cancer. It usually invades nearby tissues and sometimes can spread to distant parts of the body (metastasize). It may develop in soft tissues or in internal organs, such as the liver or lungs.
Angiosarcomas	Malignant tumors that can develop either from blood vessels (hemangiosarcomas) or from lymph vessels (lymphangiosarcomas). These tumors can sometimes develop in a part of the body that has been exposed to radiation. Angiosarcomas are sometimes seen in the breast after radiation therapy for breast cancer or in the arm on the same side as a breast that has been irradiated or removed by mastectomy. They are difficult to cure.
Kaposi sarcoma	A cancer formed by cells similar to those lining blood or lymph vessels. In the past, Kaposi's sarcoma was an uncommon cancer mostly seen in older people with no apparent immune system problems. It is most common in people with human immunodeficiency virus (HIV) infection and the acquired immunodeficiency syndrome (AIDS), but it can also develop in organ transplant patients who are taking medication to suppress their immune system. It is probably related to infection with a virus called human herpesvirus-8 (HHV-8).
Tumors of Fibrous Tissue	
Fibrous tissue forms tendons and ligaments and covers bones as well as other organs in the body.	
Fibrosarcoma	Cancer of fibrous tissue. It usually affects the legs, arms, or trunk. It is most common between the ages of 20 and 60, but can occur at any age, even in infancy.
Fibromatosis	The name given to fibrous tissue tumor with features in between fibrosarcoma and benign tumors such as fibromas and superficial fibromatosis. They tend to grow slowly but, often, steadily. At one time they were called desmoid tumors, when they were closely attached to skeletal muscles. Now they are called musculoaponeurotic fibromatosis. They do not metastasize, but they can invade nearby tissues and are sometimes fatal. Some doctors consider these to be a type of low-grade fibrosarcoma; others believe they are a unique type of fibrous tissue tumors. Certain hormones, particularly estrogen, increase the growth of some desmoid tumors. Antiestrogen drugs are sometimes useful in treating desmoids that cannot be completely removed by surgery.
Dermatofibrosarcoma protuberans (DFSP)	A slow-growing cancer of the fibrous tissue beneath the skin, usually in the trunk or limbs. It invades nearby tissues but rarely metastasizes.
Malignant fibrous histiocytoma (MFH)	Most often found in the arms or legs. Less often, it can develop inside the back of the abdomen. This sarcoma is most common in older adults. Although it mostly tends to grow locally, it can spread to distant sites. It is the most commonly diagnosed soft tissue sarcoma.
Tumors of Uncertain Tissue Type	
sarcomas have not been linked to a specific type of normal soft tissue.	
Malignant mesenchymoma	A rare type of sarcoma that contains some areas showing features of fibrosarcoma and other areas with features of at least two other types of sarcoma.
Alveolar soft-part sarcoma	A rare cancer that mostly affects young adults. The legs are the most common location of these tumors.
Epithelioid sarcoma	Most often develops in tissues under the skin of the hands, forearms, feet, or lower legs. Adolescents and young adults are often affected.
Clear cell sarcoma	A rare cancer that often develops in tendons of the arms or legs. Under the microscope, it shares some features with malignant melanoma, a type of cancer that develops from pigment-producing skin cells. How cancers with these features develop in parts of the body other than the skin is not known.
Desmoplastic small cell tumor	A rare sarcoma of adolescents and young adults, found most often in the abdomen. Its name means that it is formed by small, round cancer cells surrounded by scar-like tissue.
Other Types of Sarcoma	
There are other types of soft tissue sarcomas, however, they are less commonly encountered.	

October 10, 2007. Editorial revisions provided by William G. Ward, MD

Table 8.10: Benign Soft Tissue Tumors

Tumors of Fat Tissue	
Lipomas	**B**enign tumors of fat tissue. They are the most common benign soft tissue tumor. Most are found under the skin, but they can develop anywhere in the body.
Lipoblastomas	Benign fat tumors that occur in infants and young children.
Hibernomas	Like lipomas, are also benign fat tissue tumors. They are much less common than lipomas.
Tumors of Muscle Tissue	
Smooth muscle sarcomas (Found in internal organs such as stomach, intestines, blood vessels, or uterus (womb) and causes them to contract. These muscles are involuntary.)	
Leiomyomas	Benign tumors of smooth muscle (or involuntary muscle). Leiomyomas can arise almost anywhere in the body in either men or women because they can start in tissues as widespread, for example, as blood vessels or intestine. The most common of these is the fibroid tumor that develops in many women. It is really a leiomyoma of the uterus.
Skeletal muscle sarcomas (Muscle that allows movement of arms and legs and other body parts; voluntary movement.)	
Rhabdomyomas	Benign tumors of skeletal muscle (the muscle that is attached to bone and helps us to move). They are rare.
Tumors of Peripheral Nerve Tissue	
Neurofibromas, schwannomas (neurilemoma), and neuromas	Benign tumors of nerves. These tumors can occur almost anywhere in the body. An inherited condition called neurofibromatosis or von Recklinghausen disease causes people to develop many neurofibromas throughout their body. Some of these, if they formed from very large nerves such as those in the upper arms, neck, pelvis or thigh can become malignant.
Tumors of Joint Tissue	
Joints are surrounded by tough tissue called synovium, which produces the fluid that lubricates the joint surfaces so that they move smoothly. Tumors of joints start in the synovium.	
Nodular tenosynovitis	Benign tumor of joint tissue. It is most common in the hands and is more common in women than in men.
Tumors of Blood Vessels and Lymph Vessels	
Hemangiomas	Benign tumors of blood vessels. They are rather common, are often present at birth, and can affect the skin or internal organs. They sometimes disappear without treatment, but when located in muscles and other deep tissues, can be quite problematic and require surgical treatment.
Glomus tumors	Benign perivascular (around blood vessels) tumors. They usually are found under the skin and often under fingernails.
Hemangiopericytoma	A tumor of perivascular tissue. It most often develops in the legs, pelvis, and retroperitoneum (the back of the abdominal cavity). It is most common in adults. These can be either benign or malignant. They don't often spread to distant sites, but tend to come back where they started, even after surgery, unless very widely excised.
Lymphangiomas.	Benign lymph vessel tumors that are usually present at birth. Lymph is a type of fluid that circulates in every tissue of the body, ending up in the venous system. It contains waste products from tissues and immune system cells. Lymphangiosarcomas are the malignant lymph vessel form of angiosarcomas
Tumors of Fibrous Tissue	
Fibrous tissue forms tendons and ligaments and covers bones as well as other organs in the body.	
Fibromas, elastofibromas, superficial fibromatosis, and fibrous histiocytomas	All are benign tumors.
Tumors of Uncertain Tissue Type	
Through microscopic examination and other laboratory tests, doctors can usually find similarities between most sarcomas and certain types of normal soft tissues. However, some sarcomas have not been linked to a specific type of normal soft tissue.	
Myxoma	A benign tumor that usually is located in muscles but does not develop from muscle cells. The cells of a myxoma produce mucus-like material, a feature that distinguishes this tumor. It almost always occurs in adults.
Granular cell	Tumors are usually benign tumors of adults that occur often in the tongue but can be found almost anywhere in the body.
Tumor-like Conditions of Soft Tissue	
Some conditions of soft tissues are caused by inflammation or injury and can form a mass that looks like a soft tissue tumor. Unlike a true tumor, they do not come from a single abnormal cell, they have limited capacity to grow or spread to nearby tissues, and never spread through the bloodstream or lymph system. Examples include nodular fasciitis and myositis ossificans, which involve tissues under the skin and muscle tissues, respectively.	

Source: American Cancer Society. What is a soft tissue sarcoma? 2006 Available at: http://www.cancer.org/docroot/cri/content/cri_2_4_1x_what_is_sarcoma_38.asp?sitearea=cri. Accessed October 10, 2007.

Table 8.11: Relative Incidence of Benign Bone Tumors

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Benign Bone Tumor	Mayo [1]	UFLA [2]	Mirra [3]	Ward [4]	Prevalence Relative to Osteosarcoma [5]	National Annual Prevalence [6, 7]
Osteochrondroma	727	98	1,937	124	1.65	1,511
Unicameral Bone Cyst	NA	56	583	102	1.36	1,246 [7]
Giant Cell Tumor	425	107	1,182	63	0.84	769
Enchondroma	245	37	829	60	0.80	733
Aneurysmal Bone Cysts	208	80	492	52	0.69	632
Metaphyseal Fibrous Defect	99	30	537	47	0.63	577 [8]
Osteoid Osteoma	245	56	635	25	0.33	302 [7]
Chondroblastoma	79	43	229	14	0.19	174
Chondromyxoid Fibromas	39	27	101	6	0.08	73
Osteoblastoma	63	37	142	2	0.03	27 [7]
Malignant Bone Tumors						
Osteosarcoma [9]	1,330	324	2,525	75	1.00	916
Chondrosarcoma	732	173	746	47	0.63	987
Ewing's Sarcoma	402	141	871	33	0.44	339

[1] Source: Dahlin DC, Unni KK: *Introduction and Scope of Study in Bone Tumors: General Aspects and Data on 8,542 Cases* . Springfield, IL: Charles C. Thomas Co, 1986, pg 8, Table 1-1.

[2] Source: Enneking WF: *Musculoskeletal Tumor Surgery* , vol II. New York, NY: Churchill Livingstone, New York, 1983.

[3] Source: Mirra JM, Picci P, Gold RH (eds): *Bone Tumors: Clinical, Radiologic and Pathologic Correlations* . Philadelphia, PA: Lea & Febiger, 1989.

[4] Ward WG. Surgical case files, 1991-2004

[5] Ward WG. Computation of relative prevalence based on n=75 cases of osteosarcoma (i.e., (column 4)/(75)).

[6] Calculated as annual prevalence of cases relative to osteosarcoma (i.e., column 5 * national cases of osteosarcoma (n = 916)).

[7] Gross underestimate due to high frequency of treatments rendered by orthopaedic surgeons other than orthopaedic oncologists.

[8] Gross underestimate of prevalence since prior studies have indicated 1%-3% of children have these at some point in their childhood. Of the symptomatic ones requiring surgery, many are managed by orthopaedists other than orthopaedic oncologists, so true incidence is vastly higher than that depicted by this conservative estimate.

[9] The national prevalence of osteosarcoma between 2000 and 2003 was 916 cases. (Table 8.7) This value is used as the base for computing the estimated national prevalence of benign bone tumors.

Table 8.12: Surgically Treated Benign Soft Tissue Tumor Incidence

Tumor	Number [1]	Incidence Relative to Osteosarcoma [2]	Minimal Estimated National Incidence [3]
Lipoma	182	2.43	2,226
Ganglion	95	1.27	1,163
Hemangioma	51	0.68	623
Pigmented Villonodular Synovitis/Giant Cell Tumor of Tendon Sheath	45	0.60	550
Myxoma	38	0.51	467
Desmoid/Fibromatosis	39	0.52	476
Neurilemmoma	30	0.40	366
Neurofibroma	19	0.25	229
Myositis Ossificans	14	0.19	174
Fibroma	14	0.19	174
Other	293	3.91	3,582

[1] Ward WG: case series 1991-2004 by patients

[2] Ward WG: Computation of relative prevalence based on n=75 cases of osteosarcoma (i.e., (number/75).

[3] Calculated as annual prevalence of cases relative to osteosarcoma (i.e., column 2 * national cases of osteosarcoma (n = 916)). This provides a gross underestimate of the US national burden of these tumors, as many (perhaps most) are treated by other physicians, including family physicians, general surgeons and general orthopaedic surgeons.

Table 8.13: Neoplasms of the Bones, Joints and Soft Tissues, 20-Year Cumulative Case Counts, 1985-2004, National Cancer Data Base of the American College of Surgeons Commission on Cancer

Bone & Joint Tumors	Number
Total Bone Chondrosarcomas	11,585
Total Bone & Joint Osteosarcomas	14,191
Bone & Joint Tumors by Type	
Adamantinoma of Long Bones	196
Chondrosarcoma Dedifferentiated	238
Chondrosarcoma Juxtacortical	103
Chondrosarcoma Mesenchymal	251
Chondrosarcoma Myxoid	874
Chondrosarcoma, NOS	10,119
Chordoma	2,339
Ewing's Sarcoma	5,882
Fibrosarcoma, NOS	405
Giant Cell Tumor of Bone Malignant	606
Hemangioendothelioma Malignant	141
Hemangiosarcoma	322
Leiomyosarcoma	161
Malignant Fibrous Histiocytoma	1,266
Osteosarcoma Chondroblastic	1,564
Osteosarcoma Fibroblastic	676
Osteosarcoma in Pagets Disease of Bone	285
Osteosarcoma Parosteal	756
Osteosarcoma Small Cell	120
Osteosarcoma Telangiectatic	354
Osteosarcoma, NOS	10,436
Primitive Neuroectodermal Tumor	213
Sarcoma, NOS	668
Spindle Cell Sarcoma	338
Total	38,313

Soft Tissue Tumors	Number
Soft Tissue Malignant Hemangioendothelioma	333
Soft Tissue Chondrosarcomas	1,711
Soft Tissue Rhabdomyosarcomas	5,092
Soft Tissue Synovial Sarcomas	5,689
Soft Tissue Leiomyosarcomas*	14,622
Soft Tissue Liposarcomas	18,106
Soft Tissue Tumors (by Type)	
Alveolar Soft Part Sarcoma	517
Carcinosarcoma, NOS	187
Chondrosarcoma Mesenchymal	227
Chondrosarcoma Myxoid	750
Chondrosarcoma, NOS	734
Chordoma	303

Soft Tissue Tumors by Type (continued)	Number
Clear Cell Sarcoma	809
Dermatofibrosarcoma, NOS	2,956
Desmoplastic Small Round Cell Tumor	162
Epithelioid Sarcoma	1,271
Ewing's Sarcoma	1,113
Fibromyxosarcoma	1,523
Fibrosarcoma Infantile	193
Fibrosarcoma, NOS	3,421
Giant Cell Sarcoma	1,660
Giant Cell Tumor of Soft Parts Malignant	132
Granular Cell tumor Malignant	106
Hemangioendothelioma Malignant	162
Hemangioendothelioma Malignant Epithelioid	171
Hemangiopericytoma Malignant	986
Hemangiosarcoma	3,345
Kaposi Sarcoma	2,914
Leiomyosarcoma*	13,719
Leiomyosarcoma Epithelioid*	629
Leiomyosarcoma Myxoid*	274
Liposarcoma Mixed	627
Liposarcoma Myxoid	6,026
Liposarcoma Pleomorphic	2,288
Liposarcoma Round Cell	612
Liposarcoma Well Differentiated	3,989
Liposarcoma, NOS	3,551
Lipsosarcoma Dedifferentiated	1,013
Malignant Fibrous Histiocytoma	25,559
Mesenchymoma Malignant	253
Myxosarcoma	363
Neurilemmoma Malignant	1,343
Neurofibrosarcoma	1,583
Osteosarcoma, NOS	571
Peripheral Neuroectodermal Tumor	386
Primitive Neuroectodermal Tumor	581
Rhabdomyosarcoma Alveolar	1,419
Rhabdomyosarcoma Embryonal	1,801
Rhabdomyosarcoma, NOS	1,316
Rhabdomysarcoma Pleomorphic	556
Sarcoma Rhabdoid	140
Sarcoma, NOS	9,007
Small Cell Sarcoma	501
Spindle Cell Sarcoma	4,181
Synovial Sarcoma Biphasic	1,116
Synovial Sarcoma Spindle Cell	1,168
Synovial Sarcoma, NOS	3,405

* Totals include Gynecologic Leiomyosarcomas of the Uterus

Source: American College of Surgeons National Cancer Data Base

Chapter 9
Health Care Utilization and Economic Cost of Musculoskeletal Diseases

The annual average proportion of the United States population with a musculoskeletal disease requiring medical care has increased by more than two percentage points over the past decade and now includes more than 30% of the population. The increasing prevalence of musculoskeletal diseases in a growing and aging population has resulted in a more than 47% increase in total aggregate direct cost to treat persons with a musculoskeletal disease during this same time frame. For the years 2004-2006, the annual average direct cost, in 2006 dollars, for musculoskeletal health care, both as a direct result of a musculoskeletal disease and for patients with a musculoskeletal disease in addition to other health issues, is estimated to be $576 billion, the equivalent of 4.5% of the national gross domestic product (GDP). Incremental medical cost, that proportion of total direct cost associated with treatment incurred beyond that of persons of similar demographic and health characteristics but who do not have one or more musculoskeletal diseases (i.e., most likely attributable to a musculoskeletal disease), is estimated to be $160.5 billion.

Indirect cost, expressed primarily as wage losses for persons aged 18 to 64 with a work history, add another $373.1 billion, or 2.9% of the GDP in 2004-2006, to the cost for all persons with a musculoskeletal disease, either treated as a primary condition or in addition to another condition. Annual indirect costs attributable to musculoskeletal disease alone (incremental cost) are estimated to account for $127 billion of these indirect costs.

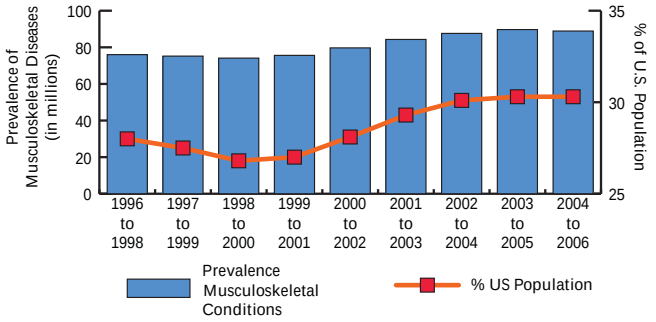
The annual estimated direct and indirect cost attributable to persons with a musculoskeletal disease is $287 billion. Taking into account all costs for persons with a musculoskeletal disease, including other comorbid conditions, the cost of treating these individuals in addition to the cost to society in the form of decreased wages, is estimated to be nearly $950 billion per year, 7.4% of the 2006 GDP.

Treatments that mitigate the long-term impact of musculoskeletal diseases and return persons to full and active lives are needed. The following chapter explores the details of cost associated with musculoskeletal diseases and establishes a baseline against which to assess future needs.

Section 9.1: Musculoskeletal Disease Prevalence

Over the period 2004-2006, an estimated 89.7 million persons annually reported a musculoskeletal disease in the Medical Expenditures Panel Survey (MEPS) as a primary health concern (Table 9.1 and Graph 9.1.1), a substantially lower number than the 110.34 million musculoskeletal diseases self-reported by adults aged 18 and over in the National Health Interview

Graph 9.1.1: Prevalence of Musculoskeletal Diseases and Proportion of Total Population with Musculoskeletal Disease, United States 1996-2006 [1]



[1] Data smoothed across each three year period.
Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Survey (NHIS) in 2008 and reported in Chapter 1 (Burden of Musculoskeletal Disease Overview.) A more expansive definition of musculoskeletal diseases includes persons in whom the musculoskeletal disease is a by-product of another condition and, therefore, is often not the primary (Dx1) diagnosis (e.g., bone metastases from cancer), as well as musculoskeletal diseases as a primary health concern. Using this more expansive definition of musculoskeletal diseases (discussed in Section 9.5 and Table 9.16), an average of 135.6 million persons, or 46.6% of the population, reported a musculoskeletal disease annually for the years 2002 to 2004. Assuming the proportion of musculoskeletal diseases among persons under the age of 18 is at least 10%, the incidence of musculoskeletal diseases in the NHIS and MEPS are similar.

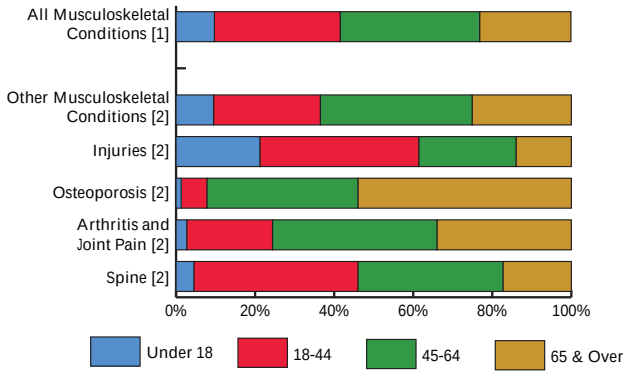
Between 1996-1998 and 2004-2006, the number of persons reporting a musculoskeletal disease increased nearly 14 million from the 76 million reported in 1996. During this same time period, the prevalence of musculoskeletal diseases in the total U.S. population increased by about 2%, from 28% to over 30%. (Table 9.1 and Graph 9.1.1)

Approximately 10% of all persons reporting musculoskeletal diseases in MEPS are under the age of 18, primarily due to the higher prevalence of musculoskeletal injuries (21%) in this age group. (Table 9.1 and Graph 9.1.2) Roughly one in four (23%) musculoskeletal diseases occur in persons aged 65 and over. A relatively high proportion (54%) of the category that includes osteoporosis, "Other Disorders of Bone and Cartilage," occurs in this age group. In contrast, the proportion of injuries and spine conditions are significantly lower in persons aged 65 and over (14% and 17%, respectively). Approximately one-third (34%) of musculoskeletal diseases occur among persons aged 45 to 64, yet this group accounts for 42% of the arthritis and joint pain conditions. Overall, more than 75% of musculoskeletal diseases are reported by persons under the age of 65.

