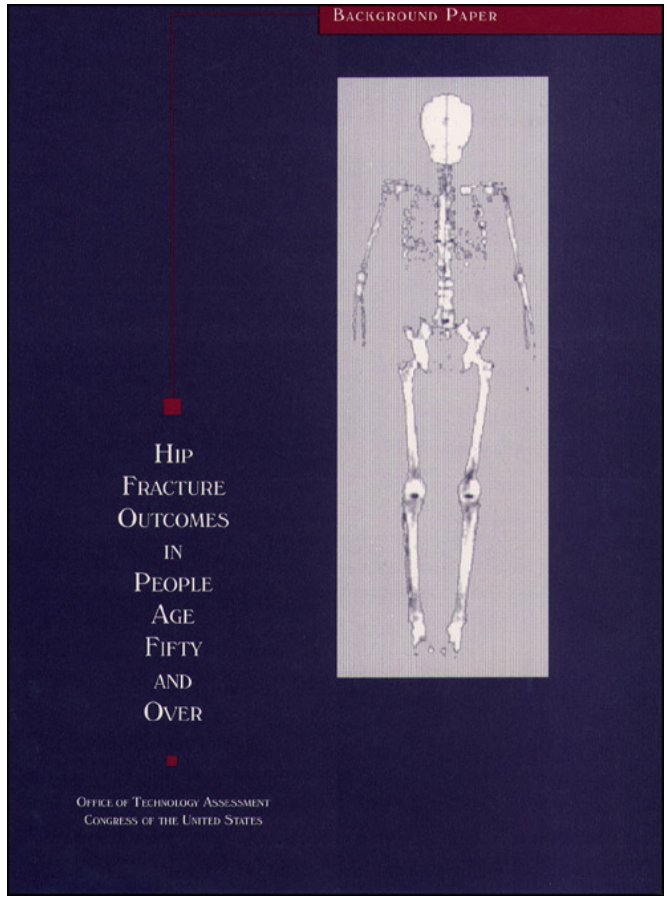
Hip Fracture Outcomes in People Age 50 and Over

September 1994

OTA-BP-H-120
NTIS order #PB94-107653



Recommended Citation: U.S. Congress, Office of Technology Assessment, *Hip Fracture Outcomes in People Age 50 and Over-Background Paper*, OTA-BP-H- 120 (Washington, DC: U.S. Government Printing Office, July 1994).

Foreword

Annually, more than 300,000 people in the United States fracture a hip. The great majority are age 50 and over, and half are age 80 and over. Hip fractures have severe consequences for many older people, and expenditures for their care are significant. This Office of Technology Assessment (OTA) background paper provides information about mortality, in-hospital and post-hospital service use, and long-term functional impairment following a hip fracture. OTA estimates that in 1990 the average per patient expenditure for in-hospital and post-hospital services for hip fracture patients was $20,000 and total public and private expenditures for all hip fracture patients were $5 billion. Expenditures for nursing home and other long-term care services account for almost half of this amount.

This background paper is one of four documents resulting from OTA's study of policy issues in the prevention and treatment of osteoporosis. Another background paper, *Public Information About Osteoporosis: What's Available, What's Needed?,* is also being issued in July 1994. Two other documents, one on the costs and effectiveness of screening for osteoporosis and the other on research and training issues in osteoporosis, will be issued later this year.

Several federal agencies are currently funding research on hip fracture treatments and outcomes. These studies are attempting to identify the most effective treatments. Once such treatments are identified and implemented, outcomes may improve. Because many hip fracture patients are very old and frail, however, the potential for significant improvements in hip fracture outcomes is limited, thus highlighting the importance of steps that maybe taken throughout life to reduce the incidence of hip fractures, including steps to increase bone mass and bone strength in young people, maintain bone mass and bone strength in middle-aged and older people, diminish the environmental and patient factors that lead to falls in older people, and protect older failers from fracture.



ROGER C. HERDMAN
Director

Advisory Panel

Robert P. Heaney, Chairperson
John A. Creighton Professor
Creighton University
Omaha, NE

Steven R. Cummings
Research Director
Division of General Internal Medicine
College of Medicine
University of California
San Francisco, CA

Barbara L. Drinkwater
Research Physiologist
Department of Medicine
Pacific Medical Center
Seattle, WA

Deborah T. Gold
Assistant Professor of Medical Sociology
Center for the Study of Aging and Human Development
Duke University Medical Center
Durham, NC

Susan L. Greenspan
Director
Osteoporosis and Metabolic Bone Disease Clinic
Beth Israel Hospital
Boston, MA

Caren Marie Gundberg
Assistant Professor
Department of Orthopedics
Yale University School of Medicine
New Haven, CT

Sylvia Hougland
Associate Director
Laboratory for Clinical Computing
VA Medical Center
Dallas, TX

C. Conrad Johnston, Jr.
Director
Division of Endocrinology and Metabolism
Indiana University School of Medicine
Indianapolis, IN

Shiriki K. Kumanyika
Associate Director for Epidemiology
College of Medicine
Pennsylvania State University
Hershey, PA

Edward O. Lanphier
Executive Vice President for Commercial Development
Somatix Therapy Corporation
Alameda, CA

Donald R. Lee
Vice President
Procter and Gamble Pharmaceuticals
Norwich, NY

Robert Lindsay
Chief, Internal Medicine
Helen Hayes Hospital
West Haverstraw, NY

Betsy Love
Program Manager
Center for Metabolic Bone Disorders
Providence Medical Center
Portland, OR

Robert Marcus
Director
Aging Study Unit
VA Medical Center
Palo Alto, CA

Lee Joseph Melton, Iii
Head, Section of Clinical Epidemiology
Department of Health Sciences Research
Mayo Clinic
Rochester, MN

Gregory D. Miller
Vice President
National Research/Technical Services
National Dairy Council
Rosemont, IL

Morris Notelovitz
President and Medical Director
Women's Medical and Diagnostic Center and the Climacteric Clinic, Inc.
Gainesville, FL

William Arno Peck
Dean
Washington University School of Medicine
St. Louis, MO

Diana Petitti
Director
Research and Evaluation
Southern California Kaiser Permanence Medical Care Program
Pasadena, CA

Neil M. Resnick
Chief, Geriatrics
Brigham and Women's Hospital
Boston, MA

Gideon A. Rodan
Executive Director
Department of Bone Biology
Merck, Sharp and Dohme Research
West Point, PA

Mehrsheed Sinaki
Professor, Physical Medicine and Rehabilitation
Mayo Medical School
Rochester, MN

Milton C. Weinstein
Henry J. Kaiser Professor
Health Policy and Management
Harvard School of Public Health
Boston, MA

Note: **OTA appreciates the valuable assistance provided by the advisory panel members. The panel does not, however, necessarily approve. disapprove. or endorse this background paper. OTA assumes full responsibility y for the background paper and the accuracy of its contents.**

Project Staff

Clyde Behney
Assistant Director
Health, Education and Environment Division

Nancy Carson
Program Director
Education and Human Resources

Sean Tunis
Program Director
Health

PRINCIPAL STAFF

Katie Maslow
Project Director

Kerry Kemp
Managing Editor

ADMINISTRATIVE STAFF

Cecile Parker
Office Administrator
Education and Human Resources

Beckie Erickson
Office Administrator
Health

Linda Rayford
PC Specialist

Tamara Kowalski
Secretary

Carolyn Martin
Secretary/Word Processor

Contents

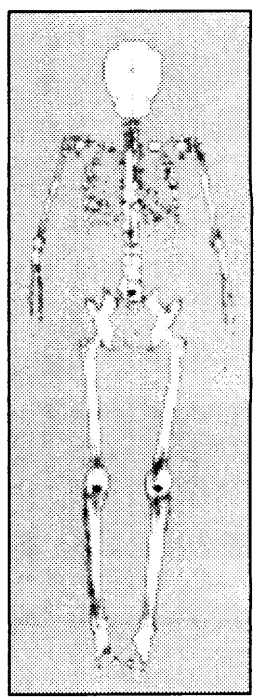
Introduction 1
Principal Findings 2
- In-Hospital Treatment 2
  Expenditures for In-Hospital Services 3
- In-Hospital and Long-Term Mortality 3
- Functional Impairment Following a Hip Fracture 4
- Use and Expenditures for Post-Hospital and Other Outpatient Services 4
  Comparison of OTA's Estimate with Other Estimates of the Cost of Hip Fractures 5

Sources of Data on Hip Fracture Outcomes 6
In-Hospital Treatment and Expenditures 9
- Use and Expenditures for Hospital Care 11
- Use and Expenditures for In-Hospital Physician Services 14
  Use and Expenditures for In-Hospital Anesthesia Services 19
- Use and Expenditures for In-Hospital Radiologic Services 20
- Use and Expenditures for In-Hospital Physical Therapy 22
- OTA's Estimate of Total Per Patient Expenditures for In-Hospital Services 23

In-Hospital Mortality 24
- Factors That Affect In-Hospital Mortality 25
- OTA's Estimate of Average In-Hospital Mortality 27

Long-Term Mortality 27
- Factors That Affect Long-Term Mortality 28
- OTA's Estimate of Average Long-Term Mortality 32

Post-Hospital and Other Outpatient Service Use and Expenditures 33
- Use and Expenditures for Nursing Home Care 34
  Use and Expenditures for Care in a Rehabilitation Facility or Another Short-Stay Hospital 41
  Use and Expenditures for Home Care Services 43
  Use and Expenditures for Physician Visits 45
- Use and Expenditures for Outpatient Physical Therapy 47



- Use and Expenditures for Emergency Room and Ambulance Services 47
- Use and Indirect Costs of Informal Care 49
- OTA's Estimate of Total Per Patient Expenditures for Post-Hospital and Other Outpatient Services 50

Long-Term Functional Impairment Following a Hip Fracture 50
Comparison of OTA's Estimates with Other Estimates of Hip Fracture Outcomes 52
Conclusion 56

APPENDICES

A Acknowledgments 57

B Mortality Following a Hip Fracture 59

References 83

Index 91

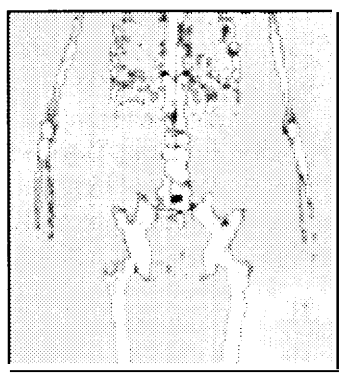
Hip Fracture Outcomes in People Age 50 and Over

INTRODUCTION

In 1991, there were 300,000 hip fractures in the United States. The great majority of these fractures (94 percent) occurred in people age 50 and over, and most occurred in very old people: 55 percent occurred in people age 80 and over, and 33 percent occurred in people age 85 and over (127,1 38). As the U.S. population ages and the number of very old people increases, the number of hip fractures will also increase.

Virtually all people with a hip fracture are hospitalized for treatment of the fracture, and a small proportion dies in the hospital. Most of those who are discharged from the hospital require further treatment. Many are transferred to a nursing home; some are transferred to a rehabilitation facility or another short-stay hospital; others are cared for at home by family members, formal (paid) service providers, or both. For some time after the fracture, average mortality and levels of functional impairment are higher for people with a hip fracture than for people of the same age who have not had a hip fracture.

Hip fracture is the most serious and costly potential result of osteoporosis. As part of a congressionally requested study of policy issues in the prevention and treatment of osteoporosis, the Office of Technology Assessment (OTA) analyzed the available information on the outcomes of hip fracture.[1] This background paper presents OTA's findings from that analysis.



[1] OTA's study of policy issues in the prevention and treatment of osteoporosis was requested by the Senate Special Committee on Aging; Senator Charles E. Grassley; Senator John Glenn, the House Select Committee on Aging; Representative Olympia J. Snowe; Representative Benjamin A. Gilman; and former Representatives Brian J. Donnelly, Thomas J. Downey, and Patricia F. Saiki.

Not all hip fractures in people age 50 and over are attributable to osteoporosis. Thus the outcomes discussed in this background paper are not entirely attributable to osteoporosis. On the other hand, osteoporosis results in many types of fractures in addition to hip fractures, and the outcomes of these other fractures add to its overall societal impact. Consequently, the outcomes of hip fracture discussed in this document are not synonymous with the societal impact of osteoporosis.

Many of the outcomes discussed in this document represent gross mortality, service use, and functional impairment for people with a hip fracture. As noted above, most people with a hip fracture are very old. Mortality, service use, and functional impairment are relatively high for very old people in general. Thus the gross estimates presented here must be considered against the background of this high mortality, service use, and functional impairment.

The first section of the background paper summarizes OTA's principal findings about the outcomes of hip fracture. Later sections discuss sources of data and detailed findings on in-hospital treatment, in-hospital and long-term mortality, post-hospital and outpatient service use, and long-term functional impairment following a hip fracture. OTA's estimates of 1990 expenditures for in-hospital, post-hospital, and outpatient services for people with a hip fracture are presented and compared with other widely cited estimates of the cost of hip fractures.

This background paper does not discuss the incidence or causes of hip fracture, nor does it analyze the effectiveness of various in-hospital treatments or post-hospital services for people with a hip fracture. Two ongoing studies funded by the Agency for Health Care Policy and Research-one at the University of Maryland School of Medicine and the other at Dartmouth Medical School—are evaluating the effectiveness of various in-hospital treatments for hip fracture. A recently published study conducted at the University of Minnesota and funded by the Health Care Financing Administration evaluates outcomes and costs associated with the use of various post-hospital services by people with a hip fracture (139). These studies provide or will soon provide information that may lead to better outcomes and more cost-effective care.

An earlier version of this background paper was reviewed by numerous outside experts on osteoporosis and hip fracture, including several individuals who are currently conducting research on hip fracture outcomes (see appendix A). OTA is grateful for their contributions to this project.

PRINCIPAL FINDINGS

Although the negative outcomes of hip fractures, including expenditures for the care of hip fracture patients, are often overstated, hip fractures have severe consequences for many older people, and public and private expenditures for the care of people with a hip fracture are significant. This section summarizes OTA's principal findings with respect to in-hospital treatment, expenditures for in-hospital services, in-hospital and long-term mortality, use of and expenditures for post-hospital and other outpatient services, and long-term functional impairment following a hip fracture.

In-Hospital Treatment

- The great majority of people with a hip fracture receive surgical treatment-either surgical pinning to stabilize the hip joint or a partial or total hip replacement.
- Total hip replacement is the newest and most costly surgical treatment for hip fracture. The proportion of hip fracture patients that receives a total hip replacement differs in different hospitals and different parts of the country but appears to be increasing.
- Nonsurgical treatment for hip fracture is rarely discussed in the current medical literature, but available data indicate that about 10 percent of hip fracture patients age 65 and over receive nonsurgical treatment. Nonsurgical treatment generally has worse outcomes than surgical treatment, but this difference is probably due to patient characteristics that lead to the use of nonsurgical treatment for a particular person, for example, characteristics that make the person a poor surgical risk.

- Average hospital length of stay for hip fracture patients, which was more than 20 days before 1980, has decreased by at least one-third. This major reduction in average length of stay has resulted in increased use of post-hospital services but no increase in in-hospital or post-hospital mortality.

Expenditures for In-Hospital Services

- OTA estimates that in 1990, the average per patient expenditure for in-hospital services was $9,322 for hip fracture patients age 65 and over and $11,337 for hip fracture patients age 50 to 64. The in-hospital services included in this estimate are hospital room and board and nursing care, in-hospital physician services, anesthesia, in-hospital radiologic services, and in-hospital physical therapy. Since 8 percent of hip fracture patients age 50 and over were age 50 to 64 and 92 percent were age 65 and over, OTA estimates that the combined average per patient expenditure for in-hospital services for all hip fracture patients age 50 and over was $9,483 in 1990.
- Medicare pays for in-hospital services for more than 90 percent of hip fracture patients age 65 and over. OTA's estimate of the average per patient expenditure for in-hospital services for hip fracture patients age 65 and over is based primarily on the Medicare payment plus the required patient copayment for the services. In contrast, most hip fracture patients age 50 to 64 are not covered by Medicare, and far less information is available about expenditures for their care. As a result, OTA's estimate of the average per patient expenditure for patients age 50 to 64 is based primarily on provider charges.
- In 1990, provider charges were 57 to 80 percent higher than the Medicare payment plus the patient copayment for in-hospital services. The unexpected finding noted above—that 1990 per patient expenditures for in-hospital services were higher for hip fracture patients age 50 to 64 than for those age 65 and over—results in part from the lack of expenditure data for patients in the younger age group and thus OTA's greater use of charge data for these patients. The higher average per patient expenditure for patients age 50 to 64 probably also reflects the effectiveness of Medicare's cost-containment procedures that have held down the cost of in-hospital services for Medicare-covered hip fracture patients.

In-Hospital and Long-Term Mortality

- An average of 4 percent of hip fracture patients age 50 and over die in the hospital. In-hospital mortality increases with age and is two to three times higher for male than female hip fracture patients. Average in-hospital mortality for female hip fracture patients is very low (2 percent or less) until after age 80. *These figures represent all-cause mortality for hip fracture patients, not just mortality attributable to the fracture.*
- An average of 24 percent of hip fracture patients age 50 and over die in the year following their fracture. Mortality increases with age and is much higher for male than female hip fracture patients in each age group. *This figure represents all-cause mortality, not just mortality attributable to the fracture.*

  Average mortality by one year post-fracture is considerably higher for hip fracture patients than for people of the same age and gender who have not had a hip fracture. In 1988, for example, average mortality by one year post-fracture was 26 percent higher for male hip fracture patients age 75 to 84 than for males of the same age who did not have a hip fracture. For females age 75 to 84, average mortality by one year post-fracture was 12 percent higher for those who had a hip fracture than for those who did not.
- Many patient characteristics in addition to age and gender are associated with long-term mortality following a hip fracture. These factors include race, general physical condition, coexisting illnesses, and residence in a nursing home or in the community at the time of the fracture. The type and timing of in-hospital

treatment may also affect in-hospital and long-term mortality.

- The higher mortality of hip fracture patients in comparison with people who have not had a hip fracture persists for one year or less following the fracture and then returns to normal for females. For males, elevated mortality may persist to the middle of the second year post-fracture.

I Functional Impairment Following a Hip Fracture

- Many hip fracture patients experience severe functional impairment following their fracture, and most never recover their pre-fracture level of functioning. Older age, poorer pre-fracture physical and mental condition, operative and post-operative complications, and many other factors predict greater functional impairment following a hip fracture.
- In two longitudinal studies, hip fracture was more likely than other serious medical conditions, including heart attack, stroke, and cancer, to lead to functional impairment.

Use and Expenditures for Post-Hospital and Other Outpatient Services

- OTA estimates that in 1990 the average per patient expenditure for post-hospital and other outpatient services was $9,852 for people age 50 and over with a hip fracture. The post-hospital and outpatient services included in this estimate are nursing home and inpatient rehabilitation services, home health care, nonmedical home care, physician visits, outpatient physical therapy, emergency room, and ambulance services.

The extent and type of post-hospital service use by hip fracture patients varies depending on patient characteristics, such as age, gender, general physical condition, and coexisting illnesses. Post-hospital service use also varies depending on the availability y of different types of services, the availability of reimbursement for services, and prevailing referral practices in different communities.

- In 1990, an average of 41 percent of hip fracture patients age 50 and over were discharged from the hospital to a nursing home. By one year post-discharge, two-thirds of the patients had gone home or died, and one-third were still in the nursing home. The hip fracture patients who were still in the nursing home one year post-discharge constituted 14 percent of all hip fracture patients age 50 and over in that year.

Nursing home residents with a primary diagnosis of hip fracture constitute a very small proportion of all nursing home residents. In 1985, nursing home residents with a primary diagnosis of hip fracture constituted only 1.8 percent of all nursing home residents. Nursing home residents with a primary diagnosis of hip fracture also have a shorter average length of stay than other nursing home residents.

In 1990, an average of 12 percent of hip fracture patients age 50 and over were discharged from the hospital to a rehabilitation facility or another short-stay hospital. The average length of stay in these facilities was short (about nine days), and virtually all the patients had gone home or to a nursing home by six weeks post-discharge.

- In 1990, one-third of hip fracture patients received paid home health services. The use of these services was concentrated in a short period following a patient's discharge from the hospital. Many hip fracture patients also received nonmedical home care services, for example, homemaker services, meals on wheels, and assistance with chores, but a large proportion of these individuals had also been receiving nonmedical home care services before their fracture.

Many hip fracture patients receive informal (nonpaid) assistance from family and friends, but most of these patients also received informal assistance before their hip fracture. Thus, it is difficult to document significant changes in

the amount of informal assistance received by these patients before and after their fracture.

Comparison of OTA's Estimate with Other Estimates of the Cost of Hip Fractures

OTA's estimates of expenditures for in-hospital and post-hospital care of people with a hip fracture are considerable y lower than other frequently cited estimates of the cost of hip fractures. Combining the figures for in-hospital and post-hospital services noted above, OTA estimates that the total average per patient expenditure for hip fracture patients age 50 and over was $19,335 for 1990. In 1990, there were about 281,000 people with a hip fracture in the United States; thus OTA's per patient estimate translates to a total societal expenditure of $5.4 billion, assuming that the per patient expenditure for people under age 50 with a hip fracture is equal to the expenditure for people over age 50. This assumption is probably false, since hip fracture patients under age 50 are far less likely than older hip fracture patients to use nursing home and other post-hospital long-term care services. Thus the $5.4 billion figure represents an upper limit estimate for 1990.

The most frequently cited estimate of the cost of hip fractures comes from a 1984 report prepared for the American Academy of Orthopedic Surgeons that analyzes the impact of various musculoskeletal conditions for people of all ages (40). The 1984 report concludes that the annual cost of hip fractures was $7.3 billion, or approximately $29,400 per patient, in 1984. A 1992 update of the 1984 report, also prepared for the American Academy of Orthopedic Surgeons, concludes that the annual cost of hip fractures was $8.7 billion, or approximately $34,400 per patient in 1988 (100). A third report, prepared for the National Institutes of Health, concludes that the per patient cost of hip fractures in 1988 ranged from $41,723 for females age 50 to 54 to $37,968 for females age 85 and over (14).

All three of these estimates are higher than OTA's estimate even though they are for earlier years and therefore would be expected to be lower than OTA's estimate. One reason for the differences between OTA's estimate and these other estimates is that some of the other estimates use old data on hospital length of stay, resulting in an overestimation of expenditures for hospital care. A second reason for the differences is that some of the other estimates include items that OTA did not include, for example, lost productivity of wage earners and homemakers. A third reason is that OTA's estimate is based primarily on expenditures, whereas the other estimates are based primarily on charges. These and other reasons for the differences among OTA's estimate and the estimates from the other sources are discussed at greater length at the end of this document.

Probably the most controversial aspect of OTA's estimate of expenditures for hip fractures from the perspective of some outside reviewers is OTA's use of Medicare allowed charges (the Medicare payment plus the required patient copayment) to estimate average expenditures for in-hospital services. Several of the reviewers pointed out that Medicare allowed charges are currently lower than hospital costs for many hospital services and that the nonreimbursed costs of care for Medicare-covered patients are shifted to other patients, thus raising the charges for the other patients' care. As discussed later in this document, the Prospective Payment Assessment Commission (PROPAC) has estimated that in 1990, Medicare payments were 1.5 percent lower than hospital costs for all hospital stays reimbursed under Medicare's prospective payment system (PPS) and that this gap had increased to almost 10 percent by 1993 (101).

The gap between Medicare allowed charges and hospital costs raises a difficult conceptual question with respect to the true expenditures for in-hospital services for people with a hip fracture, and OTA considered various options to address this question. As noted in table 7 later in this document, OTA developed an alternate figure for the average expenditure for in-hospital services to reflect the 1.5 percent gap between Medicare allowed charges and hospital costs. In the case of hip fracture, however, where such a large proportion

of patients age 65 and over (94 percent) receive hospital care paid for by Medicare, the average Medicare allowed charge would seem to be the most accurate estimate of expenditures for these patients. If the nonreimbursed cost of hospital care for Medicare-covered hip fracture patients is shifted to hip fracture patients age 50 and over whose care is paid for by a source other than Medicare, that shifted cost is presumably included in the higher, charge-based figures OTA used for those patients. If the nonreimbursed cost of hospital care for Medicare-covered hip fracture patients is shifted to younger or older patients hospitalized for the treatment of other diseases and conditions, it is hard to imagine how that cost could be ascertained.

Another controversial aspect of OTA's estimate of expenditures for hip fracture from the perspective of some outside reviewers is OTA's decision to attribute only one year of nursing home care to hip fracture. Several reviewers pointed out that some hip fracture patients remain in a nursing home for longer than one year because of complications that develop in connection with their fracture or the treatment they receive for the fracture or because they lose their home during their nursing home stay and have no place to return to in the community. OTA's reasons for limiting to one year the amount of nursing home care attributed to hip fracture are discussed at length later in this document. Clearly, the more nursing home care that is attributed to hip fracture, the greater the total estimated per patient expenditure for hip fracture patients.

In this context, it is interesting to note that the total per patient expenditure for hip fracture patients age 65 and over includes almost equal amounts for in-hospital and post-hospital services. This distribution of expenditures results in part from the reduction in average hospital length of stay for hip fracture patients, which leads to lower expenditures for in-hospital services and high use and expenditures for post-hospital services. The high use and expenditures for post-hospital services, including nursing home care, also reflect the impact of an acute trauma in very old people, many of whom lack the physiological reserve that would allow them to recover as quickly or completely as younger people, or in some cases, to recover at all.

Three types of approaches could be used to reduce the negative outcomes of hip fractures:

- approaches to prevent the fractures,
- approaches to improve in-hospital treatment for hip fracture patients, and
- approaches to improve post-hospital services for these patients.

Several federal agencies are currently funding research to support each of these approaches, including the projects mentioned earlier that have evaluated or are evaluating various in-hospital treatments and post-hospital services for hip fracture patients.

SOURCES OF DATA ON HIP FRACTURE OUTCOMES

The National Hospital Discharge Survey, an annual survey of discharges from a representative sample of nonfederal, short-stay hospitals in the United States, provides information about in-hospital mortality and discharge destination according to patient diagnosis. To OTA's knowledge, the survey is the only source of national data of this kind for all hip fracture patients. The potential problems in using the data are: 1) missing or incomplete data for about 10 percent of the sample cases, 2) the possibility of miscoded data, 3) the uncertainty associated with extrapolating from categories with small numbers of sample cases, for example, the category of individuals age 100 and over, and 4) lack of information about the small proportion of people with a hip fracture that is not hospitalized or is hospitalized in facilities

not included in the National Hospital Discharge Survey.[2]

A 1990 Health Care Financing Administration *Special Report* provides national data for 1986 on one year post-fracture mortality and hospital readmission for some types of hip fracture patients (121 ,122). The data, derived from Medicare records, pertain to individuals age 65 and over with a hip fracture for whom Medicare payment was provided for one of two types of surgical treatment:

- reduction with or without internal fixation of the joint (i.e., repositioning of the bones to restore the correct alignment with or without subsequent stabilization of the joint with surgical pins, nails, plates, and/or screws) (ICD-9-CM procedure codes 79.05, 79.15, 79.25, 79.35)[3]; or
- partial replacement of the hip joint (i.e., replacement of one part of the joint—usually the head of the femur—with an artificial prosthesis) (ICD-9-CM procedure code 81 .6).

The primary problem in using these data is the substantial number and proportion of individuals with a hip fracture that are not included. In the age group 65 and over, the categories of individuals not included in the data are Medicare beneficiaries with a hip fracture who were not treated surgically for the fracture; Medicare beneficiaries with a hip fracture who received a total hip replacement (lCD-9-CM procedure code 81.5); individuals with a hip fracture who were not enrolled in Medicare, whose Medicare claim had not been processed at the time the data were assembled, or whose hip fracture treatment was paid for by a source other than Medicare; and individuals who were not hospitalized for their hip fracture. OTA estimates that these categories include more than 30,000 individuals—about 14 percent of all people age 65 and over with a hip fracture in 1986.[4] The study population for the HCFA *Special Report* also does not include individuals under age 65 with a hip fracture.

The 1987 National Medical Expenditure Survey provides information about the use of and expenditures for inpatient and outpatient hospital care, physician services, and home health care for a nationally representative sample of the civilian, noninstitutionalized population by patient diagnosis. The institutional component of the survey provides information about a nationally representative sample of nursing home residents, including information about the number of residents discharged to a hospital in 1987 by their diagnosis. The primary problem in using these data is the relatively small number of hip fractures that occurred in the survey samples. The survey was designed to provide statistically valid estimates of the frequency of conditions and events that occurred at least 100 times in the survey samples. Hip fractures and the use of most types of services by hip fracture patients were "rare events" in this context, and the validity of population estimates derived from the survey data is questionable for this reason (104).

In addition to these sources of national data, information about hip fracture outcomes is available from numerous studies of patients treated in individual hospitals or hospitals in certain geographic areas. The findings from these studies are less likely than national data to be representative of the whole population. On the other hand, many of the

---

[2] Department ~) f Veterans Affairs (VA) hospitals are not included in the National Hospital Discharge Survey, and some hip fracture Patients are treated in VA hospitals. Males are much more likely than females to be treated *in* VA hospitals. A study in six New England states found that 4 percent of males with a hip fracture and 1 percent of females with a hip fracture were treated in VA hospitals (27). Some individuals who are treated in VA hospitals are admitted initially to a non-VA hospital, however, and may be represented in the National Hospital Discharge Survey data for this reason.

[3] ICD-9-CM procedure codes are codes for surgical and nonsurgical medical procedures from the *International Classification of Diseases, 9rh Revision, Clinical Modification*, Vol. 3, published in 1980.

[4] The HCFA Special Report provides data on 187,739 Medicare beneficiaries age 65 and over who had a hip fracture in 1986. in contrast, the National Hospital Discharge Survey cites *218,000* persons age 65 and over with a hip fracture in 1986(135)--a difference of 30,261.

studies provide more detailed information or information about outcomes not addressed in the national studies. OTA used findings from studies of hip fracture patients treated in individual hospitals or in certain geographic areas to refine, verify, and expand on data from the national studies.

Lastly, some information about hip fracture outcomes is available from studies of people in particular diagnostic related groups (DRGs).[5] Individuals with a hip fracture generally are included in one of the following five DRGs:

DRG 209: major joint and limb reattachment procedures,

- DRG 2 10: hip and femur procedures except major joint, age greater than 69 or complications or comorbidities,
- DRG 2 11: hip and femur procedures except major joint, age 18 to 69 without complications or comorbidities,

DRG471: bilateral or multiple major joint procedures of the lower extremities, and

- DRG 236: fractures of the hip and pelvis.

Several studies have collected detailed information about post-hospital mortality, service use, and functional impairment for people in one or more of these DRGs. The problem in using this information is that the five DRGs that include most hip fracture patients also include people who have not had a hip fracture. DRG 209, for example, includes people who have a hip replacement following a hip fracture as well as people who have a hip replacement because of arthritis or accidental injury and people who have other major joints (e.g., knees) replaced. Because the DRGs include people who have not had a hip fracture, data from studies of people in a particular DRG may be difficult to interpret with respect to hip fracture. As with the findings of studies of hip fracture patients treated in individual hospitals and hospitals in certain geographic areas, OTA used findings from studies of people in particular DRGs to verify, refine, and expand on findings of national surveys.

The University of Minnesota's Post Acute Care Study solved the problem noted above by using diagnostic information to identify hip fracture patients within DRGs (139). The study was conducted in 1988 and 1989 and involved 606 hip fracture patients age 65 and over who were discharged alive from 52 hospitals in three metropolitan areas (Pittsburgh, Minneapolis/St. Paul, and Houston). Information was collected about hospital discharge location and patient outcomes at six weeks, six months, and one year post-discharge. OTA used the study findings extensively to estimate the proportion of hip fracture patients that uses various post-hospital services.

