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Is Withholding Osteoporosis Medication after Fracture Sometimes Rational? A Comparison of the Risk for Second Fracture versus Death

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Abstract

Introduction—Under-treatment of osteoporosis is common, even for high risk patients. Among the reasons for under-treatment may be a clinician's perception of a lack of treatment benefit, particularly in light of patients' expected future mortality. Among U.S. Medicare beneficiaries, we evaluated the risk for second fracture vs. death in the five years following a hip, clinical vertebral, and wrist/forearm fracture.

Methods—Using data from 1999–2006 for a random 5% sample of U.S. Medicare beneficiaries, we identified individuals who experienced an incident hip, clinical vertebral, or wrist/forearm fracture in 2000 or 2001. We evaluated the risk for a second incident fracture versus death in the following five years. Results were stratified by age, gender, race/ethnicity, and medical comorbidities. In light of the competing mortality risk, and assuming 30% efficacy of an osteoporosis medication to prevent a second fracture, we calculated the number of individuals needed to treat (NNT) for 5 years after first fracture to prevent one additional subsequent fracture.

Results—We identified 18,853, 12,751, and 7,635 persons with an incident hip, clinical vertebral, and wrist/forearm fracture, respectively. While the 5-year risk of death usually exceeded the risk for second fracture across age, gender, racial groups, and primary fracture type (median ratio of death to second fracture = 1.4, inter-quartile range 0.9, 2.0), the 5-year risk for second fracture was high, varying from a low of 13% to a high of 43%. Across demographic groups, the NNT to prevent a second fracture was low, ranging from 8 to 46.

Conflicts of interest

JC: Research grants: Merck, Procter & Gamble, Eli Lilly, Amgen, Novartis; Consulting: Roche, UCB, CORRONA, Amgen, Eli Lilly;

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KGS: research grants: Novartis, Amgen, Aventis, Merck, Procter & Gamble, Eli Lilly, Roche; consulting or speaking: Merck, Procter and Gamble, Eli Lilly, Roche, Novartis, Amgen

All other coauthors: none

Disclosures

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Conclusion—Among older persons with hip, clinical vertebral, or wrist/forearm fracture, while the risk for death was usually greater than the risk for a second fracture, both were high. The relatively low NNT to prevent one additional subsequent fracture fell within a range generally considered acceptable for secondary prevention strategies.

Keywords

hip fracture; vertebral fracture; wrist fracture; epidemiology; mortality; osteoporosis

Background

Osteoporosis is a major public health problem worldwide and contributes to over 2 million fractures each year in the United States (1). Despite the substantial public health impact of osteoporosis, which is expected to grow dramatically as the population ages (2), it remains under-diagnosed and under-treated. Indeed, over a consecutive seven-year period, fewer than one-third of U.S. women over age 65 receive bone density testing using dual x-ray absorptiometry (DXA) (3), despite guideline recommendations and reimbursement for this test through the Medicare program (4). Lack of recognition of osteoporosis and under-treatment has been documented in numerous health systems both in U.S. and abroad (5,6)

Although most fracture epidemiology has been conducted in Caucasian women, men and persons of other racial backgrounds are also at risk but have been less well studied. Although men and non-Caucasians on average have lower fracture risk than Caucasian women, even high risk men and African Americans have been shown to be significantly less likely than Caucasian women to receive any DXA testing or prescription osteoporosis medications (7–9).

Numerous reasons have been posited to account for the appreciable under-treatment of osteoporosis. Appropriate management may be uncertain for particular subpopulations (e.g. patients with osteopenia and/or those without prior fracture). However, guidance is generally clear for older individuals who have already experienced one or more clinical fragility fractures. In several national guidelines (1,10,11), these individuals are recommended to receive prescription osteoporosis medications such as bisphosphonates or other potent bone-acting agents regardless of DXA results. The Center for Medicare and Medicaid Services (CMS) has also made modest additional compensation available to physicians for reporting on quality of care measures through the Physician Quality Reporting Initiative (PQRI) (12). Appropriate management of osteoporosis, including judicious use of prescription medications, is among these compensable process measures that reflect high quality of care. Despite these incentives, increasing national attention on osteoporosis, and robust evidence that various medications to reduce fracture risk among persons with at least one prior fracture (13–16), only about 1 in 5 older women with prior fracture receive any evaluation or treatment (5).