Among the major subgroups of musculoskeletal diseases, arthritis and joint pain have the highest prevalence, reflecting the overall aging population. In 1996-1998, just under 30 million persons (11.0%) reported one or more conditions related to arthritis and joint pain; by 2002-2004, 37.6 million persons (12.9%) reported one or more such conditions. The effect of the baby boom generation aging has resulted in an increase in the proportion of arthritis cases among those aged 45 to 64 as they reach the typical onset age for arthritis. As this wave ages, the proportion of persons with arthritis in the 65 and older group will increase as well. In 1996-1998, 24.8% of persons reporting arthritis were aged 18 to 44; 36.4% were aged 45 to 64. By 2002-2004, the proportions had changed to 21.7% and 41.6%, respectively. In the next decade, a higher prevalence of arthritis and joint pain is expected to occur in persons aged 65 and over.

The number of persons reporting a spine condition increased by just under 5 million, from 27.4 million in 1996-1998 to 32.7 million in 2002-2004, while the prevalence rate increased by more than one percentage point, from 10.1% to 11.3% of the population. The majority of spine conditions occur in working age people, with 42% among persons aged 18 to 44 and another 37% among those aged 45 to 64. The higher prevalence rate among working age persons is reflected in the prominence of spine conditions in workers' compensation and

Graph 9.1.2: Age Distribution of Musculoskeletal Diseases, United States, 2002-2006



Source: [1] Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2004-2006
[2] Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

disability claims. Nevertheless, about one in six spine conditions (17%) occurs among persons 65 and older.

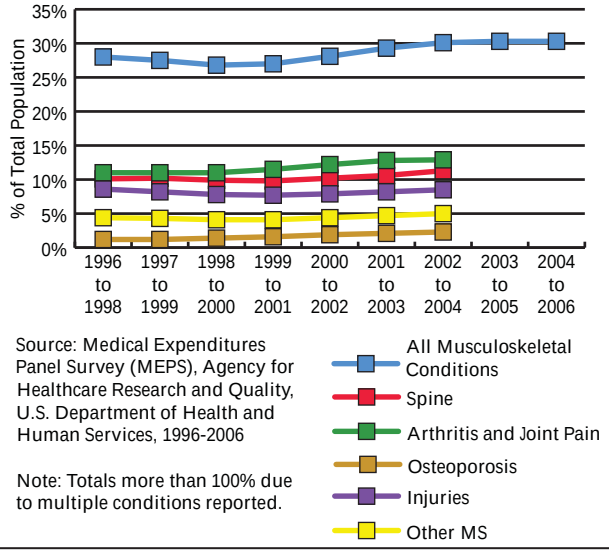
Population aging has also led to a dramatic increase in the prevalence of the category that includes osteoporosis. In the period 1996-1998, 3.2 million people (1.2%) indicated they had these conditions, but by 2002-2004, 6.8 million (2.3%) reported having them. These numbers are substantially lower than the 9.9 million persons with self-reported osteoporosis presented in Chapter 5 (Osteoporosis and Bone Health), even though the category in this chapter is not limited to osteoporosis-related conditions, and by the National Osteoporosis Foundation, which projected 44 million persons with osteoporosis in 2002. Almost two-fifths of persons in the MEPS with these conditions are aged 45 to 64, increasing the likelihood that the more than two and a half million individuals in this age group will suffer from falls and fractures for the relatively long future they can expect to live.

In contrast to spine conditions, arthritis, and joint pain, and the category including osteoporosis, the prevalence of musculoskeletal injuries has remained steady. In 1996-1998, 23.4 million persons reported a musculoskeletal injury, while 24.7 million reported such an injury in 2002-2004. The prevalence of musculoskeletal injuries remained relatively constant at 7.7% and 8.6% of the population. Age distribution of injuries may explain why the prevalence hasn't increased. In excess of 60% of injuries occur among persons younger than 45, a population segment growing more slowly than those who are older. It is possible improvements in the safety of automobiles and other public health prevention activities have also played a role. However, although the MEPS reporting of musculoskeletal injury trends supports trend data previously reported, the overall prevalence is substantially lower than the 61.2 million injury treatment episodes reported in Chapter 6 (Musculoskeletal Injuries). Injury treatment episodes include total cases treated in doctors' offices, outpatient clinics, emergency rooms, and inpatient admissions in 2006/2007.

The percentage of the population reporting other musculoskeletal diseases, which include a broad range of conditions of less frequent prevalence, increased from 4.4% to 5.0% between 1996-1998 and 2002-2004. The total number of persons reporting one or more such conditions increased from 12 million to 14.5 million.

Over the period 1996-2004, the proportion of persons with one or more of the major subgroups of musculoskeletal diseases, with the exception of injuries, has risen. Throughout the period under study, arthritis and joint pain has been the major condition subgroup with the highest prevalence rate, followed by spine conditions. (Table 9.1 and Graph 9.1.3)

Graph 9.1.3: Specific Musculoskeletal Diseases Reported by Persons as a Proportion of Total Population, United States 1996-2006



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Note: Totals more than 100% due to multiple conditions reported.

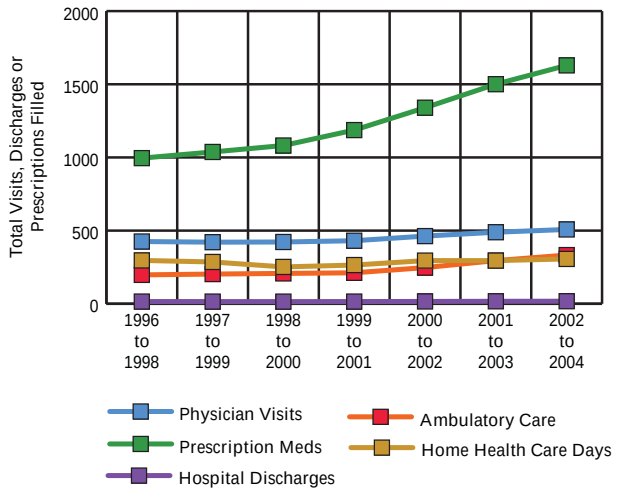
Using the more expansive definition of musculoskeletal diseases (Table 9.16), in the period 2002-2004, 83.0 million persons (vs. 32.7 million using the more conservative definition) reported one or more spine conditions and 41.7 million (vs. 37.6 million) reported arthritis and joint pain. The number reporting a condition within the category that includes osteoporosis was identical in the base

and expansive cases, but substantially lower than reported in Chapter 5, as noted above. The number reporting musculoskeletal injuries was slightly higher than in the more conservative definition (27.8 vs. 24.7 million). The increased prevalence in the "other" musculoskeletal diseases category was also substantial, with 45.1 million in the expansive definition versus 14.5 million, as discussed above.

Section 9.2: Musculoskeletal Health Care Utilization

Persons with musculoskeletal diseases account for a large and growing share of health care utilization. (Table 9.2 and Graph 9.2.1) In any given year, abut 85% of persons with musculoskeletal diseases have at least one ambulatory care visit to a physician's office, averaging just under six such visits per year. Between 1996-1998 and 2002-2004, ambulatory physician visits increased from 425.5 million to 507.9 million. Growth in the number of persons with musculoskeletal diseases, rather than an increase in the number of visits by individuals, is primarily responsible for this increase.

Graph 9.2.1: Total Units of Health Care Utilization for Persons with Musculoskeletal Diseases by Treatment Type, United States, 1996-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

In contrast to the relatively stable number of physician office visits, there was an increase in the proportion of the U.S. population with visits to ambulatory providers other than medical physicians; the average number of visits to non-physician providers by persons with musculoskeletal diseases also increased. Non-physician ambulatory health care providers include physical therapists, occupational therapists, chiropractors, social workers, physician assistants, nurse practitioners, and other related health care workers. In 1996-1998, approximately 40% of persons with musculoskeletal diseases visited an ambulatory health care resource at least once; by 2002-2004 the proportion had jumped to nearly 52%. At the same time, the average number of such visits increased from 2.6 per person to 3.8. The result was a 69% increase, from 197.5 million to 332.8 million, in total non-physician ambulatory care visits between 1996-1998 and 2002-2004. The aggregate total for all ambulatory care visits, including those to physicians and non-physicians, thus increased over the 8 year period by 35%, from 623.0 million visits to 840.7 million visits.

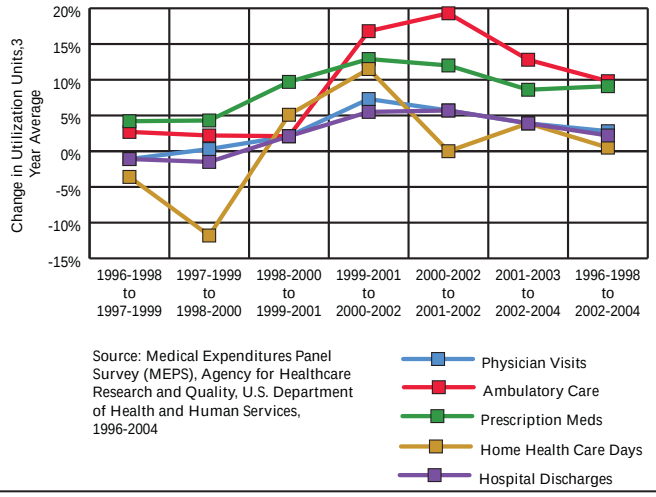
During this same time frame, the use of prescription medications among persons with musculoskeletal diseases rose substantially. While the proportion of persons with a musculoskeletal disease who filled at least one prescription changed only slightly, from 81.3% to 83.5%, the mean number of prescriptions filled per person increased from 13.1 to 18.6. The result was a 64% increase, from 995.3 million in 1996-1998 to more than 1.6 billion in 2002-2004, in the number of prescription medications filled by persons with a musculoskeletal disease.

Despite widespread concerns that an aging population would use an increasing amount of home health care, there is no evidence that this is occurring. Both the proportion of persons with a musculoskeletal disease using home health care and the average number of home health care visits declined slightly in the past 8 years. Only 4.7% of persons reported any home health care visits in 2002-2004, with an average of 3.5 visits incurred.

The total number of home health care visits to persons with a musculoskeletal disease rose slightly, from 296.3 million to 306.5 million, and is due to population increase.

A slight increase of 15%, from 15.2 to 17.5 million, in the number of hospital discharges for persons with a musculoskeletal disease occurred in the periods 1996-1998 to 2002-2004. This may be due to the aging population. The percentage of persons with a musculoskeletal disease who were hospitalized one or more times rose by 5% in relative terms, from 11.1% to 11.7%. The average number of hospitalizations per person, at 0.2, did not change.

Graph 9.2.2: Annual Change in Total Health Care Utilization Units for Persons with Musculoskeletal Diseases by Treatment Type, United States, 1996-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Over the seven 3-year averaged periods, 1996-1998 to 2002-2004, for which the MEPS data is analyzed, prescription medications and non-physician care visits increased more than other categories of health care percentage wise. (Table 9.3 and Graph 9.2.2) Both showed a mean rise of nearly 10% per year in total health care resource usage, with the most rapid rise occurring in the last four years of the study analysis. The greatest increase in health care resource use was for persons reporting a condition in the category including osteoporosis, increasing by 13% or more annually for each of the past 7 years for all except hospital discharges. Medications filled for such diseases rose by more than 20% per year between 1996 and 2000, more than twice the rate of all other musculoskeletal diseases. This is most likely due to greater awareness of these diseases and the impact of medications on mitigating long-term impacts.

Using the more expansive definition of musculoskeletal diseases, in 2002-2004 there were an estimated 705 million visits to physicians among persons with these diseases, as well as 420 million ambulatory visits to providers other than physicians, 2.3 billion prescriptions filled, 420 million home care visits, and 27.1 million hospital discharges.

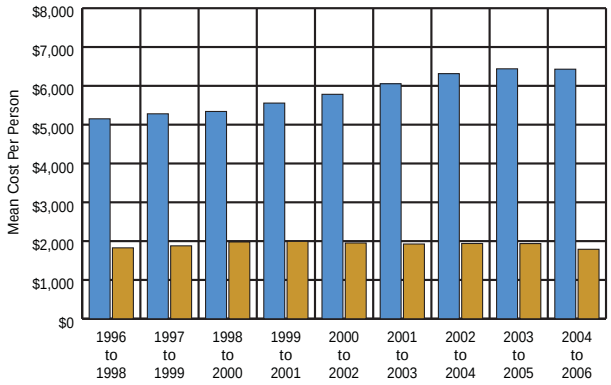
Section 9.3: Musculoskeletal Medical Care Expenditures

Musculoskeletal medical care expenditures are presented (1) for all persons with a musculoskeletal disease, regardless of whether the musculoskeletal disease was the reason for the expenditure (total cost), and (2) as a measure of the expenditures beyond those expected for persons of similar characteristics but who do not have a musculoskeletal disease (incremental cost). Incremental cost, hence, is that share estimated to be directly related to the musculoskeletal condition. Both total and incremental costs are expressed as the average cost per person with a musculoskeletal disease (Tables 9.4 and 9.4a) and the aggregate cost (total) for all persons with a musculoskeletal disease. (Table 9.5) Medical care costs are expressed in both the current year dollars (i.e., the year the data was collected) and in 2004 dollars to provide a standard of comparison across years.

Section 9.3.1: Total and Per Person Expenditures for Musculoskeletal Diseases

Overall, total average expenditures for persons with musculoskeletal diseases increased from $5,151 in 1996-1998 to $6,429 in 2004-2006, in 2006 dollars, a 25% increase. (Table 9.5, Column D and Graph 9.3.1) Aggregate total expenditures

Graph 9.3.1: Mean Medical Care Cost Per Person with a Musculoskeletal Disease in 2006 $s, United States, 1996-2006



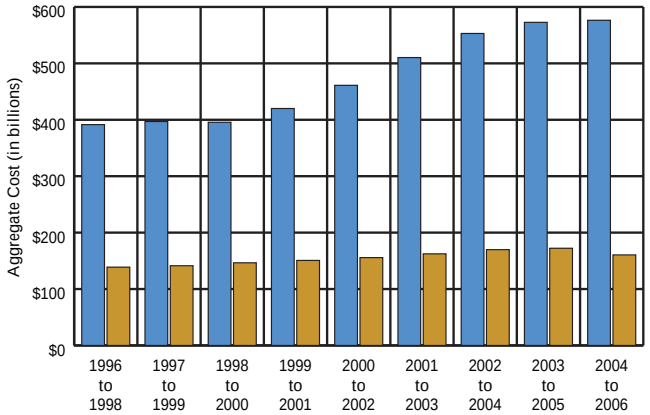
[1] Includes all medical expenditures for persons with a musculoskeletal condition regardless of whether the expenditure was to treat the musculoskeletal condition or another condition.

[2] Estimated additional medical expenditures beyond those expected for persons of similar characteristics, but without a musculoskeletal condition.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

increased from $391.4 billion to $576.4 billion, in 2006 dollars, during this time frame (Table 9.5, Column F and Graph 9.3.2), an increase of 47%. In 1996-1998, aggregate total expenditures for persons with a musculoskeletal disease, including both primary (1st) and secondary (2nd or more) diagnoses, represented 3.75% of the GDP, in 2006 dollars. By 2004-2006, the proportion had grown to 4.49% of the GDP. [1]

Graph 9.3.2: Aggregate Medical Care Cost for Person with a Musculoskeletal Disease in 2006 $s, United States, 1996-2006



[1] Includes all medical expenditures for persons with a musculoskeletal condition regardless of whether the expenditure was to treat the musculoskeletal condition or another condition.

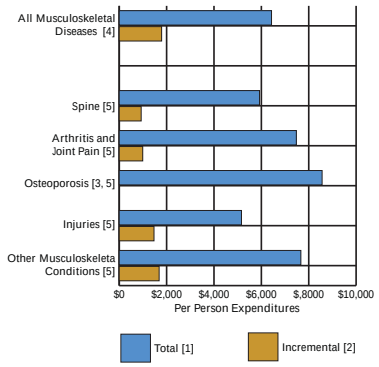
[2] Estimated additional medical expenditures beyond those expected for persons of similar characteristics, but without a musculoskeletal condition.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Incremental average expenditures for persons with musculoskeletal diseases was relatively constant between 1996-1998 and 2004-2006, in 2006 dollars. Estimated costs dropped slightly from $1,827 to $1,790, or a 2% decrease. (Table 9.5, Column H and Graph 9.3.1) Aggregate incremental expenditures, due to the higher number of persons with a musculoskeletal condition, increased from $138.8 billion to $160.5 billion, in 2006 dollars, (Table 9.5, Column J and Graph 9.3.2), or by about 16%. Incremental cost associated with a musculoskeletal condition represented the equivalent of 2.0% and 2.9% of the GDP, in 2006 dollars, for the respective time frames. To provide a basis for comparison, the economy is said to be in a recession when GDP declines by at least 1% for two or more consecutive quarters. Accordingly, the aggregate economic impact of the medical expenditures on behalf of persons with musculoskeletal diseases is in excess of the amount used to define a recession and, unlike a recession, occurs in perpetuity.

Data for specific musculoskeletal conditions has been analyzed through the 2002-2004 time period, and is shown in 2004 dollars. Total per person medical care expenditures rose slightly for each of the major subconditions between 1996-1998 and 2002-2004 (Tables 9.4 and 9.5, Column D, and Graph 9.3.3), ranging from $5,161 per person for musculoskeletal injuries to $8,565 for conditions within the category including osteoporosis in 2002-2004. Due to the higher prevalence and relatively high level of expenditures per person, aggregate expenditures have consistently been greatest for arthritis and joint pain, accounting for $281.5 billion of musculoskeletal health care costs in 2002-2004. (Table 9.5, Column F, and Graph 9.3.4) As discussed previously, approximately one-third of the cost is for ambulatory care (33%), one-third for emergency room and inpatient care (32%), and one-third for prescriptions and other costs (36%). Spine conditions, with an estimated $193.9 billion cost in 2002-2004, have held steady as the second most expensive musculoskeletal health care condition. Spine costs also split evenly, with 34%, 32%, and 34% going to ambulatory,

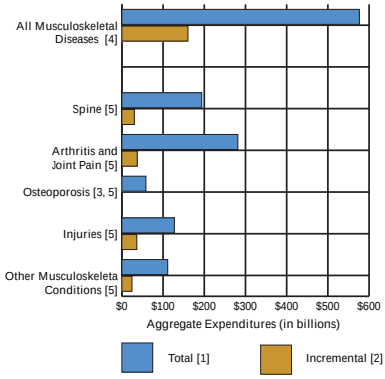
Graph 9.3.3: Total and Incremental per Person Medical Care Expenditures for Persons with Musculoskeletal Diseases, United States, 2002-2006



[1] Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal disease or another disease.
[2] Estimated additional medical expenditures beyond those expected for persons of similar characteristics, but without a musculoskeletal disease.
[3] All individuals with osteoporisis had expenditures and total increment could not be calculated.
[4] All musculoskeletal diseases per person medical cost calculated for 2004-2006, based on 2006 $s.
[5] Musculoskeletal conditions by type calculated for 2002-2004, based on 2004 $s.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2006

Graph 9.3.4: Aggregate Total and Incremental Medical Care Expenditures for Persons with Musculoskeletal Diseases, United States, 2002-2006



[1] Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal disease or another disease.
[2] Estimated additional medical expenditures beyond those expected for persons of similar characteristics, but without a musculoskeletal disease.
[3] All individuals with osteoporisis had expenditures and total increment could not be calculated.
[4] All musculoskeletal diseases aggregate medical cost calculated for 2004-2006, based on 2006 $s.
[5] Musculoskeletal conditions by type calculated for 2002-2004, based on 2004 $s.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2006

emergency room and inpatient, and prescriptions/ other costs, respectively.

