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Obesity, Healthcare Utilization and Health-Related Quality of Life after Fracture in Postmenopausal Women: Global Longitudinal Study of Osteoporosis in Women (GLOW)

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Abstract

Fractures in obese postmenopausal women may be associated with higher morbidity than in non-obese women. We aimed to compare healthcare utilization, functional status, and health-related quality of life (HRQL) in obese, non-obese and underweight women with fractures. Information from GLOW, started in 2006, was collected at baseline and at 1, 2 and 3 years. In this subanalysis, self-reported incident clinical fractures, healthcare utilization, HRQL and functional status were recorded and examined. Women in GLOW (n = 60,393) were aged ≥55 years, from 723 physician practices at 17 sites in 10 countries. Complete data for fracture and body mass index were available for 90 underweight, 3,270 non-obese and 941 obese women with ≥1 incident clinical fracture during the 3-year follow-up. The median hospital length of stay, adjusted for age, comorbidities and fracture type, was significantly greater in obese than non-obese women (6 vs. 5 days, P = 0.017). Physical function and vitality score were significantly worse in obese than in non-obese women, both before and after fracture, but changes after fracture were similar across groups. Use of anti-osteoporosis medication was significantly lower in obese than in non-obese or underweight women. In conclusion, obese women with fracture undergo a longer period of hospitalization for treatment and have poorer functional status and HRQL than non-obese women. Whether these differences translate into higher economic costs and adverse effects on longer-term outcomes remains to be established.

Keywords

Fractures; Healthcare utilization; Functional status; Quality of life; Obesity

Introduction

Recent studies indicate that fractures in obese postmenopausal women and older men contribute significantly to the overall fracture burden. In a study of postmenopausal women with incident fragility fracture attending a Fracture Liaison Clinic over a 2-year period, 28% were reported to be obese [1]. Data from a large multinational observational cohort study in postmenopausal women (Global Longitudinal study of Osteoporosis in Women [GLOW]) confirmed this observation, demonstrating that fractures in obese women accounted for 23% of previous and 22% of incident fractures occurring during 2 years of follow-up [2]. In the Study of Osteoporotic Fractures (SOF), the incidence of non-vertebral fractures over a mean follow-up period of 11 years was 37.5% in obese women and 44% in non-obese women [3]. The association between body mass index (BMI) and fracture differs according to fracture

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site, with increased risk of fracture in obese women being reported in the ankle and lower leg, humerus, and spine, whereas fracture risk at the hip and wrist is reduced [4-8].

In view of the rapidly rising prevalence of obesity [9-12], the number of obese older individuals with fracture will increase, and such people will account for a growing proportion of the overall fracture burden. Greater morbidity and adverse effects on health-related quality of life (HRQL) might be expected in obese individuals with fracture than in non-obese people because of a greater prevalence of comorbidities, higher risk of fracture non-union, more post-operative complications and slower rehabilitation [2, 13-19]. In this study, we have compared the effects of incident clinical fracture on healthcare utilization and HRQL in obese, non-obese and underweight postmenopausal women in the GLOW study.

Subjects and Methods

GLOW is a prospective cohort study involving 723 physician practices at 17 sites in 10 countries (Australia, Belgium, Canada, France, Germany, Italy, Netherlands, Spain, UK and USA). The study methods have been reported previously [20]. In brief, practices typical of each region were recruited through primary care networks organized for administrative, research, or educational purposes, or by identifying all physicians in a geographic area. Each site obtained local ethics committee approval to participate in the study. The practices provided the names of women aged ≥55 years who had been seen by their physician in the past 24 months. After appropriate exclusions, 60,393 women agreed to participate in the study.

Data Collection

Questionnaires were designed to be self administered and covered domains that included: demographic characteristics and risk factors; fracture history; current medication use; and other medical diagnoses. Data on self-reported height and weight were collected to allow calculation of body mass index (BMI). Women were defined as obese if their baseline BMI was ≥30 kg/m^2, non-obese if their BMI was 18.5–29.9 kg/m^2 and underweight if their BMI was <18.5 kg/m^2.