Despite the often-devastating consequences of a fracture (17–19), one possible reason for the failure of a high risk person with a recent fragility fracture to receive osteoporosis medications to prevent another fracture may be the treating physician's expectation of a lack of benefit for the patient. Although numerous osteoporosis medications have been shown to be effective in this population, individuals with prior fracture often have multiple medical comorbidities and polypharmacy. For this reason, these patients may be judged to have such a short life expectancy such that osteoporosis treatment would not result in a benefit. It is also not clear that practicing clinicians appreciate the magnitude of risk of a second fracture given a paucity of data about this risk, possibly resulting in the conclusion that extra efforts by the physician to initiate treatment to prevent fractures are unwarranted. To date, there is little information

regarding the risk of death (particularly related to age and various comorbidities) compared to the risk for second fracture in a post-fracture population.

We therefore used national data from the U.S. Medicare program to study older adults who experienced a hip, clinical vertebral, or distal radius/ulna fracture to determine the risk for subsequent fracture compared to the risk for death. We considered how these two risks would vary by demographics and comorbidities. We also generated data to evaluate the appropriateness of osteoporosis treatment in comparison to the published literature for other medical therapies and in light of cost-effectiveness analyses that comprise part of national osteoporosis guidelines.

Methods

Data Source and Eligibility

We obtained person-specific, longitudinal administrative claims data from CMS from 1999–2006 for a random 5% sample of individuals in the Chronic Conditions Warehouse (CCW). Use of the data was governed by a Data Use Agreement from CMS and approved by the University institutional review board. The CMS files used in the analysis included the Beneficiary Summary, Inpatient, Outpatient, and Carrier files. The date but not cause of death is available in the Beneficiary Summary File. Individuals were eligible for analysis if they experienced a hip, clinical vertebral, or distal radius/ulna fracture in 2000 or 2001, were covered by Medicare parts A and B and were not in a Medicare Advantage plan throughout the study period, were ages ≥ 65 years at the time of their initial coverage by Medicare. Unless they died, all individuals were required to have 5 subsequent years of continuous Medicare parts A + B and not be enrolled in a Medicare Advantage plan following the fracture. Individuals enrolled in Medicare Advantage typically have incomplete claims data and were excluded for this reason. Fractures were identified using claims-based algorithms that have been validated against review of medical records with adjudication (20–22). Medical comorbidities were assessed in the 365 days prior to the initial fracture.

Outcomes of Interest

The primary outcomes of interest were death and subsequent fracture (hip, femur, pelvis, tibia/fibula, ankle, humerus, wrist/distal radius, clinical vertebral, clavicle; excludes skull, finger, toe). For patients whose index fracture entailed hospitalization, observation time began on the later of the 1) date of hospital discharge; or 2) the fracture occurrence date + 14 days. For patients whose index fracture did not entail hospitalization, observation time began 14 days after the fracture occurrence date. We began observation at least 14 days after the index fracture in order to avoid misclassifying concurrent fractures as subsequent, second fractures. Subsequent fractures were identified on the basis of International Disease Classification, 9th revision (ICD9) and Current Procedural Terminology (CPT) codes using procedures similar to those validated in previous studies (7,17–19), enhanced with an algorithm developed to distinguish between prevalent and incident fractures (Appendix). Individuals who experienced a second fracture and subsequently died were counted only in the second fracture category but not in the death category so as to focus on the first of these two competing risks. Throughout the manuscript, the term ‘risk’ is synonymous with ‘cumulative incidence’.