The magnitude of increase in aggregate expenditures between 1996-1998 and 2002-2004 is greatest for the diseases within the category including osteoporosis (120%), but was substantial for all musculoskeletal diseases. (Table 9.6) The aggregate cost of health care for spine conditions increased by 49%; arthritis and joint pain by 53%; musculoskeletal injuries by 37%; and other musculoskeletal diseases by 44% over the period 1996-2004.

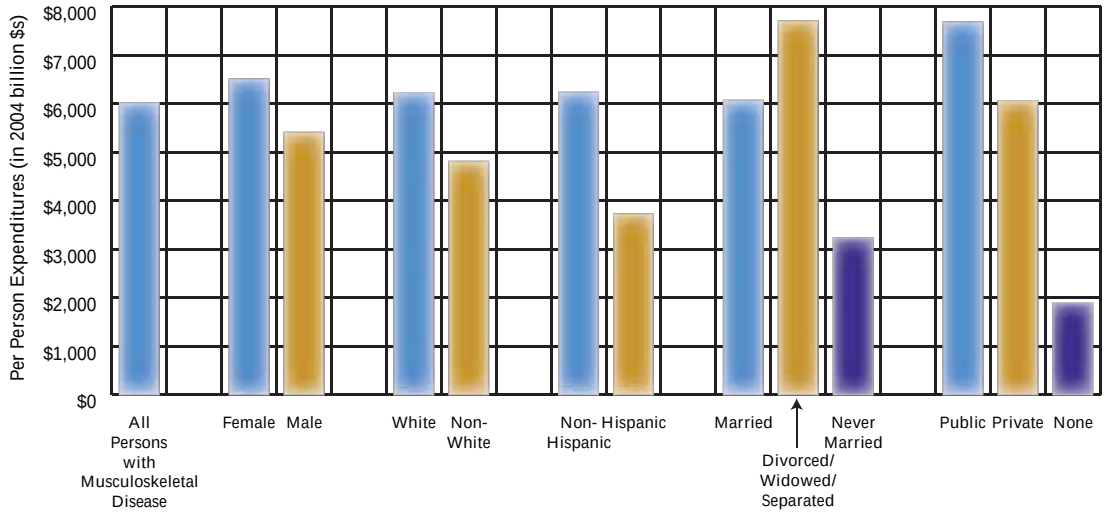
Sampling variability limits inference about time trends in incremental expenditures associated with the subcondition groups. However, while estimates do not have the same precision as those for all musculoskeletal diseases, it is fair to conclude that 2002-2004 aggregate incremental expenditures were between $24.5 billion for other musculoskeletal diseases and $37.3 billion for arthritis and joint pain. We were unable to estimate an increment in expenditures attributable to conditions in the category including osteoporosis. However, a "back of the envelope" estimate of the ratio of incremental to total expenditures for persons with all forms of musculoskeletal diseases for the period 2002-2004 is possible. Applying the same ratio to the category including osteoporosis yields an estimate of about $18 billion in incremental expenditures for these conditions.

Using the more expansive definition of musculoskeletal diseases, aggregate total medical care expenditures on behalf of persons with a musculoskeletal disease were $718.5 billion in 2002-2004, while the aggregate increment in expenditures was $322.2 in the same period. Total expenditures are the equivalent of 6.5% of GDP for those years, while the incremental cost is the equivalent of 2.9% of GDP.

Section 9.3.2: Medical Care Expenditures for Persons with a Musculoskeletal Disease by Demographics

Expenditures for musculoskeletal diseases are not distributed evenly across groups defined by gender, race, ethnicity, marital status, and type of insurance. (Table 9.7 and Graph 9.3.5) On an unadjusted basis, women with musculoskeletal diseases have about a 20% higher level of expenditures than men; whites have a 30% higher level than non-whites; non-Hispanics report 67% higher expenditures than Hispanics; those who are married or divorced, separated, or widowed have more than 87% higher expenditures than those who have never been married; and those with private and public health insurance have more than two and more than three times, respectively, the expenditures of those without any health insurance. Thus, lack of health insurance is associated with dramatically lower expenditure levels, inconsistent with the belief that persons who lack insurance are somehow able to obtain care. In contrast to the differences in expenditure levels found for gender, race, ethnicity, marital

Graph 9.3.5: Per Person Total Medical Care Expenditures for Persons with Musculoskeletal Diseases by Select Demographics, United States, 2002-2004



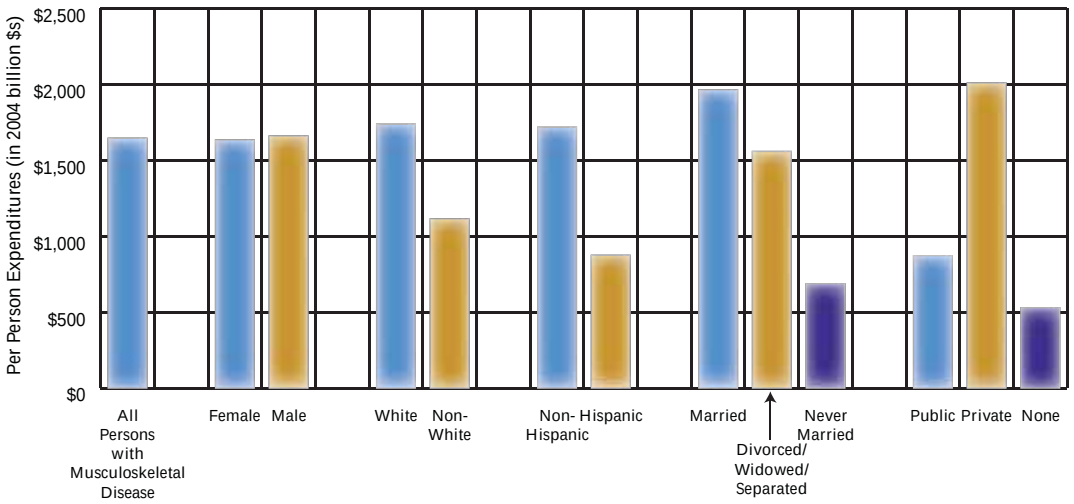
Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal condition or another disease.

status, and type of health insurance, there was no discernible pattern in expenditure levels by educational attainment.

Adjustment for other characteristics reduced the magnitude of the differences in expenditures found for most demographic characteristics, but did not eliminate them. (Table 9.7 and Graph 9.3.6) Thus, whites experienced about 55% higher levels of incremental expenditures than non-whites; non-Hispanics reported just under double the expenditures of Hispanics; and the privately insured had more than two times the expenditures of those with public insurance and almost four times the expenditures of those without insurance. Education level presented no clear picture of differences due to an anomalous result among those who have graduated from college; in general, expenditures rose with higher levels of education. In contrast, adjustment did eliminate difference in expenditures between genders.

Graph 9.3.6: Per Person Incremental Medical Care Expenditures for Persons with Musculoskeletal Diseases by Select Demographics, United States, 2002-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

Includes estimated additional medical expenditures beyond those expected for persons of similar characteristics, but without a musculoskeletal disease.

Section 9.3.3: Medical Care Expenditures for Persons with a Musculoskeletal Disease by Age

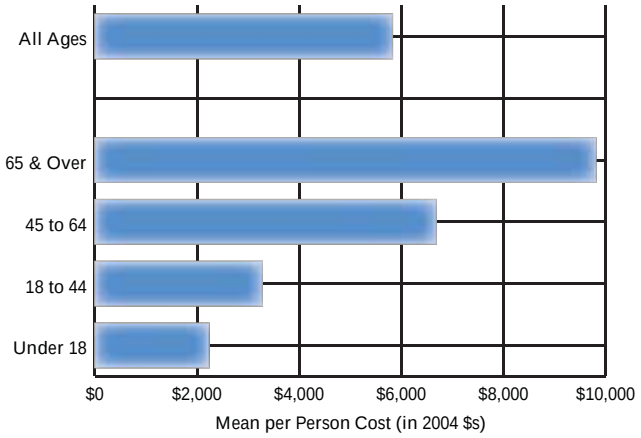
Total medical care expenditures for musculoskeletal diseases are disproportionately higher for persons 65 years of age or older, with a per person cost of nearly $10,000 in 2002-2004 compared to a per person cost of $5,824 for all ages. (Table 9.8 and Graph 9.3.7) Persons aged 65 and over represent more than one in five persons with a musculoskeletal disease; this age group accounted for 38%, or $195.2 billion, of total aggregate health care costs for musculoskeletal diseases in 2002-2004. (Table 9.9 and Graph 9.3.8) However, incremental aggregate musculoskeletal health care for the 65 and over population is estimated to comprise 25%, or $39.1 billion, of the total $156.4 billion cost. Persons aged 45 to 64 accounted for an equal or slightly higher proportion of the cost (39% of aggregate and 47% of incremental), but represent a substantially higher proportion of the population (34% aged 45 to 64; 23% aged 65 years and older).

Estimated 2002-2004 aggregate total expenditures for persons aged 18 to 64 were $295.9 billion, or 58% of total aggregate health care expenditures for musculoskeletal diseases in that year. This share occurs disproportionately among the 45 to 64 age group, which accounted for 67% of the cost for persons aged 18 to 64, and had an 83% relative increase between 1996-1998 and 2002-2004 in total aggregate cost. This compares to a 12% to 30% relative increase in total cost for other age groups. Less than $19 billion of the total musculoskeletal health care costs went for persons under the age of 18, representing only 10% of total cost.

With a 90% relative increase in incremental cost over the two periods 1996-1998 and 2002-2004, the 45 to 64 age group also accounts for the largest share of incremental aggregate health care cost for musculoskeletal diseases. (Table 9.10) In contrast, incremental costs were relatively stable over this same time period for both persons under the age of 18 and those aged 18 to 44, while the 65 and over population saw a 15% relative decrease in total incremental musculoskeletal health care costs.

As the population aged, both the proportion of total persons with a musculoskeletal disease and the share of cost attributed to the baby boomer generation, the majority of whom are now 45 to

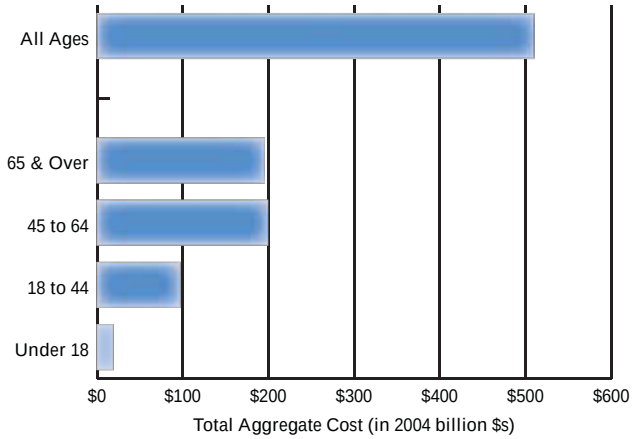
Graph 9.3.7: Total per Person Medical Care Expenditures for Persons with Musculoskeletal Diseases by Age, United States, 2002-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal disease or another disease.

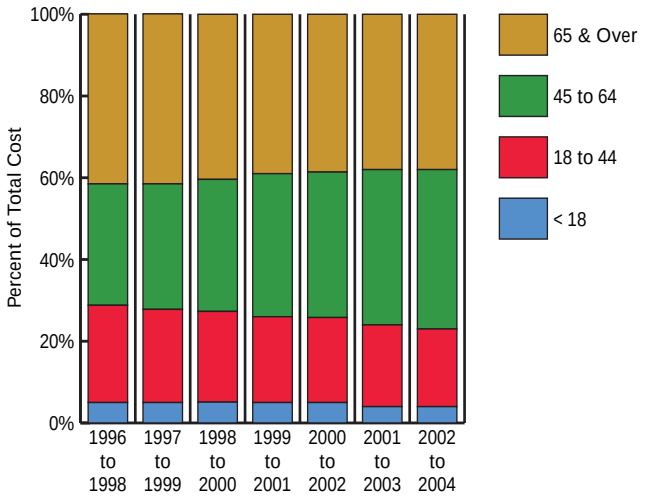
Graph 9.3.8: Aggregate Total Medical Care Expenditures for Persons with Musculoskeletal Diseases by Age, United States, 2002-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal disease or another disease.

Graph 9.3.9: Proportion of Total Medical Care Expenditures for Persons with Musculoskeletal Diseases by Age, United States, 1996-2004



Includes all medical expenditures for persons with a musculoskeletal disease regardless of whether the expenditure was to treat the musculoskeletal disease or another disease.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2002-2004

64 years of age, rose steadily, while the shares attributed to other ages declined. (Table 9.8 and Graph 9.3.9) As the U.S. population aging trend continues and boomers move into the 65 and over age group, the combination of a larger patient population with potentially higher cost of care is likely to reflect increased cost associated with musculoskeletal diseases in the years to come. These increases are likely to surpass even the rapid increases seen in the past decade.

Section 9.4: Impact of Musculoskeletal Diseases on the U.S. Economy

Section 9.4.1: Overall Change in Musculoskeletal Diseases Health Care Cost

Over the period 1996-2004, slight changes in the proportion of total medical care expenditures devoted to ambulatory physicians visits (from 31% to 33% of total) and to emergency room and inpatient care (from 36% to 32%) occurred. However, the share of musculoskeletal health care costs devoted to prescription medications increased the most, growing by 50%, from 14% to 21% of total cost. Computed in 2004 dollars, the mean annual prescription cost per person increased 83%, from $653 to $1,196. During this time, development of biologic agents for several inflammatory conditions, particularly rheumatoid arthritis, occurred, as well as the widespread use of the coxibs for musculoskeletal pain,[i] and may have accounted for some of the rapid increase.

Recent analysis for the years 2005 and 2006 has shown a slight decrease in the cost of prescriptions, resulting in a slight reduction in average mean cost. The authors has speculated that the introduction of COX-2 inhibitors in late 1999 and the subsequent aggressive advertising both increased prescription costs and brought more patients into doctors' office to request prescriptions. The withdrawal of Vioxx from the market in late 2004 necessarily meant that many individuals with musculoskeletal conditions switched to cheaper, non-COX-2 medications for pain management, or even over-the-counter medications, the cost of which is not captured in MEPS.[2]

The increment in ambulatory care expenditures for musculoskeletal diseases grew by 31% between 1996 and 2004, from $702 to $923 in 2004 dollars. Meanwhile, the increment in emergency room and inpatient care declined slightly, from $304 in the earlier years to $263 in 2002-2004, or by about 13% overall. It is noteworthy that almost no change in the increment in prescription expenditures was seen between 1996-1998 and 2002-2004, an indication that the growth in prescription medications overall did not affect those with musculoskeletal diseases disproportionately. Ambulatory care represents the largest component of the increment in expenditures, indicative of the importance of ambulatory care in musculoskeletal diseases relative to other condition groups.

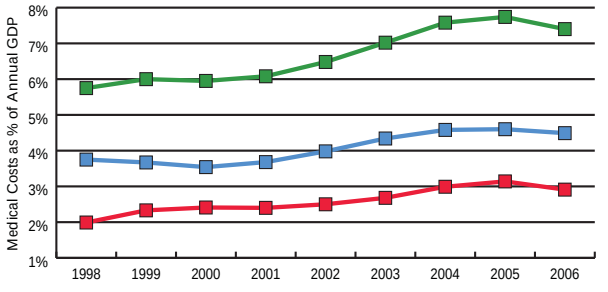
[i] Rofecoxib [Vioxx©] was removed from the market in September 2004; valdecoxib [Bextra©] was taken off the market in 2005; the use of celecoxib [Celebrex©] was curtailed starting in 2005.

The eroding share of total expenditures for emergency room and inpatient care between 1996 and 2004 is consistent across the major sub-conditions, while in each of the same subconditions, prescriptions are responsible for a growing share of total expenditures. For spine conditions, the increase in the share was from 13% to 20% of all expenditures, or an increase of 54% in relative terms. The analogous growth in the share of medical care expenditures for arthritis and joint pain was 53%. For the category including osteoporosis, it was 41%, while for injuries, it was 55%. As was the case with respect to the components of total expenditures, the increment in expenditures for prescription medications was neither large nor consistent, another indication that the growth of such expenditures did not occur disproportionately among musculoskeletal diseases relative to other condition groups.

Section 9.4.2: Indirect Cost Related to Musculoskeletal Diseases

In the studies conducted by Rice and colleagues starting in the early 1960s, indirect cost associated with earnings losses due to musculoskeletal diseases constituted between 38% and 59% of the total cost of these diseases.[3-7] The percentage shifted because in various eras, medical costs were rapidly escalating while earnings stagnated (1970s); in others times, wage growth exceeded the increase in medical costs (1960s and late 1990s). Recent analysis of musculoskeletal direct and indirect cost (i.e., the cost of lost wages due to musculoskeletal conditionsf or persons aged 18 to 64 with a work history) as a proportion of GDP shows a slow, but steady, increase in the share of GDP spent on musculoskeletal conditions between 1998 and 2005. The slight decline found in 2006 is most likely the result of the reduction in prescription costs as discussed earlier and indirect cost related to earnings loss (discussed below). However, musculoskeletal diseases have cost more than 6% of the annual GDP since the year 2003. (Table 9.14 and Graph 9.4.1)

Graph 9.4.1: Costs of Musculoskeletal Diseases as a Percentage of Annual GDP by Year, United States, 1998-2006

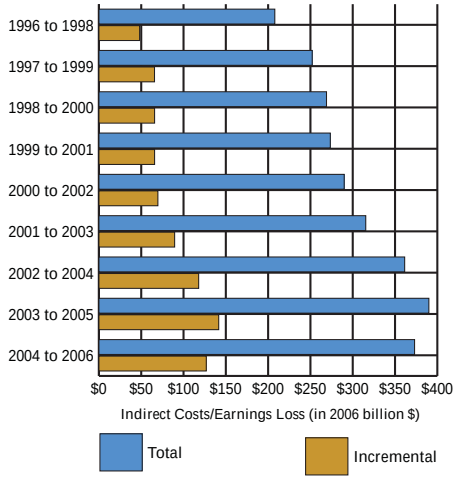


Source: Yelin E, Murphy MG, Cisternas MG, Foreman DJP, Helmick CG. Medical care expenditures and earnings losses among persons with arthritis and other rheumatic conditions in 2003, and comparisons with 1997. *Arthritis Rheum* 2007; 56:1397-1407. Additional analysis of MEPS 1996-2004 data conducted by Yelin E; 2005-2006 data conducted by Cisternas, M.

GDP: Gross Domestic Product

Trends in earnings losses associated with musculoskeletal diseases, which affect the share of GDP cost, for the period 1996-2006 show a steady increase through 2005, with a slight decrease in 2006, believed to be caused by fluctuations in the labor market and the extension of work life by workers aged 65 and older. (Table 9.12 and Graph 9.4.2)

Graph 9.4.2: Total and Incremental Aggregate Indirect Cost [1] in 2004 Dollars for Persons Age 18 to 64 with Musculoskeletal Diseases and a Work History, United States, 1996-2006



[1] Calculated as estimated earnings loss per wage earner due to a musculoskeletal condition in 2006 $.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Estimates of earnings losses are limited to persons aged 64 or younger, both because the number of workers over 65 in MEPS is too small to permit statistically reliable estimates in this age group and because in the U.S. most workers retire by that age. However, it is probable that some individuals with musculoskeletal diseases would continue working past the age of 65 in the absence of the condition. Similarly, the tabulation of earnings

losses is limited to those who have established a work history either prior to or after the onset of disease. There may be some among those without a work history who would have begun to work in the absence of a musculoskeletal disease, but who never had the opportunity to do so. Thus, the magnitude of earnings losses shown should be considered a conservative estimate.

As of 1996-1998, slightly fewer than 64 million persons with a musculoskeletal disease had established a work history. On average, these individuals sustained $3,257 in earnings losses in 2006 dollars; their earnings losses aggregated to $207.9 billion, or the equivalent of 2.0% of GDP for that period. By 2004-2006, the number of persons with musculoskeletal diseases and a work history had grown to over 74.8 million. On average, these nearly 75 million workers sustained earnings losses of $4,986 each, an increase of 53% compared to 1996-1998. Aggregate earnings losses grew to $373.1 billion, an increase of 79%, but down slightly from the $390 billion of the previous year. Aggregate losses in 2004-2006 were the equivalent of 2.9% of GDP for that period. Wage growth in the late 1990s played a large role in the increase in the estimate of earnings losses. Average earnings losses grew by more than one-third between 1996-1998 and 1998-2000 (from $3,257 to $4,373 in 2006 dollars); they stagnated through the next three 3-year periods due to the recession, before resuming their growth.

