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.