In analyzing the outcomes of hip fracture, OTA attempted to identify the types of services that might be used to treat hip fractures and then gathered information from any available source about actual use of and expenditures for these services. An alternate methodology, sometimes referred to as an *incidence-based cost of illness analysis,* would have involved selecting a time period around the hip fracture and gathering information about the use of and expenditures for any services provided in that time period. This methodology is being used by at least one group of researchers to calculate expenditures for hip fractures (25). The relative advantages of the two approaches are debatable. In the case of hip fractures, most of which occur in very old people, OTA is concerned that the incidence-based cost of illness methodology may result in the attribution of considerable expenditures to hip fracture which are more correctly attributable to a variety of other chronic and acute diseases and conditions that are common in very old people.

Some of the data used in this analysis are unpublished. Most of the unpublished data consist of figures from government surveys and databases

[5] DRGs are mutually exclusive categories used by Medicare and some private insurers to determine the amount of payment for particular types of hospital stays. DRGs are based on patient diagnosis, the surgical or medical procedures performed in a hospital stay, patient age, and the presence or absence of complications or comorbidities that are likely to affect the use of hospital resources.

that generally are not published but are available to researchers on request. Other unpublished data used in the analysis were produced especially for OTA from government surveys and other studies. Appendix A lists the names and affiliations of the individuals who provided the data. The sources and characteristics of all data used in this analysis are identified when the data are presented. In contrast to the suggestion of some reviewers that the use of unpublished data compromises the validity of the analysis (69), OTA believes that the use of these data, along with the available published data, enhances the validity of the analysis and its conclusions. One of OTA's objectives in publishing this document is to make these data available to other researchers.

Several ongoing research projects will eventually provide more complete information than is now available about hip fracture outcomes. As noted earlier, the Agency for Health Care Policy and Research (AHCPR) has funded two studies on the effectiveness of in-hospital treatments for people with a hip fracture. One of these studies, an AHCPR-funded Patient Outcomes Research Team (PORT) project, which is being conducted by researchers at the University of Maryland School of Medicine, includes an extensive literature review and collection of data on outcomes for hip fracture patients treated in Maryland hospitals. A second AHCPR-funded study, which is being conducted by researchers at the Dartmouth Medical School, is also collecting data on patient outcomes following various in-hospital treatments for hip fracture. Merck Research Laboratories are also conducting a study of hip fracture outcomes.

At the National Institutes of Health, the Center for Medical Rehabilitation Research in the National Institute of Child Health and Human Development is funding a study of patient outcomes up to two years post-fracture. The National Institute on Aging is funding a study of changes in muscle strength and other factors following a hip fracture that may account for the long-term functional impairments that often result from these fractures (78). Lastly, the National Institute of Arthritis and Musculoskeletal and Skin Diseases has formed a National Osteoporosis Data Group to promote the development of accurate information about osteoporosis, including information about the outcomes of osteoporosis-related hip fractures (120). Some preliminary information from several of these projects is noted in the following sections.

IN-HOSPITAL TREATMENT AND EXPENDITURES

In-hospital treatment for people with a hip fracture includes hospital care (e.g., room and board and nursing care), in-hospital physician services, anesthesia services, radiologic services, and physical therapy. This section presents the information OTA used to determine how many people age 50 and over with a hip fracture received each of the services and estimate 1990 expenditures for the services. OTA's principal findings based on this information were summarized earlier.

Expenditures for in-hospital treatment depend on the type of treatment received by the patient. Most hip fracture patients receive surgical treatment, but some receive nonsurgical treatment. The commonly used surgical treatments for hip fracture are: 1) reduction and internal fixation with surgical pins, nails, plates, and/or screws, and 2) partial or total hip replacement. Nonsurgical treatments for hip fracture include bed rest and traction.

In 1988, 183,354 individuals age 65 and over with a diagnosis of hip fracture received surgical treatment paid for by Medicare (12). According to the National Hospital Discharge Survey, 217,000 individuals age 65 and over were hospitalized in 1988 with a first-listed diagnosis of hip fracture (ICD-9-CM diagnostic code 820)[6](136). Thus, 84 percent of individuals age 65 and over who

[6]ICD-9-CM diagnostic codes are codes for medical diagnoses from the *International Classification of Diseases, 9th Revision, Clinical Modification*, published in 1980.

were hospitalized in 1988 with a first-listed diagnosis of hip fracture received surgical treatment paid for by Medicare. Of these individuals, two-thirds received reduction and internal fixation, and one-third received a partial or total hip replacement (12).

The proportion of people with a hip fracture that receives a total hip replacement varies greatly in different hospitals and different parts of the country. The number of total hip replacements performed for any condition has increased rapidly over the past 15 years (109).7 Researchers believe that the number of total hip replacements performed for people with a hip fracture has been increasing rapidly since about 1988, but variations in the way hip replacement procedures are coded make it difficult to document this trend (71,78).

If 84 percent of individuals age 65 and over who were hospitalized for a hip fracture in 1988 received surgical treatment paid for by Medicare, it is likely that the remaining 16 percent received either nonsurgical treatment or surgical treatment paid for by a source other than Medicare. About 4 percent of all elderly people are not enrolled in Medicare, and some Medicare enrollees age 65 and over with a hip fracture receive surgical treatment paid for by the VA, Workman's Compensation, or a private third-party insurer. These categories of individuals account for part of the **16** percent.

Individuals who received nonsurgical treatment account for another part of the 16 percent. OTA found little discussion of nonsurgical treatment for hip fractures in the medical literature, with the exception of a few studies cited later in this document that found higher in-hospital mortality for individuals who receive nonsurgical treatment and a few sources that recommend nonsurgical treatment for extremely frail patients who are poor surgical risks.[8] On the other hand, HCFA data show that in 1991, Medicare paid for nonsurgical treatment for more than 41,000 individuals with a fracture of the hip or pelvis (123). Some of these individuals had a pelvic fracture, not a hip fracture. Nevertheless, it appears that a considerable number and proportion of older people with a hip fracture receive nonsurgical treatment. This conclusion is supported by the findings of a review of the medical records of all hip fracture patients treated in Maryland hospitals in 1986: the review found that 9 to 10 percent of the patients received nonsurgical treatment (78). Likewise, findings of the 1984 National Hospital Discharge Survey cited by Pracon (99) show that 89 percent of the 239,000 people discharged from short-stay hospitals with a diagnosis of hip fracture in 1984 received surgical treatment, thus suggesting that 11 percent received nonsurgical treatment.

Very little research has been conducted on the characteristics of older people with a hip fracture who receive nonsurgical treatment. OTA found only one study that examined this subject as a secondary issue in the context of a review of the medical records of 2,762 hip fracture patients age 65 and over who were treated in 297 hospitals in five states (56). Of the 2,762 hip fracture patients, 175 (6 percent) received nonsurgical treatment. One-third of these individuals had very mild fractures, many of which involved only a bone chip. The remaining two-thirds had three distinguishing characteristics: 1) anew hip cancer, 2) inability to walk in the previous three months, and 3) less serious fractures. Sicker patients, patients who suffered a cardiac arrest in the emergency room, and patients with dementia were also somewhat more likely to receive nonsurgical treatment. A 1990 Institute of Medicine report emphasizes the need for research on the appropriateness of nonsurgical treatment for hip fracture (44).

[7] In 1991, DRG 209, which includes total hip replacement, was the fifth most frequently used DRG for Medicare patients. Because of this high volume and the relatively high Medicare reimbursement per case, DRG 209 had the second highest aggregate Medicare expenditure of any DRG ($2.5 billion in 1991) (101).

[8] See, for example, Lyons and Nevins (76); Royal College of Physicians (105); Winter(141).

Compared with the available information about in-hospital treatment received by hip fracture patients age 65 and over, much less is known about the in-hospital treatment received by hip fracture patients age 50 to 64. HCFA data show that in 1988, 3,732 hip fracture patients age 45 to 64 received surgical treatment paid for by Medicare (12). According to the National Hospital Discharge Survey, 24,000 individuals age 45 to 64 were hospitalized in 1988 with a first-listed diagnosis of hip fracture (136). Thus, 15 percent of individuals age 45 to 64 who were hospitalized in 1988 with a first-listed diagnosis of hip fracture received surgical treatment paid for by Medicare. Two-thirds of these individuals received reduction and internal fixation, and one-third received a partial or total hip replacement. OTA is not aware of any national data on the types of treatment received by the remaining 85 percent of hip fracture patients age 45 to 64.

In general, individuals underage 65 are eligible for Medicare only after they have received social security disability benefits for two years. Since the 3,732 hip fracture patients age 45 to 64 who received surgical treatment paid for by Medicare were sufficiently disabled to be receiving social security disability benefits, they cannot be considered representative of all hip fracture patients age 45 to 64.

Based on the preceding discussion, OTA concludes that in 1988, 84 percent of hip fracture patients age 65 and over received surgical treatment; 10 percent received nonsurgical treatment; and the type of treatment received by the remaining 6 percent of hip fracture patients age 65 and over and by 85 percent of hip fracture patients age 45 to 64 is not known. OTA used these conclusions in developing the estimates of expenditures for in-hospital services discussed below.

The relationship of expenditures, costs, and charges is complex, and different sources use these terms differently. In the following discussion, the term *expenditure* is used to refer to the amount actually paid for a service by the purchaser (e.g., the patient, Medicare, or a private, third-party insurer). The term *cost* is used to refer to the amount spent by the provider to produce the service; the true costs of the types of services discussed in this document often are not known. The term *charges* refers to the amount the provider bills for the services, except in the case of *Medicare allowed charges,* the term HCFA uses to refer to the amount of the Medicare payment plus the patient copayment for particular services.

I Use and Expenditures for Hospital Care

Medicare expenditures for hospital care (e.g., room and board and nursing care) depend on a patient's DRG category. As discussed earlier, hospital care for hip fracture patients generally falls into five DRGs, including four surgical DRGs (209, 210, 211, and 471) and one nonsurgical DRG (236). In 1988, the 84 percent of hip fracture patients age 65 and over who received surgical treatment paid for by Medicare were distributed as follows in the four surgical DRGs: 30 percent in DRG 209, 37 percent in DRG 210, 17 percent in DRG 211, and less than 1 percent in DRG 471 (12). The proportion of hip fracture patients in each of the four surgical DRGs differed little by age, and there was no consistent trend for increased or decreased assignment of patients to one or another DRG with increasing patient age (1 2).

As noted above, OTA concludes that 10 percent of hip fracture patients age 65 and over received nonsurgical treatment in 1988. The great majority of these individuals were in DRG 236. For the purpose of calculating average expenditures for hospital care and other in-hospital services, OTA assumed that all hip fracture patients age 65 and over who received nonsurgical treatment were in DRG 236. OTA does not have an age breakdown for hip fracture patients in DRG 236 or for the 6 percent of hip fracture patients age 65 and over for whom type of treatment is not known.

The proportion of hip fracture patients age 65 and over in various DRG categories differs in different parts of the country and probably also for different years. A study of 13,185 individuals age 65 and over treated for a first hip fracture in Maryland hospitals between 1984 and 1988 found that 16 percent were in DRG 209, 38 percent were in DRG 210, 21 percent were in DRG211, less than 1

TABLE 1: Average Medicare Submitted and Allowed Charges for the Five DRGs That Include Most Hip Fracture Patients, 1990

DRG	Category description	Average Medicare submitted charges	Average Medicare allowed charges
209	Major joint and limb replacement	$16,528	$9,084
210	Hip and femur procedures except major joint, age greater than 69 or complications or comorbidities	14,223	8,283
211	Hip and femur procedures except major joint, age 18 to 69 without complications or comorbidities	9,493	5,773
471	Bilateral or multiple major joint procedures	28,336	15,666
236	Fractures of the hip and pelvis	6,518	3,800

DRG = diagnostic related group

SOURCE U S Department of Health and Human Services, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993

percent were inDRG471, and 17 percent were in DRG 236; the remaining 6 percent were in 114 other DRGs, most of which included only one to three hip fracture patients (25). Among 185 hip fracture patients age 65 and over who were part of a population-based sample of older Iowans, 37 percent were in DRG 209, 50 percent were in DRG 210,11 percent wereinDRG211, and 3 percent were in DRG 236(13). The figure OTA used for the proportion of hip fracture patients age 65 and over that is in DRG 236-10 percent—is midway between the Maryland and Iowa figures, 17 and 3 percent, respectively.

OTA derived its estimate of the average expenditure for hospital care for hip fracture patients age 65 and over by calculating a weighted average of expenditures for patients in the five DRGs (209, 210, 211, 471, and 236) and a category "other," with weighting based on the proportion of all hip fracture patients age 65 and over in each category in 1988, the only year for which OTA has this information. These proportions are: DRG 209, 30 percent; DRG 210,37 percent; DRG211, 17 percent; DRG 471, less than 1 percent; DRG 210, 10 percent; and "other," 6 percent. OTA used Medicare allowed charges (i.e., the Medicare payment plus the patient copayment) to calculate expenditures for patients in the five DRGs. Table 1 shows the average Medicare allowed charges for each of the five DRGs in 1990, the latest year for which data are available. For patients in the category "other," which consists of individuals age 65 and over whose hospital care was paid for by a source other than Medicare, OTA used a figure based on hospital costs, discussed below. Using Medicare allowed charges for patients in the five DRGs and hospital costs for patients in the category "other," OTA estimates that the average expenditure for hospital care for hip fracture patients age 65 and over was $7,623 in 1990.

Medicare submitted charges are much higher than Medicare allowed charges (see table 1). It is generally accepted that Medicare submitted charges overstate the cost of hospital care for Medicare patients. If Medicare submitted charges were used to estimate the average expenditure for hospital care for hip fracture patients age 65 and over, the resulting figure would be $13,300 for 1990; this figure is $5,677 (74 percent) higher than OTA's estimate.

Although an estimate of expenditures based on Medicare submitted charges is undoubtedly too high, OTA's estimate, which is based primarily on Medicare allowed charges, might be too low for several reasons. First, it might be too low if OTA overestimated the proportion of hip fracture patients in DRG 236, since the Medicare allowed charge for DRG 236 is considerably lower than the Medicare allowed charges for the other four DRGs.

Second, OTA's estimate might be too low if Medicare allowed charges are lower than hospital costs for the care of hip fracture patients. According to PROPAC, Medicare allowed charges for all hospital stays reimbursed under the PPS were 1.5 percent lower than hospital costs in 1990 (101). If the figures OTA used to estimate the average expenditure for hospital care of hip fracture patients whose care was paid for by Medicare were increased to account for the difference between Medicare allowed charges and hospital costs, the average expenditure for hospital care would be **$7,732** for 1990.

PROPAC's estimate that in 1990 Medicare allowed charges were 1.5 percent lower than hospital costs is not specific to the DRGs that include hip fracture patients, and the true difference between Medicare allowed charges and hospital costs for these DRGs may be greater or smaller (4). Some analysts believe that hospital charges are set so that low-cost services subsidize high-cost services and that, as a result, DRG payment rates, which are based in part on hospital charges, may overestimate the cost of low-cost services and underestimate the cost of high-cost services (10). Since hospital care for hip fracture patients is a relatively high-cost service, the true difference between Medicare allowed charges and hospital costs may be greater than 1.5 percent for 1990.

In calculating the average expenditure for hospital care for hip fracture patients age 65 and over, OTA used data from Medicare claims for all patients in the five DRGs. As noted earlier, some patients in these DRGs are not hip fracture patients. In addition, some Medicare claims for hospital care for hip fracture patients do not reflect the total charges for the patients' hospital stay. The previously cited study of 13,185 hip fracture patients age 65 and over treated in Maryland hospitals between 1984 and 1988 found that for 2,5 16(19 percent) of the patients, the Medicare claim underestimated the expenditure for hospital care; this underestimation occurred either because Medicare was not the primary payer or because the Medicare claim did not include all the charges for the patients' hospital stay (25). If these 2,516 patients are excluded and Medicare allowed charges for the remaining 81 percent of patients in the Maryland study are inflated to 1990 dollars (using the Department of Labor's Consumer Price Index for Hospitals and Related Services), the average expenditure for hip fracture patients age 65 and over would be $10,059; this figure is $2,431 (32 percent) higher than OTA's estimate.[9] The validity of extrapolating from the Maryland data to the population as a whole is unclear, however, because of regional differences in expenditures for all types of health care services. In addition, the Maryland data include some individuals who had a diagnosis of hip fracture but received very high-cost treatments that seem unrelated to hip fracture, for example, five individuals who received a craniotomy (DRG 2) (25).

Far less information is available to calculate the average expenditure for hospital care for hip fracture patients age 50 to 64 than for those age 65 and over. As noted earlier, in 1988, 15 percent of hip fracture patients age 45 to 64 received surgical treatment paid for by Medicare. The figures listed in table 1 for DRGs 209, 210, 211, and 471 apply to these individuals, but because OTA does not have an age breakdown for hip fracture patients in DRG 236, the proportion of the 15 percent of patients age 45 to 64 that should be allocated to each DRG category cannot be determined. OTA also does not have information about expenditures for hospital care for the remaining 85 percent of patients age 45 to 64.

A compilation of data from 1990 claims for 3.7 million individuals whose health benefits were provided by large employers shows the following

[9] Data from the Maryland study indicate that the Medicare average allowed charges for the five DRGs that include most hip fracture patients, updated to 1990 dollars, would be as follows: DRG 209, $10,747; DRG 210, $10,668; DRG 211, $7,952; DRG 471, $19,01 I; and DRG 236, $8,717. These figures assume the exclusion of the 19 percent of hip fracture patients for whom Medicare was not the primary payer or whose Medicare claim did not include all the charges for their hospital care (25).

amounts for the five DRGs that include most hip fracture patients: DRG 209, $17,061; DRG 210, $19,273; **DRG211, $13,252;** DRG 471,$21 ,003; and DRG 236, $7,896 (84). These figures do not include claims by Medicare or Medicaid beneficiaries or Workman's Compensation claims. The figures are not comparable to other figures discussed in this section, however, because they include in-hospital physician services as well as hospital care.

Probably the best estimate of the average expenditure for hospital care for hip fracture patients age 50 to 64 is the figure noted earlier based on hospital costs—$7,732 for 1990. Alternatively, one might use an amount based on the average charge for a hospital day ($687 for 1990 (3)) multiplied by the average hospital length of stay for hip fracture patients age 45 to 64 (12.8 days in 1990 (137)).10 The latter alternative yields an average charge of $8,794 for 1990. This amount is $1,062 (14 **percent) higher** than the figure based on hospital costs and $1,171 (15 percent) higher than OTA's estimate of the average expenditure for hospital care for patients age 65 and over, which is based primarily on Medicare allowed charges.

Use and Expenditures for In-Hospital Physician Services

In-hospital physician services for hip fracture patients include treatment provided by surgeons and other types of physicians. (Services provided by anesthesiologists and radiologists are considered in the following sections.) Expenditures for in-hospital physician services for hip fracture patients depend on the treatment received by the patient.

To determine the average expenditure for in-hospital physician services for the 84 percent of hip fracture patients age 65 and over who received surgical treatment paid for by Medicare, OTA obtained 1990 data on average Medicare submitted charges, allowed charges (Medicare payment plus patient copayment), and number of people served for each of the surgical treatments for hip fracture listed in the 1990 CPT codebook (see table 2).[11] These treatments apply to DRGs 209, 210, and 211.[12] On the basis of Medicare allowed charges and number of people served, OTA estimates that the average physician payment for surgical treatment for hip fracture patients in DRGs 209, 210, and 211 was $1,280 in 1990.

The 1990 CPT codebook does not contain a code for bilateral hip replacement, and OTA does not have information about the Medicare submitted or allowed charges for that surgical treatment, which would apply to DRG 471. Since less than 1 percent of all hip fracture patients age 65 and over are in DRG 471, the amount used for the physician payment for surgical treatment for these patients is unlikely to affect the total estimated expenditure for in-hospital physician services. In calculating this expenditure, OTA used the same amount for patients in DRG 471 as for patients in the other surgical DRGs, i.e., $1,280 for 1990.

In addition to physician payments for surgical treatment, Medicare pays for "assistants at surgery." A RAND study of Medicare payments for assistants at surgery found that in 1986, two surgical treatments for hip fracture (CPT/HCPCS codes 27236 and 27244 (see table 2 for definitions)) were among the 20 surgical treatments for which assistants at surgery were most frequently reimbursed by Medicare (11 8). Nevertheless, in

---

10 The American Hospital Association (AHA) does not provide information about the average expenditure for a hospital day. The figure cited here is the average charge for a hospital day for AHA's category "nonfederal short-term general and other special hospital s."

11 The *Current Procedural Terminology* (CPT) code&)& lists codes for procedures and services performed by physicians. The Medicare coding system for the same services is called the HCFA common procedure coding system (HCPCS).

12 The 1990 CPT codebook has a code f$_{or}$ total hip replacement, 27130, which has a considerably higher average allowed charge, $2,575 for 1990. The codebook notes that this procedure code does not apply to hip replacement following a hip fracture and that hip replacement following a hip fracture should be coded under 27236 (1990 CPT codebook, pp. 169, 170).

TABLE 2: Average Medicare Submitted and Allowed Charges for Surgical Treatments for Hip Fracture, 1990

CPT/HCPCS code	Surgical treatment	Persons served	Average Medicare submitted charges	Total Medicare submitted charges	Average Medicare allowed charges	Total Medicare allowed charges
27220	Treatment of closed acetabulum (hip socket) fracture; without manipulation	**880**	**$545**	$479,600	$325	$286,000
27222	,,with manipulation with or without skeletal traction	**380**	**678**	257,640	345	131,100
27224	Open treatment of closed or open acetabulum (hip socket) fracture, with or without internal or external skeletal fixation; simple	820	1,865	1,529,300	1,108	908,560
27225	..complicated, intrapelvic approach	180	2,314	**416,520**	1,377	**247,860**
27230	Treatment of closed femoral fracture, proximal end, neck; without manipulation	2,940	367	1,078,980	228	670,320
27232	,., with manipulation including skeletal traction	560	864	483,840	658	368,480
27234	Treatment of open femoral fracture, proximal end, neck, with uncomplicated soft tissue closure, with manipulation, Including skeletal traction	260	1,323	343,980	949	246,740
27235	Treatment of closed or open femoral fracture, proximal end, neck, in situ pinning of undisplaced or impacted fracture	**10,240**	**1,937**	19,834,880	**1,260**	**12,902,400**
27236	Open treatment of closed or open femoral fracture, proximal end, neck, internal fixation or prosthetic replacement	65,340	2,204	144,009,360	1,332	87,032,880
27238	Treatment of closed intertrochanteric, pertrochanteric, or subtrochanteric femoral fracture, without manipulation	1,480	643	951,640	295	436,600

(continued)

TABLE 2: Average Medicare Submitted and Allowed Charges for Surgical Treatments for Hip Fracture, 1990 (cont'd.)

CPT/HCPCS code	Surgical treatment	Persons served	Average Medicare submitted charges	Total Medicare submitted charges	Average Medicare allowed charges	Total Medicare allowed charges
27240	..;with manipulation (including skeletal traction)	840	1,390	1,167,600	755	634,200
27242	Treatment of open intertrochanteric, pertrochanteric, or subtrochanteric femoral fracture, with uncomplicated soft tissue closure (including traction)	**400**	**2,216**	**886,400**	**1,170**	**468,000**
27244	Open treatment of closed or open intertrochanteric, pertrochanteric, or subtrochanteric femoral fracture, with internal fixation	88,800	2,191	194,560,800	1,341	119,080,800
27246	Treatment of closed greater trochanteric fracture, without manipulation	1,480	508	751,840	347	513,560
27248	Open treatment of closed or open greater trochanteric fracture, with or without internal or external skeletal fixation	780	1,398	1,090,440	**713**	**556,140**
Totals		**175,380**		**367,842,820**		**224,483,540**

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the Current *Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system (HCPCS).

SOURCE U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, unpublished data, 1993.

1986, Medicare paid for assistants at surgery in only 2 percent of cases in which these two surgical treatments were used. The Medicare payment for assistants at surgery is 20 percent of the physician payment for the surgical treatment (1 18). Since Medicare pays for assistants at surgery in such a small proportion of cases, OTA did not include an amount for this service in calculating the average expenditure for in-hospital physician services.[13]

In addition to physician payments for surgical treatment and payments for assistants at surgery, Medicare pays for physician hospital visits for some hip fracture patients who receive surgical

[13] Including an amount for assistants at surgery would increase the average expenditure for in-hospital physician services for hip fracture patients whose care is paid for by Medicare by 0.4 percent (2 percent x 20 percent) or $5.12 (0.4 percent x $1 ,280).

TABLE 3: Average Medicare Submitted and Allowed Charges for Physician Hospital Visits, 1990

CPT/HCPCS code	Type of physician hospital visit	Average Medicare submitted charges	Average Medicare allowed charges
90200	Initial hospital care; brief history and examination, initiation of diagnostic and treatment programs, and preparation of hospital records	$97	$63
90215	intermediate history and examination, initiation of diagnostic and treatment programs, and preparation of hospital records	133	90
	comprehensive history and examination, initiation of diagnostic and treatment programs, and preparation of hospital records	174	121
90240	Subsequent hospital care, each day; brief services	241	150
90250	,.limited services	378	254
90260	. . Intermediate services	422	291
90270	.extended services	290	202
90280	.comprehenslve services	302	203

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the *Current Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system(HCPCS)

SOURCE U S Department of Health and HumanServices, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993

treatment. Medicare requires that all necessary post-operative care be provided as part of the services covered by the physician payment for surgical treatment. Thus Medicare generally does not pay extra for hospital visits by physicians who perform hip fracture surgeries. A RAND study of Medicare payments for post-operative physician visits for patients who received various surgical treatments, including open reduction and internal fixation of a hip fracture (ICD-9-CM procedure code 79.35) and total hip replacement (ICD-9-CM procedure code 81 .5) found that in 1986, Medicare paid extra for hospital visits by the physician who performed the surgery in only 5 percent of cases (63). Since Medicare payment for hospital visits by the physician who performs the surgery is provided in such a small proportion of cases, OTA did not include an amount for this service in calculating the average expenditure for in-hospital physician services.

The RAND study cited above also found that in 1986 Medicare paid for an average of 11 post-operative physician visits for individuals who received open reduction and internal fixation and eight post-operative visits for individuals who received total hip replacement (63). Most of these post-operative visits were provided by physicians in specialties different from the physician who performed the surgery. The RAND study does not distinguish between post-operative visits provided in the hospital and post-operative visits provided after the patient was discharged from the hospital, but all visits were provided within 30 days of the date of surgery. OTA included an amount for these post-operative physician services in its estimate of expenditures for outpatient physician visits, discussed later in this document.

In-hospital physician services for hip fracture patients who receive nonsurgical treatment include hospital visits and particular nonsurgical treatments. To determine the average expenditure for in-hospital physician services for the 10 percent of hip fracture patients age 65 and over who received nonsurgical treatment paid for by Medicare, OTA obtained 1990 data on average Medicare submitted and allowed charges for physician hospital visits (see table 3). Combining the average of the Medicare allowed charges for initial

TABLE 4: Average Medicare Submitted and Allowed Charges for Five Physical Medicine Treatments That May Be Used for Hip Fracture Patients, 1990

CPT/HCPCS code	Physical medicine treatment	Average Medicare submitted charges	Average Medicare allowed charges
97012	Physical medicine treatment to one area: traction, mechanical	$122	$87
97110	Physical medicine treatment to one area, initial 30 minutes, each visit: therapeutic exercises	177	118
97114	.. functional activities	130	78
97116	..gait training	126	82
97540	Training in activities of daily living (self-care and/or daily life management skills); initial 30 minutes, each visit	106	80

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the *Current Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system(HCPCS).

SOURCE U S Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, unpublished data, 1993

physician hospital visits ($91) and the average of the Medicare allowed charges for subsequent physician hospital visits ($220), OTA estimates that the average expenditure for physician hospital visits for hip fracture patients age 65 and over who received nonsurgical treatment paid for by Medicare was $311 in 1990.

In addition to physician hospital visits, in-hospital physician services for hip fracture patients who receive nonsurgical treatment may include traction, gait training, and other physical medicine procedures. Table 4 shows the average Medicare submitted and allowed charges for five physical medicine treatments that might be used for hip fracture patients. According to the CPT codebook, these treatments may be either performed or supervised by a physician. OTA is not aware of any information about the proportion of hip fracture patients that receives any of these treatments.

A RAND study of Medicare payments for physician hospital visits for patients in nonsurgical DRGs found that patients in the *major diagnostic category, musculoskeletal,* which includes DRG 236, received an average of 1.16 physician visits per hospital day (1 19). This average includes 1.04 visits per day for patients who received hospital visits from only one physician and 1.42 visits per day for patients who received hospital visits from more than one physician.

To account for the use of physical medicine treatments for some hip fracture patients age 65 and over who received nonsurgical treatment, OTA added to its estimate of expenditures for in-hospital physician services an amount based on the average of the Medicare allowed charges for the five physical medicine treatments listed in table 4-$89 for 1990-multiplied by the average number of physician hospital visits in excess of one visit per patient per day taken from the RAND study-O. 1&multiplied by the average hospital length of stay for people in DRG 236--10 days in 1990 (123). The resulting figure was $453 for 1990.

OTA does not have information about expenditures for in-hospital physician services by sources other than Medicare. Consequently, for patients in the category “other” (i.e., patients age 65 and over whose hospital care was paid for by a source other than Medicare), OTA used an expenditure based on Medicare submitted charges for the five DRG categories as discussed below, i.e., $1,946 for 1990.

On the basis of the expenditures for in-hospital physician services discussed thus far in this section, OTA calculated a weighted average expendi-

ture for in-hospital physician services for hip fracture patients age 65 and over, with weighting based on the proportion of all such patients in each of the five DRGs and the category "other." Theresulting average expenditure was $1,236 for 1990.14

Medicare submitted charges for in-hospital physician services are much higher than Medicare allowed charges for these services (see tables 2,3, and 4). If Medicare submitted charges were used to estimate the average expenditure for in-hospital physician services, the resulting figure would be $1,946 for 1990; this figure is $710 (57 percent) higher than OTA's estimate.

The Medicare submitted and allowed charges listed in tables 2,3, and 4 apply to the 15 percent of hip fracture patients age 45 to 64 who received surgical treatment paid for by Medicare, but OTA does not know the proportion of these individuals that should be allocated to each DRG. OTA also does not have information to determine the physician payment for the remaining 85 percent of hip fracture patients age 45 to 64. Lacking this information, OTA used the just-cited figure based on Medicare submitted charges, $1,946 for 1990, as an estimated average expenditure for in-hospital physician services for hip fracture patients age 50 to 64. This figure probably overestimates the true expenditure for in-hospital physician services for these patients.

Use and Expenditures for In-Hospital Anesthesia Services

Hip fracture patients who are treated surgically receive anesthesia services in addition to other in-hospital physician services. To determine the average expenditure for anesthesia services, OTA obtained 1990 data on average Medicare submitted charges, allowed charges (Medicare payment plus patient copayment), and number of people served for all anesthesia services for procedures pertaining to the hip that are listed in the 1990 CPT codebook (see table 5). On the basis of Medicare allowed charges and the number of people served, OTA estimates that the average expenditure for anesthesia services for hip fracture patients age 65 and overinDRGs209,210,211, and 471 was $339 in 1990.

Hip fracture patients in DRG 236 generally do not receive anesthesia services, but some patients in the category "other" (individuals age 65 and over whose hospital care was paid for by a source other than Medicare) do receive anesthesia services. OTA does not have information about expenditures for anesthesia services by sources other than Medicare. Consequently, for patients in the category "other," OTA used a figure based on Medicare submitted charges as discussed below, i.e., $576 for 1990.

Using the figures discussed thus far in this section, including a zero figure for DRG 236, OTA calculated a weighted average expenditure for anesthesia services for hip fracture patients age 65 and over, with weighting based on the proportion of all such patients in each of the DRGs and the category "other." The resulting average expenditure was $319 for 1990.

Medicare submitted charges for anesthesia services are much higher than Medicare allowed charges for these services (see table 5). If Medicare submitted charges are used to estimate the average expenditure for anesthesia services, the resulting figure is $576 for 1990; this figure is $257 (8O percent) higher than OTA's estimate, which is based primarily on Medicare allowed charges.