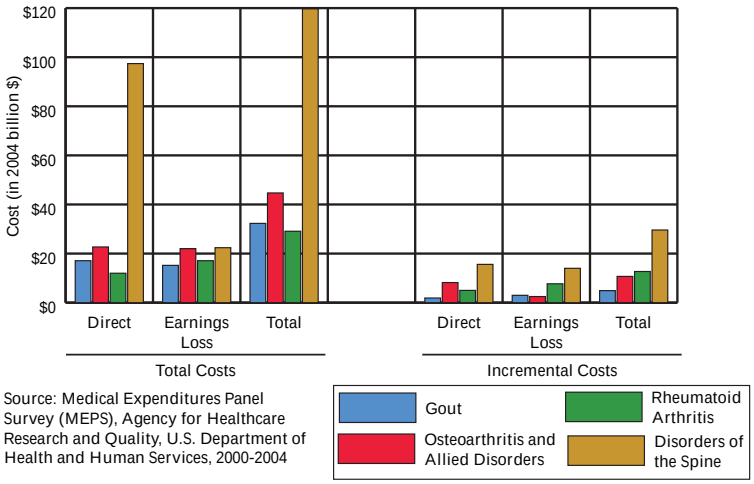
Some of the estimated earnings losses of persons with musculoskeletal diseases might have occurred in the absence of these conditions due to other factors. For example, older workers and women, two groups with high rates of musculoskeletal diseases, have lower employment rates and earnings than the average U.S. worker. The incremental earnings loss measure takes into consideration many of the factors that might cause persons to have lower earnings even without the presence of the musculoskeletal disease. However, earnings losses using the incremental measure also grew substantially between 1996-1998 and 2004-2006. In the earlier triad of years, the 64 million persons with musculoskeletal diseases and a work history sustained average incremental earnings losses of $753, or $48.1 billion overall, in 2006 dollars, the equivalent of 0.5% of GDP for 1996-1998. Average incremental earnings losses more than double by 2003-2005, to $1,906; aggregate incremental earnings losses increased by 2.5 times to $141.6 billion, or 1.1% of GDP for 2003-2005. The slight drop for the years 2004-2006 to a mean of $1,696 and an aggregate of $126.9 billion is believed to be due to market changes.

Using the more expansive definition of musculoskeletal diseases, average earnings losses increased from $3,226 in 1996-1998 to $3,972 in 2002-2004, or by just under one-fourth in real terms. At the same time, aggregate total earnings losses rose by almost 40%, from $306.0 billion in 1996-1998 to $426.0 billion in 2002-2004. Over the same time period, the average increment in earnings losses increased from $411 to $948, while aggregate incremental earnings losses surged from $39.0 billion to $101.7 billion. Interestingly, the aggregate incremental earnings losses are smaller for the conservative definition, presumably because many persons with conditions of lesser severity are included. (Note: data on earnings losses of persons meeting the expansive definition of musculoskeletal diseases not included in the tables.)

Section 9.4.3: Medical Care Expenditures and Earnings Losses for Select Musculoskeletal Diseases

Medical conditions in MEPS are self-reported and may result in misreporting of some conditions. With respect to musculoskeletal diseases, under-reporting might occur when physicians do not provide patients with a discrete diagnosis for mild osteoarthritis, for example, because it may be too mild to be recognized or treatment is included with other conditions and not distinct. Over-reporting of a condition could occur when the respondent indicates they have a specific form of arthritis, e.g., rheumatoid arthritis, even though

Graph 9.4.3: Total and Incremental Direct Cost and Earnings Losses in 2004 Dollars for Persons Aged 18 to 64 by Specific Musculoskeletal Conditions, United States, 2000-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2000-2004

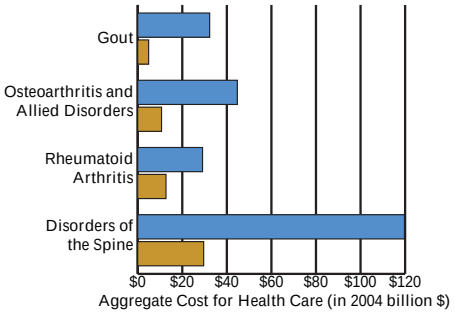
their physician did not so indicate. It should be noted that self-reporting of discrete medical conditions is lower than would be expected on the basis of epidemiological studies,[8] a conclusion that is supported by the higher prevalence numbers reported in the previous chapters of The Burden of Musculoskeletal Diseases. As a result of potential misreporting, the measures of the aggregate economic impacts of discrete conditions summarized in Table 9.13 and Graph 9.4.3 may not be as reliable as the measures previously presented that are based on larger samples, such as all musculoskeletal disease, or major subcategories, such as all forms of arthritis. Nevertheless, they do indicate in broad stroke the average economic impact for self-recognized disease and for conditions such as osteoarthritis, which are likely to be under-reported, a conservative estimate of aggregate economic impact. Estimates for discrete musculoskeletal diseases merged 5 years of MEPS data (2000-2004) to provide more stable estimates given the relatively few cases of each condition reported in individual years.

Average total direct cost for all four conditions studied—disorders of the spine, rheumatoid arthritis, osteoarthritis and allied disorders, and gout—are relatively large. In the case of gout and spinal disorders, much of the health care expenditures would not occur in the absence of the condition, as evidenced by the much smaller average incremental direct cost. Such is not the case with rheumatoid arthritis and osteoarthritis and allied disorders, where the differences between total and incremental cost are much smaller. Aggregate total cost for the persons with one of the four musculoskeletal diseases ranged from $12.0 billion for rheumatoid arthritis to $97.4 billion for spine disorders, while aggregate incremental cost ranged from $1.9 billion for gout to $15.6 billion for back disorders.

Average total earnings losses were highest for rheumatoid arthritis, $14,175 per year, followed by osteoarthritis at $10,369 per year. They were lowest for back disorders at only $1,231 per year. As evidenced by the ratio of average total to average incremental earnings losses, a much higher proportion of earnings losses are attributable to rheumatoid arthritis and spine disorders (45% and 63%, respectively) than to osteoarthritis or gout.

On an unadjusted basis for total cost, the conditions have an aggregate economic impact ranging from $29.1 billion for rheumatoid arthritis to $119.7 billion for spine disorders. (Table 9.13 and Graph 9.4.4) The greater aggregate impact of spine disorders over average earnings losses is likely due to demographics, with spine disorders occurring more frequently in persons aged 18 to 64, prime working years, while rheumatoid arthritis has been shown to affect persons 65 and older in greater numbers. After adjustment, or the incremental

Graph 9.4.4: Total and Incremental Direct Cost and Earnings Losses for Persons Aged 18 to 64 by Specific Musculoskeletal Conditions, United States, 2000-2004



Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004_

cost impact, they have an aggregate impact of from $4.9 billion for gout to $29.6 billion for spine disorders. The incremental aggregate figure for rheumatoid arthritis, $12.7 billion, is particularly striking given the relatively low prevalence of this condition and no doubt reflects the growing use of biological agents to treat this condition, along with high work disability rates.

Section 9.4.4: Summary and Conclusions

The economic impact of musculoskeletal diseases is increasing due to a combination of factors that include the aging of the U.S. population with the concomitant increase in the prevalence of musculoskeletal diseases, the growth in average total expenditures to treat musculoskeletal diseases, and the average total and incremental earnings losses that result from these conditions.

Between 1996 and 2006, the number of persons with one or more musculoskeletal diseases grew from 76.0 million, or 28.0% of the population, to 89.7 million, or 30.3% of the population. Over the time period, average total expenditures for health care for persons with a musculoskeletal disease grew from $5,151 to $6,429 in 2006 dollars, while aggregate total expenditures grew from $391.4 billion to $576.4 billion. Average incremental expenditures for persons of similar characteristics but without a musculoskeletal disease grew slower from $1,827 to $1,790, but due to population growth and increased prevalence of the conditions, aggregate incremental expenditures grew from $138.8 to $160.5 billion, all in 2006 dollars.

Average per person earnings losses between 1996 and 2006 due to musculoskeletal diseases increased from $3,257 to $4,986, while total earnings losses grew from $207.9 billion to $373.1 billion in constant 2006 dollars. Incremental earnings losses also increased dramatically, from $753 to $1,696 per person and from $48.1 to $126.9 billion on an aggregate basis.

Comparing the cost of musculoskeletal diseases to the national gross domestic product (GDP) provides a perspective on these total costs (Tables 9.11 and 9.14). Earlier estimates summarize the evidence from the studies conducted by Dorothy Rice and colleagues, the last two of which were from prior editions of the present volume,[ii] while more recent comparisons for 1998-2006 summarize the data from the present analysis in 2006 constant dollars. As discussed in the methodology section, the estimates of incremental medical care expenditures and earnings losses are roughly comparable to the estimates from Rice and colleagues in which costs are allocated on the basis of the primary diagnosis.

Notwithstanding the different methods of the studies by Rice and colleagues and the analysis of MEPS from the present volume, there is no question that the direct cost of musculoskeletal diseases has a profound economic impact on the nation, now at or in excess of 4.5% of GDP. Using 2006 constant dollars, the impact has grown by 0.74% of GDP since the 1998-2000 period, and is likely to continue to grow more severe due to population aging, more intensive treatment—particularly with respect to prescription medications, and growing displacement of older workers from industries in decline, a phenomenon that has been shown to affect those with musculoskeletal diseases disproportionately.[10]

Society has the option of passively accepting the increasing economic impact of musculoskeletal diseases, or it can seek to alleviate this impact by the use of primary, secondary, and tertiary preventive measures with strong evidence of effectiveness. Such measures run the gamut from weight loss and exercise programs designed to reduce the prevalence of arthritic conditions, to self-management classes designed to reduce the impact of existing conditions, to surgical and

[ii] The National Arthritis Data Task Force concluded that about half of the increase between the 1972 and 1980 studies by Rice and colleagues was due to improvements in the data sources available to Rice and colleagues, but the remainder represented a real increase.[8]

medical interventions that return the individual to higher levels of functioning and quality of life.[11-13] In the discussion of demographic variations, disparities in medical care expenditures were identified. This suggests the need for equal access to effective interventions and treatment modalities to keep individuals participating in society through work and other meaningful activities

Section 9.5: Background and Methodology

Economic cost for musculoskeletal-related health care diseases presented in this book are based on data from the Medical Expenditures Panel Survey (MEPS) using a methodology developed by the principal author and colleagues at the U.S. Centers for Disease Control (CDC).[14-17] The MEPS is a comprehensive data source designed for cost of illness studies.[18-21] The MEPS uses a random sample of the U.S. population and annually queries this sample three times about their medical conditions, health care utilization, and employment status. Two estimates are produced. The first, total cost, is an indication of all medical care costs and earnings losses incurred by persons with a musculoskeletal disease, regardless of the condition for which the cost was incurred. The second, incremental cost, is an estimate of the magnitude of cost that would be incurred beyond those experienced by persons of similar demographic and health characteristics but who do not have one or more musculoskeletal disease. Cost estimates are produced as the mean per person medical care cost and as the aggregate, or total cost, associated with all persons with musculoskeletal diseases.

Previous editions of this book based economic impact and cost of musculoskeletal diseases on the Rice cost of illness methodology.[6,7] The Rice model utilized the National Hospital Discharge Survey (NHDS) and other available national health care data sources. All costs associated with hospitalizations or treatments for persons with a musculoskeletal disease listed as the primary, or 1st, diagnosis were included in the model. The Rice model defines direct cost as those associated with all components of medical care (i.e., inpatient and outpatient care, medications, devices, and costs associated with procuring medical care), and indirect cost as those associated with wage loss due to morbidity or mortality, plus an estimate of intangible costs.

In the Rice model, mortality accounted for 7% of total indirect medical cost for all conditions. The MEPS data do not provide a comparable method for calculating wage loss associated with mortality. Hence, total cost presented here represents an undercount by a similar percentage. Because musculoskeletal diseases have a smaller impact on mortality than most other major categories of illness, the undercount will be an unknown, but smaller, percentage.

Comparing total cost for 1995,[7] updated to 1996 terms, the first year for which MEPS data is available, and omitting cost associated with mortality, the current analysis results in $207 billion in total cost associated with musculoskeletal diseases using the Rice method and about $173 billion using the MEPS database. This suggests the two methods yield estimates of similar magnitude, although the estimates based on MEPS may be more conservative. A series of papers provide a detailed description of the methods of estimating total and incremental direct and indirect cost of conditions, and outline the regression model used to adjust for differences of persons with and without musculoskeletal diseases due to demographic characteristics and health status.[14,16]

Conditions included in the musculoskeletal disease rubric include spine conditions, arthritis and joint pain, the category that includes osteoporosis (other diseases of bone and cartilage), injuries, and an inclusive “other” category for the remaining conditions. Conditions selected for the cost analysis presented above are based on preceding chapters in the book. Data are reported primarily for base case ICD-9-CM codes, or those codes for which musculoskeletal disease is the

principal etiology rather than a consequence of a condition for which the principal etiology is another major health condition (e.g., cancer). (Table 9.15) Estimates are also provided for a more expansive list of codes of musculoskeletal-related diseases that includes the conditions for which the musculoskeletal diseases are the primary and secondary etiologies. (Table 9.16) Although this more expansive list of conditions yields a vastly larger prevalence estimate than the base case list, it is reasonable to assume the cost of musculoskeletal diseases probably exceeds the conservative estimates presented here. For example, a person with bone metastases would incur costs to treat the bone manifestation, even though the cancer, not the bone condition, is the primary etiology. ICD-9-CM codes included in each subcategory for the base and expansive conditions are listed in Tables 9.15 and 9.16.

Although generally prevalence and cost associated with musculoskeletal diseases increase over time, sampling variability in the MEPS does not reflect this in each successive year. The impact of sampling variability is partially mitigated by smoothing, or averaging, data across 3-year periods.

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Section 9.6: Health Care Utilization and Economic Cost of Musculoskeletal Diseases Data Tables

Table 9.1: Number and Percent of Population with Musculoskeletal Diseases by Age, United States 1996-2006

				Persons with Condition		Age Distribution			
Condition	Year	Sample N	Total Population (in millions)	# Individuals (in millions)	% Total Population	Under 18	18-44	45-64	65 & Over
All Musculoskeletal Diseases	1996-1998	6,964	271.2	76.0	28.0%	11.6%	38.0%	28.7%	21.7%
	1997-1999	7,004	273.7	75.2	27.5%	11.4%	36.7%	29.5%	22.4%
	1998-2000	6,025	276.1	74.1	26.8%	11.2%	35.7%	30.5%	22.6%
	1999-2001	6,814	279.7	75.6	27.0%	10.5%	35.0%	31.6%	22.9%
	2000-2002	8,252	283.6	79.7	28.1%	9.8%	34.8%	32.5%	22.8%
	2001-2003	9,166	287.7	84.3	29.3%	9.5%	34.3%	33.4%	22.7%
	2002-2004	9,337	290.8	87.6	30.1%	9.5%	33.7%	34.0%	22.7%
	2003-2005	8,874	293.4	88.9	30.3%	9.7%	32.7%	34.6%	23.0%
	2004-2006	8,947	296.3	89.7	30.3%	9.7%	31.8%	35.3%	23.1%
Spine	1996-1998	2,510	271.2	27.4	10.1%	5.4%	47.5%	31.0%	16.1%
	1997-1999	2,580	273.7	27.9	10.2%	5.4%	45.8%	32.0%	16.8%
	1998-2000	2,199	276.1	27.2	9.9%	5.6%	44.6%	33.0%	16.9%
	1999-2001	2,411	279.7	27.3	9.8%	5.6%	44.4%	33.6%	16.4%
	2000-2002	2,927	283.6	28.8	10.2%	5.2%	44.1%	34.0%	16.7%
	2001-2003	3,258	287.7	30.6	10.6%	4.7%	42.8%	35.5%	17.0%
	2002-2004	3,408	290.8	32.7	11.3%	4.5%	41.5%	36.7%	17.3%
Arthritis and Joint Pain	1996-1998	2,804	271.2	29.9	11.0%	3.1%	24.8%	36.4%	35.7%
	1997-1999	2,853	273.7	30.0	11.0%	3.1%	23.3%	37.4%	36.3%
	1998-2000	2,498	276.1	30.3	11.0%	3.3%	22.0%	38.5%	36.2%
	1999-2001	2,936	279.7	32.2	11.5%	3.3%	21.4%	39.0%	36.2%
	2000-2002	3,632	283.6	34.7	12.2%	3.1%	21.6%	39.9%	35.4%
	2001-2003	4,058	287.7	36.9	12.8%	2.8%	22.1%	40.8%	34.3%
	2002-2004	4,103	290.8	37.6	12.9%	2.7%	21.7%	41.6%	34.0%
Osteoporosis	1996-1998	299	271.2	3.2	1.2%	4.3%	10.7%	34.8%	50.1%
	1997-1999	321	273.7	3.4	1.2%	3.1%	8.6%	32.8%	55.5%
	1998-2000	308	276.1	3.8	1.4%	2.3%	7.3%	31.5%	58.9%
	1999-2001	395	279.7	4.4	1.6%	2.2%	6.5%	32.1%	59.2%
	2000-2002	537	283.6	5.3	1.9%	1.9%	6.5%	34.7%	56.9%
	2001-2003	645	287.7	6.1	2.1%	1.7%	6.3%	37.5%	54.5%
	2002-2004	705	290.8	6.8	2.3%	1.3%	6.5%	38.2%	54.0%
Injuries	1996-1998	2,093	271.2	23.4	8.6%	24.2%	43.4%	19.4%	13.0%
	1997-1999	2,047	273.7	22.5	8.2%	24.8%	41.8%	20.0%	13.3%
	1998-2000	1,698	276.1	21.6	7.8%	24.5%	41.8%	21.0%	12.7%
	1999-2001	1,869	279.7	21.4	7.7%	23.0%	41.8%	22.4%	12.8%
	2000-2002	2,235	283.6	22.3	7.9%	21.4%	41.8%	23.4%	13.4%
	2001-2003	2,492	287.7	23.6	8.2%	21.0%	41.1%	24.1%	13.8%
	2002-2004	2,545	290.8	24.7	8.5%	21.2%	40.2%	24.6%	14.0%
Other Musculoskeletal Conditions	1996-1998	1,173	271.2	12.0	4.4%	11.8%	30.6%	31.5%	26.1%
	1997-1999	1,174	273.7	11.8	4.3%	10.4%	30.4%	32.9%	26.3%
	1998-2000	983	276.1	11.3	4.1%	9.7%	29.7%	34.2%	26.4%
	1999-2001	1,098	279.7	11.5	4.1%	9.7%	28.6%	35.5%	26.2%
	2000-2002	1,345	283.6	12.4	4.4%	9.6%	28.3%	36.4%	25.7%
	2001-2003	1,546	287.7	13.6	4.7%	9.8%	27.8%	37.1%	25.3%
	2002-2004	1,618	290.8	14.5	5.0%	9.5%	27.0%	38.4%	25.1%

Note: Totals may differ by orders of magnitude, e.g. prescriptions filled vs. hospital discharges

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Table 9.2: Health Care Utilization by Type for Persons with Musculoskeletal Diseases, United States 1996-2004