Information was collected at baseline on previous fractures (that had occurred since the age of 45 years), while incident fractures were assessed during the 1-, 2- and 3-year follow-up surveys. All surveys included details of fracture location, including spine, hip, wrist and other non-vertebral sites (clavicle, upper arm, rib, pelvis, ankle, upper leg, lower leg, foot, hand, shoulder, knee and elbow), and occurrence of single or multiple fractures. Subjects were considered to be taking anti-osteoporosis medication (AOM) if they reported current use of alendronate, calcitonin, estrogen, etidronate, ibandronate, pamidronate, recombinant human parathyroid hormone (1–84), raloxifene, risedronate, strontium ranelate, teriparatide, tibolone or zoledronic acid. Information was also obtained about comorbidities: asthma, emphysema, osteoarthritis, rheumatoid arthritis, colitis, stroke, celiac disease, Parkinson’s disease, multiple sclerosis, cancer, type 1 diabetes, hypertension, heart disease and high cholesterol.

Women were asked whether their fracture was treated at a doctor’s office/clinic and/or at a hospital; if they had undergone surgery to treat their fracture; and whether they had spent time in a rehabilitation facility or nursing home. The length of stay (LOS) for those who utilized hospital, rehabilitation center, or nursing home care was collected. Use of AOM in the year following fracture was also recorded. HRQL and functional status were assessed using the EuroQoL EQ-5D tool [21] and the vitality and physical function sections of the SF-36 health survey [22]. The EQ-5D is a five-question, three-response option scale that maps each of 243 health states to a country-specific preference-based value or utility, where 1 represents perfect health and 0 a state equivalent to death. A change of 0.03 is recognized as a minimum clinically important difference in individuals with osteoporosis [23]. Assessments of HRQL and functional status before and after fracture were compared using data from the survey immediately prior to the fracture and from the survey in which the fracture was reported.

Statistical Analyses

Women with one or more incident fractures during the 3-year follow-up were included in the analysis. In women with multiple fractures, each fracture was treated as a single fracture. Means and standard deviations (SDs) are given for continuous variables, and percentages are provided for categorical variables. For continuous variables, differences in outcome were compared between the three BMI groups using multiple regression. As LOS data were right skewed, LOS values were transformed into ranks for all group comparisons. For dichotomous variables, the differences were compared using logistic regression. In addition to univariate comparisons, BMI group differences were tested after adjusting for age alone, as well as age plus comorbidities and fracture type where univariate associations with the outcome had P values ≤0.5. In testing for pair-wise differences among the three BMI groups, results were considered statistically significant at the alpha = 0.017 level (0.05/3), in order to control for the multiple comparisons in the three groups being compared. All analyses were conducted using SAS 9.2 (SAS Institute Inc., Cary, NC).

Results

The number of women completing surveys in years 1, 2 and 3 was 51,490, 48,570 and 45,490 respectively; 54,230 women completed at least 1 year of follow-up. The reasons for failure to respond to follow-up surveys were not documented. A total of 4,301 women had at least one incident fracture and information on BMI. In some of these women, data on length of stay, HRQL and AOM or any of the variables controlled for, were missing. The percentage of women with missing data in the three BMI groups was similar.

Demographics of the three BMI groups are shown in Table 1. Obese women with fracture were significantly younger than women with fracture in the other two BMI groups. Comparison of the fracture sites showed a significantly higher incidence of ankle fractures in obese women compared with the other two groups, and a significantly higher incidence of lower leg fractures in obese women compared with non-obese women. The incidence of wrist fracture was significantly lower in obese than in non-obese women, and the incidence of hip fracture was significantly lower in obese women than in underweight women. The percentages of women with multiple fractures were 29%, 24% and 33% in the underweight, non-obese and obese groups, respectively. Obese women were significantly more likely to report hypertension, high cholesterol and asthma than the other two BMI groups. Self-reported heart disease, emphysema, diabetes and osteoarthritis were significantly more common among obese than non-obese women (Table 1).

Table 2 shows the percentages of women in each BMI group treated for fracture in a doctor's office/clinic or hospital; who underwent surgery; and who were admitted to a nursing home or rehabilitation center. Underweight women with fracture were significantly more likely to be admitted to a nursing home or rehabilitation facility than non-obese or obese women, although this difference was no longer significant after adjustment for age, comorbidities and fracture type.

LOS in a hospital or nursing home/rehabilitation facility is shown in Table 3. The median (25^{th}, 75^{th} percentile) hospital LOS was significantly higher in obese than non-obese women with fracture (6 [3, 14] vs. 5 [3, 10] days; $P = 0.017$). The median LOS in a nursing home or rehabilitation center was greater in underweight than non-obese women (28 [14, 60] vs. 20 [12, 36] days), with an intermediate value of 22 (12, 42) days for obese women.