The Medicare submitted and allowed charges listed in table 5 apply to the 15 percent of hip fracture patients age 45 to 64 who received surgical treatment paid for by Medicare. OTA does not

14 OTA computed this figure using three different assumptions about the average expenditure for in-hospital physician services for Patients in DRG 236. Assuming only one physical medicine visit per patient per hospital stay, the average expenditure would be $1,231. Assuming five physical medicine visits per patient per hospital stay, the average expenditure would be $1,267. Assuming 10 physical medicine visits per patient per hospital stay, the average expenditure would be $1,311. These small changes, -$5, +$31, and +$75 multiplied by 245,000 hip fracture patients age 65 and over in 1990, make a difference of -$1,225,000, +$7,595,000, and +$18,375,000, respectively, in annual expenditures.

TABLE 5: Medicare Submitted and Allowed Charges for Anesthesia Services for Procedures Involving the Hip Joint, 1990

CPT/HCPCS code	Anesthesia services for procedures involving the hip	Persons served	Average Medicare submitted charges	Total Medicare submitted charges	Average Medicare allowed charges	Total Medicare allowed charges
01200	Anesthesia for all closed procedures involving the hip joint	6,900	$368	$2,539,200	$175	$1,207,500
01210	Anesthesia for open procedures involving the hip joint, not otherwise specified	104,220	525	54,715,500	268	27,930,960
01214	Anesthesia for total hip replacement or revision	83,400	815	67,971,000	442	36,862,800
	Totals	**194,520**		**125,225,700**		**66,001,260**

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the *Current* Procedural *Terminology* (CPT) codebook and the HCFA common procedures coding system (HCPCS).

SOURCE. U S Department of Health and Human Services, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993

have information to determine the average expenditure for anesthesia services for the remaining 85 percent of hip fracture patients age 45 to 64. Lacking this information, OTA used the just-cited figure based on Medicare submitted charges, $576 for 1990, as an estimated average expenditure for anesthesia services for hip fracture patients age 50 to 64. This figure probably overestimates the average expenditure for anesthesia services for these patients.

Use and Expenditures for In-Hospital Radiologic Services

Hip fracture patients receive x-rays and may receive other radiologic services, such as bone densitometry to detect osteoporosis. To determine the average expenditure for in-hospital radiologic services, OTA obtained 1990 data on average Medicare submitted and allowed charges (Medicare payment plus patient copayment) for the diagnostic radiologic services pertaining to the hip that are listed in the 1990 CPT codebook (see table 6).

OTA does not have information about the number of x-rays received by hip fracture patients. For this analysis, an average of four x-rays per patient was assumed.

In 1990, the only method of bone densitometry covered by Medicare was single photon absorptiometry (SPA). That year, Medicare paid for SPA for a total of 20,060 people (123). OTA does not know the proportion of these people that was in the hospital or the proportion that had a hip fracture. Medicare data show that in 1988 only 640 (less than 1 percent) of the 17,360 people who received Medicare reimbursement for SPA were in the hospital (124). Thus it is likely that very few hip fracture patients received SPA in the hospital in 1990. For this reason, OTA did not include an amount for SPA in calculating the average expenditure for in-hospital radiologic services.

In 1990, Medicare paid for computerized axial tomography of the lower extremity, another radiologic service that may be used for hip fracture patients, for about 21,000 people (123). OTA does not know the proportion of these people that was in the hospital or the proportion that had a hip fracture. Based on the findings cited above with respect to the use of SPA, OTA assumed that very

TABLE 6: Average Medicare Submitted and Allowed Charges for Diagnostic Radiology Services That May Be Used for Hip Fracture Patients, 1990

CPT/HCPCS code	Diagnostic radiology service	Average Medicare submitted charges	Average Medicare allowed charges
73500	Radiologic examination, hip; unilateral, one view	$42	$28
73510	..complete, minimum of two views	65	41
73520	Radiologic examination, hips, bilateral, minimum of two views of each hip, including anteroposterior view of pelvis	61	35
73525	Radiologic examination, hip, arthrography, supervision and Interpretation only	79	48
73526	..complete procedure	168	**101**
78350	Bone density (bone mineral content) study, single photon absorptiometry	118	71
73700	Computerized axial tomography, lower extremity, without contrast material	217	132
73701	with contrast material(s)	183	113
73702	without contrast material, followed by contrast material(s) and further sections	204	146

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the *Current Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system(HCPCS)

SOURCE U S Department of Health and Human Services, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993

few hip fracture patients received computerized axial tomography in the hospital. For this reason, OTA did not include an amount for this service in calculating the average expenditure for in-hospital radiologic services.

For Medicare purposes, payment for the hospital costs of radiologic services, such as supplies and technicians' salaries, is considered to be included in the payment for hospital services; thus there is no additional expenditure for these components of in-hospital radiologic services for hip fracture patients whose hospital care is paid for by Medicare (i.e., 94 percent of patients age 65 and over and 15 percent of patients age 50 to 64). There is, however, an additional Medicare payment, and thus an additional expenditure, for the radiologist who reads and interprets the test for these patients. For hip fracture patients whose hospital care is paid for by a source other than Medicare (i.e., 6 percent of hip fracture patients age 65 and over and 85 percent of hip fracture patients age 50 to 64), there is an additional expenditure for radiologic services that includes both the hospital costs of the services and the radiologist's fee.

For hip fracture patients whose care is paid for by Medicare, OTA calculated an estimated expenditure for in-hospital radiologic services by multiplying four times one-half of the average of the Medicare allowed charges for the five relevant procedures (CPT/HCPCS code numbers 73500, 73510, 73520, 73525, and 73526), which yields $102 per patient for 1990. This figure assumes that the radiologist's fee accounts for one-half of the total payment for the service. For patients whose care is paid for by a source other than Medicare, OTA calculated an estimated expenditure for in-hospital radiologic services by multiplying four times the average of the Medicare submitted charges for the same five procedures, which yields $332 per patient for 1990.

Since 94 percent of hip fracture patients age 65 and over have their hospital care paid for by Medicare and 6 percent do not, the average payment for radiologic services for patients age 65 and over would be $116. Since 15 percent of the hip fracture patients age 50 to 64 have their hospital care paid for by Medicare and 85 percent do not, the average payment for radiologic services for patients age 50 to 64 would be $298.

I Use and Expenditures for In-Hospital Physical Therapy

Many hip fracture patients receive physical therapy in the hospital. A studyof814 hip fracture patients treated in Maryland hospitals from 1984 to 1986 found that virtually all received some in-hospital physical therapy. The amount of physical therapy varied greatly, however, from one to 40 sessions per patient (79).

With the decrease in average hospital length of stay in recent years, particularly since the implementation of Medicare's prospective payment system (PPS), some observers have predicted that hip fracture patients would receive less physical therapy. Three studies examined this question in individual hospitals and found that the average number of physical therapy sessions per patient per day for hip fracture patients age 65 and over increased in the post-PPS period, but because of the shorter average hospital length of stay, the total number of physical therapy sessions per patient per hospital stay decreased (28,29,95). In these three studies, the average number of physical therapy sessions per patient per hospital stay ranged from 4.9 to 9.8 in the post-PPS period. All subjects in these three studies received surgical treatment for their hip fracture. In one of the studies in which a large proportion of the sample cases in the post-PPS period was enrolled in an HMO, the average hospital length of stay was significantly shorter for the HMO cases than the conventional Medicare cases (7.3 versus 14.0 days, respectively), and the HMO patients received significantly fewer physical therapy sessions (3.5 versus 7.1 sessions, respectively) (29). OTA is not aware of any national data on the proportion of hip fracture patients that receives physical therapy or the number of physical therapy sessions they receive.

For Medicare purposes, payment for physical therapy is considered to be included in the payment for hospital care for hip fracture patients; thus there is generally no additional payment for in-hospital physical therapy for patients whose hospital care is paid for by Medicare. For patients whose hospital care is paid for by a source other than Medicare (i.e., 6 percent of hip fracture patients age 65 and over and 85 percent of patients age 50 to 64), there maybe an additional payment for physical therapy.

OTA does not have information about the amount of payments for in-hospital physical therapy. The American Physical Therapy Association is unable to provide this information but identified as physical therapy codes the CPT/HCPCS codes for physical medicine treatments plus five additional codes not listed in the 1990 CPT codebook (92).[15] **Table** 4 (earlier in this document) shows the average Medicare submitted and allowed charges for 1990 for five physical medicine treatments that may be used for hip fracture patients. These codes were among the codes identified by the American Physical Therapy Association as physical therapy codes. According to the CPT codebook, these treatments may be either performed or supervised by a physician.

Lacking national information about the number of in-hospital physical therapy sessions received by hip fracture patients, OTA assumed an average of seven sessions, based on the midpoint of the average number of physical therapy sessions received by patients in the three studies discussed above. Lacking information about the

[15] The American Physical Therapy Association identified as physical therapy codes 97010-97752 plus M0005 (Office visit, two modalities), M0006 (additional 15 minutes), M0007 (office visit and modalities and/or procedures), Q0103 (physical therapy initial evaluation), and Q0104 (physical therapy reevaluation).

TABLE 7: OTA's Estimate of Expenditures for In–Hospital Services for Hip Fracture Patients Age 50 and Over, 1990

In-hospital services	Estimated per patient expenditures	Alternate estimates
For patients age 65 **and over**		
Hospital care	$7,623	$7,732
In-hospital physician services	1,236	
Anesthesia services	319	
In-hospital radiologic services	116	
In-hospital physical therapy	28	
Total	9,322	
For patients age 50 to 64		
Hospital care	7,732	8,794
In-hospital physician services	1,946	
Anesthesia services	576	
In-hospital radiologic services	298	
In-hospital physical therapy	785	
Total	11,337	

SOURCE Off Ice of Technology Assessment, 1993

amount of payments for in-hospital physical therapy, OTA used an average of the Medicare submitted charges for the five physical medicine treatments listed in table 4-$132 per session. On the basis of these two figures, OTA estimated that the average expenditure for in-hospital physical therapy was $924 for 1990. This figure undoubtedly overestimates the true expenditure for in-hospital physical therapy, in part because it is based on charges and in part because the average charges for physical medicine treatments, which may be provided by a physician, are likely to be higher than the average charges for treatments provided by a physical therapist.

The figure just cited—$924 for 1990-applies only to hip fracture patients whose hospital care was paid for by a source other than Medicare. It is likely that some private, third-party insurers do not pay extra for in-hospital physical therapy; OTA assumed that half of the patients whose hospital care was paid for by a source other than Medicare had third-party insurance that pays extra for in-hospital physical therapy. Using that assumption, OTA added an expenditure of $924 to the in-hospital expenditures of half of the 6 percent of patients age 65 and over in the category "other," whose hospital care is paid for by a source other than Medicare, and half of the 85 percent of patients age 50 to 64, whose hospital care is also paid for by a source other than Medicare. Adding an expenditure of $924 for half of the patients in the category "other" increases the average expenditure for in-hospital services for all hip fracture patients age 65 and over by $28. Adding an expenditure of $924 for half of the 85 percent of patients age 50 to 64 whose care is not paid for by Medicare increases the average expenditure for in-hospital services for all hip fracture patients age 50 to 64 by $785.

OTA's Estimate of Total Per Patient Expenditures for In-Hospital Services

Table 7 summarizes OTA's estimate of 1990 per patient expenditures for in-hospital services for hip fracture patients age 65 and over and 50 to 64.

TABLE 8: In-Hospital Mortality for Hip Fracture Patients Treated in Short-Stay Nonfederal Hospitals, by Age and Gender, 1988

Age	Number	All hip fracture patients	Male hip fracture patients	Female hip fracture patients
50-59	**8,179**	1%	—	1%
60-69	33,557	4	7%	1
70-79	62,707	3	10	<1
80-89	98,188	2	3	2
90-99	33,476	7	16	5
1 00+	1,350	77	100	—
Totals	**237,457**	**3**	**9**	**2**

SOURCE U S. Department of Health and HumarServices, Public Health Service, National Center for HealthStatistics, unpublished data from the 1988 National Hospital Discharge Survey, 1992

Alternate amounts are given for hospital care, as discussed earlier. If the alternate amounts were used, the total per patient expenditure for patients age 65 and over would be increased by $109 (1 percent) and the total per patient expenditure for patients age 50 to 64 would be increased by $1,062 (9 percent).

Contrary to what might be expected, the estimated total per patient expenditure is higher for hip fracture patients age 50 to 64 than for those age 65 and over. This finding is explained in part by the relative dearth of expenditure data for patients whose care is paid for by a source other than Medicare—predominantly those under age 65—and thus OTA's greater use of charge data for these patients. If more information about expenditures were available for patients whose hospital care is paid for by a source other than Medicare, the estimated per patient expenditure figure for those age 50 to 64 would be lower. Likewise, if the per patient expenditure for patients age 65 and over were calculated on the basis of charge rather than expenditure data, the resulting figure would be much higher.

In addition, however, the true per patient expenditure for in-hospital services may be higher for hip fracture patients age 50 to 64 than for those age 65 and over because Medicare's cost containment procedures, primarily PPS, have been effective in holding down the cost of hospital care for Medicare-covered patients. As discussed earlier, PROPAC estimates that Medicare payments were 1.5 percent lower than hospital costs in 1990; this gap increased to 3.4 percent in 1991, 6.4 percent in 1992, and 9.9 percent in 1993 (101). This difference—in effect, the cost of hospital care for Medicare-covered patients that is not reimbursed by Medicare—may be shifted to other payers. In the case of hip fracture where such a large proportion of patients age 65 and over (94 percent) receive hospital care that is paid for by Medicare, it is unclear whether nonreimbursed costs for Medicare patients may be shifted to hip fracture patients age 65 and over whose care is paid for by a source other than Medicare, hip fracture patients under age 65 whose care is paid for by a source other than Medicare, older and younger patients hospitalized for the treatment of other diseases and conditions, or a combination of the above.

IN-HOSPITAL MORTALITY

A small proportion of hip fracture patients dies in the hospital. This section presents the information OTA used to estimate in-hospital mortality for people age 50 and over with a hip fracture. OTA's principal findings based on this information were summarized at the beginning of this document.

Tables 8 and 9 show in-hospital mortality based on unpublished data from the 1988 and 1991 Na-

TABLE 9: In-Hospital Mortality for Hip Fracture Patients Treated in Short-Stay Nonfederal Hospitals, by Age and Gender, 1991

Age	Number	All hip fracture patients	Male hip fracture patients	Female hip fracture patients
50-59	**9,970**	1%	—	1%
60-69	26,272	3	5%	1
70-79	79,273	3	7	2
80-89	122,821	4	9	3
90-99	42,281	4	9	3
1 00+	1,068	29	59	22
Totals	**281,685**	**4**	**7**	**3**

SOURCE: U S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, unpublished data from the 1991 National Hospital Discharge Survey, 1992

tional Hospital Discharge Surveys for people age 50 and over with a first-listed diagnosis of hip fracture (ICD-9-CM diagnostic code 820). The data show that an average of 3 to 4 percent of the patients died in the hospital. *These data and all other mortality data discussed in this section reflect all-cause mortality for hip fracture patients, not just mortality specifically attributable to the fracture.*

Table B-1 in appendix B presents data on all-cause mortality following hip fracture from numerous other studies. Many of these studies found higher average in-hospital mortality than the 1988 and 1991 National Hospital Discharge Surveys. As discussed below, differences among the studies in the characteristics of their subjects probably account for most of the differences in their findings on in-hospital mortality.

Factors That Affect In-Hospital Mortality

Numerous factors have been shown to affect in-hospital mortality following a hip fracture. Patient age is one factor. Virtually all studies of hip fracture patients show that in-hospital mortality is higher for older patients. Some of the studies in table B-1 included only individuals age 65 and over, whereas other studies also included younger people, who have lower in-hospital mortality. The differences among the studies in the age of their subjects is one reason for the differences in their findings on in-hospital mortality.

A second factor that affects in-hospital mortality is patient gender. In-hospital mortality is much higher for males than females. The 1988 and 1991 National Hospital Discharge Surveys found that average in-hospital mortality was 7 to 9 percent for males compared with 2 to 3 percent for females (see tables 8 and 9). Similarly, a study of 27,000 people with a hip fracture treated in Maryland hospitals from 1979 to 1988 found that average in-hospital mortality was 8 percent for males, compared with 4 percent for females (88). When other variables, such as patient age, number and type of other medical diagnoses, and post-operative complications, were included in the analysis, the relative risk of dying in the hospital was 1.6 for male versus female hip fracture patients. The greater in-hospital mortality of male hip fracture patients means that studies with a large proportion of males in their sample are likely to show higher average in-hospital mortality.

Race is a third factor that affects in-hospital mortality. A study of 19,000 people with a hip fracture treated in Illinois hospitals from 1980 to 1982 found that in-hospital mortality was higher for white males than black males (10.5 versus 9.3 percent, respectively) and lower for white females than black females (5.0 versus 8.2 percent, respec-

tively (59)). The study cited above of 27,000 people with a hip fracture treated in Maryland hospitals from 1979 to 1988 had similar findings (88). The findings from both studies are at least partially explained by differences in the average age at which hip fractures occur in different racial groups. After adjustment for age, the study of hip fracture patients treated in Illinois hospitals found that the relative risk of dying was only 1.02 for white males versus black males (59).

A fourth factor that affects in-hospital mortality is a patient's general physical condition and coexisting illnesses. In-hospital mortality is higher, on average, for individuals with poor pre-fracture functional status (17,142), serious coexisting illnesses (22,79,88), multiple medical diagnoses (88), and delirium (83). Studies that include a greater proportion of individuals with any of these conditions are likely to show higher average in-hospital mortality.

In-hospital mortality is often said to be higher for individuals living in a nursing home than for individuals living in the community at the time of their fracture. Although OTA found no research to substantiate this assertion, it is likely to be true because of the poorer general physical condition of nursing home residents and their greater average age. Moreover, several studies cited in the following section show that long-term mortality is higher for individuals living in a nursing home at the time of their fracture. If it is true that individuals living in a nursing home at the time of their fracture have higher in-hospital mortality, then studies that include such individuals are likely to show higher in-hospital mortality.

The exact location of an individual's hip fracture is sometimes said to affect in-hospital mortality, and many studies have compared in-hospital mortality for individuals with different types of hip fractures. The studies vary in their categorization of hip fractures, but with a few exceptions, they have found no significant difference in in-hospital mortality for different types of hip fractures (17,22,62,87,88).16

Another factor that affects in-hospital mortality is the type of treatment received. The study of 27,000 hip fracture patients treated in Maryland hospitals between 1979 and 1988 found that in-hospital mortality was lower for patients who received surgical treatment than for those who received nonsurgical treatment (4 percent versus 9 to 12 percent, respectively) (88). Several earlier studies had similar findings (70,83). In analyzing these findings, it is difficult to separate the effects of type of treatment from the effects of patient characteristics that lead to a decision to use that type of treatment. Nevertheless, studies that include individuals who receive nonsurgical treatment are likely to show higher average in-hospital mortality.

In addition to patient characteristics and type of treatment, hospital length of stay may affect in-hospital mortality. Average hospital length of stay for hip fracture patients has decreased greatly in recent years, partly in response to PPS, which was introduced in late 1983. A study of 2,762 hip fracture patients treated in 297 hospitals in five states between 1981 and 1986 found that average hospital length of stay dropped 28 percent, from 20.1 days in 1981 and 1982 to 14.5 days in 1985 and 1986 (51). According to the National Hospital Discharge Survey, average hospital length of stay for hip fracture patients age 45 and over was 13 days in 1990 (137). With the decrease in average hospital length of stay, it is possible that some hip fracture patients who would have died in the hospital if they had stayed longer instead die at home or in a nursing home after their discharge from the hospital. As a result, studies with shorter average hospital length of stay may show lower in-hospital mortality.

16 OTA is aware of two research groups that found differences in in-hospital mortality for individuals with different types of hip fractures. In a small, retrospective study, Lawton et al. (63) found higher in-hospitalmortality for persons with a trochanteric versus a cervical hip fracture. In contrast, in a slightly larger, prospective study, the same researchers found lower in-hospital mortality for persons with a trochanteric versus a cervical fracture (63). Matheny et al. (83) also found lower in-hospital mortality for persons with a trochanteric versus a cervical hip fracture.

Finally, it is likely that improvements in treatment procedures over time have resulted in reduced average in-hospital and post-hospital mortality for people with a hip fracture. For this reason, studies conducted 10 to 15 years ago may show higher in-hospital mortality than studies conducted in the past few years.

Many of these factors—patient age, gender, race, general physical condition and coexisting illnesses, residence at the time of the fracture, type of treatment, and average hospital length of stay—are interrelated. Together with improvements in treatment procedures over time, they help to explain observed differences in in-hospital mortality in different studies.

OTA's Estimate of Average In-Hospital Mortality

Since the National Hospital Discharge Survey sample represents almost all hip fracture patients in the United States and provides the most recent available data on in-hospital mortality, OTA used the survey data to develop an estimate of in-hospital mortality for patients age 50 and over. Combining the figures from the 1988 and 1991 surveys, OTA estimates that average in-hospital mortality for hip fracture patients age 50 and over is 4 percent and varies by patient gender and age as noted in table 10.[17]

TABLE 10: OTA's Estimate of the Proportion of Hip Fracture Patients Age 50 and Over Who Die in the Hospital, by Age and Gender

Age	All hip fracture patients	Male hip fracture patients	Female hip fracture patients
50-59	**1%**	**O%**	1%
60-69	3	6	1
70-79	3	7	2
80-89	3	7	3
90+	7	19	4
Totals	4	8	3

SOURCE Office of Technology Assessment, 1993

LONG-TERM MORTALITY

A considerable proportion of hip fracture patients die in the year following their fracture. This section presents the information OTA used to estimate long-term mortality for people age 50 and over with a hip fracture. OTA's principal findings based on this information were summarized at the beginning of this document.

Table 11 shows one-year mortality from a study of more than 22,000 Medicare beneficiaries in six New England states who had a hip fracture between 1984 and 1986 (27). As shown in the top section of the table, 24 percent died in the first year post-fracture. Average mortality increased with age and was much higher for males than females in each age group. *These data and all other mortality data discussed in this section reflect all-cause mortality for hip fracture patients, not just mortality attributable to the fracture.*

OTA is aware of two studies that provide information on longer term mortality for female hip fracture patients. Table 12 shows cumulative mortality over a five-year period from a study of more than 2,000 females age 50 and over who were enrolled in the Kaiser Permanence Health Plan in California and were treated for a hip fracture between 1980 and 1984 (96). Information on subject deaths was collected through 1985. The study data show successively higher mortality at each of nine time points and higher mortality at each time point for successive y older age groups. Because of the timing of their fracture in relation to the period of the study, many of the subjects could not be followed for the full duration of the study: for example, a subject who had a hip fracture in January 1980 could have been followed for six years, through December 1985, but a subject who had a hip fracture in December 1984, could

17 Since the total number of people age 100 and over in the National Hospital Discharge Survey samples is relatively small and in-hospital mortality varied so greatly in this age group for the two years, OTA combined the age group 100+ with the group age 90 to 99 for this estimate.

TABLE 11: One-Year Mortality for Hip Fracture Patients Age 65 and Over in New England, by Age, Gender, and Residence at the Time of the Fracture, 1984–86

Age	Number	All patients	Male patients	Female patients
		All hip fracture patients		
65-74	4,216	14Y0	22%	12%
75-84	9,082	21	34	17
85+	8,741	31	48	28
Totals	22,039	24	36	21
		Patients who were living in the community at the time of the fracture		
65-74	3,840	13?40	21%	1 1%
75-84	7,489	18	31	15
85+	6,122	28	44	25
Totals	17,451	21	32	18
		Patients who were living in a nursing **home at the time of the fracture**		
65-74	376	26%	33%	23%.
75-84	1,593	31	48	26
85+	2,619	39	60	36
Totals	4,566	35	52	32

SOURCE Calculated by the Office of Technology Assessment based on data from ES. Fisher, J.A Baron, D J. Malenka et al., "Hip Fracture Incidence and Mortality in New England, " *Epidemiology,* 1991,

only have been followed for one year (97). Thus, the data on five-year mortality are contributed by a subset (about 40 percent) of the sample, and the entire sample contributes only to the one-year mortality figures.

Table 13 shows cumulative mortality over a five-year period from a study of 612 female hip fracture patients of all ages treated in hospitals in Rochester, Minnesota, between 1980 and 1989 (85). Like the data from the Kaiser Permanence Health Plan Study, the Rochester data show successively higher mortality at each of nine time points and higher mortality at each time point for successively older age groups. The two studies' findings are not precisely comparable because of differences in the age categories used to group the data, but the findings are quite similar. The findings on one-year mortality from both studies are also similar to the one-year mortality data for female patients in the New England study (see table 1 1).

Table B-1 in appendix B presents the findings on long-term mortality from numerous other studies of hip fracture patients. As with in-hospital mortality, differences among the studies in the characteristics of their subjects probably account for most of the differences in the studies' findings on long-term mortality.

Factors That Affect Long-Term Mortality

Many factors affect long-term mortality following a hip fracture. One factor is patient age. Each of the three studies described above and virtually all the studies cited in table B-1 in appendix B show that long-term mortality is higher for older than for younger patients. A study of814 hip fracture patients treated in seven Maryland hospitals from 1984 to 1986 found that the relative risk of dying by one year post-fracture was 1.8 for patients age 85 and over compared with those age 65 to 74 (79).

TABLE 12: Cumulative Mortality for Female Hip Fracture Patients Age 50 and Over in the Kaiser Permanente Health Plan Study, 1980–85

Age	Number	3 mos	6 mos	9 mos	1 yr	18 mos	2 yrs	3 yrs	4 yrs	5 yrs
50-64	**390**	**3%**	**4%**	**5%**	7%	9%	1070	12'XO	13Y0	15'%0
65-74	565	5	8	9	10	13	15	18	20	23
75-84	693	8	12	14	17	20	25	29	32	34
85-89	252	15	21	23	26	32	34	41	44	48
90+	101	20	28	31	34	45	46	49	53	53
Total	**2,001**	**8**	**11**	**13**	**15**	**19**	**21**	**25**	**28**	**30**

SOURCE D Petitti, University of California, San Francisco, letter to the Office of Technology Assessment, July 23, 1991

TABLE 13: Cumulative Mortality for Female Hip Fracture Patients in Rochester, Minnesota, 1980–89

Age	Number	3 mos	6 mos	9 mos	1 yr	18 mos	2 yrs	3 yrs	4 yrs	5 yrs
Under 64	**62**	**2%**	**5%**	**5%**	**81%**	**8%**	**8%**	12%	12Y0	17Y0
65-84	334	8	11	13	14	18	22	28	35	41
85+	225	15	20	22	26	31	38	50	58	65

SOURCE L J Melton, III, Mayo Clinic, Rochester, MN, letter to the Off Ice of Technology Assessment, May 3, 1993

A second factor that affects long-term mortality is patient gender. Data from the New England study indicate that one-year mortality was 71 percent higher for male patients than for female patients (36 versus 21 percent, respectively (see table 11)). The Maryland study cited above found that the relative risk of dying by one year post-fracture was 1.9 for male versus female hip fracture patients (79).

The relationship between race and long-term mortality following a hip fracture is unclear. Some studies show higher long-term mortality for black hip fracture patients. According to the Maryland study, for example, the relative risk of dying by one year post-fracture was 1.8 for black versus white patients (79). In contrast, the New England study shows a lower relative risk of dying by one year post-fracture for black versus white patients (0.82) (27). A study of more than 700,000 Medicare beneficiaries with a hip fracture from 1984 to 1987 found that average mortality at one year post-fracture was nearly identical for black and white males but higher for black females than white females (45).

Data from the 1990 HCFA *Special Report* described earlier suggest that mortality for black versus white hip fracture patients differs not only by patient gender but also by patient age, type of fracture, and type of treatment.[18] at one year post-fracture, mortality was higher for black males than white males among those who had a trochanteric hip fracture and received reduction and internal fixation; lower for black males than white males

[18] As noted earlier, the 1990 HCFA Special Report provides national data for 1986 on hip fracture patients for whom Medicare reimbursement was provided for one of two types of surgical treatment: I) partial replacement of (he hip joint, and 2) reduction and internal fixation. Patients who received reduction and internal fixation were further divided into two subgroups according to the exact location of their fracture, trochanteric or cervical.

among those who had a cervical hip fracture and received reduction and internal fixation, except subjects age 65 to 74; higher for black males than white males among those who received a partial hip replacement, except subjects age 75 to 84; and higher for black females than for white females with both types of fractures, both types of treatment, and in each age category (122).

Long-term mortality is higher for hip fracture patients who have coexisting medical illnesses than for those who do not have such illnesses. The New England study found that mortality for patients with one or more coexisting illnesses was substantially higher than for those without coexisting illnesses for all subjects, for subjects in each age group, and for male and female subjects (27). Several other studies listed in table B-1 had similar findings (17,62,79). A study of 211 females treated for a hip fracture in 17 hospitals in Philadelphia found that the presence and number of coexisting illnesses was not associated with mortality (87), but the study sample included only relatively healthy hip fracture patients.

The Maryland study found that mortality was higher for hip fracture patients who had delirium at the time of hospital admission but no history of Alzheimer's disease or any other disease that causes dementia (79). The relative risk of dying by one year post-fracture was 3.1 to 3.5 for hip fracture patients with delirium but not dementia versus those with both delirium and dementia, neither delirium nor dementia, or dementia but not delirium.

Long-term mortality is higher for individuals living in a nursing home than for individuals living in the community at the time of their fracture. As shown in table 11, the New England study found that one-year mortality was at least 10 percent higher in each age interval for individuals who were living in a nursing home at the time of their fracture (27). It is interesting to note that most of the studies listed in table B-1 that report relatively low long-term mortality excluded nursing home residents (see, for example, Fitzgerald et al. (28), Fitzgerald et al. (29), Kenzora et al. (62), Mossey et al. (87), Palmer et al. (95), Weiss et al. (140)).

The exact location of an individual's hip fracture may affect long-term mortality. Data from the 1990 HCFA *Special Report* show that one-year mortality was higher for females with a trochanteric versus a cervical hip fracture in each age group (122) (see table 14). For males, mortality was lower for those with a trochanteric fracture except in the 65 to 74 age group. Two other studies cited in table B-1 found higher mortality for individuals with a trochanteric fracture (17,68); one study found lower mortality for individuals with a trochanteric fracture (83); and two studies found no significant difference in mortality by the exact location of the fracture (62,87).

The type of treatment provided for a patient probably affects long-term mortality, although, as noted earlier, it is difficult to separate the effects of the type of treatment from the effects of patient characteristics that lead to a decision to use that type of treatment. Data from the 1990 HCFA *Special Report* show that one-year mortality for female patients who received a partial hip replacement (replacement of the head of the femur) was intermediate between mortality for female patients who received reduction and internal fixation for a trochanteric fracture and female patients who received reduction and internal fixation for a cervical fracture (see table 14). For male patients, one-year mortality was somewhat higher for those who received a partial hip replacement compared with those who received reduction and internal fixation for either type of fracture (122).

Average age-specific mortality was slightly lower in the 1990 HCFA *Special Report* than in many of the other studies cited in table B-1. Hip fracture patients who received nonsurgical treatment and hip fracture patients who received a total hip replacement were not included in the samples for the HCFA *Special Report.* It is not clear whether the exclusion of patients who received these two types of treatment accounts for the lower age-

TABLE 14: One–Year Mortality for Hip Fracture Patients, by Type of Fracture, Type of Treatment, Age, and Gender, 1986

Age	Patients with a trochanteric hip fracture who had reduction and internal fixation	Patients with a cervical hip fracture who had reduction and internal fixation	Patients who had a partial hip replacement
65-74	**13%**	**1070**	**12'%0**
75-85	**20**	**18**	**19**
85+	**29**	**29**	**29**
Males			
65-74	**19**	**16**	**21**
75-85	**30**	**31**	**33**
85+	**43**	**44**	**46**
Females			
65-74	**10**	**8**	**10**
75-85	**17**	**14**	**16**
85+	**27**	**26**	**26**

SOURCE U S Department of Health and Human Services, Health Care Financing Administration, *Special Report,* Vol 3, June 1990

specific mortality in the study. [19] Research currently being conducted at the University of Maryland School of Medicine and the Dartmouth Medical School will eventually provide better information than is currently available about the relationship between type of treatment and mortality for hip fracture patients.