		Ambulatory Physician Visits			Non-physician Care Visits			Prescription Medication Filled			Home Health Care Visits			Hospital Discharges		
Condition	Year	% With Any	Mean Visits	Visits (in millions)	% With Any	Mean Visits	Visits (in millions)	% With Any	Mean Visits	Meds (in millions)	% With Any	Mean Visits	Visits (in millions)	% With Any	Mean Visits	Total Discharges (in millions)
All Musculoskeletal Diseases	1996-1998	84.8%	5.6	425.5	39.7%	2.6	197.5	81.3%	13.1	995.3	5.1%	3.9	296.3	11.1%	0.2	15.2
	1997-1999	84.9%	5.6	421.0	40.9%	2.7	203.0	81.3%	13.8	1,037.4	5.0%	3.8	285.7	11.6%	0.2	15.0
	1998-2000	85.3%	5.7	422.2	41.0%	2.8	207.4	82.5%	14.6	1,081.5	4.6%	3.4	251.9	11.6%	0.2	14.8
	1999-2001	85.9%	5.7	430.9	42.0%	2.8	211.7	83.8%	15.7	1,186.9	4.6%	3.5	264.6	11.8%	0.2	15.1
	2000-2002	86.0%	5.8	462.5	45.1%	3.1	247.2	84.5%	16.8	1,339.8	4.7%	3.7	295.1	11.7%	0.2	15.9
	2001-2003	85.8%	5.8	488.9	49.2%	3.5	295.0	84.5%	17.8	1,500.5	4.8%	3.5	295.0	11.8%	0.2	16.9
	2002-2004	85.1%	5.8	507.9	51.5%	3.8	332.8	83.5%	18.6	1,628.9	4.7%	3.5	306.5	11.7%	0.2	17.5
Spine	1996-1998	83.2%	6.2	169.7	46.7%	3.7	101.3	80.3%	12.9	353.2	4.1%	2.7	73.9	10.7%	0.2	5.5
	1997-1999	83.0%	6.1	170.2	48.4%	3.9	108.8	80.3%	13.3	371.0	3.9%	3.0	83.7	11.0%	0.2	5.6
	1998-2000	84.0%	6.2	168.7	49.1%	4.1	111.5	81.5%	14.2	386.3	3.6%	2.8	76.2	11.1%	0.2	5.4
	1999-2001	84.6%	6.2	169.0	49.5%	4.2	114.5	82.9%	15.4	419.9	3.5%	2.5	68.2	11.5%	0.2	5.5
	2000-2002	84.7%	6.2	178.7	52.4%	4.5	129.7	83.5%	16.7	481.4	3.7%	2.2	63.4	11.4%	0.2	5.8
	2001-2003	84.3%	6.1	186.7	56.1%	4.9	150.0	83.6%	17.8	544.8	3.9%	2.2	67.3	11.5%	0.2	6.1
	2002-2004	83.6%	6.1	199.7	58.6%	5.3	173.5	82.6%	18.6	609.0	4.0%	2.3	75.3	11.6%	0.2	6.5
Arthritis and Joint Pain	1996-1998	90.1%	6.8	203.3	42.4%	2.6	77.7	89.4%	18.9	565.0	7.9%	6.3	188.3	13.5%	0.2	6.0
	1997-1999	90.4%	6.8	204.0	43.4%	2.6	78.0	89.1%	20.1	603.0	7.7%	6.3	189.0	14.2%	0.2	6.0
	1998-2000	90.1%	6.8	205.7	43.2%	2.6	78.7	89.6%	21.0	635.3	7.0%	5.6	169.4	14.0%	0.2	6.1
	1999-2001	90.3%	6.8	218.8	44.7%	2.8	90.1	90.5%	22.3	717.6	6.8%	5.4	173.8	14.4%	0.2	6.4
	2000-2002	90.5%	6.9	239.2	47.8%	3.3	114.4	91.3%	23.5	814.6	6.9%	5.3	183.7	14.4%	0.2	6.9
	2001-2003	90.8%	7.0	258.6	52.5%	3.8	140.4	91.3%	24.8	916.1	7.1%	5.1	188.4	14.6%	0.2	7.4
	2002-2004	90.3%	7.1	267.3	55.0%	4.1	154.3	90.7%	26.0	978.7	6.9%	5.2	195.7	14.5%	0.2	7.5
Osteoporosis	1996-1998	96.4%	9.5	30.0	54.1%	3.4	30.0	95.6%	27.8	87.8	10.3%	7.7	24.3	19.2%	0.3	0.9
	1997-1999	97.3%	9.5	32.4	54.7%	4.0	32.4	95.5%	28.0	95.4	10.4%	8.5	28.9	18.5%	0.3	1.0
	1998-2000	97.2%	9.2	34.8	54.6%	4.0	34.8	95.5%	27.9	105.7	8.7%	7.4	28.0	17.8%	0.3	1.1
	1999-2001	96.6%	8.9	39.6	56.3%	3.6	39.6	95.9%	29.3	130.2	8.9%	7.8	34.7	17.2%	0.2	0.9
	2000-2002	95.9%	8.8	46.3	58.9%	3.7	46.3	96.6%	31.4	165.3	9.4%	8.2	43.2	17.1%	0.2	1.1
	2001-2003	95.2%	8.7	53.4	63.5%	4.2	53.4	97.2%	32.2	197.6	10.3%	8.6	52.8	17.1%	0.3	1.8
	2002-2004	95.6%	8.4	57.3	64.8%	4.4	57.3	97.1%	31.3	213.5	9.7%	7.6	51.8	15.4%	0.2	1.4
Injuries	1996-1998	83.0%	4.8	112.1	36.2%	2.3	53.7	76.3%	8.6	200.9	4.2%	2.7	63.1	10.3%	0.1	2.3
	1997-1999	82.9%	4.9	110.2	37.4%	2.6	58.5	76.4%	9.3	209.2	4.1%	3.1	69.7	10.8%	0.1	2.2
	1998-2000	83.5%	5.0	108.0	37.3%	2.8	60.5	77.6%	10.0	215.9	4.1%	3.2	69.1	11.1%	0.1	2.2
	1999-2001	84.0%	5.2	111.5	37.9%	2.8	60.0	78.7%	11.0	235.9	4.0%	3.3	70.8	11.4%	0.2	4.3
	2000-2002	83.8%	5.3	118.1	40.3%	3.0	66.9	79.1%	12.1	269.7	4.2%	3.6	80.2	11.4%	0.2	4.5
	2001-2003	83.6%	5.3	124.9	44.2%	3.3	77.8	78.5%	13.2	311.1	4.4%	3.4	80.1	11.3%	0.2	4.7
	2002-2004	82.7%	5.2	128.3	46.3%	3.7	91.3	77.8%	13.8	340.6	4.3%	3.2	79.0	10.7%	0.2	4.9
Other Musculoskeletal Conditions	1996-1998	89.8%	7.5	90.3	44.4%	3.4	41.0	86.6%	18.8	226.5	8.3%	6.7	80.7	14.0%	0.2	2.4
	1997-1999	90.6%	7.6	89.8	45.5%	3.6	42.5	87.7%	19.9	235.0	8.1%	6.5	76.8	14.9%	0.2	2.4
	1998-2000	90.8%	7.5	84.9	44.8%	3.4	38.5	88.4%	21.2	240.0	7.4%	6.0	67.9	16.2%	0.3	3.4
	1999-2001	90.8%	7.5	86.4	46.7%	3.4	39.2	89.6%	22.5	259.3	7.4%	6.5	74.9	16.3%	0.3	3.5
	2000-2002	90.6%	7.6	93.9	49.4%	3.7	45.7	89.8%	24.1	297.6	7.0%	6.8	84.0	16.0%	0.2	2.5
	2001-2003	89.9%	7.7	105.1	54.4%	4.5	61.4	90.0%	25.4	346.5	6.7%	6.0	81.9	15.0%	0.2	2.7
	2002-2004	90.2%	7.8	113.2	56.4%	4.9	71.1	89.5%	26.4	383.3	6.6%	5.8	84.2	15.3%	0.2	2.9

Note: Totals may differ by orders of magnitude, e.g. prescriptions filled vs. hospital discharges

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.3: Annual Average Change in Total Units of Health Utilization by Type of Care for Persons with Musculoskeletal Diseases, United States 1996-2004

MEPS Data Years Averaged	Ambulatory Physician Visits	Ambulatory Non-physician Visits (Ambulatory Care)	Prescription Medication Filled (Meds)	Home Health Care Days	Hospital Discharges
1996-1998 to 1997-1999	-1.1%	2.7%	4.2%	-3.6%	-1.1%
1997-1999 to 1998-2000	0.3%	2.2%	4.3%	-11.8%	-1.5%
1998-2000 to 1999-2001	2.1%	2.1%	9.7%	5.1%	2.1%
1999-2001 to 2000-2002	7.3%	16.8%	12.9%	11.5%	5.5%
2000-2002 to 2001-2003	5.7%	19.3%	12.0%	0.0%	5.7%
2001-2003 to 2002-2004	3.9%	12.8%	8.6%	3.9%	3.9%
1996-1998 to 2002-2004	2.8%	9.8%	9.1%	0.5%	2.2%
Annual Average Change for Select Musculoskeletal Diseases, 1996-1998 to 2002-2004					
Spine	2.5%	10.2%	10.3%	0.3%	2.8%
Arthritis and Joint Pain	4.5%	14.1%	10.5%	0.6%	3.7%
Osteoporosis	13.0%	13.0%	20.4%	16.2%	6.3%
Musculoskeletal Injuries	2.1%	10.0%	9.9%	3.6%	15.9%
Other Musculoskeletal Conditions	3.6%	10.5%	9.9%	0.6%	2.9%

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.4: Per Person Components of Total and Incremental Direct Costs in 2004 Dollars for Musculoskeletal Diseases, United States 1996-2004

		Total Mean and % of All Costs								
Condition	Year	Ambulatory Care		ER and Inpatient		Prescription		Residual		All
All Musculoskeletal Diseases	1996-1998	$1,496	31%	$1,728	36%	$653	14%	$874	18%	$4,751
	1997-1999	$1,493	31%	$1,791	37%	$728	15%	$858	18%	$4,870
	1998-2000	$1,525	31%	$1,795	36%	$798	16%	$808	16%	$4,925
	1999-2001	$1,600	31%	$1,762	34%	$908	18%	$853	17%	$5,125
	2000-2002	$1,734	33%	$1,742	33%	$998	19%	$858	16%	$5,333
	2001-2003	$1,823	33%	$1,771	32%	$1,119	20%	$871	16%	$5,584
	2002-2004	$1,898	33%	$1,865	32%	$1,196	21%	$864	15%	$5,824
Spine	1996-1998	$1,675	35%	$1,728	36%	$638	13%	$714	15%	$4,756
	1997-1999	$1,618	34%	$1,692	35%	$700	15%	$782	16%	$4,791
	1998-2000	$1,697	34%	$1,738	35%	$767	15%	$766	15%	$4,967
	1999-2001	$1,757	34%	$1,786	34%	$871	17%	$775	15%	$5,190
	2000-2002	$1,895	36%	$1,652	31%	$973	19%	$729	14%	$5,249
	2001-2003	$1,905	35%	$1,724	31%	$1,108	20%	$738	13%	$5,475
	2002-2004	$2,022	34%	$1,900	32%	$1,200	20%	$801	14%	$5,923
Arthritis and Joint Pain	1996-1998	$1,849	30%	$2,272	37%	$945	15%	$1,100	18%	$6,166
	1997-1999	$1,831	29%	$2,405	38%	$1,065	17%	$1,100	17%	$6,400
	1998-2000	$1,762	29%	$2,233	36%	$1,160	19%	$1,004	16%	$6,160
	1999-2001	$1,865	29%	$2,168	34%	$1,308	20%	$1,044	16%	$6,384
	2000-2002	$2,072	31%	$2,247	34%	$1,397	21%	$981	15%	$6,697
	2001-2003	$2,281	32%	$2,299	32%	$1,573	22%	$993	14%	$7,145
	2002-2004	$2,393	32%	$2,425	32%	$1,684	23%	$976	13%	$7,477
Osteoporosis	1996-1998	$2,586	31%	$3,040	36%	$1,451	17%	$1,344	16%	$8,422
	1997-1999	$2,603	31%	$2,914	35%	$1,570	19%	$1,269	15%	$8,357
	1998-2000	$2,511	31%	$2,857	35%	$1,615	20%	$1,168	14%	$8,151
	1999-2001	$2,689	33%	$2,498	31%	$1,769	22%	$1,224	15%	$8,179
	2000-2002	$2,779	32%	$2,588	30%	$1,939	23%	$1,310	15%	$8,616
	2001-2003	$2,776	31%	$2,630	30%	$2,092	24%	$1,348	15%	$8,845
	2002-2004	$2,781	32%	$2,488	29%	$2,089	24%	$1,207	14%	$8,565
Musculoskeletal Injuries	1996-1998	$1,332	33%	$1,342	34%	$420	11%	$889	22%	$3,983
	1997-1999	$1,416	33%	$1,485	35%	$485	11%	$868	20%	$4,254
	1998-2000	$1,451	33%	$1,571	36%	$542	12%	$821	19%	$4,384
	1999-2001	$1,563	34%	$1,540	33%	$631	14%	$902	19%	$4,636
	2000-2002	$1,618	33%	$1,565	32%	$718	15%	$969	20%	$4,869
	2001-2003	$1,718	33%	$1,635	32%	$835	16%	$983	19%	$5,171
	2002-2004	$1,721	33%	$1,588	31%	$898	17%	$953	18%	$5,161
Other Musculoskeletal Conditions	1996-1998	$1,918	30%	$2,435	38%	$914	14%	$1,168	18%	$6,435
	1997-1999	$2,040	30%	$2,639	39%	$1,033	15%	$1,140	17%	$6,852
	1998-2000	$2,076	29%	$2,915	41%	$1,127	16%	$1,039	15%	$7,156
	1999-2001	$2,181	30%	$2,793	38%	$1,283	17%	$1,125	15%	$7,382
	2000-2002	$2,229	30%	$2,603	35%	$1,421	19%	$1,187	16%	$7,440
	2001-2003	$2,388	32%	$2,261	30%	$1,603	22%	$1,188	16%	$7,440
	2002-2004	$2,447	32%	$2,390	31%	1712	22%	$1,120	15%	$7,668

[1] Due to the sample size, increment not calculated for this subcondition.

Note: Due to estimation errors, increment components do not always equal the total; percentages were not calculated due to this unknown error.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.4a: Per Person Components of Incremental Direct Costs in 2004 Dollars for Musculoskeletal Diseases, United States 1996-2004

		Mean Increment			
Condition	Year	Ambulatory Care	ER and Inpatient	Prescription	Residual
All Musculoskeletal Diseases	1996-1998	$702	$304	$210	$280
	1997-1999	$714	$370	$196	$255
	1998-2000	$783	$357	$206	$247
	1999-2001	$798	$353	$188	$239
	2000-2002	$849	$281	$179	$245
	2001-2003	$874	$275	$219	$247
	2002-2004	$923	$263	$212	$258
Spine	1996-1998	$690	$209	$99	$111
	1997-1999	$641	$253	$76	$100
	1998-2000	$780	$364	$60	$108
	1999-2001	$752	$473	$43	$101
	2000-2002	$767	$282	$55	$105
	2001-2003	$660	$155	$52	$90
	2002-2004	$737	$176	$1	$101
Arthritis and Joint Pain	1996-1998	$578	$26	$138	$137
	1997-1999	$529	$125	$77	$135
	1998-2000	$511	$4	$56	$139
	1999-2001	$478	$97	$69	$118
	2000-2002	$508	$112	$59	$103
	2001-2003	$548	$189	$145	$89
	2002-2004	$560	$283	$88	$104
Osteoporosis	1996-1998	[1]	[1]	[1]	[1]
	1997-1999	[1]	[1]	[1]	[1]
	1998-2000	[1]	[1]	[1]	[1]
	1999-2001	[1]	[1]	[1]	[1]
	2000-2002	[1]	[1]	[1]	[1]
	2001-2003	[1]	[1]	[1]	[1]
	2002-2004	[1]	[1]	[1]	[1]
Musculoskeletal Injuries	1996-1998	$486	$485	$36	$400
	1997-1999	$547	$581	$19	$413
	1998-2000	$587	$655	$52	$426
	1999-2001	$624	$627	-$18	$455
	2000-2002	$581	$654	-$19	$442
	2001-2003	$569	$644	$12	$417
	2002-2004	$545	$593	$53	$411
Other Musculoskeletal Conditions	1996-1998	$647	$742	$194	$247
	1997-1999	$845	$744	$260	$252
	1998-2000	$845	$1,186	$293	$249
	1999-2001	$843	$1,052	$245	$226
	2000-2002	$679	$840	$191	$253
	2001-2003	$744	$412	$249	$245
	2002-2004	$755	$532	$205	$225

[1] Due to the sample size, increment not calculated for this subcondition.

Note: Due to estimation errors, increment components do not always equal the total; percentages were not calculated due to this unknown error.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.5: Total and Incremental Direct Costs for Musculoskeletal Diseases in Current and 2004 Dollars, United States 1996-2004

		Persons with condition		Total				Incremental			
				Mean		Aggregate [1]		Mean		Aggregate [1]	
Condition	Year	Sample N	Total Population	Current $s [2]	2006 $s [2]	Current $s (in billions)	2006 $s (in billions)	Current $s [2]	2006 $s [2]	Current $s (in billions)	2006 $s (in billions)
		Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H	Column I	Column J
All Musculoskeletal Diseases	1996-1998	6,964	75,978,133	$3,600	$5,151	$274	$391.4	$1,276	$1,827	$97	$138.8
	1997-1999	7,004	75,173,840	$3,808	$5,280	$286	$396.9	$1,356	$1,879	$102	$141.3
	1998-2000	6,025	74,077,194	$3,993	$5,340	$296	$395.6	$1,482	$1,978	$110	$146.5
	1999-2001	6,814	75,600,394	$4,323	$5,556	$327	$420.0	$1,546	$1,993	$117	$150.7
	2000-2002	8,252	79,748,298	$4,704	$5,782	$375	$461.1	$1,582	$1,952	$126	$155.7
	2001-2003	9,166	84,297,419	$5,142	$6,054	$433	$510.3	$1,638	$1,926	$138	$162.4
	2002-2004	9,337	87,575,871	$5,594	$6,314	$490	$553.0	$1,715	$1,939	$150	$169.8
	2003-2005	8,874	88,946,833	$6,439	$6,439	$573	$572.7	$1,937	$1,937	$172	$172.3
	2004-2006	8,947	89,652,587	$6,429	$6,429	$576	$576.4	$1,790	$1,790	$160	$160.5

		Persons with condition		Total				Incremental			
				Mean		Aggregate [1]		Mean		Aggregate [1]	
Condition	Year	Sample N	Total Population	Current $s [3]	2004 $s [3]	Current $s (in billions)	2004 $s (in billions)	Current $s [3]	2004 $s [3]	Current $s (in billions)	2004 $s (in billions)
		Column A	Column B	Column C	Column D	Column E	Column F	Column G	Column H	Column I	Column J
Spine	1996-1998	2,510	27,376,436	$3,600	$4,756	$99	$130	$759	$1,006	$21	$28
	1997-1999	2,580	27,893,654	$3,749	$4,791	$105	$134	$812	$1,033	$23	$29
	1998-2000	2,199	27,203,474	$4,030	$4,967	$110	$135	$1,050	$1,286	$29	$35
	1999-2001	2,411	27,263,245	$4,376	$5,190	$119	$141	$1,151	$1,370	$31	$37
	2000-2002	2,927	28,825,976	$4,623	$5,249	$133	$151	$998	$1,148	$29	$33
	2001-2003	3,258	30,607,329	$5,044	$5,475	$154	$168	$754	$826	$23	$25
	2002-2004	3,408	32,740,018	$5,700	$5,923	$187	$194	$898	$927	$29	$30
Arthritis and Joint Pain	1996-1998	2,804	29,893,915	$4,675	$6,166	$140	$184	$799	$1,057	$24	$32
	1997-1999	2,853	29,998,123	$5,000	$6,400	$150	$192	$783	$1,007	$23	$30
	1998-2000	2,498	30,254,301	$4,989	$6,160	$151	$186	$666	$823	$20	$25
	1999-2001	2,936	32,177,862	$5,387	$6,384	$173	$205	$723	$857	$23	$28
	2000-2002	3,632	34,664,846	$5,914	$6,697	$205	$232	$757	$858	$26	$30
	2001-2003	4,058	36,938,769	$6,580	$7,145	$243	$264	$916	$992	$34	$37
	2002-2004	4,103	37,643,137	$7,181	$7,477	$270	$281	$951	$992	$36	$37
Osteoporosis	1996-1998	299	3,158,916	$6,391	$8,422	$20	$27	[4]	[4]	[4]	[4]
	1997-1999	321	3,405,501	$6,529	$8,357	$22	$28	[4]	[4]	[4]	[4]
	1998-2000	308	3,787,044	$6,587	$8,151	$25	$31	[4]	[4]	[4]	[4]
	1999-2001	395	4,444,849	$6,914	$8,179	$31	$36	[4]	[4]	[4]	[4]
	2000-2002	537	5,264,938	$7,605	$8,616	$40	$45	[4]	[4]	[4]	[4]
	2001-2003	645	6,136,560	$8,121	$8,845	$50	$54	[4]	[4]	[4]	[4]
	2002-2004	705	6,819,738	$8,212	$8,565	$56	$58	[4]	[4]	[4]	[4]
Injuries	1996-1998	2,093	23,358,073	$3,021	$3,983	$71	$93	$1,051	$1,386	$25	$32
	1997-1999	2,047	22,495,891	$3,329	$4,254	$75	$96	$1,258	$1,604	$28	$36
	1998-2000	1,698	21,590,412	$3,555	$4,384	$77	$95	$1,423	$1,751	$31	$38
	1999-2001	1,869	21,442,353	$3,912	$4,636	$84	$99	$1,438	$1,715	$31	$37
	2000-2002	2,235	22,285,775	$4,297	$4,869	$96	$109	$1,378	$1,571	$31	$35
	2001-2003	2,492	23,570,429	$4,763	$5,171	$112	$122	$1,392	$1,508	$33	$36
	2002-2004	2,545	24,680,193	$4,947	$5,161	$122	$127	$1,404	$1,468	$35	$36
Residual	1996-1998	1,173	12,046,200	$4,876	$6,435	$59	$78	$1,426	$1,885	$17	$23
	1997-1999	1,174	11,809,322	$5,362	$6,852	$63	$81	$1,727	$2,191	$20	$26
	1998-2000	983	11,322,533	$5,811	$7,156	$66	$81	$2,142	$2,633	$24	$30
	1999-2001	1,098	11,524,129	$6,217	$7,382	$72	$85	$2,049	$2,456	$24	$28
	2000-2002	1,345	12,350,398	$6,550	$7,440	$81	$92	$1,719	$1,971	$21	$24
	2001-2003	1,546	13,643,094	$6,853	$7,440	$93	$102	$1,500	$1,624	$20	$22
	2002-2004	1,618	14,518,291	$7,359	$7,668	$107	$111	$1,615	$1,685	$23	$24

[1] All aggregates (including total) are created by multiplying smoothed means by smoothed population in year.