Statistical analysis

Descriptive statistics were used to compare the 5-year risk of death versus second fracture in various demographic groups. Because individuals who experience a first fracture were expected to vary by age and a number of other factors, we compared the risk for second fracture by the type of first fracture for a representative person at the median age and in the most

common racial and gender category of all first fractures. We performed competing risk regression using the function *predict.crr* in the *cmprsk* package in the “R” statistical software package version 2.8.1 (23) to obtain the hazard function for a Caucasian woman at the median age of the three fracture types we considered. We further stratified risks by the presence or absence of several common comorbidities.

Some prior work has treated death as a censoring event rather than as a competing risk. Censoring patients at the time of death is commonly used in time-to-event analyses and often shown using Kaplan-Meier curves. This censoring approach estimates the risk of second fracture if people did not die; in this type of analysis, death is ‘uninformative’ and no different than if patients switched health plans. Because of high mortality commonly observed in older persons, results that treat death as a censoring event rather than as a competing risk may be less relevant or even misleading to inform clinical decision-making. We therefore modeled subsequent fractures with and without accounting for mortality. In order to examine whether the risks of death and second fracture were time-dependent, we evaluated these risks over time graphically for individuals with a hip fracture. We used the *cuminc* function in R to plot 1) the actual risk of death; 2) the actual risk of second fracture with death as a competing risk; and 3) the estimated risk (1-Kaplan Meier) of experiencing a second fracture with death as a censoring event.

In order to assess the relative merits of osteoporosis treatment based upon the expected benefit to prevent a subsequent fracture, we evaluated the 5-year risks for second fracture in light of NOF recommendations (based upon cost-effectiveness analyses) that recommend treating individuals with a $\geq 20\%$ ten-year risk for fracture (24). As a complementary approach in considering whether osteoporosis treatment is reasonable, we assumed a 30% effectiveness to reduce the risk of a subsequent clinical fracture (based upon clinical trial data, largely in populations who have had a vertebral or hip fracture) (13–16,25) and computed the number needed to treat (NNT) for each demographic group defined by age, race, and gender.

Because the decision to initiate an osteoporosis medication might be less opportune immediately post-hospital discharge, and in light of the high early mortality post-fracture previously reported (19,26,27), we evaluated the risk for second fracture restricted to persons who survived at least 6 months after the first fracture as part of a sensitivity analysis. As a second sensitivity analysis, we extended our ‘fracture episode’ window for outpatient fractures to 30 rather than 14 days. Finally, because some patients might have been using prescription osteoporosis medications that reduced the risk for second fracture, yet pharmacy information was not within our data, in a third sensitivity analysis we restricted the study population to those who never received DXA or had a physician diagnosis of osteoporosis. We anticipated that this procedure would serve as a proxy for people that were likely never treated with an osteoporosis medication. Analyses were conducted using SAS version 9.2 (SAS Institute, Cary, NC) and R version 2.8.1 (23).

Results

Table 1 summarizes characteristics of persons who experienced a hip ($n = 18,853$), clinical vertebral ($n = 12,751$), or wrist/forearm ($n = 7,635$) fracture in 2000 or 2001 and met eligibility criteria including having at least five years of follow-up (unless they died). Particularly for individuals with a hip fracture, the risk for death almost always exceeded the risk for second fracture, but both were high (Table 2). Notably, after a hip fracture, the risk for death substantially increased with age, in contrast to the risk for second fracture which was relatively flat or even declined with age. The risk difference between death and second fracture was larger for men and African Americans of both sexes compared to women. Compared to persons with a hip fracture, the risk of death compared to second fracture was somewhat lower for persons

with a clinical vertebral or wrist/forearm fracture. Across all demographic groups, the median (inter-quartile range [IQR]) risk for the ratio of death to a second fracture (excluding skull, finger, toe) was 2.6 (1.8, 3.1) after a hip fracture, 1.3 (0.9, 1.6) after a clinical vertebral fracture, and 1.0 (0.7, 1.4) after a wrist/forearm fracture. Pooling the data for the three groups, people with hip, incident vertebral, or wrist/forearm fracture, the median (IQR) ratio of death to second fracture was 1.4 (0.9, 2.0).