The timing of surgery may affect long-term mortality. One study of 406 hip fracture patients treated in a Boston hospital between 1971 and 1977 found that 23 percent of the 96 subjects who received surgery on their first hospital day died by six months post-fracture, and 34 percent died by one year post-fracture (62). In contrast, only 4 to 5 percent of the 268 patients who received surgery on their second, third, or fourth hospital day died by six months post-fracture, and only 5 to 6 percent died by one year post-fracture. Surgical delay past the fourth hospital day was associated with increased mortality in this study. Another study of 323 hip fracture patients found that delaying surgery past the second hospital day was associated with increased mortality at one year post-fracture (1 12).

It has been suggested that mortality following a hip fracture might be reduced if procedures were implemented to identify delirium or acute confusional state in elderly hip fracture patients and treat its causes (38,79,83). One attempt to implement such procedures in Sweden resulted in reduced incidence of acute confusional state, but no change in mortality (37).

With the implementation of PPS in late 1983, concerns were expressed about the impact of shorter hospital lengths of stay on outcomes for elderly patients, including hip fracture patients. Several of the studies listed in table B-1 were designed to compare mortality and other outcomes for hip fracture patients before and after the implementation of PPS. The largest of these studies,

[19] HCFA data for Medicare beneficiaries who received a total hip replacement show much lower one-year mortality than for those who received a partial hip replacement or reduction and internal fixation. The data for beneficiaries who received a total hip replacement are not broken out by patient diagnosis, however, so it is not possible to compare mortality for hip fracture patients who received a total hip replacement versus either of the other two types of treatment.

TABLE 15: OTA's Estimate of the Proportion of Hip Fracture Patients Age 50 and Over Who Die of Any Cause by One-Year Post-Fracture

Age	All hip fracture patients	Male hip fracture patients	Female hip fracture patients
50-64	*	•	7%
65-74	14Y0	22%	10
75-84	21	34	17
85+	31	48	28
Totals	24	36	21

● Data not available to determine these proportions.

SOURCE. Off Ice of Technology Assessment, 1993.

which compared outcomes for 4,368 Michigan residents with a Medicare-covered hip fracture before and after the implementation of PPS found no significant difference in mortality at 30 days, three months, or one year post-fracture (103).

Another study, which compared outcomes for 2,762 hip fracture patients treated in 297 hospitals in five states between 1981 and 1986, found no significant difference in mortality at 30-days post-fracture and a decrease in mortality at six months post-fracture from 17.9 percent in the pre-PPS period to 14.8 percent in the post-PPS period (51). Likewise, a study of hip fracture patients in one hospital found a 2 percent decrease in mortality at six months from the pre-PPS period to the post-PPS period (95).

In contrast, three studies, each conducted in a single hospital, found an increase in mortality in the post-PPS period: one study found a 3 percent increase in mortality at six months (28); the second study found a 5 percent increase in mortality atone year (29); and the third study found an 8 percent increase in mortality at one year, but this difference was not statistically significant (32).

| OTA's Estimate of Average Long-Term Mortality

Table 15 shows OTA's estimate of all-cause mortality for hip fracture patients atone year post-fracture by patient age and gender. The figures are based primarily on the results of the New England study (see table 11). For female hip fracture patients age 50 to 64 and 65 to 74, OTA used the figure from the Kaiser Permanente Health Plan Study (see table 12). OTA is not aware of data on mortality at one year post-fracture for all hip fracture patients age 50 to 64 or for male hip fracture patients age 50 to 64.

The figures in table 15 represent all-cause mortality for hip fracture patients, not just mortality specifically attributable to the fracture. To understand the true impact of hip fracture on long-term mortality, it is important to determine the proportion of observed mortality that is in excess of expected mortality given the age, sex, race, general physical condition, and coexisting illnesses of the patients.

Table 16 shows age- and gender-specific mortality for 1988 for persons over age 45. A comparison of the 1988 mortality figures for males in table 16 and the mortality figures for male hip fracture patients at one year post-fracture in table 15 indicates that mortality is 18 percent higher for male hip fracture patients age 65 to 74,26 percent higher for male hip fracture patients age 75 to 84, and 30 percent higher for male hip fracture patients age 85 and over. A similar comparison of the 1988 mortality figures for females in table 16 and the mortality figures for female hip fracture patients at one year post-fracture in table 15 indicates that mortality is 6 percent higher for female hip fracture patients age 50 to 64, 8 percent higher for female hip fracture patients age 65 to 74,

TABLE 16: Age-Specific Mortality from All Causes, 1988

Age	All persons	All males	All females
45-54	1%	1%	>1%
55-64	1	2	1
65-74	3	4	2
75-84	6	8	5
85+	16	18	14

SOURCE U S Department of Health and Human Services, *Health United States 1991,* May 1992

12 percent higher for female hip fracture patients age 75 to 84, and 14 percent higher for female hip fracture patients age 85 and over.

These figures noted above overstate the excess mortality attributable to hip fracture because older people who fall repeatedly and are therefore at greater risk for hip fracture generally are in poorer physical condition than older people who do not fall repeatedly (33,43,91,1 13,1 16); thus they are at greater risk of dying. The appropriate comparison group to determine excess mortality for people who fracture their hip and die would be other people with similar physical impairments and coexisting illnesses who do not fracture their hip—a comparison group that, to OTA's knowledge, has not been constructed.

In evaluating the effect of hip fractures on long-term mortality, it is also important to determine the duration of excess mortality that is attributable to the fracture. On the basis of their study of814 people with a hip fracture treated in seven Maryland hospitals from 1984 to 1986, Magaziner et al. (79) concluded that excess mortality persisted for six months for females and subjects age 85 and over; 10 months for subjects age 75 to 84; and more than one year for males and subjects age 65 to 74. Data from the New England study also show that excess mortality following a hip fracture persists longer for subjects age 65 to 74 than for older patients *(27).* Other researchers and commentators have concluded that excess mortality following a hip fracture persists for four months (31), six months (16,21 ,45), eight months (62,86), one year (23), and 1.6 years for females and 1.8 years for males (48).

For the purpose of OTA's analysis of the costs and effectiveness of screening for osteoporosis which pertains only to females, OTA concluded that excess mortality following a hip fracture should only be projected for one year after the fracture. The individuals who reviewed this document and commented on OTA's decision agreed with it.

POST-HOSPITAL AND OTHER OUTPATIENT SERVICE USE AND EXPENDITURES

Many people with a hip fracture are discharged from the hospital to a nursing home, a rehabilitation facility, or another short-stay hospital. Others who are discharged home receive paid home care services. Virtually all hip fracture patients have post-hospital physician visits, and some are rehospitalized in the year following their fracture for problems related to the fracture or its treatment. In addition, hip fracture patients use emergency room and ambulance services, and some use outpatient physical therapy. This section presents the information OTA used to determine how many people age 50 and over with a hip fracture used each of these post-hospital and other outpatient services and estimate 1990 expenditures for the services. OTA's principal findings based on this information were summarized at the beginning of this document.

Medicare expenditures for nursing home, rehabilitation, and home health care services for hip fracture patients constitute a notable proportion of all Medicare expenditures for these services. From 1984 to 1985, Medicare expenditures for nursing home care for patients in DRGs 209,210, and 236 accounted for more than 20 percent of all Medicare expenditures for nursing home care (89). Medicare expenditures for post-hospital rehabilitation and home health care services for patients in DRGs 209 and 210 accounted for 10 percent and 8 percent respectively of all Medicare expenditures for the two types of services. Not all patients in these DRG categories are hip fracture patients, but many are.[20]

[20] **In 1988, hip fracture patients constituted 32 percent of individuals in DRG 209 and 86 percent of individuals in DRG 210 (based on data from Charlson (12) and Latta and Helbing (66)). A study of post-hospital service use by a 20 percent sample of Medicare beneficiaries discharged from short-stay hospitals in 1984/85 found that among those in DRG 209, hip fracture patients were three times more likely than other patients in the same DRG to use Medicare-covered post-hospital services (90).**

As average hospital length of stay has decreased in recent years, the proportion of hip fracture patients that receives post-hospital services has increased. Expenditures for post-hospital services for these patients have also increased-certain] y as a proportion of all Medicare expenditures for the services (89) and probably also as a proportion of expenditures by other payers.

Since the implementation of PPS, a somewhat larger proportion of hip fracture patients has been discharged from the hospital in a medically unstable condition. The previously cited study of more than 2,500 hip fracture patients treated in 297 hospitals in five states between 1981 and 1986 found that the proportion of patients discharged with one or more medical instabilities increased from 19 percent in the pre-PPS period to 23 percent in the post-PPS period (64).[21] Most of the increase was observed in patients who were discharged home. Before PPS, only 9 percent of hip fracture patients who were discharged home had one or more medical instabilities, compared with 17 percent in the post-PPS period. For hip fracture patients discharged to a nursing home, the proportion with one or more medical instabilities increased only slightly, from 26 percent in the pre-PPS period to 27 percent in the post-PPS period (64).

The University of Minnesota's Post Acute Care Study—a study of post-hospital service use for elderly Medicare beneficiaries discharged from 52 hospitals in three metropolitan areas (Pittsburgh, Minneapolis/St. Paul, and Houston) in 1988 and 1989—found that many hip fracture patients use several different types of services in the year following their discharge from the hospital (139). Movement from one service to another was relatively rapid in the period just after hospital discharge. About 45 percent of the 606 hip fracture patients in the study sample moved one or snore times in the first six weeks following their discharge from the hospital, not counting the initial move when they left the hospital (53, 139). Thus it cannot be assumed that hip fracture patients who are receiving a particular service at the time of hospital discharge will still be receiving the service even six weeks later.

On the other hand, the Post Acute Care Study also found that the movement of hip fracture patients from one service to another slows down by six months post-discharge. Of the 202 hip fracture patients in DRGs 210,211, and 236 who were discharged from the hospital to a nursing home, for example, 31 percent were in a nursing home at six months post-discharge; the same proportion and presumably most of the same individuals were in a nursing home six months later, at one year post-discharge (53).

Finally, post-hospital service use varies in different geographic areas because of differences in referral practices and the availability of particular types of services in different communities. Referral practices, service availability, and service use are all affected by funding. Differences in funding for particular services among Medicare fiscal intermediaries and state Medicaid programs are associated with differences in service use from state to state (90,102). In fact, the availability of funding for different types and amounts of post-hospital services may be more important than other factors, including patient need, in determining what services are used, by which patients, and for how long.

| Use and Expenditures for Nursing Home Care

Tables 17 and 18 present unpublished data from the 1988 and 1991 National Hospital Discharge Surveys on the number and proportion of people age 50 and over with a first-listed diagnosis of hip fracture (ICD-9-CM diagnostic code 820) according to their discharge status and destination .22 The

[21] For most hip fracture patients, these medical instabilities consisted of new incontinence or new confusion (64).

[22] The findings of the two surveys with respect to the proportion of hip fracture patients that died in the hospital (column 1, tables 17 and 18) were shown previously in tables 8 and 9.

TABLE 17: Discharge Status and Destination for People with a Hip Fracture Treated in Short-Stay Nonfederal Hospitals in 1988

Age	Died in the hospital	Discharged to home	Left against medical advice	Discharged to another short-stay hospital	Discharged to a long-term care institution	Discharged alive: destination not stated	Discharge status not stated
50-59	**46**	**4,975**		**367**	**2,172**	**619**	
n=8, 179	*1%*	*61%*		*4%*	*27%*	*8%*	
60-69	1,184	18,016	479	2,848	8,499	1,736	795
n=33,557	*4%*	*54%*	*1%*	*8%*	*25%*	*5%*	*2%*
70-79	**1,651**	**26,949**	**883**	**2,319**	**22,635**	**7,774**	**796**
n=62, 707	*3%*	*43%*	*1%*	*4%*	*36%*	*12%*	*1%*
80-89	2,001	28,483	760	9,045	49,568	6,655	1,676
n=98, 188	*2%*	*29%*	*1%*	*9%*	*50%*	*7%*	*2%*
90-99	**2,206**	**4,406**	**78**	**2,066**	**23,000**	**1,698**	
n=33,476	*7%*	*13%*	*<1%*	*6%*	*69%*	*5%*	
1 00+	*1,043*	*262*			*45*		
n= 1,350	*77%*	**19%**			**3%**		
Totals	8,131	83,093	1,900	16,665	105,919	18,482	3,267
n=237,457	3%	35%	1%	**7%**	**45%**	**8%**	**1%**
Males							
50-59		**1,539**		**367**	**266**	**57**	
n=2,231		*69%*		*16%*	*12%*	*3%*	
60-69	**920**	**5,767**	**420**	**1,433**	**2,956**	**694**	**795**
n= 12,985	**7%**	**44%**	**3%**	*1 1%*	**23%**	**5%**	**6%**
70-79	**1,427**	**5,991**	**583**	**311**	**5,783**	**875**	
n=14,970	*10%*	*40%*	*4%*	*2%*	*39%*	*6%*	
80-89	**564**	**5,305**	**376**	**709**	**12,346**	**889**	**240**
n=20,429	**3%**	**26%**	*2%*	*3%*	*60%*	*4%*	*1%*
90-99	**945**	**946**		**204**	**3,238**	**554**	
n=5,887	*16%*	*16%*		*3%*	**55%**	*9%*	
100+	*1,043*						
n= **1,043**	*100%*						
Totals	*4,899*	*19,548*	1,379	**3,024**	**24,591**	**3,069**	**1,035**
n=57,545	**9%.**	**34%**	**2%**	**5%**	**43%**	**5%**	**2%**
Females							
50-59	**46**	**3,436**			**1,304**	**562**	
n=5,948	*1%*	*58%*			*32%*	*9%*	
60-69	**264**	**12,249**	**59**	**1,415**	**5,543**	**1,042**	
n=20,572	*1%*	*60%*	*< 1%*	**7%**	**27%**	**5%**	
70-79	**224**	**20,958**				**6,899**	**796**
n=47, 737	*<1%*	*44%*		*4%*	*35%*	*14%*	**2%**
80-89	**1,437**	**23,178**	**384**	**8,336**	**37,222**	**5,766**	**1,436**
n=77, 759	*2%*	*30%*	*< 1%*	*11%*	**48%**	**7%**	**2 %**
90-99	**1,261**	**3,462**	**78**	**1,882**	**59,762**	**1,144**	
n=27,589	**5%**	*13%*	*<1%*	**7%**	*72%*	*4%*	
100+		**262**			**45**		
n=307		**85%**			**15%**		
Totals	**3,232**	**63,545**	**521**	**13,641**	**81,328**	**15,413**	**2,232**
n= 179,912	**2%**	**35%**	**<170**	**8%**	**45%**	**9%**	**1%**

SOURCE U S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, unpublished data from the 1988 National Hospital Discharge Survey, 1992

TABLE 18: Discharge Status and Destination for People with a Hip Fracture Treated in Short-Stay Nonfederal Hospitals in 1991

Age	Died in the hospital	Discharged to home	Left against medical advice	Discharged to another short-stay hospital	Discharged to a long-term care institution	Discharged alive: destination not stated	Discharge status not stated
50-59	**51**	**7,851**	**37**	**1,266**	**440**	**325**	
n=9,970	***1%***	***79%***	***<1%***	***13%***	***4%***	***3%***	
60-69	749	15,029	37	1,693	6,499	1,992	273
n=26,272	*3%*	*57%*	*<1%*	*6%*	*25%*	*8%*	*1%*
70-79	**2,477**	**28,408**	**799**	**11,063**	**25,915**	**9,756**	**855**
n=79,273	***3%***	***36%***	***1%***	***14%***	***33%***	***12%***	***1%***
80-89	5,187	30,456	481	14,797	55,954	12,887	3,059
n=122,821	*4%*	*25%*	*<1%*	*12%*	*46%*	*10%*	*2%*
90-99	**1,757**	**8,717**	**36**	**7,444**	**19,760**	**3,996**	**571**
n=42,281	***4%***	***21%***	***<1%***	***18%***	***47%***	***9%***	***1%***
100+	314	428		15	188	123	
n=1,068	*29%*	*40%*		*1%*	*18%*	*12%*	
Totals	10,535	90,889	1,390	36,278	108,756	29,079	4,758
n=281,685	*4%*	*32%*	*<1%*	*13%*	*39%*	*10%*	*2%*
Males							
50-59		**3,466**		**1,126**	**273**	**141**	
n=5,006		***69%***		***22%***	***5%***	***3%***	
60-69	526	4,499		271	3,994	445	
n=9,735	*5%*	*46%*		*3%*	*41%*	*5%*	
70-79	**1,252**	**5,179**	**188**	**3,546**	**5,716**	**2,024**	
n=17,905	***7%***	***29%***	***1%***	***20%***	***32%***	***11%***	
80-89	2,557	7,851		3,582	11,803	2,425	309
n=28,527	*9%*	*28%*		*13%*	*41%*	*9%*	*1%*
90-99	**653**	**1,893**	**36**	**326**	**2,636**	**1,391**	**219**
n=7,154	***9%***	***26%***	***1%***	***5%***	***37%***	***19%***	***3%***
100+	126			15	45	28	
n=214	*59%*			*7%*	*21%*	*13%*	
Totals	5,114	22,888	224	8,866	24,467	6,454	528
n=68,541	*7%*	*33%*	*<1%*	*13%*	*36%*	*9%*	*<1%*
Females							
50-59	**51**	**4,386**	**37**	**140**	**167**	**184**	
n=4,964	***1%***	***88%***	***1%***	***3%***	***3%***	***4%***	
60-69	223	10,530	37	1,422	2,505	1,547	273
n=16,537	*1%*	*64%*	*<1%*	*9%*	*15%*	*9%*	*2%*
70-79	**1,225**	**23,229**	**611**	**7,517**	**20,199**	**7,732**	**855**
n=61,368	***2%***	***38%***	***1%***	***12%***	***33%***	***13%***	***1%***
80-89	2,630	22,605	481	11,215	44,151	10,462	2,750
n=94,294	*3%*	*24%*	*1%*	*12%*	*47%*	*11%*	*3%*
90-99	**1,104**	**6,824**		**7,118**	**17,124**	**2,605**	**352**
n=35,127	***3%***	***19%***		***20%***	***49%***	***7%***	***1%***
100+	188	428			143	95	
n=854	*22%*	*50%*			*17%*	*11%*	
Totals	5,421	68,001	1,166	27,412	84,289	22,625	4,230
n=213,144	*3%*	*32%*	*1%*	*13%*	*40%*	*11%*	*2%*

SOURCE U.S Department of Health and Human Services, Public Health Service, National Center for Health Statistics, unpublished data from the 1991 National Hospital Discharge Survey, 1992.

data show that 45 percent of people age 50 and over who were hospitalized with a hip fracture in 1988 were discharged to a nursing home (see table 17).[23] In 1991, 39 percent of people age 50 and over who were hospitalized with a hip fracture were discharged to a nursing home (see table 18). The proportion discharged to a nursing home varies by age, from a third or fewer of those under age 80 to half or more of those age 80 and over. The proportions differ greatly between the two surveys for the age group 50 to 59, which has relatively few patients, and the age group 90 to 99, in which 69 percent of patients were discharged to a nursing home in 1988 compared with 47 percent in 1991. On average, male hip fracture patients are slightly less likely than female hip fracture patients to be discharged to a nursing home.

Data from the University of Minnesota's Post Acute Care Study show that of the 227 hip fracture patients in DRG 209, 35 percent (80 patients) were discharged from the hospital to a nursing home. Of the 379 hip fracture patients in DRGs 210,211, and 236,53 percent (202 patients) were discharged from the hospital to a nursing home (53, 139).

Other studies of hip fracture patients treated in individual hospitals or hospitals in certain geographic areas have found that anywhere from 24 to 78 percent of patients were discharged to a nursing home (28,29,32,50,57,59,64,79,95). This variation reflects differences in the study samples as well as differences in referral practices and the availability of various types of services in different communities.

Most studies that have compared the proportion of hip fracture patients discharged to a nursing home before and after the implementation of PPS have found that the proportion is higher in the post-PPS period (28,29,32,51,89). Both before and after the implementation of PPS, virtually all persons who were living in a nursing home at the time of their fracture have been readmitted to the nursing home after their discharge from the hospital (26,51). The change post-PPS has been in the proportion of patients that was living at home at the time of their fracture and is discharged from the hospital to a nursing home (51).

In the past, most hip fracture patients who were discharged from the hospital to a nursing home went to a skilled nursing facility (SNF) rather than an intermediate care facility (ICF). A study of 19,000 people with a hip fracture treated in Illinois hospitals from 1980 to 1982 found that almost three-quarters of those discharged to a nursing home went to a SNF (59). The distinction between SNFS and ICFS was eliminated for purposes of Medicaid reimbursement in 1990, but hip fracture patients whose nursing home care is paid for by Medicare still must be in a nursing home that is Medicare-certified as providing a skilled level of care.

Nursing home residents with a hip fracture have a shorter average length of stay than other nursing home residents. The 1985 National Nursing Home Survey found that among residents with a primary admission diagnosis of hip fracture who were discharged from a nursing home in 1985 for any reason, including death, 34 percent had stayed less than one month; 41 percent had stayed from one to six months, and 25 percent had stayed more than six months; their mean length of stay was 299 days, and their median length of stay was 59 days (133). In contrast, among all nursing home residents discharged in 1985, 31 percent had stayed less than one month; 32 percent had stayed one to six months, and 37 percent had stayed more than six months; the mean length of stay for all residents discharged in 1985 was 401 days, and their median length of stay was 82 days.

The Post Acute Care Study found that of the 80 hip fracture patients in DRG 209 who were discharged from the hospital to a nursing home, 37 percent stayed less than six weeks, 20 percent stayed from six weeks to six months, 3 percent stayed from six months to one year, and 40 percent stayed more than one year (53). Of the 202 hip

23 The survey instrument for the National Hospital Discharge Survey uses the term king-term care institution for nursing homes.

fracture patients in DRGs 210,211, and 236 who were discharged from the hospital to a nursing home, 36 percent stayed less than six weeks, 33 percent stayed from six weeks to six months, and 31 percent stayed more than one year (53).

Studies of hip fracture patients treated in individual hospitals indicate that 33 to 82 percent of patients discharged to a nursing home were still in the nursing home six months later (7,28,95) and that 32 to 66 percent of those discharged to a nursing home stayed in the nursing home more than one year (29,32,57). Data on 565 hip fracture patients in two states show that only 17 percent of those who were discharged from the hospital to a nursing home in 1985 and 1986 were still in the nursing home six months later (51).

These wide-ranging and incompatible figures on nursing home length of stay reflect differences in the study samples as well as differences in patterns of service use in different communities. The figures from the 1985 National Nursing Home Survey are based on a discharge sample that includes only residents who are discharged from the nursing home in the time frame of the study; thus the figures underestimate average length of stay for all nursing home residents with a hip fracture. The figures from the Post Acute Care Study and the other studies cited above are based on admission samples that include all residents with a hip fracture admitted to a nursing home in the time frame of the study. These studies include residents with longer lengths of stay but still do not provide information about length of stay for residents with very long stays.

In comparison with both admission and discharge samples, samples of current nursing home residents show a greater proportion of residents with long lengths of stay and a smaller proportion of residents with short lengths of stay (72). In part because hip fracture patients have a shorter average length of nursing home stay than other nursing home residents, they constitute a very small proportion of current residents. According to the 1985 National Nursing Home Survey, only 1.8 percent of all residents had a primary diagnosis of hip fracture at the time of the survey.[24] In contrast, residents with a primary admission diagnosis of hip fracture constituted 5 percent of all residents discharged in 1985 (130).

On the basis of an average of the figures from the 1988 and 1991 National Hospital Discharge Surveys, OTA estimates that 41 percent of all hip fracture patients age 50 and older are discharged from the hospital to a nursing home. The comparable proportions are 39 percent for male hip fracture patients and 42 percent for female hip fracture patients. Averaging the figures from the two years and combining the age categories 90 to 99 and 100+, the age-specific proportions of hip fracture patients discharged to a nursing home are as follows: age 50 to 59, 14 percent; age 60 to 69, 25 percent; age 70 to 79,34 percent; age 80 to 89,48 percent; and age 90 and over, 55 percent.

For length of stay, OTA estimates that 24 percent of hip fracture patients discharged to a nursing home remain for one month, 8 percent remain for two months, 8 percent remain for three months, 8 percent remain for four months, 8 percent remain for five months, 10 percent remain for six months, and 34 percent remain for one year or longer. These figures are based primarily on averaged data from the Post Acute Care Study, which included only people age 65 and over. OTA is not aware of any data that can be used to estimate nursing home length of stay for hip fracture patients age 50 to 64. Thus OTA used the figures just cited for all hip fracture patients discharged to a nursing home, regardless of age. Since patients age 65 and over are likely to remain in a nursing home longer than patients age 50 to 64, these figures probably overestimate length of stay and therefore expenditures for the younger patients.

24 Of these 26,600 residents, 1,600 were under age 65; 1,700 were age 65 to 74; 7,300 were age 75 to 84; and 16,000 were age 85 and over (1 34). Of the 26,600 residents, 21 ,900 were females. Of the female residents, 21,400 were age 65 and over, 6,100 were age 75 to 84, and 14,100 were age 85 and over. Female residents with a primary diagnosis of hip fracture constituted 2 percent of all female nursing home residents.

No data are available to determine the average length of stay for the 34 percent of hip fracture patients who remain in the nursing home for one year or longer. On the basis of data from the 1985 National Nursing Home Survey, Spence and Wiener (1 14) estimated that 36 percent of all nursing home residents admitted in 1985 would remain in the nursing home more than one year, including 17 percent who would remain for one to three years, 9 percent who would remain for three to five years, and 10 percent who would remain for more than five years. One could use these figures, which are not hip fracture-specific, to estimate average length of stay for long-stay hip fracture patients, subtracting 2 percent from one of the length of stay categories to total to 34 percent. Alternatively, one could assume that nursing home stays longer than one year generally are not attributable to hip fracture.

In considering these two alternatives, it is important to keep in mind the relatively high background level of nursing home use among very old people. In 1985,22 percent of individuals age 85 and over were in a nursing home at any one time, compared with only 1 percent of individuals age 65 to 74 and 6 percent of individuals age 75 to 84 (133). Older females are more likely than older males to be in a nursing home, and in 1985,25 percent of females age 85 and over were in a nursing home at any one time.[25]

Several studies have shown that hip fracture patients who remain in a nursing home for longer than six months or a year tend to be over age 80, female, lacking in family involvement, disoriented, and unable to transfer from bed to chair, bathe, or ambulate without assistance (7,57,81). These characteristics predict nursing home placement irrespective of hip fracture.

In addition, as noted earlier, some individuals fracture their hip while they are living in a nursing home. These individuals are almost always readmitted to the nursing home when they are discharged from the hospital (26,5 1,79), and they are likely to remain in the nursing home for the rest of their lives. According to the 1985 National Nursing Home Survey, more than 18,000 individuals were discharged from a nursing home to a short-stay hospital with a primary *discharge* diagnosis of hip fracture (130); virtually all these individuals had an additional discharge code (E code) indicating that the hip fracture was the result of an accidental fall (39). One cannot be sure that all these individuals experienced a new hip fracture in the nursing home, but it is likely that most did.

Some nursing homes do not formally discharge residents when the residents are hospitalized; thus the number of individuals who fracture their hip while they are living in a nursing home may be greater than 18,000. Unpublished data from the 1987 National Medical Expenditure Survey indicate that 34,000 nursing home residents were hospitalized with a primary hospital diagnosis of hip fracture in 1987 (126). If all of these 34,000 individuals survived and returned to the nursing home from the hospital, they would constitute about one-third of all hip fracture patients discharged from a short-stay hospital to a nursing home in that year.

Given that the majority of hip fracture patients are age 80 or over, that hip fracture patients who remain in a nursing home for a prolonged period generally have characteristics that predict nursing home placement irrespective of hip fracture, and that a large number of nursing home residents fracture their hip in the nursing home and return to the nursing home after discharge from the hospital, it is not surprising that some hip fracture patients who are discharged from the hospital to a nursing home are still in a nursing home one year after their fracture. Nor is it likely that their pro-

25 On the basis Of data from the National Mortality Follow back Survey, Kemper and Murtaugh (60) concluded that among females who died in 1986, the proportion that had spent some time in a nursing home before their death was 9 percent for those who died at age 45 to 64,2 I percent for those who died at age 65 to 74,42 percent for those who died at age 75 to 84,65 percent for those who died at age 85 to 94, and 77 percent for those who died over age 95. About half of all persons who entered a nursing home spent at least one year there.

longed nursing home stays are primarily attributable to their hip fracture.

For these reasons, OTA concluded that the maximum nursing home length of stay that should be attributed to hip fracture is one year and that including longer stays would allocate expenditures to hip fracture that are actually attributable to frailty and dementia in very old people, lack of alternative care settings, and other factors. Undoubtedly, there are some cases in which a prolonged nursing home stay is attributable to hip fracture. If there are many such cases, OTA's decision to use a one-year maximum length of stay for this analysis will result in an underestimation of expenditures for nursing home care for hip fracture patients. On the other hand, OTA's estimate of expenditures for nursing home care may be too high since no reduction was made to account for the large number of cases in which individuals fracture their hip while they are in a nursing home and return to the nursing home after their hospital discharge; many of these individuals probably would have stayed in the nursing home for a prolonged period even if they had not fractured their hip. The potential overestimation of expenditures for nursing home care from the latter cases probably outweighs any underestimation of expenditures due to cases in which a nursing home stay longer than one year is legitimately attributable to hip fracture.

In addition to hip fracture patients who are initially discharged from the hospital to a nursing home, some hip fracture patients are initially discharged home or to a rehabilitation facility and later admitted to a nursing home. As noted earlier, the Post Acute Care Study found that 80 of the 227 hip fracture patients in DRG 209 were initially discharged from the hospital to a nursing home (1 39). Among the other 147 hip fracture patients in this DRG, 8 percent of those who were initially discharged home and 22 percent of those who were initially discharged to a rehabilitation facility were in a nursing home by one year post-discharge. Of the 379 hip fracture patients in DRGs 210, 211, and 236, 202 were initially discharged from the hospital to a nursing home. Among the other 177 hip fracture patients in these DRGs, 8 percent of those initially discharged home and 17 percent of those initially discharged to a rehabilitation facility were in a nursing home by one year post-discharge. These individuals who were initially discharged home or to a rehabilitation facility but were in a nursing home by one year post-discharge constitute 6 percent of all hip fracture patients in the study sample. OTA does not have information about the reason these individuals were admitted to a nursing home. Lacking this information, OTA assumed that their nursing home admission was attributable to their hip fracture. OTA also does not have information about average length of nursing home stay for these individuals. Since they were initially discharged to home or a rehabilitation facility, OTA assumed that, on average, they were in a nursing home for 10 of the 12 months in the first year post-discharge. This assumption may result in an overestimation of the use of and expenditures for nursing home care by hip fracture patients.

Most hip fracture patients receive skilled level nursing home care, at least for their first few months in the nursing home, and many receive Medicare reimbursement for the first weeks of care, thus reimbursement for their care is likely to be above the average reimbursement for all residents. In 1985, the average monthly charge for nursing home care was $1,456. This overall average includes an average monthly charge of $2,141 for individuals for whom Medicare was the primary **payer, $1,998** for individuals for whom Medicaid was the primary payer and the resident was receiving skilled level care, $1,292 for individuals for whom Medicaid was the primary payer and the resident was receiving intermediate level care, and $1,450 for residents who were paying for their own care (1 33). The average monthly charge for residents with a primary diagnosis of hip fracture was $1,608 in 1985 (134), compared with the average monthly charge of $1,456 for all residents, noted above. On the basis of figures from the 1985 National Nursing Home Survey and HCFA's Skilled Nursing Home Facility Input Price Index, Kemper et al. (61) estimated that the average annual nursing home charge for 1990 was $25,000

or $2,083 per month.[26] Thus, OTA estimated the 1990 nursing home expenditure for hip fracture patients as $2,293 per month ($2,083 multiplied by the ratio of $1,608 to $1 ,456).