Table 4 shows HRQL scores before and after fracture. Obese women had a significantly lower EQ-5D before and after fracture compared with non-obese women; these differences were no longer significant after adjustment for age, comorbidities and fracture type. Changes in the EQ-5D following fracture were generally similar between the three BMI groups. However, both before and after fracture, obese women had significantly lower physical function than non-obese and underweight women, and a significantly lower vitality score than non-obese women; these differences were significant before and after adjustment. There were no significant differences in the changes in physical function or vitality score following fracture between the three BMI groups.

AOM use, adjusted for age, comorbidities and fracture type, was significantly lower among obese women both before and after fracture compared with non-obese and underweight women, but use of calcium and vitamin D supplements before and after fracture was similar in the three groups (Table 5). Use of combined AOM, calcium and vitamin D supplements was significantly less among obese women than among non-obese women before, but not after, fracture.

Discussion

Our results provide the first data comparing healthcare utilization and HRQL among obese, non-obese and underweight women with incident clinical fracture. In general, following fracture, healthcare utilization was highest for underweight women, although hospital LOS was greatest for obese women. Physical function and vitality score were lowest in obese women, both before and after fracture.

Although healthcare utilization was generally highest among underweight women with fracture, these women formed only a relatively small proportion (2.1%) of all women with fractures in this study, whereas 21.9% were obese. Reasons for the greater utilization in underweight women may include the higher incidence of hip and spine fractures in this group, older age and, perhaps, also a greater likelihood of frailty. The numbers of fractures at specific sites in each of the three groups of women were insufficient to allow comparison of the effect of individual fracture types on healthcare utilization and HRQL, but the impact of hip fractures on the former is recognized to be greater than that of other fractures, and both spine and hip fractures are associated with substantial effects on HRQL [24, 25]. Our data show that obese women have a significantly longer hospital LOS but a similar nursing home/rehabilitation facility LOS than non-obese women, which may translate into higher short-term healthcare fracture costs in the former group.

The lower EQ-5D, physical function and vitality scores in obese compared with non-obese women, both before and after fracture, are not unexpected. As the differences in physical function and vitality scores remained significant after adjustment for age, comorbidities and fracture type, they most likely reflect the effects of obesity *per se* on HRQL. Although the reductions in HRQL were similar across the three groups of women following fracture, the lower baseline values in obese women might be expected to impact on recovery in the longer term. This could not be assessed in the present study, but is an important topic for future research.

As previously reported [2], use of AOM, adjusted for age and comorbidities, was significantly lower among obese women following fracture than among non-obese and

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underweight women although, interestingly, the use of calcium and vitamin D supplements was similar in all three groups. The rates of AOM use prior to incident fracture were 45.8% in underweight women, 39.9% in non-obese women and 28.5% in obese women. Of these women using AOM before their fracture, 65.7%, 50.2% and 51.0%, respectively, had suffered a previous fracture. The reasons for the low treatment rate of obese women with incident fracture compared with the other two groups are unclear, but may reflect the perception that fractures in obese people are not “osteoporotic” fractures, particularly because bone mineral density (BMD) is often normal or only mildly osteopenic in obese women with fractures [1, 3]. In particular ankle fractures, which constituted one-fifth of incident fractures in obese women, are widely believed to be ‘traumatic’ as opposed to ‘fragility’ fractures, and would generally not be treated with AOM.

Previous studies on healthcare utilization in obese subjects with fracture are sparse. A population-based study from the Mayo Clinic showed no increase in cardiac complications in obese elderly individuals undergoing surgery for hip fracture, although the risk was increased in underweight people [26]. Another study by the same group reported no increase in a range of non-cardiac complications in obese subjects [27]. However, a greater risk of non-union of fractures, post-operative complications and slower rehabilitation have been reported in obese patients with long bone, humerus, or pelvic fractures [13-19].

Strengths and Limitations

Our study has several strengths. The data collected provide an assessment of healthcare utilization in a “real-world” setting, and include areas of healthcare use such as office/clinic visits and rehabilitation. We utilized data from patient questionnaires and collected information in a similar manner from different geographic regions, thus avoiding problems with data quality due to differences in regional or national databases [28]. Other strengths include the large sample size, prospective design and international scope of the study.