Table 3 describes the risk for death and second fracture stratified by the presence or absence of various comorbidities. As was previously observed for advancing age, the presence of various comorbidities had a large impact on the risk for death but typically did not appreciably change the risk for second fracture. The risk difference among individuals age 85 and older with a hip fracture and dementia was most striking; there was a greater than 7-fold difference in the risk for death (80.8%) and the risk for second fracture (11.5%). Notably, the 5-year risk for second fracture exceeded 10% in every group, and most exceeded 20%.

Using an 81 year old Caucasian woman as an example, the risk for a second fracture was dependent on the site of the first fracture, as shown in Figure 1. It was greatest for clinical vertebral fractures, with a 5 year risk of 40%, and least for hip fractures, 5 year risk of 27%. The risk for both death and second fracture was time-dependent, as shown in Figure 2. More than one-half of the fractures that occurred during the five year observation period occurred within 18 months following the first fracture. Moreover, the estimated risk for second fracture (dotted line) with patients censored at the time of death (as would be done in a survival analysis or Kaplan-Meier curve) was approximately 50% higher compared to the actual risk for fracture (solid line) observed with death as a competing risk.

Table 4 shows the NNT for 5 years with an osteoporosis medication to prevent a subsequent clinical fracture. At the extremes of these NNTs, one would need to treat 7.7 Caucasian women age 75–84 with a clinical vertebral fracture with an oral bisphosphonate for 5 years to prevent one additional subsequent fracture. In contrast, the largest NNT (45.6) was for African American men age 75–84 with a hip fracture.

Sensitivity analyses did not meaningfully change our results. Among Caucasian women who survived at least 6 months after their first fracture, the risk of second fracture increased approximately 1–6% (depending on age and the type of first fracture). In a second sensitivity analysis extending our fracture episode window to 30 days, our results were minimally different and are not shown. Finally, in a third sensitivity analysis that restricted the study population to individuals who never received a DXA or had an osteoporosis diagnosis, the risk for second fracture was the same or lower than indicated by our main results.

Discussion

In this large, population-based study of older Americans with a hip, clinical vertebral, or wrist/forearm fracture, we found that the risk for death was substantial and often exceeded the risk for second fracture after a first hip, clinical vertebral, or wrist/forearm fracture. However, despite the substantial mortality observed in this post-fracture population, the risk for subsequent fracture was substantial, and prescription osteoporosis treatment fell within an approximate range considered cost-effective in the U.S by the NOF (24). Our results also suggest that the increased fracture risk associated with age is largely offset by a corresponding increase in mortality among older fracture patients. This resulted in a risk of death that was highly variable, but a risk for a subsequent fracture that was much less so. Practicing clinicians may find this study useful as they consider the merits of prescribing fracture prevention therapy for their older patients with fracture.

Our results are compatible with prior literature showing a substantial mortality after hip and vertebral fractures (25–28). As we found, this risk has been shown to vary over time, with a greater risk both for mortality and second fracture occurring within the first 6–24 months after the first fracture (28). Several studies examining mortality risk over time have found the highest risk of death within six months following hip fracture (27). It was for this reason that we conducted our sensitivity analysis restricting eligible participants to those who survived 6 months after their first fracture, since this is likely to be a more relevant decision-making time for many physicians, particularly those who may not have provided care for the patient while hospitalized for fracture.

Many reports of second fracture and mortality following an initial fracture have differed from ours with respect to both methodology and presentation of results. Importantly, a common statistical method known as censoring removes patients from further consideration at the time of death in contrast to our approach, which was to treat death as a competing risk (28,29). We found that the censoring approach may substantially inflate the apparent risk for second fracture, which gives a more favorable impression of the benefits of osteoporosis treatment. The use of survival analysis, while appropriate for determining the efficacy of a therapy in older populations where there is a high rate of drop out due to death, may not be optimal for economic analyses or for clinical decision making for individual patients, where the competing risk method more accurately reflects the absolute risk of both fracture and death.