For the 66 percent of hip fracture patients discharged to a nursing home who remain in the nursing home less than a year, the weighted average expenditure for nursing home care based on the length of stay figures given above and a payment of $2,293 per month is $6,810 per patient for 1990. For the 34 percent of patients discharged to a nursing home who remain in the nursing home at one year post-discharge, the average per patient expenditure for nursing home care, based on the same figures and assuming a maximum attributable length of stay of one year, is $27,516 per patient for 1990. Combining these two amounts, the weighted average per patient expenditure for nursing home care for hip fracture patients who are discharged from the hospital to a nursing home is $13,849 for 1990. For hip fracture patients who are initially discharged home or to a rehabilitation facility but later admitted to a nursing home, the average per patient expenditure for nursing home care is $22,930 for 1990. Assuming that 41 percent of all hip fracture patients are discharged from the hospital to a nursing home and that 6 percent are initially discharged home or to a rehabilitation facility but later admitted to a nursing home, the average per patient expenditure for nursing home care for all hip fracture patients is $7,054 for 1990.

If it were assumed that nursing home stays beyond one year are attributable to hip fracture and Spence and Wiener's figures for average length of stay beyond one year for all nursing home residents were used (subtracting 2 percent from the one- to three-year length of stay category to total to 34 percent), the average per patient expenditure for the 34 percent of hip fracture patients discharged from the hospital to a nursing home who remain in the nursing home at one year post-discharge would be $93,878 for 1990. Combining this amount with the $6,810 estimate for patients who remain in the nursing home less than one year yields a weighted average per patient expenditure of $36,412 for 1990. Assuming that 41 percent of all hip fractures patients are discharged to a nursing home, the average per patient expenditure for all hip fracture patients would be $14,929 for 1990. If it were additionally assumed that the 6 percent of hip fracture patients who are initially discharged home or to a rehabilitation facility but later admitted to a nursing home also remain in the nursing home beyond one year, using Spence and Wiener's figures for length of stay, the average per patient expenditure for all hip fracture patients would be $20,286 for 1990. As noted earlier, however, OTA believes that, in general, expenditures for nursing home stays beyond one year are not legitimately attributable to hip fracture.

Use and Expenditures for Care in a Rehabilitation Facility or Another Short-Stay Hospital

Some hip fracture patients are discharged from the hospital to a free-standing rehabilitation hospital, a rehabilitation unit in a short-stay hospital, or another type of unit in a short-stay hospital. In addition, some patients are readmitted to a short-stay hospital in the year following their fracture. The National Hospital Discharge Survey does not collect information about discharges to rehabilitation facilities, but discharges to rehabilitation facilities are probably included in the survey response category, *discharges to another short-stay hospital.* Data from the 1988 survey show that an average of 7 percent of hip fracture patients age 50 and over were discharged to a short-stay

26 This number might be too low. According to a 1988 survey of state Medicaid programs, the average per diem for Medicaid SNF care was $60.65 ($1 ,820 per month) in 1988 and the average per diem for Medicaid ICF care was $46.03 ($ I ,382 per month) in 1988. These rates varied greatly from state to state (8). The state Medicaid programs estimated that private pay rates were $11.98 per day higher for SNF care and $10.19 per day higher for ICF care in 1987. Neu and Harrison (89) report that in 1984/85, Medicare allowed charges for one day of skilled care were $110.63 for patients in DRG 209, $118.49 for patients in DRG 210, and $111 .80 for patients in DRG 236.

hospital (see table 17). The proportion varies for different age groups but shows no obvious trend to increase or decrease with increasing patient age. The 1991 National Hospital Discharge Survey found that an average of 13 percent of hip fracture patients age 50 and over were discharged to a short-stay hospital, again with no obvious trend to increase or decrease with increasing patient age (see table 18).

A review of 1988 Medicare data conducted for PROPAC found that 8 percent of hip fracture patients age 65 and over were discharged to a rehabilitation facility (102). Hip fracture patients age 85 and over were less likely than those under age 85 to be discharged to a rehabilitation facility, and black patients were less likely than white patients to be discharged to a rehabilitation facility.

The University of Minnesota's Post Acute Care Study, which included Medicare beneficiaries discharged from 52 hospitals in three metropolitan areas in 1988 and 1989, found that of the 227 hip fracture patients in DRG 209, 16 percent (36 patients) were discharged from the hospital to a rehabilitation facility (53, 139). Of the 379 patients in DRGs 210,211, and 235, 14 percent (53 patients) were discharged to a rehabilitation facility. Six weeks later, most of these patients had left the rehabilitation facility to go home or to a nursing home.

The proportion of hip fracture patients discharged to a rehabilitation facility varies in different geographic areas and among hospitals. The study of hip fracture patients treated in seven Maryland hospitals between 1984 and 1986 found that less than 5 percent of patients were discharged to a rehabilitation facility (79). In contrast, a study of hip fracture patients discharged from one hospital in Boston in 1983 and 1984 found that 40 percent were discharged to a rehabilitation facility (50). The high proportion of patients discharged to a rehabilitation facility in the latter study is not replicated in any other study OTA is aware of and probably reflects the availability of this type of service in Boston at the time of the study and referral practices at the discharging hospital.

The proportion of hip fracture patients discharged to a rehabilitation facility maybe increasing (78). From 1984 to 1985, only 3 percent of hip fracture patients in DRGs 209 and 210 received Medicare payment for post-hospital care in a rehabilitation facility (90) compared with 8 percent in 1988 (102). Since rehabilitation facilities are exempt from PPS, there is probably a financial incentive for greater use of these facilities for Medicare beneficiaries.

Average length of stay for hip fracture patients in rehabilitation facilities is short. In 1984 and 1985, the average length of stay in a rehabilitation facility was 8.8 days for Medicare beneficiaries in DRG 209 and 10.1 days for Medicare beneficiaries in DRG 210 (90).

Many hip fracture patients are readmitted to a short-stay hospital in the year following their fracture, sometimes for complications resulting from the fracture or treatment they received for the fracture. Among 536 hip fracture patients who were treated in seven Maryland hospitals from 1984 to 1986 and survived for at least one year, 35 percent were rehospitalized in the year following their fracture (80). Among 1,045 hip fracture patients treated in 57 hospitals in five states in 1985 and 1986, 42 percent of those discharged alive were rehospitalized in the year following their fracture, and the average length of stay for these rehospitalization was eight days (51).

Many hip fracture patients who are rehospitalized in the year following their fracture are hospitalized for conditions unrelated to the fracture. To determine the proportion of patients rehospitalized for fracture-related conditions, HCFA convened a panel of orthopedic surgeons to develop lists of potential adverse events for patients who receive one of two treatments for hip fracture: partial hip replacement or reduction and internal fixation (122). Based on the lists of adverse events and associated time frames developed by the panel, HCFA concluded that in 1986, 5 to 10 percent of the patients were rehospitalized in the year following their original hospital discharge for a condition related to their hip fracture. A larger

proportion of the patients was rehospitalized for any cause.[27]

On the basis of the preceding discussion, OTA estimates that 12 percent of all hip fracture patients are discharged from the original hospital to a rehabilitation facility or another short-stay hospital. This figure is the average of the figures on discharges to short-stay hospitals from the 1988 and 1991 National Hospital Discharge Surveys and discharges to rehabilitation facilities from the Post Acute Care Study and the study conducted for PROPAC. Using this figure assumes that most discharges to short-stay hospitals in the National Hospital Discharge Survey are actually discharges to rehabilitation facilities.

On the basis of the findings of Neu and Harrison (89), OTA estimates that the average length of stay for hip fracture patients who are discharged to a rehabilitation facility or other short-stay hospital is nine days.

To determine the average per patient expenditure for post-hospital care in a rehabilitation facility or another short-stay hospital, OTA used the average charge for a hospital day, $687 in 1990 (3).[28] Using this figure, the average expenditure for hip fracture patients discharged to a rehabilitation facility or short-stay hospital is $6,183 (nine days multiplied by $687 per day) for 1990. Assuming that 12 percent of hip fracture patients were discharged to a rehabilitation facility or another short-stay hospital, the weighted average per patient expenditure for all hip fracture patients is $742 for 1990. These amounts may overestimate the true amounts because they are based on hospital charges.

OTA further assumed that 8 percent of hip fracture patients (the midpoint of HCFA's 5 to 10 percent figures cited above) were readmitted to a short-stay hospital for a fracture-related condition at some time in the year following their fracture and that these patients had an average length of stay in the short-stay hospital of eight days, based on the study of hip fracture patients treated in 57 hospitals in five states (51). Using these figures, the average per patient expenditure for hip fracture patients rehospitalized in a short-stay hospital is $5,496 for 1990. The weighted average per patient expenditure for all hip fracture patients is $440.

Use and Expenditures for Home Care Services

Some hip fracture patients receive paid home care services either immediately after their discharge from the hospital or later in the first year post-fracture. In addition, many patients receive unpaid home care services provided by family members and others. The discussion below pertains only to paid home care services. Unpaid services provided by family members and others are discussed later in this document.

Medicare pays for some types of home care, including skilled nursing, physical therapy, and home health aide services. In 1984 and 1985,26 percent of hip fracture patients in DRG 209, 25 percent of hip fracture patients in DRG 210, and 25 percent of all patients in DRG 236 received Medicare-covered home health care services sometime in the first six months post-discharge (89,90). Most of these services were provided in the first two months post-discharge. Patients in DRGs 209 and 236 received an average of 16 Medicare-covered home health care visits in the first 60 days post-discharge and an additional four Medicare-covered visits by 190 days post-discharge (89). Patients in DRG 210 received an average of 18 Medicare-covered home health care visits in the first two months post-discharge and an additional six Medicare-covered visits by 190 days post-discharge. The use of Medicare-covered home health services by all patients in DRG 209 increased with age from 28 percent of those

27 From 1976 to 1988, there were 334 or more hospital discharges per year per 1,000 persons age 65 and over in the United States(1). Thus, at least one-third of elderly people are hospitalized per year for all causes.

28 AHA does not provide information about average payment for a hospital day.

under age 70, to 34 percent of those age 70 to 74, 39 percent of those age 75 to 79, and 41 percent of those age 85 to 89, and then decreased to 32 percent of those age 89 and over (90). The use of Medicare-covered home health services by all patients in DRG 210 varied with patient age but showed no obvious trend to increase or decrease with increasing patient age.

A review of 1988 Medicare data conducted for PROPAC found that an average of 31 percent of hip fracture patients age 65 and over received Medicare-covered home health services (102). Hip fracture patients age 85 and over were less likely than those under age 85 to receive home health services, and white patients were less likely than black patients to receive home health services.

The University of Minnesota's Post Acute Care Study found that of the 227 hip fracture patients in DRG 209, 27 percent (62 patients) were discharged from the hospital to home with paid home care services (53, 139). At six weeks post-discharge, 93 percent of these patients were still at home, and 7 percent were in an institution. Of the 379 hip fracture patients in DRGs 210, 211, and 236, 14 percent (53 patients) were discharged from the hospital to home with paid home care services (53, 139). At six weeks post-discharge, 92 percent of these patients were still at home, and 8 percent were in an institution.

The previously cited study of 657 hip fracture patients treated in seven Maryland hospitals from 1984 to 1986 found higher use of paid home care services in the early post-discharge period and a drop off in service use by six months post-fracture (55). The study collected information about 10 types of paid home care services, including both home health and other nonmedical home care services. The 10 types of home care services were personal care, domestic care, meals on wheels, medical supervision, nursing care, physical therapy, indoor mobility assistance, outdoor mobility assistance, emotional support, and assistance with arranging services. At two months post-fracture, 27 percent of the hip fracture patients were receiving one or more of these types of services for an average of 24 hours per week with an average expenditure from all sources of $182 per week. By six months post-fracture, only 17 percent of the patients were receiving any of the home care services, and those receiving the services were receiving fewer hours, an average of 17 hours per week, with an average expenditure from all sources of $87 per week. Patients who received home care services were in poorer physical condition on average than patients who did not receive the services.

In evaluating the impact of hip fracture on the use of home care services, it is important to consider the background levels of use of these services by all elderly people and by elderly people with physical impairments. With respect to service use by all elderly people, the Supplement **on** Aging of the 1985 National Health Interview Survey found that 1 percent of persons age 65 and over reported receiving homemaker services in the previous year; 3 percent reported receiving visiting nurse services; and 2 percent reported receiving home health aide services (128). Individuals over age 75 were more likely than individuals age 65 to 74 to use these services, and females were more 1ikely than males to use each of the services; nevertheless, only 6 percent of females over age 75 reported using any of the services in the previous year. Thus, the use of home care services by hip fracture patients is considerably higher than the use of these services by elderly people in general.

With respect to service use by elderly people with physical impairments, the 1982 National Long Term Care Survey found that 26 percent of elderly individuals with chronic disabilities who were unable to care for themselves independently were receiving paid home care services (73). This number includes 5 percent who were receiving only paid services and 21 percent who were receiving both paid and unpaid home care services. Thus the use of home care services by hip fracture patients is similar to the use of home care services by all elderly people with physical impairments, at least in the early post-discharge period.

In this context, it is interesting to note that 17 percent of the 657 hip fracture patients in the Maryland study cited above were receiving paid

home care services at an average cost of $94 per week *before* their hip fracture (55). The proportion receiving paid home care services and the average expenditures for the services were considerably higher at two months post-fracture. By six months post-fracture, however, the proportion of patients receiving paid home care services was again 17 percent, and the average weekly expenditure for home care services was lower than in the pre-fracture period. Some individuals who were receiving paid home care services before their hip fracture probably were no longer receiving the services at six months post-fracture because they had died or were in a nursing home. Nevertheless, it is likely that a considerable proportion of the individuals who used paid home care services after their hip fracture would have used these services even without the fracture.

In 1984 and 1985, the average Medicare allowed charge for home health care visits for persons in DRGs 209, 210, and 236 was $53 per visit (89). The average Medicare allowed charge for home health care visits for all types of patients was $51 in 1985,$55 in 1986(106),$62 in 1988(1 10), and $69 in 1990 (123).

On the basis of the preceding discussion, OTA estimates that 30 percent of hip fracture patients received an average of 22 Medicare-covered home health care visits in the first six months post-discharge for an average per patient expenditure of $1,518 ($69 multiplied by 22 visits). Using this amount, the weighted average per patient expenditure for all hip fracture patients is $453 for 1990.

There may be an additional expenditure for homemaker and other nonmedical home care services for these or other hip fracture patients, but little information is available to calculate the amount. The expenditure of $1,518 for home health care services includes payment for 17 home health visits in the first two months post-discharge: a total of 17 visits in two months amounts to about two visits per week, which would entail a weekly expenditure of $110 at 1986 **rates.** Kashner and Magaziner (55) found that expenditures for home care services averaged $182 per week at two months post-fracture, thus leaving $72 per week ($182 minus $11 O) for homemaker and other nonmedical home care services. This amount is close to the $94 per week spent on home care by patients in the pre-fracture period and the $87 per week spent on home care by patients at six months post-fracture. Thus one could assume that there is no additional expenditure for nonmedical home care services associated with hip fracture. Anecdotal evidence suggests that this assumption is false. Instead, OTA assumed a weekly expenditure of $50 (a little over half of the three amounts **above,** $72, $94, and $87) for nonmedical home care services for nine months, or $1,935. Adding this amount for 17 percent of all hip fracture patients (the proportion that was receiving any home care services at six months post-fracture in the Maryland study), the weighted average per patient expenditure for all hip fracture patients is $329 for 1990. This figure may overestimate expenditures for nonmedical home care services in excess of the services that would be used by individuals with similar physical impairments who have not had a hip fracture.

Combining the two figures gives an average expenditure of $782 per patient for home health and other nonmedical home care services for all hip fracture patients.

| Use and Expenditures for Physician Visits

As noted in the earlier section on in-hospital services, in 1986, Medicare paid for an average of 11 post-operative physician visits for individuals who received open reduction and internal fixation of a hip fracture and eight post-operative v i sits for individuals who received a total hip replacement (63). Most of these visits were provided by physicians in specialties different from the physician who performed the surgery. It is not clear what proportion of the visits occurred in the hospital versus after the patient discharge from the hospital. Since OTA did not include expenditures for these visits in the estimated expenditures for in-hospital services discussed earlier, the expenditures are included in this section. OTA does not have any specific information about the number of physician visits for hip fracture patients who re-

ceive a partial hip replacement or for those who are treated nonsurgically.

The study of 657 hip fracture patients treated in seven Maryland hospitals from 1984 to 1986 found that 82 percent of the patients had at least one visit to a physician's office in the first two months after hospital discharge and that these patients averaged 2.6 physician office visits in that period (55). In the period from two to six months post-fracture, 81 percent of the patients had at least one visit to a physician's office, and these patients averaged 4.1 physician office visits in that time.

The National Ambulatory Medical Care Survey provides information about physician office visits based on a nationally representative sample of people of all ages. The survey data for 1991 show that there were 912,000 physician office visits for people age 50 and over in any of the following diagnostic categories: osteoporosis (ICD-9-CM diagnostic code 733.0), fracture of the vertebral column without mention of spinal cord injury (ICD-9-CM diagnostic code 805), fracture of the radius and ulna (ICD-9-CM diagnostic code 813), and fracture of the neck of the femur (ICD-9-CM diagnostic code 820) (108). Further differentiation of the 912,000 physician office visits by the four diagnostic categories, by patient age, or by patient gender results in statistically unreliable data. By combining data on physician office visits for 1989 and 1990 from the National Ambulatory Medical Care Survey, however, it is possible to obtain statistically reliable data for the number of physician office visits for people age 50 and over in these diagnostic categories. The two-year data show 996,000 office visits for people age 50 and over with a hip fracture, including 891,000 office visits for those age 65 and over with a hip fracture (107).29

According the 1988 National Hospital Discharge Survey, about 20,000 people age 50 to 64 were discharged alive from the hospital with a first-listed diagnosis of hip fracture. Assuming that physician office visits reported in the 1989 and 1990 National Ambulatory Medical Care Surveys were evenly distributed between the two years (1989 and 1990), one could conclude that the 20,000 hip fracture patients received 52,500 office visits (996,000 minus 891,000, divided by two years) or about three visits per patient. In 1988, there were about 209,000 people age 65 and over who were discharged alive from the hospital with a first-listed diagnosis of hip fracture. Again, assuming that the physician office visits reported in the 1989 and 1990 National Ambulatory Medical Care Surveys were distributed even] y between the 2 years, one could conclude that the 209,000 hip fracture patients received 445,500 physician office visits (891 ,000 divided by two years) or about two visits per patient. It is unclear why the average number of physician office visits based on data from the National Ambulatory Medical Care Survey is lower than the average number of physician office visits from the Maryland study.

Using the figures on Medicare payments for post-operative physician visits and the Maryland figures on physician office visits, OTA estimates that hip fracture patients age 50 and over receive an average of eight physician visits per patient. Table 19 shows the Medicare submitted and allowed charges for 1990 for all types of physician office visits listed in the 1990 CPT codebook. For individuals age 65 and over, OTA used an average of the Medicare allowed charges for established patients—$67—multiplied by eight visits, yielding $536 for 1990. For individuals age 50 to 64, OTA used an average of the Medicare submitted charges for established patients—$89—multiplied by eight visits, yielding $712 for 1990. According to the 1988 National Hospital Discharge Survey, 9 percent of hip fracture patients age 50 and over were age 50 to 64; the comparable figure for 1991 was 8 percent. Assuming that an average of 8 percent of hip fracture patients age 50 and

29 Hip fracture could have been the primary diagnosis or one of the secondary diagnoses listed by the physician who reported these visits (107).

TABLE 19: Average Medicare Submitted and Allowed Charges for Physician Office Visits, 1990

CPT/HCPCS code	Type of physician office visit	Average Medicare submitted charges	Average Medicare allowed charges
90000	New patient: Office and other outpatient medical service, new patient; brief service	$40	$29
90010	..limited service	46	36
90015	. . intermediate service	58	44
90017	extended service	68	49
90020	..comprehensive service	107	77
90030	Established patient: Office and other outpatient medical service, established patient; minimal	37	26
90040	.. brief service	61	45
90050	..limited service	110	82
90060	.intermediate service	135	104
90070	extended service	102	77
90080	..comprehensive service	87	65

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the Current *Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system (HCPCS).

SOURCE U.S Department of Health and Human Services, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993

over are age 50 to 64 and the remaining 92 percent are age 65 and over, the weighted average expenditure for physician visits for all hip fracture patients age 50 and over is $550 per patient for 1990.

Use and Expenditures for Outpatient Physical Therapy

Some hip fracture patients receive physical therapy after their discharge from the hospital. Medicare covers in-home physical therapy as part of the home health care benefit, and in-home physical therapy was included in the Medicare-covered home health care services discussed earlier. OTA is not aware of any data on the use of office-based physical therapy for hip fracture patients, although anecdotal evidence suggests that some hip fracture patients receive office-based physical therapy (34). The literature on hip fracture that OTA has reviewed does not mention the use of office-based physical therapy, and other analyses of the cost of hip fractures generally do not include payments for office-based physical therapy.

Some nursing home residents with a hip fracture receive physical therapy that is billed to Medicare as a Part B service in addition to payments from Medicare or other sources for their nursing home care. OTA does not have any data on the use of or expenditures for this service.

Given the lack of information about expenditures for nursing home or office-based physical therapy and the inclusion of expenditures for in-home physical therapy earlier in this document, OTA decided not to include an additional payment for outpatient physical therapy.

Use and Expenditures for Emergency Room and Ambulance Services

Many hip fracture patients are first evaluated in a hospital emergency room before being admitted to the hospital. For Medicare payment purposes,

TABLE 20: Average Medicare Submitted and Allowed Charges for Physician Emergency Room Services, 1990

CPT/HCPCS	Type of emergency room service	Average Medicare submitted charges	Average Medicare allowed charges
90500	Emergency department service, new patient minimal service	$39	$21
90505	..brief service	46	25
90510	..limited service	63	36
90515	..intermediate service	92	52
90517	..extended service	141	83
90520	..comprehensive service	187	114
90530	Emergency department service, established patient, minimal service	38	17
90540	..brief service	49	26
90550	..limited service	60	31
90560	. intermediate service	77	39
90570	..extended service	102	51
90580	..comprehensive service	144	65

CPT/HCPCS = codes for procedures and services performed by physicians as listed in the *Current Procedural Terminology* (CPT) codebook and the HCFA common procedures coding system (HCPCS).

SOURCE: U S. Department of Health and Human Services, Health Care Financing Administration, Off Ice of Research and Demonstrations, unpublished data, 1993.

hospital emergency room services, including radiology services for emergency room patients, are considered part of the inpatient care for individuals who are admitted to the same hospital before midnight of the next day. Thus there is generally no additional expenditure for hospital emergency room services for hip fracture patients whose hospital care is paid for by Medicare (i.e., 94 percent of those age 65 and over and 15 percent of those age 50 to 64). There maybe an additional expenditure, however, for the physician who sees the patient in the emergency room. To determine the amount of this expenditure, OTA obtained 1990 data on the average Medicare submitted and allowed charges for the physician emergency room services listed in the 1990 CPT codebook (see table 20). Using an average of the Medicare allowed charges for physician emergency room services for new patients, OTA estimates that the per patient expenditure for physician emergency room services for hip fracture patients whose hospital care is paid for by Medicare is $55 for 1990.

For hip fracture patients whose hospital care is paid for by a source other than Medicare (i.e., 6 percent of those age 65 and over and 85 percent of those age 50 to 64), there maybe an additional expenditure for emergency room services, including radiology, as well as for physician emergency room services. OTA is not aware of any data on expenditures for emergency room services for hip fracture patients whose care is paid for by a source other than Medicare. Moreover, Medicare information that might be useful in estimating these expenditures is not available because Medicare payments for emergency room and other hospital outpatient services are determined retrospectively, on a hospital-specific basis, using a mix of costs and charges from various cost centers, and national data that differentiate payments by type of service are not compiled (143). Lacking this in-

formation, OTA assumed a per patient expenditure of $200 for emergency room services for hip fracture patients whose care is paid for by a source other than Medicare. In addition, using an average of the Medicare submitted charges for physician emergency room services for new patients (see table 20), OTA estimated that the per patient expenditure for physician emergency room services for these patients is $95. Combining these figures yields an average per patient expenditure of $295 for all emergency room services, including radiology and physician services, for hip fracture patients whose hospital care is paid for by a source other than Medicare.

It is likely that almost all hip fracture patients are taken to the hospital by ambulance. Expenditures for ambulance services vary greatly in different parts of the country. Lacking national data on the average expenditure for ambulance services, OTA assumed a $200 expenditure per patient.

Combining the figures discussed above, the average per patient expenditure for emergency room and ambulance services for hip fracture patients whose care is paid for by Medicare is $255. For hip fracture patients whose care is paid for by a source other than Medicare, the comparable figure is $495. Assuming that 94 percent of hip fracture patients age 65 and over receive care paid for by Medicare and 6 percent receive care paid for by a source other than Medicare, the combined average per patient expenditure for emergency room and ambulance services for hip fracture patients age 65 and over is $269 for 1990. Assuming that 15 percent of hip fracture patients age 50 to 64 receive care paid for by Medicare and 85 percent receive care paid for by a source other than Medicare, the combined average per patient expenditure for emergency room and ambulance services for hip fracture patients age 50 to 64 is $459 for 1990. Assuming further that an average of 8 percent of hip fracture patients age 50 and over are age 50 to 64 and the remaining 92 percent are age 65 and over, the weighted average expenditure for emergency room and ambulance services for all hip fracture patients age 50 and over is $284 for 1990.

I Use and Indirect Costs of Informal Care

Many hip fracture patients receive informal (unpaid) assistance from their family and friends. OTA is aware of only one completed study that has attempted to quantify the informal care received by hip fracture patients (55). The study of 657 hip fracture patients age 65 and over who were treated in seven Maryland hospitals between 1984 and 1986 found that most of these individuals were receiving a substantial amount of care from family and friends before their fracture. In the week before their fracture, 82 percent of the patients received an average of 41 hours of informal care from their families or friends. At **two** months post-fracture, 88 percent of the patients were receiving an average of 44 hours per week of informal care-an increase that **was not** statistically significant. By six months post-fracture, the proportion of patients receiving care and the average hours of care per week had decreased; at that point, 84 percent of patients were receiving an average of 39 hours of unpaid care per week.

Although the Maryland study found very little change in the proportion of patients receiving informal care and the amount of care they received, the type of informal care provided for these patients changed considerably. Before the patient's fracture, unpaid caregivers were more likely to be assisting with shopping, transportation, and arrangements for medical services, whereas after the fracture, they were more likely to be assisting with housework and helping the patient **to** transfer from bed to chair, walk indoors, and get to the toilet.

Researchers at the University of Minnesota are currently analyzing the findings of a study of informal care provided for Medicare beneficiaries with a hip fracture or stroke. The subjects for this study are a subsample of subjects from the Post Acute Care Study. The researchers interviewed family caregivers of 157 hip fracture patients at two weeks, six weeks, six months, and one year after the patient discharge from the hospital (52). Preliminary data from the study show that 70 percent of the family caregivers reported providing

informal care of some kind before the patient's fracture, compared with 82 percent in the Maryland study. At 6 weeks post-fracture, 92 percent of the family caregivers reported providing informal care of some kind. Once the findings of this study are fully analyzed, they will provide better information than is currently available about the amount and types of informal care provided for hip fracture patients.

Given the limited available information about changes in the amount and types of informal care provided for an individual following a hip fracture, OTA decided not to attempt to estimate the indirect costs of informal care for hip fracture patients. As noted above, the only completed study of informal caregiving for hip fracture patients found that the proportion of patients receiving informal care and the hours of care increased in the post-fracture period, but the increases were not statistically significant. There were significant changes from pre- to post-fracture in the types of care provided, and it might be possible to attribute costs to some types of care and not others in a way that would result in a significant change in costs from pre- to post-fracture; to OTA's knowledge, however, there are no generally accepted criteria for making such an attribution of costs. Thus despite the important role that families and friends play in caring for hip fracture patients, OTA's estimate of expenditures for post-hospital services for hip fracture patients does not include an amount for the indirect costs of informal care.

■ OTA's Estimate of Total Per Patient Expenditures for Post-Hospital and Other Outpatient Services

Table 21 summarizes OTA's estimate of 1990 per patient expenditures for post-hospital and other outpatient services for hip fracture patients age 50 and over. It is interesting to note that the total amount for these services exceeds the total per patient expenditures for in-hospital services for hip fracture patients age 65 and over (see table 7), thus reflecting the importance of post-hospital services in determining overall expenditures for the care of these patients.

TABLE 21: OTA's Estimate of Expenditures for Post–Hospital and Other Outpatient Services for Hip Fracture Patients Age 50 and Over, 1990

Post-hospital services	Estimated per patient expenditure
Nursing home care	$7,054
Post-hospital care in a rehabilitation facility or other short-stay hospital	742
Readmission to a short-stay hospital	440
Home health care	453
Nonmedical home care	329
Physician visits	550
Outpatient physical therapy	—
Emergency room and ambulance services	284
Total	9,852

SOURCE: Office of Technology Assessment, 1993

LONG-TERM FUNCTIONAL IMPAIRMENT FOLLOWING A HIP FRACTURE

Most people who have a hip fracture do not recover their pre-fracture level of functioning. Different studies have used different criteria to measure functional capacity, including ability to walk independently; ability to perform activities of daily living (ADLs), such as bathing, dressing, transferring, and toileting; and ability to perform instrumental activities of daily living (IADLs), such as shopping, doing housework, and getting to places out of walking distance. Using various combinations of these criteria, four studies have found that only about one-third of all elder] y hip fracture patients regain their pre-fracture level of functioning (5,20,50,87). The previously cited study of 536 hip fracture patients treated in seven Maryland hospitals found that more than 60 percent of the patients regained their ability to walk indepen-

dently and almost half regained their ability to perform ADLs by six months post-fracture, but less than one-third regained their ability to perform IADLs (80). At one year post-fracture, more than 40 percent of the patients still could not walk unaided; 60 percent could not perform all ADLs independent y, and more than 80 percent could not perform all IADLs independently.

Focusing on specific functional abilities, Marottoli et al. (82) found that only 8 percent of 120 hip fracture patients treated in two New Haven hospitals from 1982 to 1988 were able to climb stairs six months after their fracture, and only 15 percent were able to walk across a room without assistance, although 74 percent were able to do so with a cane or walker. Ability to transfer independently from bed to chair decreased from 90 percent before a hip fracture to 32 percent after the fracture, although 68 percent of the patients could transfer with the use of a cane or walker at six months post-fracture. Ability to dress independently decreased from 88 percent before a hip fracture to 49 percent after the fracture.[30]

Most recovery of functional abilities following a hip fracture occurs by six months post-fracture (50,80). The Maryland study found that in the period from 6 to 12 months post-fracture, about 10 percent of patients improved in their functional abilities, but an equal proportion lost functional abilities (80).

Factors that have been found to be associated with failure to regain pre-fracture level of functioning in some studies are older age (5,50,80,87), female gender (5,80), race (30), poorer pre-fracture physical condition and functioning (5,30,50, 82,87), impaired mental status (20,80,82,87), depression (80,87), type of fracture (50,80), operative and post-operative complications (50), post-operative delirium without dementia (80), longer hospital stay (80), less arm strength (20), and smaller size of the patient's social network (20,80). On the other hand, many of these factors have not been found to be associated with failure to regain pre-fracture level of functioning in other studies.