There are, however, also some limitations. GLOW is a practice-based rather than a population-based study and is therefore subject to bias both in the selection of physicians and in the sampling and recruitment of patients. All data were collected by patient self-report and may be limited by recall bias. Studies that have examined the validity of self-reported prescription medication use and fractures have shown reasonable accuracy [26, 29, 30], but self-reporting of comorbidities and healthcare utilization may be less reliable, although there is no reason why accuracy should differ according to BMI. Type 1 diabetes was specified on the questionnaire, but may have been confused with Type 2 diabetes. Differences among insurers may influence hospitalization rates for patients. Also, subclinical vertebral fractures were not included, but may have an impact on HRQL [31]. However, all these factors would be expected to operate independently of weight and so should not invalidate the comparisons performed in this study [28]. It is possible that there was greater loss to follow-up in non-obese and underweight women because of their older age and higher incidence of hip and spine fractures, leading to greater underestimation of utilization and HRQL in those groups when compared with obese women. Only women were included in the study, and because other investigators have found that healthcare utilization differs between the sexes, inferences regarding healthcare use should not be generalized to men [28]. Finally, although diverse geographical regions were represented in our study, no Asian or African countries were included and our results may therefore not be generalizable to these populations.

Conclusions

Following clinical incident fracture, median hospital LOS was significantly greater in obese than in non-obese women. In general, healthcare utilization was highest among underweight postmenopausal women, but these women comprised only 2.1% of all women with fracture. Fractures had a similar impact on HRQL, physical function and vitality scores in all weight categories, but the EQ-5D and physical function scores were significantly lower in obese women both before and after fracture when compared with non-obese and underweight women. These findings were not explained by the increased prevalence of comorbidities in obese women. As fractures in obese postmenopausal women contribute significantly to the overall burden, there is a need for further studies to establish the economic costs of fractures associated with obesity and to investigate longer-term outcomes on physical function and HRQL.

Footnotes

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Author Contributions Authors' roles: Study design: JEC, FHH, FAA, JDA, SB, RDC, CC, AD-P, SLG, AZL, RL, JCN, JP, MR, CR, KGS, SS, ESS, NBW, SG. Study conduct: JEC, FHH, FAA, JDA, SB, RDC, CC, AD-P, SLG, AZL, RL, JCN, JP, MR, CR, KGS, SS, ESS, NBW, SG. Data collection: JDA, SB, RDC, CC, AD-P, SLG, AZL, RL, JCN, JP, MR, CR, KGS, SS, NBW. Data analysis: JF. Data interpretation: JEC. Drafting manuscript: JEC. Revising manuscript content: JF, FHH, FAA, JDA, SB, RDC, CC, AD-P, SLG, AZL, RL, JCN, JP, MR, CR, KGS, SS, ESS, NBW, SG. Approving final version of manuscript: All authors. JF takes responsibility for the integrity of the data analysis.

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GlaxoSmithKline, Servier and Wyeth. KGS has previously consulted for or received other remuneration from Eli Lilly & Co, Merck, Novartis and Amgen; and has conducted paid research for Eli Lilly & Co, Merck, Novartis and Amgen. SS has received grant support from Wyeth, Lilly, Novartis and Alliance; has served on Speakers' Bureaus for Lilly, Novartis, Pfizer and Procter & Gamble; has received honoraria from Procter & Gamble; and has previously consulted/acted as an Advisory Board member for Lilly, Argen, Wyeth, Merck, Roche and Novartis. ESS has previously consulted for Amgen, Lilly, Novartis and The Alliance for Better Bone Health; and has served on Speakers' Bureaus for Amgen and Lilly. NBW has received honoraria for lectures in the past year from Amgen, Lilly, Novartis and Warner Chilcott; has received consulting fees during the past year from Abbott, Amgen, Bristol-Myers Squibb, Endo, Imagepace, Johnson & Johnson, Lilly, Medpace, Merck, Nitto Denko, Noven, Novo Nordisk, Pfizer/Wyeth, Quark; has received research support (through his Health System) from Merck and NPS; and cofounded, has stock options in and is a director of OsteoDynamics.