In further considering whether a patient will benefit or not from treatment, based upon the competing risk for death, we showed that the risk for death often exceeded the risk for second fracture. For that reason, whether it might be reasonable to *not* provide osteoporosis medications to some individuals who experience a fragility fracture is debatable. In the extreme, we found that individuals age 85 and older with dementia who experience a hip fracture have a 7-fold greater risk for death (81%) than a subsequent fracture (12%) in the next five years. Many patients, physicians and policymakers may question whether it is worth treating such individuals for osteoporosis. A similar uncertainty exists for older individuals regarding receipt of other preventive testing and services such as cancer screening, where the number needed to screen with mammography for women ages 75–85 ranges from several hundred to greater than 1,000, depending upon life expectancy (30). However, the NNTs we observed for almost all demographic and fracture groups are comparable to the NNTs for accepted secondary prevention strategies for aspirin after myocardial infarction (MI) (NNT = 150), statins after MI (NNT = 94), or beta blockers after MI (NNT = 54) (31). Furthermore, the NNTs that we calculated are broadly similar to those observed (NNT = 8–64) from the pivotal osteoporosis medication randomized clinical trials in post-menopausal women (most with a 3-year time horizon) (32).

As a complementary consideration, the National Osteoporosis Foundation (NOF) has recommended prescription treatment for anyone in the U.S. with a 10-year risk of major fracture (hip, clinical vertebral, wrist, or humerus) that exceeds 20% (24). In our analysis, a majority of subgroups had a 5-year risk for second fracture that exceeded 20%. Therefore, treatment might be reasonably inferred to be cost-effective in light of the NOF recommendations. Moreover, the NOF recommends treatment for all persons with a hip or vertebral fracture, irrespective of BMD or 10-year risk of fracture. Despite this recommendation for prescription osteoporosis treatment, adhering to guidelines for preventive services requires time and energy on the part of the physician, particularly for complex patients with multiple comorbidities who each have individualized goals and treatment preferences (36, 37).

The strengths of our study include a large, population-based sample that is representative of the entire U.S. fee-for-service Medicare population. Because of the large sample size, we had precision to stratify by a number of important demographic factors and various common

medical comorbidities. Moreover, we were able to provide data for men and African Americans, who have typically been understudied in fracture epidemiology. Despite these strengths, our study must be interpreted in the context of some limitations. Importantly, this analysis focused on risks did not take into account the substantial morbidity and impact on health-related quality of life that is typically associated with fractures (17,18); considering this aspect of fracture prevention makes the need for osteoporosis treatment even more compelling. Additionally, we did not have access to medical records to confirm fractures or comorbidities. However, we used published, claims-based algorithms that have been shown to have high positive predictive values to identify incident fractures compared to a gold standard of medical record review (20–22). Any mis-classification of first fractures (e.g. incidence vertebral fracture) would lead to an under-estimation of the 5 year fracture risk following a certain clinical vertebral fracture, which would strengthen our conclusions with respect to the appropriateness of pharmacologic therapy. Information regarding comorbidities was derived from administrative data, which despite their high validity (33,34), lack precision on the severity of these conditions. Likewise, other important factors such as body mass index or bone mineral density are not available in this type of data. Until 2006 (the end of our study period), medications were not covered for Medicare beneficiaries, and it is possible that some individuals received treatment for osteoporosis which lowered the observed risk for subsequent fracture. Our sensitivity analysis restricted to patients who never had a DXA or an osteoporosis diagnosis (as a proxy for persons likely not treated with an osteoporosis medication) addressed this and supported the robustness of our results. We assumed that osteoporosis medications would reduce the risk of clinical fractures by 30% in our NNT calculations; the actual effectiveness of individual drugs may vary and also will be impacted by sub-optimal adherence. Finally, although every individual had five years of follow-up time after their fracture (unless they died), the time horizon relevant for treatment, and comparisons with fracture risk derived from the fracture risk assessment tool (35), may need to extend beyond five years.