[2] 2006 and current $ for year=2006 (all musculoskeletal diseases only) are no longer equal due to smoothing.

[3] 2004 and current $ for year=2004 are no longer equal due to smoothing.

[3] All individuals with osteoporosis had expenditures and total increment could not be calculated.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Table 9.6: Annual Average and Total Change in Health Care Cost for Persons with Musculoskeletal Diseases, United States, 1996-2004

	Average Annual Increase			
	Total		Incremental	
MEPS Data Years Averaged	Mean	Aggregate [1]	Mean	Aggregate [1]
1996-1998 to 1997-1999	2.5%	1.4%	2.8%	1.8%
1997-1999 to 1998-2000	1.1%	-0.3%	5.3%	3.7%
1998-2000 to 1999-2001	4.1%	6.2%	0.8%	2.8%
1999-2001 to 2000-2002	4.1%	9.8%	-2.1%	3.3%
2000-2002 to 2001-2003	4.7%	10.7%	-1.3%	4.4%
2001-2003 to 2002-2004	4.3%	8.4%	0.7%	4.6%
1996-1998 to 2002-2004	3.2%	5.9%	0.9%	3.2%
Total Increase 1996-1998 to 2002-20	22.6%	41.3%	6.2%	22.4%
Annual Average Change for Select Musculoskeletal Diseases, 1996-1998 to 2002-2004				
Spine	3.5%	7.0%	-1.1%	1.5%
Arthritis and Joint Pain	3.0%	7.5%	-0.9%	2.6%
Osteoporosis	0.2%	17.1%	[2]	[2]
Musculoskelegal Injuries	4.2%	5.3%	0.8%	1.7%
Other Musculoskeletal Conditions	2.7%	6.2%	-1.5%	1.1%
Total Increase in Health Care Cost for Select Musculoskeletal Diseases, 1996-1998 to 2002-2004				
Spine	24.5%	48.9%	-7.9%	10.2%
Arthritis and Joint Pain	21.3%	52.7%	-6.1%	18.2%
Osteoporosis	1.7%	119.6%	[2]	[2]
Musculoskelekal Injuries	29.6%	36.9%	5.9%	11.9%
Other Musculoskeletal Conditions	19.2%	43.6%	-10.6%	7.7%

[1] All aggregates (including total) are created by multiplying smoothed means by smoothed population in year.

[2] All individuals with the conditions within the category including osteoporosis had expenditures and total increment could not be calculated.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.7: Total and Incremental Expenditures for Musculoskeletal Diseases by Demographic Characteristics, United States, 2004

	Number of Respondents		Estimated Population (in 1000s)		Total Expenditures			Incremental Expenditures	
Demographic Characteristics	Total	With Musculoskeletal Diseases	Total	With Musculoskeletal Diseases	Mean	Standard Error (±)	Aggregate (in millions)	Mean	Aggregate (in millions)
Total Population	32,737	9,027	293,527	89,740	$6,018	$213	$540.1	$1,645	$147.6
Gender									
Female	17,298	5,264	149,658	49,916	$6,506	$225	$324.8	$1,634	$81.6
Male	15,439	3,763	143,869	39,824	$5,407	$371	$215.3	$1,660	$66.1
Race									
White	25,210	7,301	236,409	76,489	$6,227	$244	$476.3	$1,737	$132.9
Nonwhite	7,527	1,726	57,118	13,252	$4,809	$261	$63.7	$1,114	$14.8
Ethnicity									
Hispanic	9,022	1,523	42,212	7,668	$3,730	$323	$28.6	$874	$6.7
Nonhispanic	23,715	7,504	251,315	82,072	$6,232	$229	$511.5	$1,717	$140.9
Education [1]									
Less than High School	8,359	2,299	49,087	16,141	$6,509	$402	$105.1	$1,056	$17.0
High School	10,422	2,876	91,613	28,947	$6,165	$297	$178.5	$1,731	$50.1
Some College	6,935	1,956	70,070	21,377	$5,847	$384	$125.0	$2,070	$44.3
College Graduate	4,071	1,103	48,284	13,596	$4,762	$334	$64.7	$730	$9.9
Graduate School	2,681	737	32,730	9,256	$6,974	$1,195	$64.6	$2,770	$25.6
Marital status [2]									
Never Married	7,012	1,469	62,411	14,975	$3,235	$194	$48.4	$687	$10.3
Married or w/Partner	19,205	5,043	175,791	51,417	$6,067	$298	$311.9	$1,964	$101.0
Divorced-Widowed-Separated	6,457	2,507	55,005	23,289	$7,708	$426	$179.5	$1,558	$36.3
Insurance									
Any Private	18,364	5,530	200,787	63,323	$6,062	$284	$383.9	$2,009	$127.2
Public	9,180	2,535	56,530	18,347	$7,679	$313	$140.9	$872	$16.0
None	5,193	962	36,211	8,071	$1,899	$192	$15.3	$529	$4.3

[1] Education status for individuals < 18 was set to the highest level in the household. *Education status for individuals < 18 was set to the highest level in the household; marital status for individuals < 18 were set hierarchically by household to married, div/wid/sep, and never married.

[2] Marital status for individuals < 18 were set hierarchically by household to married, div/wid/sep, and never married.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2004

Table 9.8: Age Distribution of Total and Incremental Direct Costs (2004 $'s) of Musculoskeletal Diseases, United States 1996-2004

		Years Averaged						
	Age	1996-1998	1997-1999	1998-2000	1999-2001	2000-2002	2001-2003	2002-2004
TOTAL COST								
Persons with Condition (Sample N)	< 18	858	849	715	762	893	989	1,002
	18-44	2,481	2,419	2,020	2,252	2,715	3,012	3,030
	45-64	2,118	2,171	1,922	2,243	2,765	3,102	3,179
	65+	1,506	1,564	1,368	1,557	1,879	2,063	2,127
Persons with Condition (Total Population)	< 18	8,837,738	8,587,926	8,270,671	7,909,778	7,812,654	8,015,131	8,339,766
	18-44	28,857,105	27,582,172	26,465,903	26,434,506	27,764,847	28,914,760	29,523,069
	45-64	21,794,220	22,136,282	22,574,221	23,930,631	25,951,528	28,209,432	29,802,135
	65+	16,489,070	16,867,460	16,766,399	17,325,479	18,219,269	19,158,096	19,910,901
Total Mean in 2004 $	< 18	$ 1,880	$ 2,034	$ 2,271	$ 2,586	$ 2,535	$ 2,359	$ 2,238
	18-44	$ 2,945	$ 3,019	$ 3,036	$ 3,101	$ 3,148	$ 3,221	$ 3,278
	45-64	$ 4,993	$ 5,062	$ 5,237	$ 5,598	$ 5,934	$ 6,401	$ 6,682
	65+	$ 9,132	$ 9,092	$ 8,792	$ 8,712	$ 9,009	$ 9,283	$ 9,806
Total Aggregate in 2004 $ (in billions)	< 18	$ 16.6	$ 17.5	$ 18.8	$ 20.5	$ 19.8	$ 18.9	$ 18.7
	18-44	$ 85.0	$ 83.3	$ 80.4	$ 82.0	$ 87.4	$ 93.1	$ 96.8
	45-64	$ 108.8	$ 112.1	$ 118.2	$ 134.0	$ 154.0	$ 180.6	$ 199.1
	65+	$ 150.6	$ 153.4	$ 147.4	$ 150.9	$ 164.1	$ 177.8	$ 195.2
INCREMENTAL COST								
Persons with Condition (Sample N)	< 18	858	849	715	762	893	989	1,002
	18-44	2,481	2,419	2,020	2,252	2,715	3,012	3,030
	45-64	2,118	2,171	1,922	2,243	2,765	3,102	3,179
	65+	1,506	1,564	1,368	1,557	1,879	2,063	2,127
Persons with Condition (Total Population)	< 18	8,837,738	8,587,926	8,270,671	7,909,778	7,812,654	8,015,131	8,339,766
	18-44	28,857,105	27,582,172	26,465,903	26,434,506	27,764,847	28,914,760	29,523,069
	45-64	21,794,220	22,136,282	22,574,221	23,930,631	25,951,528	28,209,432	29,802,135
	65+	16,489,070	16,867,460	16,766,399	17,325,479	18,219,269	19,158,096	19,910,901
Increment Mean in 2004 $	< 18	$ 1,145	$ 1,191	$ 1,365	$ 1,445	$ 1,355	$ 1,261	$ 1,250
	18-44	$ 1,140	$ 1,251	$ 1,185	$ 1,208	$ 1,175	$ 1,156	$ 1,105
	45-64	$ 1,794	$ 1,884	$ 2,186	$ 2,336	$ 2,364	$ 2,577	$ 2,492
	65+	$ 2,797	$ 2,598	$ 2,569	$ 2,289	$ 2,156	$ 1,735	$ 1,965
Increment Aggregate in 2004 $ (in billions)	< 18	$ 10.1	$ 10.2	$ 11.3	$ 11.4	$ 10.6	$ 10.1	$ 10.4
	18-44	$ 32.9	$ 34.5	$ 31.4	$ 31.9	$ 32.6	$ 33.4	$ 32.6
	45-64	$ 39.1	$ 41.7	$ 49.3	$ 55.9	$ 61.3	$ 72.7	$ 74.3
	65+	$ 46.1	$ 43.8	$ 43.1	$ 39.7	$ 39.3	$ 33.2	$ 39.1

[1] In 2004 $.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.9: Distribution of Total Direct Costs for Musculoskeletal Diseases by Age, United States 1996-2004

	% Total Aggregate Cost (in 2004 $)			
	< 18	18-44	45-64	65+
1996-1998	5%	24%	30%	42%
1997-1999	5%	23%	31%	42%
1998-2000	5%	22%	32%	40%
1999-2001	5%	21%	35%	39%
2000-2002	5%	21%	36%	39%
2001-2003	4%	20%	38%	38%
2002-2004	4%	19%	39%	38%

	% Increment Aggregate Cost (in 2004 $)			
	< 18	18-44	45-64	65+
1996-1998	8%	26%	30%	36%
1997-1999	8%	26%	32%	34%
1998-2000	8%	23%	37%	32%
1999-2001	8%	23%	40%	29%
2000-2002	7%	23%	43%	27%
2001-2003	7%	22%	49%	22%
2002-2004	7%	21%	47%	25%

Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.10: Annual Change in Total and Incremental Health Care Cost for Persons with Musculoskeletal Diseases by Age, United States 1996-2004

	Total Aggregate Cost			
MEPS Data Years Averaged	<18	18 to 44	45 to 64	65 & Over
1996-1998 to 1997-1999	5.1%	-2.0%	3.0%	1.8%
1997-1999 to 1998-2000	7.5%	-3.5%	5.5%	-3.9%
1998-2000 to 1999-2001	8.9%	2.0%	13.3%	2.4%
1999-2001 to 2000-2002	-3.2%	6.6%	15.0%	8.7%
2000-2002 to 2001-2003	-4.5%	6.6%	17.3%	8.4%
2001-2003 to 2002-2004	-1.3%	3.9%	10.3%	9.8%
Annual Average Increase	1.8%	2.0%	11.9%	4.2%
Total Increase	12.3%	13.9%	83.0%	29.7%

	Incremental Aggregate Cost			
MEPS Data Years Averaged	<18	18 to 44	45 to 64	65 & Over
1996-1998 to 1997-1999	1.1%	4.9%	6.7%	-5.0%
1997-1999 to 1998-2000	10.4%	-9.1%	18.3%	-1.7%
1998-2000 to 1999-2001	1.2%	1.8%	13.3%	-7.9%
1999-2001 to 2000-2002	-7.4%	2.2%	9.7%	-1.0%
2000-2002 to 2001-2003	-4.5%	2.5%	18.5%	-15.4%
2001-2003 to 2002-2004	3.1%	-2.4%	2.2%	17.7%
Annual Average Increase	0.4%	-0.1%	12.8%	-2.2%
Total Increase	3.0%	-0.8%	89.9%	-15.2%

Source: Medical Expenditure Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2004

Table 9.11: Costs of Musculoskeletal Diseases as a Percentage of GDP [1] by Year, United States, Select Years

Year	Direct Costs	Indirect Costs	Total
1963	0.3	0.3	0.7
1972	0.3	0.4	0.7
1980	0.5	0.3	0.8
1988	1.2	1.3	2.5
1995	1.2	1.7	2.9

[1] GDP: Gross Domestic Product, in annual year dollars

Source: Yelin E, Murphy MG, Cisternas MG, Foreman DJP, Helmick CG. Medical care expenditures and earnings losses among persons with arthritis and other rheumatic conditions in 2003, and comparisons with 1997. *Arthritis Rheum* 2007; 56:1397-1407.

Table 9.12: Total and Incremental Indirect Cost [1] in 2006 Dollars for Persons Age 18 to 64 with Musculoskeletal Diseases and a Work History, United States 1996-2006

Year	Population with Musculoskeletal Disease Who Ever Worked	Indirect Cost (Earnings Loss, in 2006 $)			
		Total		Increment	
		Mean	Aggregate (in billion $)	Mean	Aggregate (in billion $)
1996-1998	63,840,865	$3,257	$207.9	$753	$48.1
1997-1999	62,603,143	$4,027	$252.1	$1,049	$65.7
1998-2000	61,508,942	$4,373	$269.0	$1,070	$65.8
1999-2001	63,182,182	$4,328	$273.5	$1,041	$65.8
2000-2002	66,886,534	$4,334	$289.9	$1,042	$69.7
2001-2003	70,931,602	$4,447	$315.4	$1,262	$89.5
2002-2004	73,343,698	$4,928	$361.4	$1,607	$117.9
2003-2005	74,309,513	$5,248	$390.0	$1,906	$141.6
2004-2006	74,832,482	$4,986	$373.1	$1,696	$126.9

[1] Calculated as estimated earnings loss per wage earner due to a musculoskeletal condition in 2006 $.

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 1996-2006

Table 9.13: Average Annual Total and Incremental Direct Costs and Total and Incremental Earnings Losses of Persons Age 18 to 64 for Select Musculoskeletal Diseases, United States 2000-2004

			Musculoskeletal Disease			
			Gout [1]	Osteoarthritis and Allied Disorders [2]	Rheumatoid Arthritis [3]	Other and Unspecified Disorders of the Back [4]
	Sample N		227	206	128	1,860
	# individuals		2,309,103	2,120,057	1,205,328	18,160,441
	% total pop		0.8	0.7	0.4	6.3
Direct Costs	Total	Mean	7,389	10,730	9,938	5,361
		Aggregate (in billions)	17.1	22.7	12.0	97.4
	Incremental	Mean	834	3,883	4,116	857
		Aggregate (in billions)	1.9	8.2	5.0	15.6
Earnings Losses	Total	Mean	6,594	10,369	14,175	1,231
		Aggregate (in billions)	15.2	22.0	17.1	22.4
	Incremental	Mean	1,296	1,175	6,414	771
		Aggregate (in billions)	3.0	2.5	7.7	14.0
Total	Total	Aggregate (in billions)	32.3	44.7	29.1	119.7
	Incremental	Aggregate (in billions)	4.9	10.7	12.7	29.6

[1] ICD-9-CM Codes: Gout=274

[2] ICD-9-CM Codes: Osteoarthritis and Allied Disorders=715

[3] ICD-9-CM Codes: Rheumatoid Arthritis=714

[4] ICD-9-CM Codes: Other and Unspecified Disorders of the Back=724

Source: Medical Expenditures Panel Survey (MEPS), Agency for Healthcare Research and Quality, U.S. Department of Health and Human Services, 2000-2004

Table 9.14: Cost of Musculoskeletal Conditions Aggregate and Indirect (Earnings Losses) as a Proportion of Gross Domestic Product, United States 1996-2006

				Aggregate Values in 2006 $			% of GDP in 2006 $		
	GDP (current $, in billions)	Inflation Factor to 2004	GDP [1] in 2006 $	Total (raw) Aggregate Direct Cost	Total (raw) Indirect Costs	Total Direct + Indirect	Total (raw) Aggregate Direct Cost	Total (raw) Indirect Costs	Total Direct + Indirect
1996	7,816.9	1.2849							
1997	8,304.3	1.2561							
1998	8,747.0	1.2368	$ 10,431.0	$391.4	$207.9	$599.3	3.75%	1.99%	5.75%
1999	9,268.4	1.2101	$ 10,821.6	$396.9	$252.1	$649.0	3.67%	2.33%	6.00%
2000	9,817.0	1.1707	$ 11,175.7	$395.6	$269.0	$664.6	3.54%	2.41%	5.95%
2001	10,128.0	1.1383	$ 11,412.6	$420.0	$273.5	$693.5	3.68%	2.40%	6.08%
2002	10,469.6	1.1206	$ 11,584.9	$461.1	$289.9	$751.0	3.98%	2.50%	6.48%
2003	10,960.8	1.0957	$ 11,756.9	$510.3	$315.4	$825.8	4.34%	2.68%	7.02%
2004	11,685.9	1.0672	$ 12,071.1	$553.0	$361.4	$914.4	4.58%	2.99%	7.58%
2005	12,433.9	1.0323	$ 12,438.6	$572.7	$390.0	$962.7	4.60%	3.14%	7.74%
2006	13,194.7	1.0000	$ 12,833.8	$576.4	$373.1	$949.5	4.49%	2.91%	7.40%

[1] Earnings losses due to musculoskeletal conditions for persons aged 18-64 who ever worked

Source: Cisternas, M., MGC Data Services, www.mgcdata.com

Table 9.15: Base Case ICD-9-CM Codes by Musculoskeletal Disease Included in Economic Impact Analysis