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Table 1

Demographics of Women with Incident Fracture

	BMI group			Significant *P* values[a]
	Underweight (1) (*n* = 90)	**Non-obese (2) (*n* = 3,270)**	**Obese (3) (*n* = 941)**	
Age (years)	72 (11)	70 (9)	69 (8)	(1) vs. (3), (2) vs. (3)
Prior fracture	51.1	39.4	39.7	
Incident fracture site				
Hip	14.4	8.0	6.5	(1) vs. (3)
Spine	12.4	11.2	9.7	
Rib	4.5	13.9	13.5	(1) vs. (2), (1) vs. (3),
Wrist	27.0	24.0	20.2	(2) vs. (3)
Upper arm	9.0	8.9	9.9	
Upper leg	8.9	4.0	5.6	
Lower leg	5.7	5.5	8.8	(2) vs. (3)
Pelvis	6.8	4.5	3.2	
Ankle	10.1	12.6	20.4	(1) vs. (3), (2) vs. (3)
Clavicle	2.3	3.5	4.0	
Baseline comorbidities				
Hypertension	43.8	46.3	69.3	(1) vs. (3), (2) vs. (3),
Heart disease	16.9	16.9	23.5	(2) vs. (3)
High cholesterol	37.2	49.4	59.6	(1) vs. (3), (2) vs. (3)
Asthma	3.4	11.8	20.8	(1) vs. (2), (1) vs. (3), (2) vs. (3)
Emphysema	11.4	10.2	17.5	(2) vs. (3)
Osteoarthritis	48.3	45.8	52.7	(2) vs. (3)
Rheumatoid arthritis	2.4	1.1	1.3	
Stroke	2.3	4.8	5.7	
Colitis	0.0	2.6	3.5	
Celiac disease	1.1	0.8	0.4	
Parkinson’s disease	3.4	1.0	1.4	
Multiple sclerosis	0.0	1.1	1.3	
Cancer	12.5	15.9	18.2	
Diabetes	3.4	3.4	9.4	(2) vs. (3)
Current smoking	15.7	8.9	8.4	
Alcohol use ≥3 units/day	0.0	0.8	0.4	

Data are expressed as means (standard deviations) or percentages

BMI body mass index

[a]From pairwise comparisons (alpha = 0.017)

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Table 2

Percentages of BMI Groups Treated for Fracture at Various Locations

	Underweight (1)	Non-obese (2)	Obese (3)	*P* values		
				Comparison	Unadjusted	Adjusted[a]
Office	77.1 (68.1-86.1)	68.5 (66.9-70.2)	69.1 (66.1-72.1)	(1) vs. (2)	0.09	0.08
Hospital	75.3 (66.1-84.5)	69.9 (68.2-71.5)	70.6 (67.6-73.5)			
Surgery	45.9 (33.4-58.4)	38.7 (36.6-40.7)	40.6 (36.7-44.4)			
Nursing home/rehabilitation center	28.6 (18.9-38.2)	17.7 (16.4-19.1)	18.8 (16.2-21.4)	(1) vs. (2)	0.01	

Data are expressed as percentages (95% confidence intervals)

[a]Controlled for different comorbidities for each model: office = high cholesterol and emphysema; hospital = hypertension, cholesterol, asthma, emphysema and diabetes; surgery = hypertension, heart disease, cholesterol, emphysema and osteoarthritis; nursing home/rehab = hypertension, heart disease, cholesterol, emphysema, osteoarthritis and diabetes. Controlled for eight fracture types in each adjusted model: wrist, spine, rib, hip, pelvis, ankle, upper and lower leg

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Table 3

LOS in Hospital and Nursing Home or Rehabilitation Facility by BMI Group

	BMI group			Significant *P* values[a]
	Underweight (1)	**Non-obese (2)**	**Obese (3)**	
Hospital LOS (days)				(2) vs. (3)
n	30	891	260	
Median (25th, 75th)	5 (3, 12)	5 (3, 10)	6 (3, 14)	
Mean (SD)	11 (16)	10 (14)	12 (17)	
Nursing home/rehabilitation center LOS (days)				
n	19	398	132	
Median (25th, 75th)	28 (14, 60)	20 (12, 36)	22 (12, 42)	
Mean (SD)	39 (29)	32 (35)	34 (33)	

BMI body mass index, *IQR* quartile 1, quartile 3, *LOS* length of stay, *SD* standard deviation

[a]Significant pairwise comparisons with $P < 0.017$ for both unadjusted and adjusted[b] means