In conclusion, despite a substantial risk of death after a hip, clinical vertebral, or wrist/forearm fracture, the risk for a subsequent fracture at the same or another site was generally high enough to warrant preventive treatment with prescription osteoporosis medications. This is consistent with existing national recommendations largely motivated by cost-effectiveness considerations. These results are likely to be useful to clinicians managing patients post-fracture and provide support for treating older individuals with prescription medications, irrespective of age or comorbidities, unless there is a very high expectation of short term mortality. As with all medical services, particularly preventive services for older individuals, this decision-making process must be shared between the physician, the patient and caregivers to maximize quality of life. Mitigating fracture risk should remain an important goal of that process and may be informed by our study results.

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Appendix

Claims-Based Algorithm for Identifying Incident Fractures During the Observation Period

In order to distinguish a new fracture occurring after the index fracture from a fracture occurring before or concurrently with the index fracture, we required a possible new fracture claim to satisfy one of the following conditions:

1. No fracture of the same anatomic site as the possible new fracture occurred during the look-back period (365 days before the index fracture occurrence date) or concurrently with the index fracture (on or before the later of index fracture hospital discharge date or the index fracture occurrence date + 14 days).
2. A fracture of the same type as the possible new fracture occurred in the look-back period or concurrently with the index fracture, and both the new fracture and the previous fracture of the same type were surgically repaired.
3. A fracture of the same type occurred in the look-back period or concurrently with the index fracture, but there was a gap of at least 90 days between the new fracture and the most recent claim for the previous fracture of the same type.

Figure 1. Time-Dependent Risk (i.e. Cumulative Incidence) for Second Fracture Depending on Site of First Fracture for an 81 year old Caucasian Woman

Figure 2. Comparison of the Risk (i.e. Cumulative Incidence) for Second Fracture after a Hip Fracture, Depending on Whether Death is Considered a Competing Risk or a Censoring Event

Table 1

Characteristics of Medicare Beneficiaries with Incident Hip, Clinical Vertebral, or Distal Radius/Ulna Fracture in 2000–2001

	Number with fracture		
	Hip	Clinical Vertebral	Distal Radius/Ulna
Total, n	18,853	12,751	7,635
Age (years)			
65–74	14.3	22.2	30.7
75–84	42.5	46.9	45.0
85+	43.2	30.9	24.3
Mean	82.8	80.5	78.9
Sex			
Women	76.8	75.2	87.5
Men	23.2	24.8	12.5
Race/Ethnicity			
White	93.4	95.3	95.0
African American	3.8	1.9	2.6
Other	2.7	2.8	2.4
Year of fracture			
2000	51.9	50.4	51.6
2001	48.1	49.6	48.4
Comorbidities			
Acute myocardial infarction	4.6	5.3	3.1
Stroke	8.8	6.8	5.3
Heart failure	17.0	17.3	10.3
Chronic kidney disease	3.2	2.5	1.0
Diabetes	15.5	14.6	12.4
COPD	17.0	20.4	13.1
Dementia	8.1	3.3	3.6

Numbers all shown as % except for the first row

COPD = Chronic Obstructive Pulmonary Disease

Five-Year Risk of Death or Second Fracture Among Persons with Hip, Clinical Vertebral, or Distal Radius/Ulna Fracture, by Age, Gender, and Race/Ethnicity

Table 2

Type of Fracture	Age (years)					
	65–74		75–84		85+	
	Death	second Fracture	Death	second Fracture	Death	second Fracture
Hip Fracture						
All (n=18,853)	38.1	24.2	49.0	25.5	63.7	22.5
Men (n=4,371)	48.7	17.7	61.7	17.4	75.4	16.3
Women (n=14,482)	33.1	27.2	44.8	28.0	61.0	23.9
Caucasian (n=17,618)	37.4	24.4	48.5	26.0	63.4	23.0
African American (n=719)	49.2	15.4	59.9	13.7	71.8	13.8
Clinical Vertebral Fracture						
All (n=12,751)	29.3	33.4	36.0	39.4	50.4	36.1
Men (n=3,159)	38.5	24.5	49.3	28.4	60.9	30.2
Women (n=9,592)	25.3	37.4	31.7	43.0	47.7	37.6
Caucasian (n=12,158)	28.9	34.0	35.7	39.9	50.3	36.3
African American (n=237)	44.2	23.4	51.4	24.3	58.5	24.5
Distal Radius/Ulna Fracture						
All (n=7,635)	13.1	20.5	23.7	29.9	44.8	32.6
Men (n=951)	17.3	17.6	32.6	18.7	60.4	23.1
Women (n=6,684)	12.3	21.1	22.6	31.4	43.3	33.5
Caucasian (n=7,250)	13.1	20.8	23.7	30.1	44.5	33.1
African American (n=199)	12.5	16.3	25.3	25.3	59.1	18.2