Compared with older people who have not had a hip fracture, hip fracture patients are more functionally impaired, at least at six months and one year post-fracture. Studies of nationally representative samples of older people indicate that 19 percent of all people age 65 and over have difficulty walking (129), and 19 percent are unable to perform at least one ADL or IADL independently (77, 125). The proportion of older people who are functionally impaired increases with age, and older females are more likely than older males to be functionally impaired. The 1984 Supplement on Aging to the National Health Interview Survey found that the proportion of older females unable to walk independently increased from 12 percent of those age 65 to 69 to 32 percent of those age 85 and over (129). The 1987 National Medical Expenditure Survey found that the proportion of older females unable to perform at least one ADL or IADL independently increased from 11 percent of those age 65 to 69 to 60 percent of those age 85 and over (1 25).

The results of two longitudinal studies of changes in functional abilities in older people illustrate clearly the severe impact of a hip fracture. One study of change in functional abilities over a six-year period among 356 older people in California found that a hip fracture led to significantly greater loss of functional abilities than any of the other acute medical conditions measured, including heart attack, stroke, and cancer (54). Another study of change in mobility over a six-year period among 7,000 older people in three

30 Many studies of post-fracture functional capacity conducted in Europe show that a larger proportion of hip fracture patients regain their pre-fracture level of functioning (see, for example, Ceder et al. (11), Jensen and Bagger (47), Jensen et al. (49), Kreutzfeldt et al. (65), Thomas and Stevens (11 5)). These studies use much broader criteria to measure recovery of functional capacity, e.g., whether a patient returns home after hospitalization, whether the patient receives any home care services, or a global clinical judgment about the patient's functional capacity. By these broader criteria, the studies cited in the text above also would have found that a larger proportion of patients regain their pre-fracture level of functioning.

locations (East Boston, Massachusetts; two counties in Iowa; and New Haven, Connecticut) found that the risk for loss of mobility was two to five times greater for people who had a hip fracture than for people who did not (36). Moreover, the relative risk of loss of mobility was greater following a hip fracture than a heart attack, stroke, or cancer.

COMPARISON OF OTA'S ESTIMATES WITH OTHER ESTIMATES OF HIP FRACTURE OUTCOMES

As noted at the beginning of this document, OTA's estimates of expenditures for in-hospital, post-hospital, and other outpatient services for people with a hip fracture are considerably lower than other frequently cited estimates of the cost of hip fractures, even though the other estimates are for earlier years and therefore would be expected to be lower. A 1984 report prepared for the American Academy of Orthopedic Surgeons concludes that the annual cost of hip fractures was $7.3 billion, or approximately $29,400 per patient, in 1984 (40). A 1992 update of the 1984 report, also prepared for the American Academy of Orthopedic Surgeons, concludes that the annual cost of hip fractures was $8.7 billion, or approximately $34,400 per patient, in 1988 (100). A third report, prepared for the National Institutes of Health concludes that the per patient cost of hip fractures in 1988 ranged from $41,723 for females age 50 to 54 to $37,968 for females age 85 and over (1 4).

The estimates from the 1984 and 1992 reports prepared for the American Academy of Orthopedic Surgeons apply to all hip fracture patients, whereas OTA's estimate applies only to hip fracture patients age 50 and over. The estimate from the 1991 report prepared for the National Institutes of Health applies only to female hip fracture patients age 50 and over. OTA has not calculated per patient expenditures for hip fracture patients under age 50. One would expect that average per patient expenditures for in-hospital services for hip fracture patients under age 50 might be higher than for older hip fracture patients because payments by non-Medicare third-party insurers are higher than Medicare payments. On the other hand, the **true** cost of in-hospital care for younger patients is probably lower because of the lesser likelihood of complications and comorbidities that drive up true costs. With respect to post-hospital and other outpatient services, one would expect that average per patient expenditures for hip fracture patients under age 50 would be considerably lower than for older hip fracture patients because younger people are much less likely than older people to be admitted to a nursing home. Thus the fact that OTA's estimate applies only to hip fracture patients age 50 and over probably does not account for the difference between OTA's estimate and the estimates from the 1984 and 1992 reports.

To make a precise comparison between OTA's estimate of expenditures for the care of hip fracture patients age 50 and over in 1990 and the estimates from the other reports, one would have to convert all the figures to a common base year. OTA has not undertaken that conversion. The following discussion focuses on the reasons for differences between OTA's estimate and the estimates from the other reports using the dollar figures presented in each report. Clearly, the differences between OTA's estimate and the estimates from the other three reports would be much larger if all the figures were converted to a common base year.

One reason that OTA's estimate is lower than the other three estimates is that it does not include certain categories of costs included in the other estimates. The 1984 and 1992 reports prepared for the American Academy of Orthopedic Surgeons (40,100) include four categories of costs that are not included in OTA's estimate: 1) drugs; 2) non-health sector goods and services; 3) prepaid costs of insurance and administration of federal programs; and 4) lost productivity of wage earners and homemakers. The 1991 report prepared for the National Institutes of Health (14) includes only one of these categories, lost productivity of wage earners and homemakers.

In the category *drugs,* the 1984 report prepared for the American Academy of Orthopedic Sur-

geons includes $3.4 million,or$14perpatient, for drugs prescribed in a physician's office. This figure is based on information from the 1977 National Ambulatory Medical Care Survey about the number of physician visits for any musculoskeletal condition during which any prescription was given and an assumption that 1.5 drugs were prescribed in each visit (40). The 1992 report, also prepared for the American Academy of Orthopedic Surgeons, includes $5 million, or $20 per patient, for the same expenditures. This figure is based on reported per capita expenditures for prescribed drugs for any musculoskeletal condition from the 1980 National Medical Care Utilization and Expenditure Survey, inflated to 1988 dollars (loo).

OTA did not include expenditures for *drugs* in its estimate because of the lack of information about average use of or expenditures for drugs for hip fracture patients. It should be noted, however, that payment for drugs provided in the hospital for patients whose hospital care is paid for by Medicare is included in the payment for hospital services. Likewise, payment for drugs provided in a nursing home for patients whose nursing home care is paid for by Medicaid is included in the payment for nursing home care.

The category of expenditures *non-health sector goods and services,* which is included in the 1984 and 1992 reports, refers to expenditures for transportation to physicians' offices, special diets, extra household help needed because of the patient's condition, retraining and education, and alterations to a patient's home. The 1984 report includes $900 mill ion, or $3,644 per patient, for this category of expenditures. The 1992 report includes $875 million, or $3,445 per patient, for the same category of expenditures. These figures were based on the results of a 1978 study that found that the non-health sector costs of illness amount to 15 percent of total direct care costs (Mushkin and Landefeld, 1978, cited in Holbrook et al. (40)). This information is not specific to hip fracture, and OTA is not aware of any such information that is specific to hip fracture, except the information on use of paid and unpaid in-home care that was discussed earlier.

The category of expenditures *prepaid costs of insurance and administration of Federal programs,* which is included in the 1984 and 1992 reports, refers to the net cost of insurance and administrative expenses of federally-financed programs. The 1984 report includes $270 million, or $1,093 per patient, for this category of expenditures. The 1992 report includes $339 million, or $1,335 per patient, for the same category of expenditures. These figures are based on HCFA estimates that are not specific to hip fracture (40,100). Moreover, administrative costs are generally included in the reported expenditures for the programs.[31]

The category of expenditures *Zest productivity of wage earners and homemakers* is included in all three other reports. The 1984 report includes $92 million, or $375 per patient, for this category of expenditures; these figures are based on the number of days lost from work due to hip fracture and the number of bed disability days for unemployed female hip fracture patients from the 1970 through 1977 National Health Interview Surveys (40). The 1991 report prepared for the National Institutes of Health includes $3,968 per patient for this category of expenditures for females age 50 to 64 and successively smaller amounts for older age groups; these figures are based on the number of days lost from work due to hip fractures as cited in the 1984 report, the proportion of the population in the labor force (39.35 percent), average daily earnings ($97), the cost of housekeeping for the

[31] OTA did not attempt to separate administrative and other components of reported expenditures for hip fracture patients. OTA's primary purpose in calculating these expenditures was to develop figures for inclusion in the agency's analysis of the costs and effectiveness of screening for osteoporosis. For this purpose, the important consideration is the marginal change in expenditures with and without treatment. Administrative costs are unlikely to change in this context and therefore are not important for this analysis, although other researchers may choose to calculate these costs separately.

population in the labor force ($46), and the cost of housekeeping for the population not in the labor force ($66) (14). The 1992 report prepared for the American Academy of Orthopedic Surgeons includes $1,415 million, or $5,571 per patient, for lost earnings of wage earners and homemakers due to disability, based on the number of bed disability days for hip fracture patients from the 1988 National Health Interview Survey (100). The 1992 report also includes $260 million, or $1,024 per patient, for lost earnings of wage earners and homemakers due to death.

OTA did not calculate an amount for lost productivity of wage earners and homemakers for several reasons. OTA's primary purpose in calculating expenditures for hip fracture patients is to develop figures for the agency's analysis of the costs and effectiveness of screening for osteoporosis. Costs of lost productivity are nontransactional costs that are not relevant for a costs and effectiveness analysis. Moreover, estimates of the costs of lost productivity are highly uncertain. They are also likely to undervalue the work, including housework, of women and minorities, thus raising equity issues. Some analysts may prefer to include an amount for lost productivity, but the appropriate amount is unclear as evidenced by the wide-ranging estimates in the other three reports—$375 to $3,968 per patient.

Expenditures in the categories that are included in the three other reports but not in OTA's estimate account for some of the differences between OTA's estimate and the other three estimates. The remainder of the differences is largely accounted for by differences in the amounts attributed to particular in-hospital and post-hospital services that are included in all four estimates. OTA's estimate is based primarily on expenditures for services—i.e., what is actually paid—rather than what providers charge for the services. To estimate expenditures for hospital care for hip fracture patients age 65 and over, for example, OTA used Medicare allowed charges (Medicare payment plus patient copayment) by DRG category. In contrast, the other estimates are based on the average charge for a day of hospital care, as reported by the American Hospital Association, multiplied by the average hospital length of stay for hip fracture patients. The use of hospital charges rather than payments or expenditures results in considerably higher estimates of the cost of hospital care.

OTA's figure for hospital care also includes expenditures for hip fracture patients who are treated nonsurgically. As discussed earlier, in-hospital expenditures are considerably lower for these patients than for hip fracture patients who are treated surgically.

OTA's estimate of expenditures for hospital care for hip fracture patients age 65 and over is based on unpublished information about 1990 Medicare allowed charges obtained from HCFA's Office of Research and Demonstrations. A published report from the same office cites higher average charges, ranging from $10,439 to $13,730 for 1987, for Medicare beneficiaries who received one of four surgical treatments used for hip fracture patients (67). These higher figures represent Medicare submitted charges and therefore would be expected to be considerably higher than the Medicare allowed charges for the same procedures (58). In addition, the two highest cost procedures (ICD-9-CM procedure codes 81.51 and 81.59) are total hip replacement procedures. OTA does not know what proportion of hip fracture patients receives a total hip replacement, but most total hip replacements are performed on persons with osteoarthritis, and hip fracture patients are more likely to receive a partial hip replacement. Three of the four procedures (the two hip replacement procedures plus ICD-9-CM procedure code 81 .62) are generally reimbursed in DRG 209, and a 1991 HCFA report from the same office cites the average Medicare allowed charge for patients in DRG 209 as $8,560 for 1988 (66). The fourth procedure (ICD-9-CM procedure code 79.35) is generally reimbursed in DRG 210, and the 1991 HCFA report cites the average Medicare allowed charge for patients in DRG 210 as $7,968 for 1988. OTA used the comparable figures for 1990 in its analysis.

Almost half of OTA's estimate of per patient expenditures for hip fracture is for post-hospital services, including nursing home care, post-hospital care in a rehabilitation facility or other short-stay

hospital, readmission to a short-stay hospital for fracture-related problems, paid home health care, paid nonmedical home care, and physician visits. All of the other estimates of the cost of hip fractures include nursing home costs and the cost of physician visits but not costs associated with the use of rehabilitation facilities, other short-stay hospitals, or paid home care.

OTA's estimate of expenditures for nursing home care are much lower than the estimates included in the 1984 report prepared for the American Academy of Orthopedic Surgeons and the 1991 report prepared for the National Institutes of Health. The figures for nursing home care from these two reports are close to the average annual cost of nursing home care in the base years of the reports; thus it would appear that the authors assumed that all hip fracture patients were admitted to a nursing home, that they remained in the nursing home for a full year, and that they therefore incurred a full year of nursing home costs. Instead, the 1984 report implies that only 44 percent of all hip fracture patients (108,800 out of 247,000) are admitted to a nursing home but estimates the annual cost of their care as $4,001 million, or about $36,700 per patient for 1984 (40)-an amount that is more than twice the average annual cost of nursing home care in that year. The 1991 report uses the final figure from the 1984 report, $16,202, updated to 1988 dollars *(14).*

The 1992 report prepared for the American Academy of Orthopedic Surgeons uses a final figure for nursing home care that is very similar to OTA's estimate but derives the figure from quite different assumptions. The 1992 report assumes that about one-fourth of hip fracture patients (66,300 out of 254,000) were admitted to a nursing home in 1988 and estimates the average per patient expenditure for their care as about $23,600 per patient (100), thus suggesting that all patients who were admitted to a nursing home remained in the nursing home for a full year. In contrast, OTA estimates that 41 percent of hip fracture patients were admitted to a nursing home in 1990, that only 34 percent of those patients remained in the nursing home for a year or longer, and that the average per patient expenditure for the care of hip fracture patients admitted to a nursing home was $13,849.

OTA's estimate of excess mortality following a hip fracture is within the range of other recent estimates. The two most widely cited estimates of excess mortality following hip fracture are: 1) 12 to 20 percent excess mortality in the first year post-fracture (19), and 2)5 to 20 percent excess mortality in the first year post-fracture (18). In a 1992 article on the effects of hormone therapy, Grady et al. (35) estimate that in comparison with age-specific mortality for all females, mortality in the year following a hip fracture is 5.4 percent higher for female hip fracture patients under age 75, 8 percent higher for female hip fracture patients age 75 to 84, and 13.2 percent higher for female hip fracture patients age 85 and over. OTA's figures for female hip fracture patients are slightly higher: OTA estimates that mortality is 6 percent higher for those age 50 to 64, 10 percent higher for those age 65 to 74, 12 percent higher for those age 75 to 84, and 14 percent higher for those age 85 and over.

Neither OTA's figures nor the figures cited by Grady et al. (35) indicate that excess mortality following a hip fracture reaches 20 percent, even in the oldest age group, but both sets of figures apply only to female hip fracture patients. Average mortality is much higher for male hip fracture patients and exceeds 20 percent in the first year post-fracture for male hip fracture patients ages 75 to 84 and 85+ (see tables 15 and 16). In this context, it is important to reiterate that all of these figures overestimate true excess mortality for hip fracture patients because older persons who fall repeatedly and are therefore at greater risk of hip fracture tend to be in poorer physical condition than older people who do not fall repeatedly; since they are in poorer physical condition, they are also at greater risk of dying. The appropriate comparison group to determine true excess mortality for hip fracture patients would be a group of patients with similar physical impairments and coexisting illnesses who do not fracture their hip.

CONCLUSION

This OTA background paper has reviewed the available information about in-hospital treatment, in-hospital and long-term mortality, post-hospital and other outpatient service use, and functional impairment following hip fracture and provided estimates of per patient expenditures for in-hospital, post-hospital, and other outpatient services for people with a hip fracture. Clearly, hip fractures have many negative outcomes. They are costly, although somewhat less costly than previous reports have indicated. Hip fractures also result in excess mortality and long-term functional impairments.

Some portion of the negative outcomes following a fracture is undoubtedly avoidable. As noted earlier, several federal agencies are currently funding studies of hip fracture treatments and outcomes. These studies are attempting to identify the most effective in-hospital treatments and post-hospital services for hip fracture. Once the most effective treatments and services are identified and implemented, outcomes may improve. Expenditures for specific treatments and services may increase, but any reduction in average nursing home lengths of stay that results from improved treatments is likely to lead to equal or greater savings.

It is important to recognize, however, that many hip fracture patients are very old and frail. Some are already in a nursing home or receiving supportive services at home before their hip fracture. The capacity of such individuals to withstand the trauma of a fall, a fracture, and surgical treatment, including anesthesia, is limited, as is their capacity to participate in and respond to rehabilitative treatments. Thus, the potential for improvement in hip fracture outcomes is also limited. These limitations point to the importance of steps that may be taken throughout life to reduce the incidence of hip fractures, including steps to increase bone mass and bone strength in young people, maintain bone mass and strength in middle-aged and older people, diminish the environmental and patient characteristics that lead to falls in older people, and protect older failers from fracture.

Appendix A: Acknowledgments

A

OTA is grateful to the following individuals who reviewed an earlier version of this background paper.

Anne P. Clark, Ph.D.
Scientific Review Administrator
Lung Biology and Pathology Study Section
Division of Research Grants
National Institutes of Health
Bethesda, MD

Elizabeth A. Chrischilles, Ph.D.
Department of Preventive Medicine and Environmental Health
College of Medicine
University of Iowa
Iowa City, IA

Robert S. Epstein, M. D., M.S.
Director, Epidemiologic Research
Merck Research Laboratories
West Point, PA

Bruce Ettinger, M.D.
Division of Research
Kaiser Foundation Research Institute
Oakland, CA

Deborah T. Gold, Ph.D.
Assistant Professor of Medical Sociology
Center for the Study of Aging and Human Development
Duke University Medical Center
Durham, NC

Susan L. Greenspan, M.D.
Director, Osteoporosis and Metabolic Bone Disease Clinic
Beth Israel Hospital
Boston, MA

Caren Marie Gundberg, Ph.D.
Assistant Professor
Department of Orthopedics
Yale University School of Medicine
New Haven, CT

Sylvia Hougland, M.P.A.
Associate Director
Laboratory for Clinical Computing
VA Medical Center
Dallas, TX

C. Conrad Johnston, Jr., M.D.
Director
Division of Endocrinology and Metabolism
Indiana University School of Medicine
Indianapolis, IN

Shiriki K. Kumanyika, Ph. D., M.P.H.
Associate Director for Epidemiology
College of Medicine
Pennsylvania State University
Hershey, PA

Donald R. Lee
Vice President
Proctor and Gamble Pharmaceuticals
Norwich, NY

Jay Magaziner, Ph.D.
Department of Epidemiology and Preventive Medicine
University of Maryland at Baltimore
Baltimore, MD

Lee Joseph Melton III, M. D., M.P.H.
Head, Section of Clinical Epidemiology
Department of Health Sciences Research
Mayo Clinic
Rochester, MN

Diana Petitti, M. D., M.P.H.
Director
Research and Evaluation
Southern California Kaiser Permanence Medical Care Program
Pasadena, CA

Neil M. Resnick, M.D.
Chief, Geriatrics
Brigham and Women's Hospital
Boston, MA

Gideon A. Rodan, M. D., Ph.D.
Executive Director
Department of Bone Biology
Merck, Sharp & Dohme Research
West Point, PA

Anna N.A. Tosteson, Sc.D.
Clinical Research
Dartmouth Hitchcock Medical Center
Lebanon, NH

OTA is also grateful to the following individuals who provided unpublished data for this background paper.

Robert S. Epstein, M. D., M.S.
Director, Epidemiologic Research
Merck Research Laboratories
West Point, PA

Mike Finch, Ph.D.
Division of Health Services Research and Policy
School of Public Health
University of Minnesota
Minneapolis, MN

Edmund J. Graves
Division of Health Care Statistics
National Center for Health Statistics
Centers for Disease Control and Prevention
Public Health Service
U.S. Department of Health and Human Services
Hyattsville, MD

Robert Kane, M.D.
Minnesota Chair in Long-Term Care and Aging
Institute for Health Services Research
School of Public Health
University of Minnesota
Minneapolis, MN

Diana Petitti, M. D., M.P.H.
Director
Research and Evaluation
Southern California Kaiser Permanence Medical Care Program
Pasadena, CA

John Petrie
Research Analyst
Office of Research and Demonstrations
Health Care Financing Administration
U.S. Department of Health and Human Services
Baltimore, MD

Jeff Rhoades
Service Fellow
Division of Medical Expenditure Studies
Center for General Health Services Intermural Research
Agency for Health Care Policy and Research
Public Health Services
U.S. Department of Health and Human Services
Rockville, MD

Susan M. Schappert
Survey Statistician
National Center for Health Statistics
Centers for Disease Control and Prevention
Public Health Service
U.S. Department of Health and Human Services
Hyattsville, MD

Appendix B: Mortality Following a Hip Fracture

B

TABLE B–1: Mortality Following a Hip Fracture

Author, date	Time period of the study	Sample characteristics	In-hospital mortality	Cumulative post-hospital mortality (measured from the time of the fracture)	Comments
Jacobsen et al , 1992	1984-87	712,027 Medicare beneficiaries with a hip fracture. 79% female All subjects over age 65 3% black Persons who had a previous hip fracture, were being treated for complications of a hip fracture, or had cancer as a likely cause of their fracture were excluded from the sample.		*At 1 year:* 33.7% white males 33.5% black males 17,2% white females 22,9% black females For age 65-74: 18,9% white males 19.7% black males 94% white females 13,6% black females For ages 75-84: 32.4% white males 34.3% black males 14.3% white females 20,2% black females For age 85-94: 50.7% white males 56.2% black males *24.4'%.* white females 30.O% black females For age 95 t : 84.5% white males 72.6% black males *43.9%* white *females* 45 *6%* black females	
Marottoli et al., 1992	1982-88	118 persons with a hip fracture treated in 2 hospitals in New Haven, CT. 72% female All subjects over age 65: 31% age 65-74, 51% age 75-84, 19% age 85+ 19% admitted from a nursing home.		*At* 6 months: 18% (22 subjects)	All hip fractures were treated surgically.

Health Care Financing Administration, June 1990	1986	118,379 Medicare beneficiaries with a hip fracture who received open or closed reduction and internal fixation (procedure codes 79.05, 79.15, 79.25, and 79.35). All subjects over age 65 Persons with a diagnosis of cancer or aseptic necrosis were excluded from the sample.	*At 1 month:* 6% including: 9.7% white males 7.5% black males 5.0% white females 4.2% black females For age 65-74: 5.7% white males 2.8% black males 2.7% white females 3.4% black females For age 75-84: 9.4% white males 8.9% black males 4.2% white females 3.9% black females For age 85+: 14.5% white males 13.9% black males 7.2% white females 5.1% black females *At 1 year* for persons with pertrochanteric fractures only: 22.3% including: 31.8% white males 32.5% black males 19.9% white females 22.1% black females For age 65-74: 19.0% white males 21.2% black males 10.1% white females 13.3% black females For age 75-84: 30.4% white males 30.8% black males 16.5% white females 18.6% black females	1-year mortality data are for 75,101 persons with trochanteric fractures and 17,719 persons with cervical fractures who received reduction and internal fixation (procedure codes 79.15 or 79.35).

For age 85+:
43.2'%. white males
48.7% black males
26.5 white females
28.7% black females

At 1 year **for persons with transcervicai fractures only:**
19.5°A including:
30.7% white males
27.6% black males
16.4% white females
23.5'%. black females

For age 65-74:
16.2%. white males
18.6% black males
7.6°A white females
18.5% black females

For age 75-84:
31 .3% white males
28.2% black males
14.3%. white females
17.8% black females

For age 85+
44.9% white males
40.9% black males
25.8'%. white females
31.3% black female

Health Care Financing Administration, June 1990	1986	59,733 Medicare beneficiaries with a hip fracture who received a partial hip replacement (procedure code 81.6). All subjects over age 65 Persons with a diagnosis of cancer or aseptic necrosis were excluded from the sample.	*At 1 month:* 5.5% including: 9.0% white males 10.9% black males 4.5% white females 4.7% black females For age 65-74: 4.9% white males 2.7% black males 2.6% white females 3.2% black females For age 75-84: 9.4% white males 13.1% black males 3.7% white females 4.4% black females For age 85+: 15.2% white males 17.3% black males 6.9% white females 6.2% black females *At 1 year:* 21% including: 34.5% white males 35.8% black males 18.0% white females 24.5% black females For age 65-74: 21.0% white males 23.8% black males 9.6% white females 17.2% black females For age 75-84: 32.9% white males 30.6% black males 15.5% white females 22.2% black females For age 85+: 45.4% white males 51.9% black males 25.5% white females 30.5% black females	1-year mortality data are for 43,063 persons who received a partial hip replacement.

Myers et al., 1991	1979-88	27 37° persons with a hip fracture treated in hospitals in Maryland. 80% females All subjects over age 65 6.3% black Subjects included: 18.1% white males (average age: 79) 1.9% black males (average age: 76) 75.5% white females (average age: 81) 4.4% black females (average age: 81)	4.9% (1,339 subjects) including: 7.9% white males 7.5% black males 4.1% white females 5.1% black females For age 65-69 (2,542 subjects): 5.2% white males 5.5% black males 1.5% white females 3.2% black females For age 70-74 (3,842 subjects): 6.0% white males 4.8% black males 2.8% white females 4.6% black females For age 75-79 (5,374 subjects): 6.7% white males 5.3% black males 3.3% white females 4.8% black females For age 80-84 (6,541 subjects): 8.2% white males 10.6% black males 3.6% white females 5.4% black females For age 85+ (9,071 subjects): 11.0% white males 13.2% black males 6.0% white females 6.0% black females	The adjusted relative odds of dying with each 1-year age increment were 1.04. The adjusted relative odds of dying for all males vs. all females were 1.6. Racial differences in death rates virtually disappeared in initial regression analyses. The adjusted relative odds of dying for white vs. black males were 0.9; the adjusted relative odds of dying for black vs. white females were 1.3. The adjusted relative odds for dying for whites vs. blacks were 1.1 Type of fracture (pertrochanteric vs. transcervical) was not a significant factor in mortality. Mortality differed for the 5 procedure categories: 1) no procedure of any type, 9.2%; 2) no surgical hip procedure but other procedures, 11.6% 3) reduction of the fracture without fixation, 5.3%; 4) internal fixation of the fracture, 4.2%; and 5) total hip replacement or other arthroplasty, 4.2%. The relative odds of dying were highest for subjects with serious infections, 12.3% for septicemia and 4.9% for pneumonia/influenza. As total number of medical diagnoses increased, the odds of dying increased.

Fisher et al., 1991	7/84-6/86	22,039 persons**with a hlp fracture in 6 New England states** **80% female** **All subjects over age 65** **21 %. admitted from a nursing home.** **Persons who had a previous hip fracture, were being treated for complications of a previous fracture, or had cancer as a likely cause of their fracture were excluded from the sample.**		*At 1 month:* ***6.3%*** ***At 3 months: 12.5%*** ***At 1 year: 24%*** **Including.** **For age 65-74:** **22% males** **12% females** **For age 75-84.** ***34%*** **males** **1770 females** **For age 85+:** **48%. males** **28% females** **Relative risk for blacks vs. whites 82**	
Magaziner et al,, 1989	**10/84-4/86**	**814 persons with a hip fracture treated in 7 hospitals in Baltimore, MD** **80%. female** **All subjects over age 65; average age: 80; 24.2% age: 65-74; 45.3°A age: 75-84; 30.6% age: 85+** **6.5% black** **All subjects living in the community prior to the fracture.**	*4.3% (37* subjects) **Average hospital length of stay. less than** *20* days	***At*** *3 months: 8.2%* ***At*** *6 months.* 12.6% *At 1 year:* 17. **4%** **Relative risk for males vs. females:** **1.4 at 3 months** **1.5 at 6 months** **1.9 at 1 year** **Compared with those age 65-74, relative risk for subjects age 75-84 was:** **1.1 at 3 months** **1.0** at **6 months** **0.9** at 1 year **Compared with those age 65-74, relative risk for subjects age 85+ was:** **2.6 at 3 months** **2.1 at 6 months** **1.8 at 1 year** **Relative risk for blacks vs. whites was:** **1.5 at 3 months** **1.9 at 6 months** **1.8 at 1 year**	Observed mortality approached expected mortality at 6 months **for females and subjects over age 85** and at 10 months for subjects age 75-84. Mortality for males and subjects age 65-74 was higher than expected beyond 1 year. For subjects with delirium, relative risk was: 3.2 at 3 months 3.5 at 6 months 3.1 at 1 year For subjects with serious coexisting medical conditions, relative risk was: **4.6 at 3 months** **3.6 at 6 months** **2.6 at 1 year** **Subjects with dementia did** not have **an increased risk of death.**

Neu et al., 1989	**7/84-6185**	**31,504 Medicare beneficiaries discharged from a hospital in** DRG 209 209 and 23,944 Medicare beneficiaries discharged from a hospital in DRG 210.	**2% for persons in DRG** 4.2% for persons **in** DRG 210		
Bonar et al., 1990	10/83-1 2/86	1,292 **persons with a hip fracture** treated in 2 hospitals in New Haven, CT. All subjects over age 65	**4.6% (60 subjects)**	**At 6 months: 3% of the 151** subjects admitted from the community and discharged to a nursing **home had died.**	**This study focuses on the** 151 subjects who were admitted from the commu**nity and discharged to a nursing home,**
Kahn et al., 1990	**1/81 -1 2/82 and 7/85-6/86**	**1,358 persons with a hip fracture in the first time period and 1,404 persons with a hip fracture in the second time period.** **The subjects included persons with a hip fracture from a stratified random sample of Medicare-eligible persons treated in 297 hospitals in 5 states (CA, TX, IN, PA, and FL).** **79% female in the first time period; 77% female in the second time period.** **58% of the subjects were over age 80 in both time periods.** **14% nonwhite in the first time period; 13°A nonwhite in the second time period.** **24% were admitted from a nursing home in the first time period; 20% were admitted from a nursing home in the second time period.**	**5.7% in the first time peri-**od and 3.3% in the second time period **Average hospital length of stay: 20.1 days in the first time period and 14.5 days in the second time period,**	***At* 30** *days:* **5.3% in the first** time period and 4.6% in the second time period, ***At* 6 months: 17.9% in the first time period and 14.8% in the second time period.**	This study compares outcomes pre- and post-**PPS,** **Mortality is adjusted for severity of illness (sickness at the time of hospital admission), according to scales developed by the researchers.**

Gerety et al., 1989	9/82-9/84 and 9/84-1/86	180 persons with a hip fracture treated at Stanford University Hospital, including 65 subjects treated in the first time period and 115 subjects treated in the second time period. 85% female in the first time period and 78% female in the second time period. All subjects over age 69; average age 84 in the first time period and 83 in the second time period. 65% admitted from the community in the first time period and 66% in the second time period; 11% admitted from a nursing home in the first time period and 18% in the second time period; 25% admitted from a residential care facility in the first time period and 16% in the second time period. Persons who had a previous fracture, were terminally ill, or had cancer as a likely cause of their fracture were excluded from the sample.	2% in the first time period and 4% in the second time period. Average hospital length of stay: 12.3 days in the first time period and 11 days in the second time period.	*At 1 year:* 15% in the first time period and 23% in the second time period.	This study compares outcomes pre- and post-PPS. There was no significant difference in mortality between the two time periods.
Ray et al., 1990	10/81-9/83 and 10/84-9/86	4,368 Michigan residents with a Medicare-covered hip fracture, including 2,130 persons with a hip fracture in the first time period and 2,238 persons with a hip fracture in the second time period; the subjects constituted a 20% random sample of Michigan residents with a hip fracture. 78% female in the first time period and 77% female in the second time period. All subjects over age 65; average age: 81. 5% nonwhite	Average hospital length of stay: 18.7 days in the first time period and 14.4 days in the second time period.	*At 30 days:* 5.7% in the first time period and 6.8% in the second time period *At 3 months:* 12.8% in the first time period and 13.4% in the second time period. *At 1 year:* 23.2% in the first time period and 23.7% in the second time period	This study compares outcomes pre- and post PPS. There was no significant difference in mortality between the two time periods. The relative odds of dying by 1 year post-fracture were: age 65-70: 1 age 70-74: 1.7 age 75-79: 2.2 age 80-84: 2.8 age 85-89: 4.2 age 90-94: 6.1 age 95+: 11.2 females: 1 males: 2.3 whites: 1 nonwhites: 1.2

Fitzgerald et al., 1988	10/81 - 10/83 and 4/84-3/86	331 persons with a hip fracture treated in 1 Midwestern hospital; 149 were treated in the first time period; 189 were treated in the second time period, and 7 were lost to followup. 77% female in both time periods. All subjects over age 65: average age: 79 in the first time period and 80 in the second time period. 9%0 black in the first time period, and 11% black in the second time period. All subjects living in the community at the time of the fracture. Persons who had a previous hip fracture or had cancer as a likely cause of their fracture were excluded from the sample.	3% in the first time period and 4% in the second time period, Average hospital length of stay: 21.9 days in the first time period and 12.6 days in the second time period.	*At 1 year: 7%* in the first time period and 12% in the second time period.	This study compares outcomes pre- and post-PPS In the post-PPS period, the hospital became affiliated with an HMO, which may have affected patient outcomes: average hospital length of stay was 7.3 days for HMO enrollees compared with 14.0 days for other post-PPS subjects.
Palmer et al., 1989	1/81 -6/84 and 7184-12187	Random sample of 386 persons with a hip fracture discharged alive from 1 hospital in Indianapolis, IN. 76% of the 190 subjects treated in the first time period were female; 85% of the 196 subjects treated in the second time period were female. All subjects over age 65; average age: 80 All subjects were living in the community at the time of the fracture. Persons who had not had a previous hip fracture on the same side or had cancer as a likely cause of their fracture were excluded from the sample.	Potential subjects who died in the hospital were excluded from the sample. Average hospital length of stay 17 days in the first time period and 12.9 days in the second time period	*At 6 months:* 7.4% in the first time period and 5.6% in the second time period. Not *comparable to other studies because these figures are cumulative from the date of hospital discharge.*	This study compares outcomes pre- and post-PPS All subjects were treated surgically.