[b]Controlled for different comorbidities for each model. Hospital = hypertension, heart disease, cholesterol, asthma, emphysema, osteoarthritis and diabetes. Nursing home/rehab = heart disease, cholesterol, emphysema and osteoarthritis. Controlled for eight fracture types in each adjusted model: wrist, spine, rib, hip, pelvis, ankle, upper and lower leg

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Table 4

HRQL Scores and *P* Values for Comparisons Between BMI Groups

	Underweight (1)	Non-obese (2)	Obese (3)	Significant *P* values
EQ-5D before fracture	0.69 (0.64-0.74)	0.76 (0.75-0.77)	0.72 (0.70-0.73)	(1) vs. (2),[a] (2) vs. (3)[a]
EQ-5D after fracture	0.66 (0.61-0.71)	0.73 (0.72-0.74)	0.69 (0.67-0.70)	(2) vs. (3)[a]
Reduction in EQ-5D	0.02 (−0.02-0.07)	0.03 (0.02-0.04)	0.03 (0.02-0.04)	
Physical function before fracture	67.0 (60.9-73.1)	70.0 (69.0-71.0)	55.4 (53.6-57.3)	(1) vs. (3),[b] (2) vs. (3)[b]
Physical function after fracture	59.6 (53.1-66.0)	64.8 (63.7-65.9)	50.9 (48.9-52.8)	(1) vs. (3),[b] (2) vs. (3)[b]
Reduction in physical function	7.2 (2.6-11.8)	5.1 (4.4-5.9)	4.7 (3.2-6.1)	
Vitality score before fracture	53.7 (49.1-58.3)	58.4 (57.7-59.2)	50.8 (49.4-52.2)	(2) vs. (3)[b]
Vitality score after fracture	50.3 (45.5-55.1)	56.0 (55.3-56.8)	50.0 (48.5-51.5)	(2) vs. (3)[b]
Reduction in vitality score	3.0 (−0.6-6.6)	2.3 (1.7-2.9)	1.0 (−0.1-2.1)	

Data are unadjusted means (95% confidence intervals)

BMI body mass index, *CI* confidence interval, *HRQL* health-related quality of life

[a]Alpha level ≤ 0.017 for pair-wise unadjusted comparisons

[b]Alpha level ≤ 0.017 for pair-wise unadjusted and adjustedc comparisons

[c]Adjusted for age, comorbidities (hypertension, heart disease, high cholesterol, asthma, emphysema, osteoarthritis and diabetes), and fracture type (clavicle, upper arm, wrist, spine, rib, hip, pelvis, ankle, upper and lower leg)

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Table 5

Women Within Each BMI Group Who Were on Treatment Before and After Fracture

	Underweight (1)	Non-obese (2)	Obese (3)	Significant *P* values
AOM use				
Before fracture	51.5 (39.6-63.3)	40.6 (38.7-42.5)	27.9 (24.7-31.2)	(1) vs. (3)[b], (2) vs. (3)[b]
After fracture	63.2 (51.8-74.7)	46.3 (44.4-48.2)	33.2 (29.8-36.6)	(1) vs. (3)[b], (2) vs. (3)[b], (1) vs. (2)[a]
Calcium & vitamin D				
Before fracture	34.9 (24.7-45.2)	39.9 (38.1-41.6)	38.6 (35.4-41.8)	
After fracture	45.8 (35.1-56.5)	45.2 (43.4-46.9)	45.5 (42.2-48.7)	
AOM, calcium & vitamin D				
Before fracture	26.6 (15.7-37.4)	22.2 (20.6-23.8)	15.8 (13.1-18.4)	(2) vs. (3)[b]
After fracture	34.4 (22.7-46.0)	26.0 (24.3-27.7)	20.9 (17.9-23.9)	(1) vs. (3)[a], (2) vs. (3)[a]

Data are unadjusted percentages (95% confidence intervals)

AOM anti-osteoporosis medication, *BMI* body mass index

[a]Alpha level ≤ 0.017 for pair-wise unadjusted comparisons

[b]Alpha level ≤ 0.017 for pair-wise unadjusted and adjustedc comparisons

[c]Adjusted for age, comorbidities (hypertension, heart disease, high cholesterol, asthma, emphysema, osteoarthritis and diabetes), and fracture type (clavicle, upper arm, wrist, spine, rib, hip, pelvis, ankle, upper and lower leg)