ICD-9-CM Code	Condition Name
Spine	
720	Ankylosing Spondylitis and Other Inflammatory Spondylopathies
721	Spondylosis and Allied Disorders
722	Intervertebral Disc Disorders
723	Other Disorders of Cervical Region
724	Other and Unspecified Disorders of Back
737	Curvature of Spine
781	Symptoms Involving Nervous and Musculoskeletal Systems
805	Fracture of Vertebral Column without Mention of Spinal Corde Injury
806	Fracture of Vertebral Column with Spinal Cord Injury
830	Dislocation of Jaw
846	Sprains and Strains of Sacroiliac Region
847	Sprains and Strains of Other and Unspecified Parts of Back
Arthritis and Joint Pain	
274	Gout
390	Rheumatic Fever without Mention of Heart Involvement (arthritis, rheumatic, acute or subacute)
391	Rheumatic Fever with Heart Involvement
710	Diffuse Diseases of Connective Tissue
711	Arthropathy Associated with Infections
712	Crystal Arthropathies
713	Arthropathy Associated with Other Disorders Classified Elsewhere
714	Rheumatoid Arthritis and Other Inflammatory Polyarthropathies
715	Osteoarthrosis and Allied Disorders
716	Other and Unspecified Arthropathies
719	Other and Unspecified Disorders of Joint
725	Polymyalgia Rheumatica
726	Peripheral Enthesopathies and Allied Syndromes
727	Other Disorders of Synovium, Tendon, and Bursa
Osteoporosis	
733	Other Disorders of Bone and Cartilage
Other Musculoskeletal Conditions	
015	Tuberculosis of Bones and Joints
135	Sarcoidosis; Lupoid of Boeck; Lupus Pernio
170	Malignant Neoplasm of Bone and Articular Cartilage
171	Malignant Neoplasm of Connective and Other Soft Tissue
213	Benign Neoplasm of Bone and Articular Cartilage
268	Vitamin D Deficiency
728	Disorders of Muscle, Ligament, and Fascia
729	Other Disorders of Soft Tissues
730	Osteomyelitis, Periostitis, and Other Infections Involving Bone
731	Osteitis Deformans & Osteopathies Assoc with Disorders Classified Elsewhere
732	Osteochondropathies
734	Flat Foot Pesplanus (acquired); Talipes planus (acquired)
735	Acquired Deformities of Toe
736	Other Acquired Deformities of Limbs
738	Other Acquired Musculoskeletal Deformity
739	Nonallopathic Lesions, NEC
741	Spina Bifida
754	Certain Congenital Musculoskeletal Deformities
755	Other Congenital Anomalies of Limbs
756	Other Congenital Musculoskeletal Anomalies
V49	Other Conditions Influencing Health Status
V54	Other Orthopaedic Aftercare
Musculoskeletal Injuries	
717	Internal Derangement of Knee
718	Other Derangement of Joint
807	Fracture of Rib(s), Sternum, Larynx, and Trachea
808	Fracture of Pelvis
809	Ill-defined Fractures of Bones of Trunk
Musculoskeletal Injuries (continued)	
810	Fracture of Clavicle
811	Fracture of Scapula
812	Fracture of Humerus
813	Fracture of Radius and Ulna
814	Fracture of Carpal Bone(s)
815	Fracture of Metacarpal Bone(s)
816	Fracture of One or More Phalanges of Hand
817	Multiple Fractures of Hand Bones
818	Ill-defined Fractures of Upper Limb
819	Multiple Fractures Involving Both Upper Limbs, and Upper Limb with Rib(s) and Sternum
820	Fracture of Neck of Femur
821	Fracture of Other and Unspecified Parts of Femur
822	Fracture of Patella
823	Fracture of Tibia and Fibula
824	Fracture of Ankle
825	Fracture of One or More Tarsal and Metatarsal Bones
826	Fracture of One or More Phalanges of Foot
827	Other, Multiple, and Ill-defined Fractures of Lower Limb
828	Multiple Fractures Involving Both Lower Limbs, Lower with Upper Limb, and Lower Limb(s) with Rib(s)*
829	Fracture of Unspecified Bones
831	Dislocation of Shoulder
832	Dislocation of Elbow
833	Dislocation of Wrist
834	Dislocation of Finger
835	Dislocation of Hip
836	Dislocation of Knee
837	Dislocation of Ankle
838	Dislocation of Foot
839	Other, Multiple, and Ill-defined Dislocations
840	Sprains and Strains of Shoulder and Upper Arm
841	Sprains and Strains of Elbow and forearm
842	Sprains and Strains of Wrist and Hand
843	Sprains and Strains of Hip and Thigh
844	Sprains and Strains of Knee and Leg
845	Sprains and Strains of Ankle and Foot
848	Other and Ill-defined Sprains and Strains
875	Open Wound of Chest (wall)
876	Open Wound of Back
877	Open Wound of Buttock
880	Open Wound of Shoulder and Upper Arm
881	Open Wound of Elbow, forearm, and Wrist
882	Open Wound of Hand Except Finger(s) Alone
883	Open Wound of Finger(s)
884	Multiple and Unspecified Open Wound of Upper Limb
885	Traumatic Amputation of Thumb (complete) (partial)
886	Traumatic Amputation of Other Finger(s) (complete) (partial)
887	Traumatic Amputation of Arm and Hand (complete) (partial)
890	Open Wound of Hip and Thigh
891	Open Wound of Knee, Leg (except Thigh), and Ankle
892	Open Wound of Foot Except Toe(s) Alone
893	Open Wound of Toe(s)
894	Multiple and Unspecified Open Wound of Lower Limb
895	Traumatic Amputation of Toe(s) (complete) (partial)
896	Traumatic Amputation of Foot (complete) (partial)
897	Traumatic Amputation of Leg(s) (complete) (partial)
905	Late Effects of Musculoskeletal and Connective Tissue Injuries
927	Crushing Injury of Upper Limb
928	Crushing Injury of Lower Limb
929	Crushing Injury of Multiple and Unspecified Sites

Table 9.16: Expansive List ICD-9-CM Codes by Musculoskeletal Disease Included in Economic Impact Analysis

ICD-9-CM Code	Condition Name
Spine	
307	Special Symptoms or Syndromes, NEC
346	Migraine
350	Trigeminal Nerve Disorders
353	Nerve Root and Plexus Disorders
524	Dentofacial Anomalies, Including Malocclusion
625	Pain and Other Symptoms Associated with Female Genital organs
627	Menopausal and Postmenopausal Disorders
780	General Symptoms
782	Symptoms Involving Skin and Other Integumentary Tissue
784	Symptoms Involving Head and Neck
786	Symptoms Involving Respiratory System and Other Chest Symptoms
787	Symptoms Involving Digestive System
789	Other Symptoms Involving Abdomen and Pelvis
951	Injury to Other Cranial Nerve(s)
953	Injury to Nerve Roots and Spinal Plexus
Arthritis and Joint Pain	
098	Gonococcal Infections
099	Other Venereal Diseases
136	Other and Unspecified Infectious and Parasitic Diseases
277	Other and Unspecified Disorders of Metabolism
287	Purpura and Other Hemorrhagic Conditions
344	Other Paralytic Syndromes
354	Mononeuritis of Upper Limb and Mononeuritis Multiplex
357	Inflammatory and Toxic Neuropathy
437	Other and Ill-defined Cerebrovascular Disease
443	Other Peripheral Vascular Disease
446	Polyarteritis Nodosa and Allied Conditions
447	Other Disorders of Arteries and Arterioles
696	Psoriasis and Similar Disorders
Musculoskeletal Injuries	
874	Open Wound of Neck
879	Open Wound of Other and Unspecified Sites, Except Limbs
922	Contusion of Trunk
923	Contusion of Upper Limb
924	Contusion of Lower Limb and of Other and Unspecified Sites
926	Crushing Injury of Trunk

ICD-9-CM Code	Condition Name
Other Musculoskeletal Conditions	
3	Other Salmonella Infections
26	Rat-bite Fever
36	Meningococcal Infection
56	Rubella
88	Other Arthropod-borne Diseases
91	Early Syphilis, Symptomatic
95	Other forms of Late Syphilis, with Symptoms
102	Yaws
137	Late Effects of Tuberculosis
195	Malignant Neoplasm of Other and Ill-defined Sites
198	Secondary Malignant Neoplasm of Other Specified Sites
202	Other Malignant Neoplasms of Lymphoid and Histiocytic Tissue
203	Multiple Myeloma and Immunoproliferative Neoplasms
215	Other Benign Neoplasm of Connective and Other Soft Tissue
238	Neoplasm of Uncertain Behavior of Other and Unspecified Sites and Tissues
239	Neoplasms of Unspecified Nature
252	Disorders of Parathyroid Gland
272	Disorders of Lipoid Metabolism
275	Disorders of Mineral Metabolism
282	Hereditary Hemolytic Anemias
327	organic Sleep Disorders
355	Mononeuritis of Lower Limb and Unspecified Site
567	Peritonitis and retroperitoneal infections
682	Other Cellulitis and Abscess
759	Other and Unspecified Congenital Anomalies
906	Late Effects of Injuries to Skin and Subcutaneous Tissues
958	Certain Early Complications of Trauma
996	Complications Peculiar to Certain Specified Procedures
V13	Personal History of Other Diseases
V42	organ or Tissue Replaced By Transplant
V43	organ or Tissue Replaced By Other Means
V45	Other Postprocedural States
V48	Problems with Head, Neck, and Trunk
V53	Fitting and Adjustment of Other Device
V66	Convalescence and palliative care
V67	Follow-up Examination
V74	Special Screening Examination for Bacterial and Spirochetal Diseases

Appendices

Appendix A - Musculoskeletal Diseases Diagnosis Codes

Table A1: ICD-9-CM Diagnosis Codes for Specific Musculoskeletal Diseases

Condition	ICD-9-CM Code	Description
Chapter 2: Spinal Deformity and Related Conditions		
	737	Curvature of the spine
Chapter 3: Spine: Low Back and Neck Pain		
Back Pain (Lumbar and Low Back)		
Back Disorders	720*	Ankylosing spondylitis and other inflammatory spondylopathies
	721.2-.721.9	Spondylosis and allied disorders
	724	Other and unspecified disorders of back
Disk Disorders	722.10, 722.11	Displacement of intervetebral disc
	722.30-722.39	Schmorl's nodes
	722.51, 722.52, 722.60	Degeneration of intervetebral disc
	722.72, 722.73	Intervertebral disc disorder with myelopathy
	722.80, 722.82, 722.83	Postlaminectomy syndrome
	722.90, 722.92, 722.93	Other and unspecified disc disorder
Back Injury	805.20-805.80	Closed fracture of vertebra without mention of spinal coard injury
	806.20-806.90	Closed fracture of vertebra with spinal cord injury
	839.20-839.49	Closed dislocation, betebra
	846	Sprains and strains of sacroiliac region
	847.10-749.90	Other sprains and strains of back
Cervical (Neck) Pain		
Neck Disorders	721.00, 721.11	Cervical spondylosis
	723.00-723.90	Disorders of cervical region
Disk Disorders	722.00	Displacement of cervical intervertebral disc
	722.40	Degeneration of cervical intervertebral disc
	722.71	Intervertebral disc disorder, with myelopathy
	722.81	Postlaminectomy syndrome of cervical region
	722.91	Other and unspecified disc disorders of cervical region
Neck Injury	805	Closed fFracture of cervical vertebra without mention of spinal cord injury
	806	Closed fracture of cervical bertebra with spinal cord injury
	839	Closed dislocation, cervical vertebra
	847.00	Neck sprain
Spine Procedures (ICD-9-CM Procedures Code)	81.02, 81.03	Cervical fusion
	81.04, 81.05	Thoracic fusion
	81.06-81.08	Lumbar fusion
	81.00, 81.01	Other fusion
	81.62-81.64	Fusion/refusion multiple vertebrae
	81.30-81.39	Spine refusion
	03.09	Spinal decompression
	80.50, 80.51	Spinal diskectomy

Table A1 (continued) **: ICD-9-CM Diagnosis Codes for Specific Musculoskeletal Diseases**

Condition	ICD-9-CM Code	Description
Chapter 4: Arthritis and Joint Pain		
Arthritis and Other Rheumatic Conditions	715	Osteoarthritis
	714	Rheumatoid arthritis
	274, 712	Gout and other crystal arthropathies
	710.00	Systemic lupus erythematosus (Lupus)
	710.01	Sytemic sclerosis
	710.20	Sjogren's syndrome
	729.10	Fibromyalgia
	446.50, 725.00	Polymyalgia rheumatica and giant cell arteritis
	099.30, 696.00, 720, 721	Spondylarthropathies
	716, 719	Joint pain
	354, 711, 726, 727, 728, 729.40	All other arthritis and rheumatic conditions
Joint replacement (ICD-9-CM Procedures Code)	81.54, 815.5, 00.80-00.84	Knee arthroplasty/revision arthroplasty
	81.51-81.53, 00.70-00.76	Hip arthroplasty/revision arthroplasty
	81.56, 81.57, 81.59	Ankle, foot, toe arthroplasty
	81.71, 81.72	Finger arthroplasty
	81.73-81.73, 81.79	Wrist arthroplasty
	81.80, 81.81, 81.83	Shoulder arthroplas;ty
	81.84, 81.85	Elbow arthroplas;ty
	81.97	Upper extremity unspecified
Chapter 5: Osteoporosis and Bone Health		
Primary Osteoporosis	733	Osteoporosis
Low Energy Fractures	805.00-805.08, 805.20, 805.40, 805.60, 805.80, 808.00, 808.41-808.49, 808.80	Vertebral and pelvic fracture
	810.00-810.03, 811.00-811.03, 811.09, 812.00-812.03, 812.09, 812.20, 812.21, 812.40-812.44, 812.49	Upper limb fracture (closed)
	813.00-813.08, 813.20-813.23, 813.40-813.45, 813.80-813.83, 814.00-814.09, 815.00-815.04, 815.09	Wrist fracture (closed)
	820.00-820.03, 820.09, 820.20-820.22, 820.80	Hip fracture (closed)
	821.00-821.01, 821.20-821.23, 821.29, 822.00, 823.00-823.02, 823.20-823.22, 823.80-823.82	Lower limb fracture, excluding foot and ankle (closed)
	824.00, 824.20, 824.40, 824.60, 824.80, 825.00, 825.20-825.25, 825.29	Ankle and foot fracture (closed)
	733.10-733.16, 733.19, 733.93-733.95	Stress and pathological fractures
	E800-E807, E810-E838, E840-E848, E990-E999	Exclude cases with E-code of high energy fracture
Secondary Osteoporosis	242.90-242.91, 252.00-252.02, 252.08, 255.00, 255.30, 256.20, 256.31, 256.39, 257.10, 257.20, 259.30, 259.90, 268.20, 268.90, 588.00, 588.81, 627.20, 627.40, 627.80, 627.90	Diagnosis that may lead to osteoporosis
	806.00-806.40, 806.50, 806.60-806.62, 806.69, 807.70-706.72, 706.79, 806.80, 806.90	Vertebral fractures with spinal cord injury

Table A1 (continued) **: ICD-9-CM Diagnosis Codes for Specific Musculoskeletal Diseases**

Condition	ICD-9-CM Code	Description
Chapter 6: Musculoskeletal Injuries		
Fractures	807.00-807.4, 808, 809, 819, 828, 829	Trunk and multiple site fractures
	810, 811, 812, 813, 814, 815, 816, 817	Upper limb fractures
	820, 821, 822, 823, 824, 825, 826, 827	Lower limb fractures
Derangement	717	Knee derangement
	718	Other joint derangement
Dislocation	831, 832, 833	Upper limb dislocation
	834, 835, 836, 837, 838	Lower limb dislocatin
	839	Other site dislocation
Sprains/Strains	840, 841, 842	Upper limb sprain/strain
	843, 844, 845	Lower limb sprain/strain
	848	Other site sprain/strain
Contusions	922, 923, 924	
Crushing Injury	926, 927, 928, 929	
Open Wound	874, 875, 876, 877, 879, 880, 881, 882, 883, 884, 890, 891, 892, 893, 894	
Traumatic Amputation	885, 886, 887, 895, 896, 897	
Late Effect of Injury	954, 955, 956, 957, 959	
Chapter 7: Musculoskeletal Congenital and Infantile Developmental Conditions		
	741	Spina bifida
	754.1-754.9	Certain congenital musculoskeletal deformities
	755	Other congenital anomalies of limbs
	756	Other congenital musculoskeletal anomalies
Chapter 8: Neoplasms of Bone and Connective Tissue		
	Data based on National Cancer Institute Classifications	

Appendix B - Musculoskeletal Data Summaries

Table B1: Hospitalizations for All Musculoskeletal Diseases by 3-Digit ICD-9-CM Diagnosis by Age Category, United States 2007

ICD-9-CM	Description	< 18	18 - 44	45 - 64	64+	Total
99.3	Rieter's disease	*	*	*	*	196 *
135	Sarcoidosis	*	14,950	35,956	17,017	68,865
170	Malignant neoplasm of bone and articular cartilage	10,122	7,334	3,658	2,913	24,398
171	Malignant neoplasm of connective and other soft tissue	4,516	6,417	9,255	7,851	29,125
199	Secondary malignant neoplasm of other specified sites; Bone and bone marrow	5,031	19,627	103,248	134,769	279,450
203	Multiple myeloma and immunoproliferative neoplasms	*	2,703	28,365	48,950	86,374
213	Benign neoplasm of bone and articular cartilage	1,060	1,797	2,086	1,336	6,421
215	Other benign neoplasm of connective and other soft tissue	*	1,788	3,070	1,748	7,286
238	Neoplasm of uncertain behavior of other and unspecified sites and tissues; Connective and other soft tissue, Bone soft tisue and skin	*	2,129	1,984	1,685	6,475
239.2	Neoplasms of unspecified nature; Bone soft tisue and skin	*	*	*	*	2,235
274	Gout; Gouty arthroplathy	*	5,075	26,441	51,773	95,078
354	Mononeuritis of upper limb and mononeuritis multiplex	*	7,818	14,369	9,523	33,754
710	Diffuse diseases of connective tissue	3,131	61,690	66,290	32,549	166,509
711	Arthropathy associated with infections	4,136	11,284	20,895	18,475	57,849
712	Crystal arthropathies	*	*	1,960	6,488	11,128
713	Arthropathy associated with other disorders classified elsewhere	*	3,045	10,945	5,625	20,073
714	Rheumatoid arthritis and other inflammatory polyarthropathies	2,127	35,508	129,480	210,145	409,702
715	Osteoarthrosis and allied disorders	*	66,785	597,801	1,207,890	2,202,259
716	Other and unspecified arthroplasties	*	27,132	124,463	193,280	391,596
717	Internal derangement of knee	*	5,468	8,926	6,091	21,848
718	Other derangement of joint	4,703	12,043	19,805	20,904	62,051
719	Other and unspecified disorders of joint	19,196	61,064	98,546	128,872	348,625
720	Ankylosing spondylitis and other inflammatory spondylopathies	*	3,494	6,861	6,057	17,679
721	Spondylosis and allied disorders	*	38,075	137,694	167,141	382,775
722	Intervertebral disc disorders	1,222	172,067	293,506	196,873	692,653
723	Other disorder of cervical region	4,135	34,838	65,689	45,824	157,958
724	Other and unspecified disorders of back	6,851	200,132	378,870	398,467	1,069,018
725	Polymyalgia rheumatica	*	*	5,812	51,125	76,944
726	Peripheral enthesopathies and allied syndromes	1,545	16,106	42,578	48,235	116,619
727	Synovitis & tenosynovitis	4,051	15,092	32,748	33,592	90,235
728	Disorders of muscle, ligament, and fascia	8,231	60,677	92,778	108,156	302,123
729	Other disorders of soft tissue	10,909	118,451	240,516	195,558	603,277
730	Acute osteomyelitis	7,008	35,496	87,385	70,498	213,555
731	Osteitis deformans and osteopathies associated with other disorders classified elsewhere	*	9,009	33,142	28,177	77,454
732	Osteochondropathies	3,591	2,675	1,917	1,113	9,089
733	Other disorders of bone and cartilage (Osteoporosis; pathologic fracture, cyst, necrosis of bone, malunion and nonunion of fracture)	11,906	69,330	272,242	803,929	1,472,083
734	Flat foot	*	*	1,894	1,468	4,294
735	Acquired deformities of toe	*	1,252	4,232	5,226	12,311

* Estimate does not meet standard of reliability or precision.

Source: National Center for Health Statistics, National Inpatient Survey, 2007

Table B1 (continued): Hospitalizations for All Musculoskeletal Diseases by 3-Digit ICD-9-CM Diagnosis by Age Category, United States 2007

ICD-9-CM	Description	< 18	18 - 44	45 - 64	64+	Total	
736	Acquired deformities of forearm	3,994	10,856	27,982	35,028	82,099	
737	Curvature of spine	16,445	35,511	33,246	63,693	174,706	
738	Other acquired deformity (of musculoskeletal system), spondylolisthesis	2,005	11,380	31,987	34,321	82,861	
739	Nonallopathic lesions, not elsewhere classified	*	3,698	4,407	4,521	13,678	
741	Spina bifida	8,639	13,461	4,665	*	27,974	
754	Certain congenital musculoskeletal deformities	26,473	3,214	2,101	1,512	33,632	
755	Other congenital anomalies of limbs (Polydactyly)	31,482	4,531	4,923	1,763	42,985	
756	Other congenital musculoskeletal anomalies	7,011	10,482	14,849	14,619	48,560	
805	Fracture of vertebral column without mention of spinal cord injury	5,421	37,886	34,157	62,321	166,276	
806	Fracture of vertebral column with mention of spinal cord injury	*	5,154	2,826	2,418	11,613	
807	Fracture of vertebral column with mention of spinal cord injury	5,066	39,606	46,357	44,970	152,562	
808	Fracture of pelvis (Acetabulum, closed)	4,650	22,716	16,627	31,591	105,335	
809	Ill-defined fractures of bones and trunk	*	*	*	*	357	*
810	Fracture of clavicle (closed)	3,386	11,006	9,046	6,596	32,714	
811	Fracture of scapula (closed)	1,038	7,647	5,345	2,872	17,584	
812	Fracture of humerus (Upper end, closed)	13,687	13,908	21,024	41,379	106,334	
813	Fracture of radius and ulna (Upper end, closed)	12,916	28,419	25,374	29,668	107,455	
814	Fracture of carpal bone(s) (Closed)	*	3,670	2,045	2,065	9,153	
815	Fracture of metacarpal bone(s) (Closed)	1,272	7,818	3,752	2,728	16,550	
816	Fracture of one or more phalanges of hand (Closed)	1,674	9,298	6,141	3,764	22,150	
817	Multiple fractures of hand bones	*	*	*	*	1,563	
818	Ill-defined fractures of upper limb	*	*	*	*	205	*
819	Multiple fractures involving both upper limbs, and upper limb with rib(s) and sternum	*	*	*	*	57	*
820	Fracture of neck of femur (transcervical fracture, closed)	2,556	9,506	34,567	178,256	336,338	
821	Fracture of other and unspecified parts of femur (Shaft or unspecified part, closed)	12,520	18,221	12,095	19,024	70,812	
822	Fracture of patella	*	5,096	5,850	7,887	21,064	
823	Fracture of tibia & fibula, upper end (closed)	8,346	36,242	31,381	17,693	98,310	
824	Fracture of ankle	7,081	40,665	45,779	32,379	132,807	
825	Fracture of one or more tarsal and metatarsal bones	1,988	18,903	13,370	7,148	73,183	
826	Fracture of one or more phalanges of foot	*	3,189	3,252	2,432	10,294	
827	Other, multiple, and ill-defined fractures of lower limb	*	*	*	*	317	*
828	Multiple fractures involving both lower limbs, lower with upper limb, and lower limb(s) with rib(s) and sternum	*	*	*	*	185	*
829	Fracatures of unspecified bones	*	*	*	*	494	*
831	Dislocation of shoulder	*	3,661	3,023	3,488	11,863	
832	Dislocation of elbow	*	1,118	*	*	2,719	
833	Dislocation of wrist	*	1,432	*	*	2,323	
834	Dislocation of finger	*	1,210	*	*	3,182	
835	Dislocation of hip	*	2,340	1,027	*	5,240	
836	Dislocation of knee	*	5,243	4,877	3,296	14,771	
837	Dislocation of ankle	*	1,414	*	*	3,731	
838	Dislocation of foot	*	1,322	*	*	2,888	
839	Other, multiple, and ill-defined dislocations	*	4,356	3,080	1,394	9,875	

* Estimate does not meet standard of reliability or precision.