Fitzgerald et al. 1987	1/81-1/84 and 1/84-4/85	70 persons with a hip fracture treated in 1 hospital in Indianapolis, IN. 47 subjects in the first time period and 23 subjects in the second time period. 65% female in the first time period and 60% female in the second time period. All subjects over age 65; average age: 75 30% black in the first time period and 40% black in the second time period. All subjects admitted from the community. Persons with a previous hip fracture or cancer as a likely cause of their fracture were excluded from the sample.	2% in the first time period and 4% in the second time period. Average length of hospital stay: 16.6 days in the first time period and 10.3 days in the second time period.	*At 6 months:* 6% in the first time period and 9% in the second time period.	This study compares outcomes pre- and post-PPS. The two groups did not differ in the location of the fracture, the proportion or types of coexisting conditions, in-hospital complications, or prefracture function status. All subjects were treated surgically.
Petitti and Sidney, 1989	98[illegible]-85	2,048 females enrolled in a prepaid medical plan in California and treated for a hip fracture from 1/80 to 12/84. All subjects over age 5[illegible] 10% black	3.7% including: 1% age 50-59, 2% age 60-64, 4% age 65-69, 3% age 70-79, 4% age 80-84, 7% over age 85. Average hospital length of stay: 14.3 days	See table 12	
Campion et al., 1987 and Jette et al., 1987	6/83-7/84	79 persons with a hip fracture treated in 1 hospital in Boston, MA. 67% female All subjects over age 57: average age: 78; 9% under age 65; 23% age 65-74 48% age 75-84 21% over age 85 1% black 14% admitted from a nursing home. Persons with cancer as a likely cause of their fracture were excluded from the sample.	5.1% (4 subjects) Average hospital length of stay: 21.7 days; median hospital length of stay: 14.5 days	*At 3 months:* 16% *At 6 months:* 22% *At 1 year:* 29%	Study was conducted before DRGs went into effect in Massachusetts. All subjects were treated surgically.

Mossey et al., 1989	8/84-1/86	211 females treated for a hip fracture in 17 hospitals in Philadelphia, PA. All subjects over age 59; average age: 78.5 All subjects white. All subjects living in the community at the time of the fracture. All subjects able to walk across a room with a cane or less before the fracture and not too confused to answer questions after the fracture. Subjects did not have cancer or other health problems that were likely to result in death in the following year.	0.4% (1 subject)	*At* 6 months: 4% (8 subjects) *At 1 year: 8%* (15 subjects)	Higher mortality was associated with poor cognitive function, subjects' self-rated health as fair or poor, and length of hospital stay. Mortality was not associated with the subjects' age, pre-fracture physical functioning, number of preexisting health problems, number of medical diagnoses classified as serious, number of post-surgical medical complications, fracture site, type of treatment, or any the psychosocial variables measured in the study. These are the "healthier" hip fracture patients.
Cummings et al., 1988	Not reported	286 persons with a hip fracture treated in 3 hospitals in San Francisco, CA.	5.2% (15 subjects)		
Furstenberg and Mezey, 1987	1/80-7/83	119 persons with a hip fracture treated in 1 urban hospital. All subjects over age 60. 31% black All subjects living in the community prior to the fracture. Persons who had severe, multiple fractures or cancer as a likely cause of their fracture were excluded from the sample.	8% (10 subjects) including 7.3% of whites and 11% of blacks; this difference is not statistically significant. Average hospital length of stay: 30.4 days for whites and 41.2 days for blacks.		

Kellie and Brody, 1990	9[illegible]80 82	19,070 persons with a Medicare reimbursed hip fracture in Illinois. 80% female 4% black All subjects over age 65	White males, 10.5% black males, 9.3% white females, 5.0% black females, 8.2% Average hospital length of stay: white males, 24.2 days; black males, 28.0 days; white females, 23.1 days; black females, 28.2 days.		The differences in in-hospital mortality are partially explained by differences in the age at which fractures occur in these different groups. After adjustment for age, the odds ratio for in-hospital death was twice as high for white men as for white women.
Crane and Kerr[illegible]ek, 1983	11/71 12/80	159 persons with a hip fracture in 1 health care facility. 87% female Average age: 84.3; age range: 58-100 59% living in the geriatric hospital section of the facility and 41% living in the residential care section of the facility.	0.5% (16 subjects) Average hospital length of stay: 14.3 days for those who survived and 15.1 days for those who died. Average age of subjects who died in the hospital—88; age range: 70-94.	*By 2 months after hospital discharge:* 14% (22 subjects) *At 10 years:* 64.7% of females and 90% of males.	Subjects' pre- and post-fracture ambulatory status was correlated with mortality. Subjects who were more functionally impaired before the fracture were more likely to die after it. For subjects with femoral neck fracture: 8.3% died in the hospital, 13.7% by 2 months 30.8% by 6 months 39.3% by 1 year 69.2% by 10 years. For subjects with intertrochanteric fracture: 8% died in the hospital, 25.6% by 2 months 33.3% by 6 months 34.9% by 1 year; 67.8% by 10 years. For subjects with subtrochanteric fracture: 20% died in the hospital; 40% by 2 months 40% by 6 months 80% by 1 year 80% by 10 years.

Keene and Anderson, 1982	1/78-12/78	108 persons with a hip fracture treated at 1 hospital in Madison, WI. 75% female All subjects over age 50; average age 76; age range: 51-99	4%(4 subjects) 41% of the subjects were discharged to a nursing home, and 5 (11%) of these died in the next year; mortality for those discharged to home is not reported.	
Weiss et al., 1983	1976-79	168 females with a hip fracture in 1 county in Washington State. Average age: 64.1; age range: 50-74 All subjects white All subjects living in the community prior to the fracture. Subjects with cancer as a likely cause of their fracture were excluded from the sample.	At 1 year: 5.9% *At 2 years:* 10.5%	This study was intended to determine whether it is the hip fracture or factors that cause the person to fall that lead to increased mortality,

Matheny et al., 1980	1972-77	342 persons with a hip fracture treated in 1 hospital in Huntington, WV. 75% female Average age: 74 32.2% were confused on admission to the hospital, and 25% became confused in the hospital.	10% (34 subjects), including 7% of females and 18.6% of males Average age of those who died was 82, compared with 73 for those who did not die.	Mortality was 8.9% for persons with trochanteric fracture and 11.1% for persons with a femoral neck fracture. 17.3% of those who were confused on admission died, compared with 7.7% of those who were not confused on admission. 20.7% of those who developed confusion in the hospital died, compared with 1.1% of those who did not develop confusion in the hospital. For those treated surgically, 7.4% died; the average hospital say was 23 days for those who survived and 20 days for those who died; the timing of surgery did not affect mortality. For those not treated surgically, 27.3% died; the average hospital length of say was 15 days for those who survived and 6 days for those who died.

Kenzora et al., 1984 1/71 -12/77	**406 persons with a hip fracture treated at 1 hospital in Boston, MA.** **75% female** **12% had bilateral fractures**	**3% (13 subjects)** **399 treated surgically and 7 were treated with bed rest; average length of hospital stay was 20.8 to 25.4 days, depending on the type of treatment.**	*At 1 year:* 14.3% (58 subjects), including 14% of females and 16% of males; this difference is not significant,	Authors say the anticipated mortality was 9% Mortality was 13.4% for subjects with subcapital fracture and 15% for subjects with intertrochanteric fracture (no significant difference). **Age was a significant factor for subjects with intertrochanteric fracture but not subcapital fracture** **The timing of surgery affected mortality:** **• Of the 96 subjects who had surgery on day 1, 8.3% died within 3 weeks, 22.9% died within 6 months, and 34% died within 1 year;** **• Of the 1988 subjects who had surgery on day 2, 1.6% died with in 3 weeks, 4.3% died within 6 months, and 6% died within 1 year;** **• Of the 62 subjects who had surgery on day 3,0 died within 3 weeks, 4.8% died within 6 months, and 4.8% died within 1 year;** **• Of the 18 subjects who had surgery on day 4, 5.5% died within 3 weeks, 5.5% died within 6 months, and 5.5% died within 1 year;** **• Of the 9 subjects who had surgery on day 5, 0 died with in 3 weeks, 11% died within 6 weeks, and 11% died within 1 year;**

					• **Of the 26 subjects who had surgery after day 5, 3.8% died within 3 weeks, 26% died** within 6 months, and 35% died within 1 year. ▪ Mortality was 110/0 for subjects with O to 3 coexisting medical conditions and 25%. for those with 4 to 6 coexisting medical conditions. • **Of the** subjects who had O to 3 coexisting medical conditions, mortality at 1 year was significantly higher for those who had **surgery on day 1 compared with days 2 to 5 (28% VS. *4%).***
Owen et al., 1980	**1976**	**36 persons with a hip fracture in** Rochester, MN. 72% female Average age: 84; age range: 50 to 90	14% (5 subjects) Average hospital length of stay. 21 days		
Miller, 1978	1972-74	360 to 403 persons with hip fracture **treated in 2 hospitals in Charlottesville, VA.** **71 % female** **Average age 73** **90% white** **13% admitted from a nursing home.**	8% (30 subjects)	***At 1 year:* 27%. Including 23% of females and 37% of males.** **Mortality at 1 year increased with age:** **9% under age 60;** **13% age 60-69;** **27% age 70-79,** **33% age 80-89,** 70% **age 90+**	**Mortality was elevated in the first 4 months and returned to normal by [8] months,**

Gallagher et al., 1980	**1965-74**	**415 persons with a hip fracture in Rochester, MN.** **79% female** **Of female subjects:** 1% **were** under 50, 5% were 50-59, **15% were 60-69, 30% were 70-79, 49%. were 80+.** **Of male subjects:** **14°A were under 50, 8% were 50-59, 14% were 60-69, 17% were 70-79, 47% were 80+** **All subjects white** **Persons with a second fracture, cancer as a likely cause of their fracture, or a fracture following an accident were excluded from the sample.**		***At* 18** *months:* ***27%*** **At 4 years: 50%.** **At 6** *years:* **65%** *At* **8** *years:* **81%** *At 10 years:* **93%**	**The authors say that the survival curves show a 12% difference between expected and observed survival for** 4 months post-fracture and that after 4 months, the curves are approximately parallel **for the duration of the study.**
FOREIGN STUDIES					
Nydegger et al, 1991	**1987**	**329 persons with a hip fracture treated in 1 hospital in Geneva, Switzerland.** **83% female** **Average age for females: 82; age range: 49 to 98** **Average age for males 75.7; age range: 34 to 97** **Persons with cancer as a likely cause of their fracture were excluded from the sample.**	**8%** (27 subjects) including **7.3% of females and 12.7% of males**		
Baudoin et al., 1991	1987	142 **persons randomly selected from 1,178 persons with** a hip fracture in Picardy, France. 72% of the 1178 **persons were female** **All subjects over age 20** **Persons with cancer as a likely cause of their fracture were excluded from the sample.**	**7.6% for females and 9%** for males	***At* 2** *years:* **25% including** 28% for females and 21% for males	**Subjects' age did not have** a statistically significant effect on mortality.

Simonen and Mikkola, 1991	1982-83	A random sample of 383 persons with a hip fracture in Finland. 77% female All subjects over age 70		*At 1 year:* 26% including 22.9% of females and 35.2% of males *At 5 years:* 59% including 55.7% of females and 71.9% of males	
Davidson and Bodey, 1986	1981-82	155 persons with a hip fracture treated in 1 hospital in Middlesex, England. 84% female Average age: 80.8; age range: 53-102 8% had a previous hip fracture 7% (11 subjects) had cancer, and in 9 of these 11 subjects, the cancer had metastasized.	28.4% (44 subjects), including 27% of females and 36% of males; 0% of those under age 70, 23% of those age 70-79, 35% of those age 80-89, and 53% of those age 90+. Average hospital length of stay: 51 days	*At 1 year:* 43% (67 subjects) (7 subjects were lost to followup)	In-hospital mortality was correlated with gender, age, coexisting illness, and dementia. Mortality was higher in males, even though they were younger on average. There was no significant difference in mortality between subjects with subcapital vs. trochanteric fractures. All subjects were treated surgically. Delay of surgery was not correlated with mortality. 80% of the diabetic subjects and 54% of the subjects with dementia died ir the hospital.
Beringer, T.R.O. et al., 1984	1981-82	150 females with a hip fracture treated in 1 hospital in Belfast, Ireland. All subjects over age 65; mean age 81.2 87 persons with cervical fracture and 63 with trochanteric fracture.	21% (31 subjects) Average hospital length of say: 37 days		Subjects with a cervical fracture were younger on average than subjects with a trochanteric fracture, but there was no significant difference in mortality between subjects with a cervical vs. a trochanteric fracture within age groups.

Young and Gibbs, 1984	198[illegible]	125 persons with a hip fracture treated in 1 hospital in Glasgow, Scotland. 88% female All subjects over age 65; median age: 89; age range: 66-95 25% admitted from a nursing home or old age home	20.8% (26 subjects) Average hospital length of say: 43 days; median hospital length of stay for survivors: 31 days.	*At 1 year:* 26%	Predictors of mortality in the order of their significance were: 1) post-operative complications, 2) prefracture mental status, 3) co-existing illness, 4) prefracture mobility, and 5) age. Source of admission did not predict mortality. 32.5% of subjects with post-operative complications and 2.2% of subjects without post-operative complications died. 10% of the 81 subjects who were mentally alert on admission and 41% of the 34 subjects who were confused on admission died. 32% of the 72 subjects with 1 or more coexisting illnesses and 6% of the 53 subjects without coexisting illnesses died.
Holmber and Thorngren, 1985	1975-83	3,053 persons with a hip fracture in Stockholm, Sweden. 79% admitted from home; 5% admitted from old people's homes; 16% admitted from long stay hospitals. Subjects' age and gender were not reported.		*At 4 months:* 16% including 9% for persons admitted from home *At 1 year:* 22% including 16% for persons admitted from home *At 2 years:* 30% including 22% for persons admitted from home	

El Banna et al.,1984	**1976-82**	**224 persons with a hip fracture treated m 1 hospital in Belgium, 78% female Average age, 77**	**36%(82 subjects) 16% in the first 30 days post-fracture**		**Greater patient age, greater number of preexisting medical conditions, preexisting mental impairment, and postoperative complications were associated with higher mortality Type of fracture and type of treatment did not influence mortality.**
Kreutzfeldt, et al., **1984**	1978	117 persons with a hip fracture in 1 **county in Denmark. All subjects over age 60**	Average hospital length **of stay: 66 days.**	***At 1 year:* 26% (31 subjects)**	**Mortality was highest in the first 3 months post-fracture, but only for subjects with coexisting diseases.**
Lawton et al., 1983		**128 persons with hip fracture in 1 hospital in Leeds, England. All subjects over age 55**	**In 1 retrospective pilot study, mortality was 40% including 29% for the 24 subjects with a cervical fracture and 50% for the 26 subjects with a trochanteric fracture. In a prospective study, mortality was 14% including 15% for the 39 subjects with a cervical fracture and 13% for the 30 subjects with a trochanteric or basal cervical fracture.**		**Study concludes that subjects with a trochanteric fracture are more likely than subjects with a cervical fracture to die.**
Lund et al., 1981	Not reported	145 subjects with a hip fracture treated in 1 hospital **in Aarhus, Denmark.**		***At 1 year:* 21% (31 subjects)**	

Jensen et al., 1979; Jensen and Bagger, 1982; Jensen, 1984	1/77- 12/77	518 persons with a hip fracture treated in 1 hospital in Denmark, 80.5% female Median age: 78; age range: 26 to 96 26% admitted from a nursing home	6% (30 subjects) Average hospital length of stay: 23 days. For subjects admitted from a nursing home, m-hospital mortality was 5.1 % and their average length of hospital stay was 7 days,	*At* 6 *months:* 15.6%, ranging from 2.7% in the group that was least dependent before the fracture to 27,9% in the group that was most dependent before the fracture. *At* 2.5 *years:* 35%, ranging from 12% in the group that was least dependent before the fracture to 58% in the group that was most dependent before the fracture. *At* 2.5 *years:* 26% for those admitted from home	Subjects were divided into 4 groups: 1) independent, 2) slightly dependent, 3) moderately dependent, and 4) totally dependent The factors most predictive of long-term mortality were prefracture independence/dependence and age. Subjects in group 1 had a survival probability identical to the general population, The factor most predictive of in-hospital mortality was postoperative complications,
Ceder et al., 1980	9/76-4/77	103 persons with a hip fracture treated in 1 hospital in Lund, Sweden. 73% female All subjects over age 50; average age: 75	2% (2 subjects)	*At* 4 *months:* 4% *At 1 year:* 12%	
Holmberg et al., 1986	1/75- 12/77	3,002 persons with a hip fracture in Stockholm, Sweden. 75% female All subjects over age 50 21 % admitted from a long-term care institution	4.4% in the first 3 weeks post-fracture.	*At* 3 months: 12%, including 8% for subjects admitted from home and 27% for subjects admitted from an institution, *At 1 year:* 16% for subjects admitted from home and 46% for subjects admitted from an restitution. *At* 3 *years:* 35% *At* 6 *years:* 54%	For all subjects, mortality paralleled mortality for the population at 1 year. For subjects over age 80, mortality was higher for the general population than for hip fracture patients from 1 to 6 Years post-fracture.

Jensen and Tondevold, 1979	4/71 -3/77	1,592 persons with a **hip fracture** in Denmark, 77'%, female All subjects over age 50, average age for females. 78; average age **for mal**-es: 74	**86% (137 subjects)** Average hospital length of stay. 24 days	***At* 3 months: 17% including** 152% **for** females and 21 .5% for males ***A? 6*** months: 21.5% including Post-fracture, with a *20%* for females and 25% for males ***At 1 year:* 26.8%** ***At* 3 *years:* 43%** ***At* 5 *years:* 56%**	For males, the actual and expected mortality be-came parallel at 1 8 years 23.2% decrement For females, the actual **and expected mortality became parallel at 1.6 years with a 16.5% decre-ment.** **Age, sex, and complica-tions, but not fracture type, affected mortality,**
Thomas and Stevens, 1974	**Not reported**	**205 persons with a hip fracture in Eng-land.** **All subjects over age 57**	**12,2% (25 subjects)**	***At 1 year:* 31%**	
Dahl, 1980	**1960-71**	**675 persons with a hip fracture treated in 1 hospital in Norway.** **74% female** **Average age: 73,9, including 71.5 for females and 74.7 for males; age range: 17-99,**	**13.9% (94 subjects)** **Average hospital length of stay: 34.6 days,**	***At 1 month:* (most subjects were still in the hospital at this time): 9.8% (79 subjects) including 9.8% of females and 17,17.** of males; **2% of all females and males under age 65 died; 2170 of females over age 84, and 38% of mal-es over age 84 died,** ***In the second month:*** no **sub-jects under age 65 died, but 10% of females over age 84 and 1770 of males over age 84 died.** ***At* 6 *months:* 21%** ***At* 4 *years:* 61 % of females over age 75 and 78% of mal-es over age 75**	Mortality was higher than expected for 2 months post-fracture. Subjects with severe coex-isting diseases had higher mortality: 2% of subjects with O coexisting illnesses, 23% of subjects with 1 coexisting illness, 40% of subjects with 2 coexisting illnesses, and 63% of all subjects with 3 coexisting illnesses died. 65% of subjects with 1 or more *severe* coexisting Ill-nesses died in the first 6 months. There was no significant difference in mortality for subjects with trochanteric vs femoral neck fractures.

SOURCE Off Ice of Technology Assessment, 1993

References

1. *Aging America: Trends and Projections,* prepared by the U.S. Senate Special Committee on Aging, the American Association of Retired Persons, the Federal Council on the Aging, and the U.S. Administration on Aging, DHHS Pub. No. (FCoA) 91-28001 (Washington, DC: 1991).
2. American Hospital Association, *AHA Hospi/al Statistics 1990-91* (Chicago, IL: 1990).
3. American Hospital Association, Statistics Branch, personal communication, Mar. 1, 1993.
4. Ashby, J. L., Prospective Payment Assessment Commission, Washington, DC, personal communication, Mar. 5, 1993.
5. Baudoin, C., Fardellone, P., Hec, F., et al., "Outcome of Patients with Hip Fracture in Picardy, France, Immediately and Two Years Later," *Osteoporosis 90, C.* Christianson and K. Overgaard (eds.) (Copenhagen, Denmark: Osteopress ApS, 1990).
6. Beringer, T. R. O., McSherry, D. M. G., and Taggart, H. McA., "A Microcomputer Based Audit of Fracture of the Proximal Femur in the Elderly," *Age and Ageing* 13:344-348, *1984.*
7. Bonar, S. K., Tinetti, M. E., Speechley, M., et al., ● 'Factors Associated with Short- Versus Long-Term Skilled Nursing Facility Placement Among Community-Living Hip Fracture Patients," *Journal of the American Geriatrics Society 38(10):* 1139-1144, 1990.
8. Buchanan, R.J., Madel, R. P., and Persons, D., "Medicaid Payment Policies for Nursing Home Care: A National Survey," *Health Care Financing Review* 13(1):55-72, *1991.*
9. Campion, E. W., Jette, A. M., Cleary, P. D., et al., "Hip Fracture: A Prospective Study of Hospital Course, Complications, and Costs," *Journal of General Internal Medicine* 2(2):78-82, *1987.*
10. Carter, G. M., and Rogowski, J. A., "How Recalibration Method, Pricing, and Coding Affect DRG Weights," *Health Care Financing Review* 14(2):83-96, 1992.
11. Ceder, L., Thorngren, K., and Wallden, B., "Prognostic Indicators and Early Home Rehabilitation in Elderly Patients with Hip Fractures," *Clinical Orthopedics and Related Research 152: 173-184,* October 1980.
12. Charlson, M. E., Associate Professor of Medicine, New York Hospital-Cornell Medical Center, unpublished data from the 1988 MEDPAR tapes analyzed under contract to the Office of Technology Assessment, U.S. Congress, Washington, DC, July 10, 1991.
13. Chrischilles, E. A., Shireman, T., and Wallace, R. B., "Costs and Health Effects of Osteoporotic Fractures," draft, Department of Preventive Medicine and Environmental Health, University of Iowa, Iowa City, 1993.
14. Clark, A. P., Shuttinga, J. E., Stark, S. P., et al., *Targeted Estrogen/Progestogen Replacement Therapy for Osteoporosis: Example of Cost Savings Resulting from NIH-Funded Research,* National Institute of Arthritis and Musculoskeletal and Skin Diseases, Office of Program Planning and Evaluation, Bethesda, MD, Jan. 7, 1991.

15. Clark, A. P., and Shuttinga, J. E., "Targeted Estrogen/Progestogen Replacement Therapy for Osteoporosis: Calculation of Health Care Costs," *osteoporosis International* 2:195-200, 1992.
16. Cooper, C., Atkinson, E.J., Jacobsen, S.J., et al., "Population-Based Study of Survival After Osteoporotic Fractures," *American Journal of Epidemiology 137(9):1001-*1005, 1993.
17. Crane, J.G., and Kernek, C. B., "Mortality Associated with Hip Fractures in a Single Geriatric Hospital and Residential Health Facility: A Ten-Year Review," *Journal of the American Geriatrics Society* 31(8):472-475, *1983.*
18. Cummings, S. R., "Osteoporotic Fractures: The Magnitude of the Problem," *Osteoporosis 1987,* C. Christiansen, J.S. Johansen, and B.J Riis (eds.) (Copenhagen, Denmark: Osteopress ApS, 1987).
19. Cummings, S. R., Kelsey, J. L., Nevitt, M. C., et al., "Epidemiology of Osteoporosis and Osteoporotic Fractures," *Epidemiologic Reviews 7:* 178-208, 1985.
20. Cummings, S. R., Phillips, S. L., Wheat, M. E., et al., "Recovery of Function After Hip Fracture: The Role of Social Supports," *Journal of the American Geriatrics Society* 36(9):801-806, *1988.*
21. Dahl, E., "Mortality and Life Expectancy After Hip Fractures," *Acta Orthopaedica Scandinavia* 51(1):163-170, *1980.*
22. Davidson, T.I., and Bodey, W.N., "Factors Influencing Survival Following Fractures of the Upper End of the Femur," *Injury* 17:12-14, *1986.*
23. Dwyer, A. P., and Nelson, C. L., "Hip Fractures in the Elderly," *The Aging Musculoskeletal System,* 1984.
24. El Banna, S., Raynal, I., and Gerebtzof, A., "Fractures of the Hip in the Elderly: Therapeutic and Medico-Social Considerations," *Archives of Gerontology and Geriatrics* 3:31*1-319, 1984.*
25. Epstein, R. S., Director, Epidemiologic Research, Merck Research Laboratories, West Point, PA, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, June 4, 1993.
26. Finch, M., Division of Health Services Research and Policy, School of Public Health, University of Minnesota, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, Sept. 3, 1991.
27. Fisher, E. S., Baron, J.A., Malenka, D.J., et al., "Hip Fracture Incidence and Mortality in New England," *Epidemiology* 2(2):1*16-122, 1991.*
28. Fitzgerald, J. F., Fagan, L. F., Tierney, W. M., et al., "Changing Patterns of Hip Fracture Care Before and After Implementation of the Prospective Payment System," *Journal of the American Medical Association* 258(2):218-221, *1987.*
29. Fitzgerald, J. F., Moore, P. S., and Dittus, R. S., "The Care of Elderly Patients with Hip Fracture," New *England Journal of Medicine 319(21): 1392-1397, 1988.*
30. Furstenberg, A., and Mezey, M. D., "Differences in Outcome Between Black and White Elderly Hip Fracture Patients," *Journal of Chronic Disease* 40(10):931-938, *1987.*
31. Gallagher, J.C., Melton, L.J., Riggs, B.L., et al., "Epidemiology of Fractures of the Proximal Femur in Rochester, Minnesota," *Clinical Orthopedics and Related Research* 150:163-171, *1980.*
32. Gerety, M. B., Soderholm-Difatte, V., and Winograd, C. H., "Impact of Prospective Payment and Discharge Location on the Outcome of Hip Fracture," *Journal of General Internal Medicine 4:388-391, 1989.*
33. Gibson, M.J., "Falls in Later Life," *Improving the Health of Older People* R.L. Kane, J.G. Evans, and D. MacFadyen (eds.) (Oxford, England: Oxford University Press, 1990).
34. Gold, D.T., Assistant Professor, Duke University Medical Center, Durham, NC, letter

to the Office of Technology Assessment, Washington, DC, Apr. 28, 1993.
35. Grady, D., Rubin, S. M., Petit(i, D. B., et al., ● 'Hormone Therapy To Prevent Disease and Prolong Life in Postmenopausal Women," *Annals of Internal Medicine* 11 7(1 2): 1016-1037, 1992.
36. Guralnik, J. M., LaCroix, A. Z., Abbott, R. D., et al., "Maintaining Mobility in Late Life," *American Journal of Epidemiology* 137(8):845-857, *1993.*
37. Gustafson, Y., Brannstrom, B., Berggren, D., et al., "A Geriatric-Anethesiologic Program To Reduce Acute Confusional States in Elderl y Patients Treated for Femoral Fractures," *Journal of the American Geriatrics Society* 39(7):655-662, *1991.*
38. Gustafson, Y., Brannstrom, B., and Norberg, A., '* Underdiagnosis and Poor Documentation of Acute Confusional States in Elderly Hip Fracture Patients," *Journal of the American Geriatrics Society* 39(8):760-765, 1991.
39. Hing, E., Statistician, Division of Health Care Statistics, National Center for Health Statistics, Hyattsville, MD, personal communication, Jan. 22, 1993.
40. Holbrook, T. L., Grazier, K., Kelsey, J. L., et al., *Frequency of Occurrence, Impact and Cost of Selected Musculoskeletal Conditions in the United States* (Chicago, IL: American Academy of Orthopedic Surgeons, 1984).
41. Holmberg, S., and Thomgren, K., "Rehabilitation After Femoral Neck Fracture," *Acta Orthopaedica Scandinavia* 56(4):305-308, *1985.*
42. Holmberg, S., Conradi, P., Kalen, R., et al., "Mortality After Hip Fracture," *Acta Orthopaedica Scandinavia 57:8-11,* 1986.
43. Hombrook, M. C., Wingfield, D. J., Stevens, V.J., et al., "Falls Among Older Persons: Antecedents and Consequences," *Prevention of Falls in the Elderly: The Study of Accidental Falls in the Elderly,* M.C. Hornbrook, Center for Health Research, Kaiser Permanence, Northwest Region (Principal Investigator), unpublished draft, May 1991.
44. Institute of Medicine, *Hip Fracture: Setting Priorities for Electiveness Research* (Washington, DC: NAP, 1990).
45. Jacobsen, S. J., "Race and Sex Differences in Mortality Following Fracture of the Hip," *American Journal of Public Health* 82(8):1 *147-1150, 1992.*
46. Jensen, J. S., "Determining Factors for the Mortality Following Hip Fractures," *Injury* 15:41 1-414, 1984.
47. Jensen, J. S., and Bagger, J., "Long-Term Social Prognosis After Hip Fractures," *Acta Orthopaedica Scandinavia* 53:97-101, *1982.*
48. Jensen, J. S., and Tondevold, E., "Mortality After Hip Fractures," *Acta Orthopaedica Scandinavia 50: 161-167, 1979.*
49. Jensen, J. S., Tondevold, E., and Sorensen, P. H., "Social Rehabilitation Following Hip Fractures," *Acta Orthopaedica Scandinavia* 50:777-785, 1979.
50. Jet(e, A. M., Harris, B. A., Cleary, P. D., et al., "Functional Recovery After Hip Fracture," *Archives of Physical Medicine and Rehabilitation* 68(10):735-740, *1987.*
51. Kahn, K. L., Keeler, E. B., and Sherwood, M.J., "Comparing Outcomes of Care Before and After Implementation of the DRG-Based Prospective Payment System," *Journal of the American Medical Association 264(15): 1984-1988, 1990.*
52. Kane, R. A., Principal Investigator, Heinz Endowment Study of Informal Caregiving, information presented to the conference on "Family Caregiving in Long-Term Care: Next Steps for Policy," Morgantown, WV, Dec. 4, 1990.
53. Kane, R. L., Minnesota Chair in Long-Term Care and Aging, Institute for Health Services Research, School of Public Health, University of Minnesota, Minneapolis, MN, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, Aug. 31, 1993.