Data shown as %

Table 3

Five-Year Risk of Death or Second Fracture Among Persons with Hip, Clinical Vertebral, or Distal Forearm Fracture By Age and Comorbidity

		Age (years)					
		65–74		75–84		85+	
Type of First Fracture and Comorbidity		Death	second Fracture	Death	second Fracture	Death	second Fracture
Hip Fracture	No comorbidity	28.2	23.6	39.3	27.3	57.4	25.5
	Acute myocardial infarction	50.4	27.6	62.5	22.3	72.8	19.3
	Stroke	46.8	23.8	57.3	23.1	70.3	19.0
	Heart failure	59.5	21.8	65.6	23.1	74.7	17.5
	Chronic kidney disease	76.7	14.7	74.2	19.1	77.2	17.8
	Diabetes	48.6	23.6	58.1	22.9	69.8	19.0
	COPD	49.4	27.7	61.9	24.2	70.0	21.1
	Dementia	64.7	21.6	69.2	16.1	80.8	11.5
Clinical Vertebral Fracture	No comorbidity	19.3	33.5	27.7	41.7	44.5	38.8
	Acute myocardial infarction	46.7	29.6	46.9	34.2	50.7	41.9
	Stroke	44.1	32.9	40.4	39.3	52.7	34.9
	Heart failure	53.8	26.9	53.8	32.4	59.9	32.4
	Chronic kidney disease	65.2	29.2	63.0	29.1	61.2	32.8
	Diabetes	40.5	33.6	46.4	35.3	60.0	31.7
	COPD	44.5	33.0	49.1	36.0	60.8	30.6
	Dementia	61.8	20.6	52.8	36.9	64.4	25.8
Distal Radius/Ulna Fracture	No comorbidity	9.2	16.6	17.4	28.5	39.1	32.5
	Acute myocardial infarction	26.8	26.8	41.6	32.8	48.3	34.5
	Stroke	28.0	30.5	37.1	29.3	49.6	35.9
	Heart failure	33.3	30.2	43.5	34.5	59.2	32.3
	Chronic kidney disease	31.6	42.1	54.1	32.4	70.8	29.2
	Diabetes	21.7	29.9	32.2	33.1	55.2	29.8
	COPD	26.0	30.8	38.3	32.5	55.7	31.5
	Dementia	56.0	28.0	51.6	28.7	65.9	23.3

Data shown as %

Table 4

Number of Persons Needed to Treat with an Osteoporosis Medication* to Prevent One Subsequent Clinical Fracture, by Age, Gender, and Race/Ethnicity

First Fracture	65–74	75–84	≥ 85
Hip Fracture			
Caucasian Women	12.2	11.7	13.6
Caucasian Men	18.8	18.4	20.1
African American Women	28.3	20.4	22.4
African American Men	17.2	45.6	35.0
Clinical Vertebral			
Caucasian Women	8.8	7.7	8.8
Caucasian Men	13.5	11.5	11.0
African American Women	14.2	12.9	13.9
African American Men	14.3	17.3	11.7
Distal Radius/Ulna			
Caucasian Women	15.5	10.6	9.8
Caucasian Men	19.2	18.0	14.4
African American Women	20.0	13.5	19.0
African American Men	23.3	10.0	13.3

* assumes a 30% reduction in the risk for fracture with the use of the medication