Source: National Center for Health Statistics, National Inpatient Survey, 2007

Table B1 (continued): Hospitalizations for All Musculoskeletal Diseases by 3-Digit ICD-9-CM Diagnosis by Age Category, United States 2007

ICD-9-CM	Description	< 18	18 - 44	45 - 64	64+	Total	
840	Sprains and strains of shoulder and upper arm	*	3,589	9,908	12,949	29,105	
841	Sprains and strains of elbow and forearm	*	*	*	*	1,962	
842	Sprains and strains of wrist and hand	*	1,609	1,409	1,556	5,387	
843	Sprains and strains of hip and thigh	*	*	1,509	2,927	6,892	
844	Sprains and strains of knee and leg	1,224	7,835	6,290	6,209	23,111	
845	Sprains and strains of ankle and foot	*	8,053	6,995	6,256	24,114	
846	Sprains and strains of sacroiliac region	*	1,081	*	1,208	3,640	
847	Sprains and strains of other and unspecified parts of back	*	4,167	4,154	4,192	14,281	
848	Other and ill-defined sprains and strains	*	1,081	1,983	1,802	6,295	
875	Open wound of chest (wall)	*	5,661	1,539	*	8,426	
876	Open wound of back	*	3,792	*	*	5,712	
877	Open wound of buttock	*	2,508	*	*	4,836	
879	Open wound of other and unspecified sites (except limbs)	1,753	9,960	3,403	1,637	17,421	
880	Open wound of shoulder and upper arm	1,388	7,476	1,836	1,316	12,765	
881	Open wound of elbow, forearm, and wrist	5,303	28,967	10,667	9,331	60,247	
882	Open wound of hand except finger(s) alone	2,028	11,672	6,373	4,724	26,667	
883	Open wound of finger(s)	1,867	12,891	7,224	3,098	26,098	
884	Multiple and unspecified open wound of upper limb	*	2,775	*	1,288	6,597	
885	Traumatic amputation of thumb	*	*	*	*	1,885	
886	Traumatic amputation of other finger(s)	*	2,979	2,149	*	6,287	
887	Traumatic amputation of arm and hand (complete) (partial)	*	*	*	*	727	*
890	Open wound of hip and thigh	1,591	7,817	2,425	1,014	13,141	
891	Open wound of knee, leg [except thigh], and ankle	4,131	17,644	9,650	9,612	45,691	
892	Open wound of foot except toe(s) alone	2,211	4,686	4,100	2,095	13,582	
893	Open wound of toe(s)	*	1,545	1,721	1,595	5,743	
894	Multiple and unspecified open wound of lower limb	*	*	*	*	2,374	
895	Traumatic amputation of toe(s)	*	*	*	*	1,025	
896	Traumatic amputation of foot (complete) (partial)	*	*	*	*	349	*
897	Traumatic amputation of leg(s) (complete) (partial)	*	*	*	*	847	*
922	Contusion of trunk	3,482	15,797	16,661	25,138	71,143	
923	Contusion of upper limb	2,294	9,789	9,505	19,041	50,928	
924	Contusion of lower limb and of other and unspecified sites	4,438	18,313	20,917	44,748	110,946	
926	Crushing injury of trunk	*	*	*	*	1,011	
927	Crushing injury of upper limb	*	2,511	1,497	*	4,603	
928	Crushing injury of lower limb	*	2,022	1,356	*	4,101	
929	Crushing injury of multiple and unspecified sites	*	*	*	*	113	*
954	Injury to other nerve(s) of trunk, excluding shoulder and pelvic girdles	*	*	*	*	289	*
955	Injury to peripheral nerve(s) of shoulder girdle and upper limb	1,055	7,145	3,006	*	12,164	
956	Injury to peripheral nerve(s) of pelvic girdle and lower limb	*	1,902	*	*	3,781	
959	Injury, other and unspecified (to musculoskeletal system)	3,187	13,233	9,597	10,529	41,067	
996	Complications peculiar to certain specified procedures	2,067	17,442	52,479	69,344	153,066	
V43.6	Organ or tissue replaced by other means (joint)		21,342	179,862	472,380	783,154	
V54	Other orthopaedic aftercare	3,543	20,144	41,608	97,796	196,480	
V67	Follow-up examination, following surgery	*	*	*	*	208	*

* Estimate does not meet standard of reliability or precision.

Source: National Center for Health Statistics, National Inpatient Survey, 2007

Table B2: Musculoskeletal Diseases with 50,000 or More Hospital Diagnoses by 3-Digit ICD-9-CM Code, United States 2007

3-Digit ICD-9-CM Code	Description	Hospital Diagnoses
715	Osteoarthrosis and allied disorders	2,202,259
733	Other disorders of bone and cartilage (Osteoporosis; pathologic fracture, cyst, necrosis of bone, malunion and nonunion of fracture)	1,472,083
724	Other and unspecified disorders of back	1,069,018
V43.6	Organ or tissue replaced by other means (joint)	783,154
722	Intervertebral disc disorders	692,653
729	Other disorders of soft tissue	603,277
714	Rheumatoid arthritis and other inflammatory polyarthropathies	409,702
716	Other and unspecified arthroplasties	391,596
721	Spondylosis and allied disorders	382,775
719	Other and unspecified disorders of joint	348,625
820	Fracture of neck of femur (transcervical fracture, closed)	336,338
728	Disorders of muscle, ligament, and fascia	302,123
199	Secondary malignant neoplasm of other specified sites; Bone and bone marrow	279,450
730	Acute osteomyelitis	213,555
V54	Other orthopaedic aftercare	196,480
737	Curvature of spine	174,706
710	Diffuse diseases of connective tissue	166,509
805	Fracture of vertebral column without mention of spinal cord injury	166,276
723	Other disorder of cervical region	157,958
996	Complications peculiar to certain specified procedures	153,066
807	Fracture of vertebral column with mention of spinal cord injury	152,562
824	Fracture of ankle	132,807
726	Peripheral enthesopathies and allied syndromes	116,619
924	Contusion of lower limb and of other and unspecified sites	110,946
813	Fracture of radius and ulna (Upper end, closed)	107,455
812	Fracture of humerus (Upper end, closed)	106,334
808	Fracture of pelvis (Acetabulum, closed)	105,335
823	Fracture of tibia & fibula, upper end (closed)	98,310
274	Gout; Gouty arthroplathy	95,078
727	Synovitis & tenosynovitis	90,235
203	Multiple myeloma and immunoproliferative neoplasms	86,374
738	Other acquired deformity (of musculoskeletal system), spondylolisthesis	82,861
736	Acquired deformities of forearm	82,099
731	Osteitis deformans and osteopathies associated with other disorders classified elsewhere	77,454
725	Polymyalgia rheumatica	76,944
825	Fracture of one or more tarsal and metatarsal bones	73,183
922	Contusion of trunk	71,143
821	Fracture of other and unspecified parts of femur (Shaft or unspecified part, closed)	70,812
135	Sarcoidosis	68,865
718	Other derangement of joint	62,051
881	Open wound of elbow, forearm, and wrist	60,247
711	Arthropathy associated with infections	57,849
923	Contusion of upper limb	50,928

Source: National Center for Health Statistics, National Inpatient Survey, 2007

Table B3: Musculoskeletal System Procedures Performed More than 20,000 Times, United States 2007

ICD-9-CM Code	Description		Procedures
81.54	Total knee replacement		551,259
80.51	Excision of intervertebral disc (diskectomy)		331,282
81.62	Fusion or refusion of 2-3 vertebrae		293,709
81.51	Total hip replacement		252,680
84.51	Insertion of interbody spinal fusion device (coded with spinal fusion or refusion)		180,977
79.35	Open reduction of fracture with internal fixation, Femur		157,162
81.08	Lumbar and lumbosacral fusion, posterior technique		150,446
79.36	Open reduction of fracture with internal fixation, Tibia and fibula		148,758
81.02	Other cervical fusion, anterior technique (arthrodesis of C2 level or below)		135,455
81.52	Partial hip replacement		103,748
84.52	Insertion of recombinant bone morphogenetic protein		103,194
77.79	Excision of bone for graft, Other (pelvic bones, phalanges, vertebrae)		86,611
81.91	Arthrocentesis (joint aspiration)		70,800
79.15	Closed reduction of fracture with internal fixation, Femur		69,000
81.63	Fusion or refusion of 4-8 vertebrae		54,793
84.11	Amputation of toe		53,090
All codes	Revision of knee replacement		52,124
00.80	Revision of knee replacement, total (all components)	18,657	
00.81	Revision of knee replacement, tibial component	11,411	
00.82	Revision of knee replacement, femoral component	7,307	
00.83	Revision of knee replacement, patellar component	3,918	
00.84	Revision of total knee replacement, tibial insert (linear)	6,687	
81.55	Revision of knee replacement, not otherwise specified	4,144	
79.32	Open reduction of fracture with internal fixation, Radius and ulna		51,536
81.66	Percutaneous vertebral augmentation (Arcuplasty, Kyphoplasty, Skyphoplasty, Spineoplasty)		45,878
81.92	Injection of therapeutic substance into joint or ligament		45,614
77.49	Biopsy of bone (other)		42,479
All codes	Revision of hip replacement		39,010
00.70	Revison of hip replacement, both acetabular and femoral components	17,710	
00.71	Revision of hip replacement, acetabular component	6,299	
00.72	Revisionof hip replacement, femoral component	6,543	
00.73	Revision of hip replacement, acetabular liner and/or femoral head only	5,736	
81.53	Revision hip replacement, not otherwise specified	2,722	
78.69	Removal of implanted devices from bone, Other (pelvic bones, phalanges, vertebrae)		37,871
78.55	Internal fixation of bone without fracture reduction, Femur		37,843
79.31	Open reduction of fracture with internal fixation, Humerus		37,609
84.15	Other amputations below knee		32,033
81.06	Lumbar and lumbosacral fusion, anterior technique		31,882
83.45	Other excision of muscle, tendon, and fascia,other myectomy (debridement of muscle NOS)		29,168
79.06	Closed reduction of fracture without internal fixation, Tibia and Fibula (Leg NOS)		28,530
84.17	Amputation above knee		26,353
78.67	Removal of implanted devices from bone, Femur		24,685
78.65	Removal of implanted devices from bone, Tibia and Fibula		24,467
81.80	Total shoulder replacement		23,358
79.66	Debridment of open fracture site, Tibia and Fibula (Leg NOS)		22,555
77.69	Local excision of tissue or bone, Other (pelvic, phalanges of foot or hand, vertebrae)		22,416
81.05	Dorsal and dorsolumbar fusion, posterior technique		22,206
83.63	Rotator cuff repair		21,976
79.02	Closed reduction of fracture without internal fixation, Radius and Ulna (Arm NOS)		20,630
83.09	Other incision of soft tissue		20,346

Source: National Center for Health Statistics, National Inpatient Survey, 2004

Appendix C - Data Sources

The primary sources of data used in this publication were the National Health Care Surveys (NHCS) family of provider-based surveys conducted by the National Center for Health Statistics (NCHS). NCHS surveys are designed to meet the need for objective, reliable information about the organizations and providers that supply health care, the services rendered, and the patients they serve. The National Health Care Surveys are designed to answer key questions of interest to health care policy makers, public health professionals, and researchers. Key questions can include the factors that influence the use of health care resources, the quality of health care, including safety, and disparities in health care services provided to population subgroups in the United States.

Collectively, NCHS surveys have a combination of design features that make them unique. The surveys are nationally representative, provider-based, and cover a broad spectrum of health care settings. Within each setting, data are collected from a sample of organizations that provide care (such as home health care agencies, inpatient hospital units, or physician offices) and from samples of patient (or discharge) encounters within the sampled organizations.

Each of the National Health Care Surveys collects core information which remains stable over time. Consequently, trends in the types of care delivered in each setting can be monitored in an objective and reliable manner, and can be examined in relation to characteristics of providers, patients, and clinical management of patients' care. In addition, the surveys are flexible enough to accommodate special data collection modules and to sample provider organizations as new information is needed. For most databases, the most current year of data available at the time of analysis was for the year 2006 or 2007. Timeliness of data releases and the time required for thorough analysis of multiple databases limits the time span for data presented in the book. In recent years, the release of NCHS databases has shortened.

NHCS surveys used in the *Burden of Musculoskeletal Diseases, Second Edition* in the United States include:

[1] The National Health Interview Survey (NHIS), a nationwide cross-sectional survey of the non-institutional population conducted by household interview, designed to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics. 2008 survey data used; sample size of the person file 73,973; sample size of the adult file 21,781.

[1a] The National Health Interview Survey Injury Database (NHIS-Injury). A subset of variables in the NHIS.

[2] The National Hospital Discharge Survey (NHDS), is a national probability survey designed to meet the need for information on characteristics of inpatients discharged from non-Federal short-stay hospitals in the United States. The NHDS collects data from a sample of approximately 270,000 inpatient records acquired from a national sample of about 500 hospitals. Only hospitals with an average length of stay of fewer than 30 days for all patients, general hospitals, or children's general hospitals are included in the survey. Federal, military, and Department of Veterans Affairs hospitals, as well as hospital units of institutions (such as prison hospitals), and hospitals with fewer than six beds staffed for patient use, are excluded. 2006 survey data used; sample size 376,328.

[3] The National Ambulatory Medical Care Survey (NAMCS), based on a sample of visits to non-federally employed office-based physicians who are primarily engaged in direct patient care (physicians in the

specialties of anesthesiology, pathology, and radiology are excluded from the survey). 2006 survey data used; sample size 39,392.

[4]&[5] The National Hospital Ambulatory Medical Care Survey (NHAMCS) collects data on the utilization and provision of ambulatory care services in hospital emergency (ER) and outpatient departments (OP). Findings are based on a national sample of visits to the emergency departments and outpatient departments of non-institutional general and short-stay hospitals, exclusive of Federal, military, and Veterans Administration hospitals, located in the 50 States and the District of Columbia. 2006 survey data used; sample size 35,849 (ER) and 35,105 (OP).

[6] The National Health and Nutrition Examination Survey (NHANES), the only national survey that collects extensive health information from both face-to-face interviews and medical examinations, providing unique opportunities to study major nutrition, infection, environmental, and chronic health conditions in the U.S. Because of the smaller sample size in the NHANES, data is merged for several years to provide statistically reliable data. In the Burden of Musculoskeletal Diseases, Second Edition, NHANES data for the period 2005-2006 was merged with two prior data releases (2001-2002 and 2003-2004). Sample size for the combined period 2001-2006 was 31,509 for the Medical Conditions and 15,429 for the Osteoporosis sample.

[7] The National Nursing Home Survey (NNHS), one in a continuing series of nationally representative sample surveys of United States nursing homes, their services, their staff, and their residents. This survey had not released new data from the first edition. 2004 survey data used; sample size 13,507.

The following surveys were also used:

[8] The Healthcare Cost and Utilization Project Nationwide Inpatient Sample (HCUP-NIS), conducted by the Agency for Healthcare Research and Quality (AHRQ), a family of health care databases that brings together the data collection efforts of state data organizations, hospital associations, private data organizations, and the Federal government to create a national information resource of patient-level health care data. 2006 survey data used; sample size 8,043,415.

[9] The Medical Expenditures Panel Survey (MEPS) , conducted by the Agency for Healthcare Research and Quality, a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States, and the most complete source of data on the cost and use of health care and health insurance coverage. Data averaged for seven 3-year periods from 1996 to 2004 in included for the majority of economic cost analysis. Updated estimates are provided for the period 1996 to 2006. Data analyzed by MGC Data Services.

[10] The Survey of Occupational Injuries and Illnesses, conducted by the Bureau of Labor Statistics, U.S. Department of Labor, that provides data on illnesses and injuries on the job and data on worker fatalities. Published data summaries for 2007 used.

[11] The National Birth Defects Prevention Network (NBDPN), from which estimates of prevalence for selected defects are drawn based on state birth defects surveillance programs.

[12] The Centers for Disease Control and Prevention (CDC) Metropolitan Atlanta Congenital Defects Program (MACDP), which collects data on birth defects.

[13] The CDC Metropolitan Atlanta Developmental Disabilities Surveillance Program (MADDSP), which monitors the occurrence of selected developmental disabilities in school-age children.

[14] The Surveillance, Epidemiology, and End Results (SEER) Program of the National Cancer Institute, DCCPS, Surveillance Research Program, Cancer Statistics Branch, an authoritative source of information on cancer incidence and survival in the United States, including cancer incidence and survival data from population-based cancer registries covering approximately 26% of the U.S. population. Published summary data from 2006 data submission.

[15] National Cancer Data Base (NCDB), maintained by the American College of Surgeons Commission on Cancer.

The small size of some databases precludes analysis at a detailed level. In general, ICD-9-CM codes were combined into major musculoskeletal disease classifications to provide sufficient sample size for reliable estimates.

Extensive use was also made of published studies in scientific and epidemiologic journals as secondary sources of data.

It is important to recognize that any one source of data provides an incomplete view of the frequency and impact of a disease or condition. Interview surveys, for instance, generally underestimate the frequency of most musculoskeletal diseases. However, information obtained through the use of interviews is essential to assess an individual's symptoms or how that individual indicates he or she has been affected by a disease. In addition, for some conditions, this may be the only possible means of collection of data.

In contrast, the use of objective methods such as physical examination, laboratory measurements, and radiographs for the detection and diagnosis of disease and injury is not dependent on the subjective reporting of symptoms. However, the objective evidence used to establish the presence or absence of a condition does not always correlate with reported symptoms. It is clear that numerous individuals who report symptoms do not have evidence of disease upon examination and, conversely, some individuals who have objective evidence of disease do not experience symptoms. Thus, although objective measures are valuable tools, they may yield an incomplete picture of the impact of a given disease. This type of study is also more expensive, involves a smaller number of individuals, and may under-represent less frequently occurring disorders.

Data obtained from medical records are also subject to certain limitations. Many persons affected with certain musculoskeletal diseases do not seek medical care. Although records of visits to physicians and hospitals provide estimates of the volume of visits, these records do not include those who do not seek medical care. Therefore, data based on existing records, will yield only a partial representation of how various musculoskeletal diseases affect the population.

Medical records do not necessarily indicate the underlying musculoskeletal condition. For instance, fractures at various sites, especially hip fractures, are a major consequence of osteoporosis. When admitted to the hospital, a fracture diagnosis is usually listed rather than osteoporosis. Medical records may also be subject to "upcoding" to maximize reimbursement and may overstate the frequency of more severe conditions.

By analyzing and including data from a wide range of sources, each with its own strength and weaknesses, it is hoped that the results presented have been integrated into a comprehensive and reasonable understanding of the impact of musculoskeletal diseases on the United States population.

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