54. Kaplan, G.A., Strawbridge, W.J., Camacho, T., et al., "Factors Associated with Change in Physical Functioning in the Elderly," *Journal of Aging and Health 5(1):140-153, 1993.*
55. Kashner, T. M., and Magaziner, J. S., "Long Term Care of Aged Hip Fractures: Public vs. Private Costs," unpublished report to the Health Care Financing Administration, University of Maryland School of Medicine, Baltimore, MD, April 1990.
56. Keeler, E. B., Kahn, K.L., and Bentow, S. S., "A RAND Note: Assessing Quality of Care for Hospitalized Medicare Patients with Hip Fracture Using Coded Diagnoses from the Medicare Provider Analysis and Review Files," RAND/UCLA/Harvard Center for Health Care Financing Policy Research, Santa Monica, CA, 1992.
57. Keene, J. S., and Anderson, C. A., "Hip Fractures in the Elderly: Discharge Predictions with a Functional Rating Scale," *Journal of the American Medical Association* 248(5):564-567, *1982.*
58. Keene, R. E., Office of Research and Demonstrations, Health Care Financing Administration, Baltimore, MD, personal communication, Feb. 10, 1993.
59. Kellie, S.E., and Brody, J.A., "Sex-Specific and Race-Specific Hip Fracture Rates," *American Journal of Public Health* 80(3): *326-328, 1990.*
60. Kemper, P., and Murtaugh, C. M., "Lifetime Use of Nursing Home Care," New *England Journal of Medicine* 324(9):595-600, *1991.*
61. Kemper, P., Spillman, B.C., and Murtaugh, C. M., "A Lifetime Perspective on Proposals for Financing Nursing Home Care," *Inquiry* 28:333-344, winter 1991.
62. Kenzora, J. E., McCarthy, R.E., and Lowell, J. D., "Hip Fracture Mortality," *Clinical Orthopaedics and Related Research* 186:45-56, *1984.*
63. Kominski, G. F., and Biddle, A. K., "Changes in Follow-Up Care for Medicare Surgical Patients Under the Prospective Payment System," RAND/UCLA/Harvard Center for Health Care Financing Policy Research, Santa Monica, CA, 1992.
64. Kosecoff, J., Kahn, K.L., Rogers, W.H., et al., "Prospective Payment System and Impairment at Discharge: The 'Quicker and Sicker' Story Revisited," *Journal of the American Medical Association 264(15): 1980-1983, 1990.*
65. Kreutzfeldt, J., Haim, M., and Bach, E., "Hip Fracture Among the Elderly in a Mixed Urban and Rural Population," *Age and Ageing 13:11* 1-119, 1984.
66. Latta, V. B., and Helbing, C., "Medicare Short-Stay Hospital Services by Diagnosis-Related Groups," *Health Care Financing Review* 12(4):105-140, *1991.*
67. Latta, V. B., and Keene, R. E., "Leading Inpatient Surgical Procedures for Aged Medicare Beneficiaries, 1987," *Health Care Financing Review* 11(2) :99-110, 1989.
68. Lawton, J.O., Baker, M. R., and Dickson, R. A., "Femoral Neck Fractures—Two Populations," *Lancet* 2(8341):70-72, July 9, 1983.
69. Lee, D. R., Chairperson, American Osteoporosis Alliance, New York, NY, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, May 17, 1993.
70. Lewis, A. F., "Fracture of Neck of the Femur: Changing Incidence," *British Medical Journal 283: 1217-1220, 1981.*
71. Liu, G., Dartmouth Medical School, Hanover, NH, personal communication, Dec. 2, 1992.
72. Liu, K., and Manton, K. G., "The Characteristics and Utilization Pattern of an Admission Cohort of Nursing Home Patients," *Gerontologist* 23(1):92-98,1983.
73* Liu, K., Manton, K.G., and Liu, B. M., "Home Care Expenses for the Disabled Elderly," *Health Care Financing Review* 7(2):51-58, *1985.*
74. Lund, B., Hogh, J., and Lucht, U., "Trochanteric and Subtrochanteric Fractures," *Acta Orthopaedica Scandinavia* 52:645-648, *1981.*

75. Lydick, E., Merck Research Laboratories, West Point, PA, personal communication, Mar. 18, 1990.
76. Lyons, J. L., and Nevins, M. A., "Nontreatment of Hip Fractures in Senile Patients," *Journal of the American Medical Association 238: 1175, 1970.*
77. Macken, C. L., "A Profile of Functionally Impaired Elderly Persons Living in the Community," *Health Care Financing Review* 7(4):33-49, 1986.
78. Magaziner, J., Department of Epidemiology and Preventive Medicine, University of Maryland School of Medicine, Baltimore, MD, personal communications, Mar. 7, 1991 and July 22, 1993.
79. Magaziner, J., Simonsick, E. M., Kashner, T. M., et al., "Survival Experiences of Aged Hip Fracture Patients," *American Journal of Public Health* 79(3):274-278, *1989.*
80. Magaziner, J., Simonsick, E. M., Kashner, T. M., et al., '*Predictors of Functional Recovery One Year Following Hospital Discharge for Hip Fracture: A Prospective Study," *Journal of Gerontology* 45(3): *MI O1-107, 1990.*
81 Manton, K. G., Liu, K., and Cornelius, E. S., "An Analysis of the Heterogeneity of U.S. Nursing Home Patients," *Journal of Gerontology 40(* 1):34-46, 1985.
82. Marottoli, R. A., Berkman, L. F., and Cooney, L. M., ● 'Decline in Physical Function Following Hip Fracture," *Journal of the American Geriatrics Society* 40(9):86 1-866, 1992.
83. Matheny, L., Scott, T. F., Craythome, C. M., et al., "Hospital Mortality in 342 Hip Fractures," *West Virginia Medical Journal 76(8): 188-190, 1980.*
84. MEDSTAT Systems, Inc., *DRG Guide: Descriptions and Normative Values* (Ann Arbor, MI: 1992).
85. Melton, L. J., Head, Section of Clinical Epidemiology, Department of Health Sciences Research, Mayo Clinic, Rochester, MN, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, May 3, 1993.
86. Miller, C. W., "Survival and Ambulation Following Hip Fracture," *Journal of Bone and Joint Surgery 60-A(7) :930-934,* 1978.
87. Mossey, J. M., Mutran, E., Knott, K., et al., "Determinants of Recovery 12 Months After Hip Fracture: The Importance of Psychosocial Factors," *American Journal of Public Health* 79(3):279-286, *1989.*
88. Myers, A. H., Robinson, E. G., Van Natta, M. L., et al., "Hip Fractures Among the Elderly: Factors Associated with In-Hospital Mortal ity," *American Journal of Epidemiology* 134(10): 1128-1137, 1991.
89. Neu, C. R., and Harrison, S. C., "Posthospital Care Before and After the Medicare Prospective Payment System," RAND Corp., Santa Monica, CA, March 1988.
90. Neu, C. R., Harrison, S. C., and Heilbrunn, J. Z., *Medicare Patients and Postacute Care: Who Goes Where?* (Santa Monica, CA: RAND Corp., November 1989).
91. Nevitt, M. C., Cummings, S. R., Kidd, S., et al., "Risk Factors for Recurrent Nonsyncopal Falls," *Journal of the American Medical Association* 261(18):2663-2668, *1989.*
92. Nugent, J., Reimbursement Branch, American Physical Therapy Association, Alexandria, VA, personal communication, Feb. 19, 1993.
93. Nydegger, V., Rozzoli, R., Rapin, C. H., et al., "Epidemiology of Fractures of the Proximal Femur in Geneva: Incidence, Clinical and Social Aspects," *Osteoporosis International 2(1*):42-47, *1991.*
94. Owen, R. A., Melton, L.J., Gallagher, J. C., et al., "The National Cost of Acute Care of Hip Fractures Associated with Osteoporosis," *Clinical Orthopedics and Related Research 150: 172-176, 1980.*
95. Palmer, R. M., Saywell, R. M., Zollinger, T. W., et al., "The Impact of the Prospective Payment System on the Treatment of Hip Fractures in the Elderly," *Archives of Internal Medicine* 149:2237-2241, *1989.*

96. Petitti, D. B., University of California, San Francisco, unpublished data from the study "Hip Fracture in Women," July 23, 1991.
97. Petitti, D. B., University of California, San Francisco, CA, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, Apr. 16, 1993.
98. Petitti, D. B., and Sidney, S., "Hip Fracture in Women: Incidence, In-Hospital Mortality, and Five-Year Survival Probabilities in Members of a Prepaid Health Plan," *Clinical Orthopedics and Related Research 246: 150-155, 1989.*
99. Pracon, Inc., "The Annual Direct Medical Costs of Osteoporosis for American Women 45 and Older: Final Report," prepared for Rorer Pharmaceuticals, Fort Washington, PA, by Pracon, Inc., Reston, VA, Sept. 19, 1986.
100. Praemer, A., Furner, S., and Rice, D. P., *Musculoskeletal Conditions in the United States* (Park Ridge, IL: American Academy of Orthopedic Surgeons, February 1992).
101. Prospective Payment Assessment Commission, *Medicare and the American Health Care System: Report to the Congress,* Washington, DC, June 1993.
102. Prospective Payment Assessment Commission, *Medicare and the American Health Care System: Report to the Congress* (Washington, DC: June 1992).
103. Ray, W. A., Griffin, M. R., and Baugh, D. K., "Mortality Following Hip Fracture Before and After Implementation of the Prospective Payment System," *Archives of Internal Medicine* 150:2109-21*14,* October 1990.
104. Rhoades, J., Center for General Health Services Intermural Research, Agency for Health Care Policy and Research, Public Health Service, U.S. Department of Health and Human Services, Rockville, MD, letter to the Office of Technology Assessment, June 8, 1993.
105. Royal College of Physicians, '*Fractured Neck of Femur: Prevention and Management: Summary and Recommendations of a Report of the Royal College of Physicians," *Journal of the Royal College of Physicians of London* 23(1):8-12, 1989.
106. Ruther, M., and Helbing, C., "Use and Cost of Home Health Agency Services Under Medicare," *Health Care Financing Review* 10(1):105-108, *1988.*
107. Schappert, S. M., Survey Statistician, National Center for Health Statistics, Hyattsville, MD, personal communication, May 14, 1993.
108. Schappert, S. M., Survey Statistician, National Center for Health Statistics, Hyattsville, MD, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, Feb. 8, 1993.
109. Sharkness, C. M., Hamburger, S., Moore, R. M., et al., "Prevalence of Artificial Hip Implants and Use of Health Services by Recipients," *Public Health Reports 108(1): 70-75, 1993.*
110. Silverman, H. A., "Use of Medicare-Covered Home Health Agency Services, 1988," *Health Care Financing Review* 12(2): 113-126, 1990.
111. Simonen, O., and Mikkola, T., "Excess Mortality After Femoral Neck Fracture," *Osteoporosis 90 C.* Christiansen and K. Overgaard (eds.) (Copenhagen, Denmark: Osteopress ApS, 1990).
112. Skovron, M. L., Fessel, K., Cohen, H., et al., "Surgical Delay and Long-Term Outcome in Previously Ambulatory Hip Fracture Patients," *Journal of the American Geriatrics Society* (abstract) 39(8):A6, 1991.
113. Speechley, M., and Tinetti, M., "Falls and Injuries in Frail and Vigorous Community Elderly Persons," *Journal of the American Geriatrics Society* 39(1):46-52, *1991.*
114. Spence, D. A., and Wiener, J. M., "Nursing Home Length of Stay Patterns: Results from the 1985 National Nursing Home Survey," *Gerontologist 30(1): 16-20, 1990.*
115. Thomas, T.G., and Stevens, R. S., "Social Effects of Fractures of the Neck of the Femur," *British Medical Journal* 3:456-458, 1974.

116. Tinetti, M. E., Speechley, M., and Ginter, S. F., "Risk Factors for Falls Among Elderly Persons Living in the Community," New *England Journal of Medicine 319(26): 1701-1707, 1988.*

117. Tosteson, A. N. A., Rosenthal, D. I., Melton, L. J., et al., "Cost Effectiveness of Screening Perimenopausal White Women for Osteoporosis: Bone Densitometry and Hormone Replacement Therapy," *Annals of Internal Medicine* 113:594-603, 1990.

118. Trude, S., *A RAND Note: The Determinants of the Use of Assistants at Surgery* (Santa Monica, CA: RAND/UCLA/Harvard Center for Health Care Financing Policy Research, February 1990).

119. Trude, *S., A RAND Note: Physician's Hospital Visits: A Description of Rates of Visits Under Medicare* (Santa Monica, CA: RAND/UCLA/Harvard Center for Health Care Financing Policy Research, 1992).

120. Tuttleman, M., Coordinator, National Osteoporosis Data Group, Office of Prevention, Epidemiology, and Clinical Applications, National Institute of Arthritis and Musculoskeletal and Skin Diseases, National Institutes of Health, Bethesda, MD, letter to the Office of Technology Assessment, U.S. Congress, Washington, DC, Mar. 22, 1993.

121. U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, *Health Care Financing Special Report: Hospital Data by Geographic Area for Aged Medicare Beneficiaries: Selected Procedures, 1986,* Vol. 2 (Baltimore, MD: June 1990).

122. U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, *Health Care Financing Special Report: Rehospitalization by Geographic Area for Aged Medicare Beneficiaries: Selected Procedures, 1986-87,* Vol. 3 (Baltimore, MD: June 1990).

123. U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, unpublished Medicare data provided for the Office of Technology Assessment by J. Petrie, Research Analyst, Jan. 26, 1993-Mar. 29, 1993.

124. U.S. Department of Health and Human Services, Health Care Financing Administration, Office of Research and Demonstrations, unpublished Medicare data provided for the Office of Technology Assessment by W. Kirby, Research Analyst, 1991.

125. U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, *National Medical Expenditure Survey: Functional Status of the Noninstitutionalized Elderly: Estimates of ADL and IADL Difficulties,* DHHS Pub. No. (PHS) 90-3462 (Rockville, MD: June 1990).

126. U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and Research, unpublished data from the 1987 National Medical Expenditure Survey provided for the Office of Technology Assessment by J. Rhoades, Service Fellow, June 25, 1993.

127. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, unpublished data from the 1988 and 1991 National Hospital Discharge Surveys provided for the Office of Technology Assessment by E.J. Graves, 1992.

128. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Aging in the Eighties, Age 65 Years and Over—Use of Community Services, Advancedata, No. 124,* DHHS Pub. No. (PHS) 86-1250 (Hyattsville, MD: Sept. 30, 1986).

129. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Aging in the Eighties, Functional Limitations of Individ-*

uals Age 65 Years and Over, Advancedata, No. *133,* DHHS Pub. No. (PHS) 87-1250 (Hyattsville, MD: June 10, 1987).

130. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Discharges from Nursing Homes: 1985 National Nursing Home Survey,* DHHS Pub. No. (PHS) 90-1764 (Hyattsville, MD: March 1990).
131. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Health United States 1991,* DHHS Pub. No. (PHS) 92-1232 (Hyattsville, MD: May 1992).
132. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *National Ambulatory Medical Care Survey: 1990 Summary, Advance Data, No. 213,* DHHS Pub. No. (PHS) 92-1250 (Hyattsville, MD: Apr. 30, 1992).
133. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *The National Nursing Home Survey: 1985 Summary for the United States,* DHHS Pub. No. (PHS) 89-1758 (Hyattsville, MD: January 1989).
134. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *Nursing Home Utilization by Current Residents: United States, 1985,* DHHS Pub. No. (PHS) 89-1763 (Hyattsville, MD: October 1989).
135. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, 1986 *Summary: National Hospital Discharge Survey, Advancedata, No. 145,* DHHS Pub. No. (PHS) 87-1250 (Hyattsville, MD: Sept. 30, 1987).
136. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, *1988 Summary: National Hospital Discharge Survey, Advance Data, No.* 185, DHHS Pub. No. (PHS) 90-1250 (Hyattsville, MD: June 19, 1990).
137. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, 1990 *Summary: National Hospital Discharge Survey, Advance Data, No. 210,* DHHS Pub. No. (PHS) 92-1250 (Hyattsville, MD: Feb. 18, 1992).
138. U.S. Department of Health and Human Services, Public Health Service, National Center for Health Statistics, 1991 *Summary: National Hospital Discharge Survey, Advance Data, No. 227,* DHHS Pub. No. (PHS) 93-1250 (Hyattsville, MD: Mar. 3, 1993).
139. University of Minnesota School of Public Health, *A Study of Post Acute Care: Final Report* (Minneapolis, MN: 1993).
140. Weiss, N. S., Liff, J. M., Ure, C. L., et al., "Mortality in Women Following Hip Fracture," *Journal of Chronic Disease* 36(12): *879-882, 1983.*
141. Winter, N.G., ● 'Nonoperative Treatment of Proximal Femoral Fractures in the Demented, Nonambulatory Patient," *Clinical Orthopedics 21* 8:97-103, *1987.*
142. Young, T. B., and Gibbs, A. C. C., "Prognostic Factors for the Elderly with Proximal Femoral Fracture," *Archives of Emergency Medicine* 1(4):215-224, *1984.*
143. Yucel, L., Analyst, Policy Development and Research, Health Care Financing Administration, Baltimore, MD, personal communication, May 27, 1993.

Index

A

Activities of daily living
  functional impairment and, 50-51
ADLs. See Activities of daily living
Age factors. See *also* Patients age 65 and over; Patients age 50 to 64
  discharge to a nursing home, 37
  discharge to rehabilitation facility or other short-stay hospital, 42
  home health care, 44
  in-hospital mortality, 25
  long-term mortality, 28,32-33,55
Agency for Health Care Policy and Research
  in-hospital treatment effectiveness studies, 2, 9
AHCPR. See Agency for Health Care Policy and Research
Ambulance services, 49
American Academy of Orthopedic Surgeons
  annual cost of hip fractures studies, 5, 52-53, 54,55
American Hospital Association
  average charge for a day of hospital care, 54
American Physical Therapy Association
  in-hospital physical therapy, 22
Anesthesia services, 19-20
Assistants at surgery
  Medicare payments, 14, 16

B

Bone densitometry, 20

C

Center for Medical Rehabilitation Research
  post-fracture outcomes study, 9
Charges definition, 11
Coexisting illnesses
  in-hospital mortality and, 26
  long-term mortality and, 30
Computerized axial tomography, 20-21
Conclusions of report, 56
Cost definition, 11
CPT codes
  expenditures for in-hospital physician services, 14, 15-16
  expenditures for emergency room services, 48
  expenditures for physical medicine treatments, 18
  expenditures for physical therapy, 22
  expenditures for physician visits, 46
  expenditures for radiologic services, 20

D

Dartmouth Medical School study
  in-hospital treatment effectiveness, 2, 9
  type of treatment relationship to mortality, 31
Delirium/dementia
  functional impairment and, 51
  long-term mortality and, 30,31
Diagnostic related groups
  discharge to nursing home and, 40,42
  five groups used for hip fractures, 8
  home health care and, 43,44,45
  in-hospital care costs and, 11, 13, 14, 54
  Medicare expenditure for hospital care and, 11
DRGs. See Diagnostic related groups
Drugs category of cost estimates, 52-53

E

Emergency room services
  evaluation of hip fractures, 47-48
  Medicare payment for, 47-49
  OTA estimate of per patient expenditure, 49
Ethnic differences
  functional impairment, 51
  in-hospital mortality, 25-26
  long-term mortality, 29
Expenditure definition, 11

F

Family caregivers. See Informal care
Functional impairment
  factors, 4,51

measurement criteria, 50
principal findings, 4
study results, 50-52

G
Gender differences
discharge to a nursing home, 37
functional impairment, 51
home health care use, 44
in-hospital mortality, 3, 25
long-term mortality, 3,27-28,29,32-33,55
nursing home length of stay, 39
Geographic factors
discharge to a nursing home, 37
discharge to rehabilitation facility, 42
post-hospital service use and expenditure, 34

H
HCFA. See Health Care Financing Administration
Health Care Financing Administration. See *also* Special Report
Medicare allowed charges definition, 11
Medicare nonsurgical payments data, 10
post-hospital services effectiveness study, 2
rehospitalization after hip fracture, 42-43
Health maintenance organizations
number of physical therapy sessions and, 22
HMOs. See Health maintenance organizations
Home health care. See *also* Informal care
average cost of, 44-45
background levels of use, 44
examples of, 4, 43
Medicare coverage, 43-44
nonmedical services, 45
number of hip fracture patients receiving, 4, 43-44
number of visits per week, 45
OTA estimate of per patient expenditures, 45
Hospital length of stay
decrease in, 26
expenditures and, 3,22
functional impairment and, 51
impact of PPS on mortality, 31-32
mortality and, 26
physical therapy and, 22
post-hospital services and, 34
prospective payment system and, 22

I
IADLs. See Instrumental activities of daily living
ICFS. See Intermediate care facilities
In-hospital mortality. See *also* Long-term mortality
all-cause mortality following hip fracture, Appendix B
data sources, 24-25
factors affecting, 25-27
nonsurgical treatment and, 10
OTA estimate, 27
principal findings, 3-4
In-hospital physical therapy. See *also* Outpatient physical therapy
HMO patients and, 22
hospital length of stay and, 22
number of hip fracture patients receiving, 22
OTA estimate, 22-23
In-hospital physician services
assistants at surgery payments, 14, 16
average expenditure, 14
average expenditure calculation, 14
hospital visits, 17
Medicare submitted and allowed charges, 15-16
nonsurgical treatment expenditures, 17-18
services included, 14
In-hospital treatment and expenditures
anesthesia services, 19-20
average length of stay, 3, 22
expenditures, 3
hospital care, 11-14
OTA's per-patient estimate, 12-13,23-24
patient characteristics and, 10
physical therapy, 22-23
physician services, 14-19
principal findings, 2-3
radiologic services, 20-22
services included, 9
Informal care. See *also* Home health care
family caregivers, 49
number of hip fracture patients receiving, 4-5
OTA estimate, 50
Institute of Medicine
nonsurgical treatment appropriateness research, 10
Instrumental activities of daily living, 50-51
Intermediate care facilities
discharge to SNFs instead of, 37

K
Kaiser Permanence Health Plan Study
long-term mortality, 27-28,29,32

L
Location of hip fracture
in-hospital mortality and, 26
long-term mortality and, 30,31
Long-term mortality. See *also* In-hospital mortality

all-cause mortality for hip fracture patients, 27, 32
data sources, 27-28
factors affecting, 28-32
OTA estimate, 32-33,55
patient characteristics, 3-4
principal findings, 3-4
prospective payment system and, 31-32
study findings, Appendix B
Lost productivity
OTA estimates and, 5,54

M

Medical instabilities
discharge with, 34
Medicare. See *also* Prospective payment system
allowed charge and submitted charge comparison, 12, 15-16, 17, 18, 19
allowed charges and hospital costs gap, 5-6
allowed charges definition, 11
anesthesia payments, 19-20
assistants at surgery payments, 14, 16
bone densitometry payments, 20
computerized axial tomography payments, 20-21
DRG category relation to expenditures, 11, 12
eligibility, 11
emergency room service payment, 47-49
home health care payments, 43-44,45
in-hospital expenditures, 3, 11, 12, 13, 14, 24,54
nonsurgical treatment payments, 10
nursing home payments, 40
OTA's estimate of total average per patient expenditure compared with Medicare allowed charges, 5-6
outpatient physical therapy payment, 47
physical medicine treatments submitted and allowed charges, 18
physician hospital visit payments, 16-17
physician hospital visit submitted and allowed charges, 17-18
post-hospital expenditures, 33
post-hospital physician visit payments, 45,46,47
post-operative physician visit payments, 17
radiologists payments, 21
rehabilitation facility payments, 42
surgical treatment payments, 9-10, 11, 13, 14, 15-16
Merck Research Laboratories
hip fracture outcomes study, 9
Mortality. See *also* In-hospital mortality; Long-term mortality
average mortality one year post-fracture, 3
excess mortality, 33,55
gender differences, 3,55

N

National Ambulatory Medical Care Survey
drugs prescribed per physician visits, 53
post-hospital physician visits, 46
National Health Interview Survey Supplement on Aging
functional impairment, 51
home health care use, 44
National Health Interview Surveys
lost productivity estimates, 53,54
National Hospital Discharge Surveys
decrease in average length of hospital stay, 26
description, 6-7
discharges to nursing homes, 34,37
in-hospital mortality, 24-25
number of hip fracture patients, 9-10, 11
rehabilitation facility or other short-stay hospital data, 41-42,43
surgical treatment data, 10
National Institute of Arthritis and Musculoskeletal and Skin Disease
National Osteoporosis Data Group, 9
National Institute on Aging
changes in muscle strength following hip fracture study, 9
National Institutes of Health. **See** *also* Center for Medical Rehabilitation Research; National Institute of Arthritis and Musculoskeletal and Skin Disease; National Institute on Aging
annual cost of hip fractures study, 5, 52, 53
lost productivity estimates, 53-54
National Long Term Care Survey
home health care use, 44
National Medical Care Utilization and Expenditure Survey
per capita expenditures for prescribed drugs, 53
National Medical Expenditure Survey
description, 7-8
functional impairment, 51
nursing home admissions of hip fracture patients, 39
National Osteoporosis Data Group, 9
Negative outcomes of hip fractures
approaches to reducing, 6, 56
NIH. See National Institutes of Health
Non-health sector goods and services category of cost estimates, 53
Nonpaid care. See Informal care
Nonsurgical treatment
DRG 236 and, 11
in-hospital mortality and, 10, 26
in-hospital physician services, 17-18
long-term mortality and, 30-31
lower cost for, 54
Medicare payments, 10

patient characteristics, 10
principal findings, 2
Nursing homes. See *also* Intermediate care facilities; Skilled nursing facilities
average length of stay, 37-38
average monthly charges, 40-41
discharges with a diagnosis of hip fracture, 39
expenditure overestimation potential, 40
in-hospital mortality and, 26
initial discharge home and, 40
long-term mortality and, Appendix B, 30
number of residents with hip fracture as primary diagnosis, 4,34,37
OTA estimate of expenditures for, 41,55
OTA estimate of length of stay, 38-41
OTA one-year maximum length of stay, 6,40
physical therapy and, 47
readmission after hip fracture, 37, 39

O

Osteoporosis
excess mortality attributable to hip fracture and, 33
hip fracture as result of, 1
types of fractures other than hip fractures attributable to, 2
Outpatient physical therapy, 47. See *also* In-hospital physical therapy
Outpatient services. See Outpatient physical therapy; Post-hospital and other outpatient service use and expenditures

P

Partial hip joint replacements. See *also* Surgical treatment; Total hip joint replacements
description, 7
long-term mortality and, 30
Patient characteristics
in-hospital mortality and, 25-27
mortality rates and, 3-4
nonsurgical treatment and, 10
nursing home length of stay and, 39
post-hospital and other outpatient services and, 4
Patients age 50 to 64. See *also* Age factors
estimated total expenditure for, 24
in-hospital expenditures, 3
Medicare payments for in-hospital services, 3
OTA estimate of average per patient expenditure for in-hospital services, 3
OTA estimate of total average per patient expenditure compared with other estimates, 5-6, 52-55
surgical treatment, 11
Patients age 65 and over. See *also* Age factors
estimated total expenditure for, 24
in-hospital expenditures, 3
Medicare payments for in-hospital services, 3
nonsurgical treatment, 2, 10
OTA estimate of average per patient expenditure for in-hospital services, 3, 12-13
OTA estimate of total average per patient expenditure compared with other estimates, 5-6,52-55
surgical treatment, 9-10
Physical condition
functional impairment and, 51
in-hospital mortality and, 26
long-term mortality and, 33
Physical therapy. See In-hospital physical therapy; Outpatient physical therapy
Physician services. See *also* In-hospital physician services
OTA estimates of expenditures, 46-47
post-hospital, 45-47
Post-hospital and other outpatient service use and expenditures
ambulance services, 49
average expenditures, 4-5
discharge status and destination, 35-36
emergency room services, 47-49
home health care services, 43-45
increase in, 34
informal care, 49-50
Medicare expenditures, 33
movement from one service to another, 34
nursing home care expenditures, 34-41
OTA estimate of total per patient expenditures, 50,54-55
patient characteristics and, 4
physical therapy, 47
physician visits, 45-47
PPS and, 34
principal findings, 4-5
rehabilitation facilities or other short-stay hospitals, 41-43
types of services, 1,4,33
PPS. See Prospective payment system
Prepaid costs of insurance and administration of federal programs category of cost estimates, 53
Principal findings
functional impairment, 4
in-hospital service expenditures, 3
in-hospital treatment, 2-3
mortality, 3-4
OTA cost estimate compared with other estimates, 5-6, 52-55
post-hospital and other outpatient service expenditures, 4-5
PROPAC. See Prospective Payment Assessment Commission

☆ U.S. GOVERNMENT PRINTING OFFICE: 1994– 301-804/17417

Prospective Payment Assessment Commission
discharge to rehabilitation facility or other short-stay hospital, 42, 43
home health care services coverage, 44
Medicare allowed charges relation to hospital costs, 13, 24
Medicare payment estimate, 5
Prospective payment system. See also Medicare
average length of hospital stay and, 22
discharge to a nursing home and, 37
discharge with medical instabilities and, 34
hospital care cost containment and, 24
long-term mortality and, Appendix B,31 -32

R
Racial differences. See Ethnic differences
Radiologic services
bone densitometry, 20
computerized axial tomography, 20-21
OTA estimate, 21-22
x-rays, 20
Radiologists
Medicare payments for, 21
Reduction with or without internal fixation of the joint. See *also* Surgical treatment
description, 7
long-term mortality and, 30
Rehabilitation facilities or other short-stay hospitals
average length of stay, 4, 42
OTA estimate of average length of stay, 43
OTA estimate of number of patients discharged to, 43
OTA estimate of per patient expenditure, 43
percent of hip fracture patients discharged to, 41-42
rehospitalization for a condition related to hip fracture, 42-43
Rehospitalization
for a condition related to hip fracture, 42-43
number of hip fracture patients affected, 33

S
Short-stay hospitals. See Rehabilitation facilities or other short-stay hospitals
Single photon absorptiometry, 20
Skilled nursing facilities. See also Nursing homes
discharge to rather than intermediate care facility, 37
Medicare reimbursement, 40
SNFs. See Skilled nursing facilities
SPA. See Single photon absorptiometry
Special Report
description, 7
long-term mortality, 29-31
study population, 7
Surgical treatment. See *also* Partial hip joint replacements; Reduction with or without internal fixation of the joint; Total hip joint replacements
assistants at surgery payments, 14, 16
HCFA data, 7
in-hospital mortality and, 26
long-term mortality and, 30
Medicare payments for, 10, 13
Medicare submitted and allowed charges, 14, 15-16
number of patients receiving, 10
patients age 50 to 64, 11
patients age 65 and over, 9-10
post-operative physician visits, 17
principal findings, 2
rehospitalization after, 42-43
timing of, 31
types, 9

T
Total hip joint replacements. See *also* Partial hip joint replacements
increase in number of, 10
proportion of hip fracture patients receiving, 2,54
Treatment procedure improvement
in-hospital mortality and, 27

U
University of Maryland School of Medicine study
in-hospital treatment effectiveness, 2, 9, 10
type of treatment relationship to mortality, 31
University of Minnesota Post Acute Care Study
average length of stay in nursing home, 37-38
description, 2
discharge to nursing home, 37,40
discharge to rehabilitation facility, 42,43
DRGs and, 8
home health care, 44
informal care, 49-50
movement from one service to another, 34
types of post-discharge services used, 34
Unpaid care. See Informal care
Unpublished data sources, Appendix A, 8-9,24-25

V
VA. See Veterans Administration
Veterans Administration
surgical treatment payments, 10

X
X-rays
number of hip fracture patients receiving, 20