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UNDERDIAGNOSIS AND UNDERTREATMENT OF NURSING HOME RESIDENTS AT HIGH RISK FOR FRAGILITY FRACTURES

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Abstract: *Background:* Identifying older individual at risk for fragility fractures is a priority among healthcare providers. However, the prevalence of osteoporosis, fragility fractures and the prescription of antifracture drugs among Nursing Home (NH) residents is almost ignored. The aim of this study is to describe the prevalence of osteoporosis and fragility fractures, and the main correlates of antifracture drug prescriptions among NH residents. *Design:* Observational multicentre prospective study. *Setting:* Nursing homes and assisted living facilities. *Participants:* 1995 NH residents aged 60 and older participating to the U.LI.S.S.E. (Un Link Informatico sui Servizi Sanitari Esistenti per l'Anziano) project were evaluated using a standardized comprehensive geriatric assessment instrument (Resident Assessment Instrument Minimum Data Set - RAI-MDS). *Results:* 256 (13%) persons (age 84.5±7.62 years) have diagnosis of osteoporosis without any fracture; 355 (17%) had previous fragility hip fracture with one out of three reporting a diagnosis of osteoporosis. An antifracture treatment is prescribed to 5.5% (n:111) of eligible persons: 18% of osteoporotic and 11% of hip fracture residents, respectively. Independent of age, gender, BMI and disability, subjects affected by osteoporosis are more likely to receive antifracture drugs (β=0.17, SE: 0.04; p: <0.0001),but not those with previous hip fracture. The probability to receive treatments decreases when dementia co-occurs (β=-0.07, SE: 0.03; p:0.05). Residents managed according with RAI-MDS show higher probability to receive appropriate antifracture treatment (β= 0.07, SE: 0.03; p: 0.01). *Conclusion:* NH residents at high risk for fragility fractures receive suboptimal care. Residents with a history of hip fracture or dementia are less likely to be treated, while those managed according to the geriatric comprehensive approach are more likely to receive adequate care.

Key words: Nursing homes, antifracture drugs, fragility fracture, observational study, care gap.

Introduction

Osteoporosis is a skeletal disorder characterized by compromised bone strength, which leads to fragility fractures (1). Osteoporotic fractures are particularly common in frail older individuals. Chronic disease states and polypharmacy further contribute to deleterious effects on bone health(2). Within the elderly population, those living in nursing homes (NH) generally comprise the oldest and most frail subgroup of individuals (3). Epidemiological studies conducted in U.S. indicate that osteoporosis is prevalent among NH residents, with approximately 50% of men and 64-90% of women meeting the World Health Organization criteria for central or peripheral DXA (4,5). The rate of hip fracture per 100 NH residents per year has been estimated between 3.7 and 5.0 which reflects a fracture risk 2.5-10 times greater than that of community-dwelling older individuals (5). Limited data exists regarding the prevalence of osteoporosis and fragility fractures among European NH residents. According to some authors, the rates of hip fractures range from 8% in Netherlands, to 10% in Finland, 18% in Italy and 21% in Austria (6,7). The prevalence of osteoporosis and vertebral fractures has also been shown to be 52% and 36%, respectively, among oldest NH residents (mean age, 85.9±0.6 years) living in Geneva, Switzerland. Additionally, the ten-year fracture probability as assessed by the FRAX tool was 27% and 15% for major fractures and hip fractures, respectively (8).With hip fracture comes the associated risk for further disability, hospitalization, and healthcare utilization. Therefore, hip fracture reduction is an essential concern in healthcare policy (9-13).

Falls and low bone mineral density (BMD) are the main determinants of hip fractures among NH residents and, therefore, are the key targets of interventions. The effect of fall prevention on hip fracture reduction remains unclear, especially among NH residents (14). In addition, they seldom receive antiosteoporotic drug treatments (i.e. vitamin D, calcium and bisphosphonates) although strong evidence supporting the improvement of the BMD and the reduced risk of fracture (15,1 6). Fracture risk is often underestimated among NH residents. Therefore, osteoprotective agents are generally under-prescribed, with rates as low as 20% in some cases (17). Due to a lack of data in the literature, the goals of this study were to assess the prevalence of osteoporosis and hip fragility fractures among NH residents, and the rate of antifracture drug use among participants in the Un Link Informatico sui Servizi Sanitari Esistenti per l'anziano - A computerized network on healthcare services for the elderly (ULISSE) study.

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Methods

Study sample

The study sample consisted of older individuals participating in the ULISSE project, an observational multicentre, prospective one-year study investigating the characteristics of older patients and the quality of care provided to them in acute, home, and NH care settings. This study was approved by the ethics committee of The Catholic University of Rome. Briefly, in February 2004, 1775 residents aged 60 years or older, living in 31 NHs distributed across Italy were enrolled and were followed until August 2007. In each instance where a participant was discharged or died, a new participant replaced him or her.In addition to the 1775 residents enrolled at baseline, 202 residents were enrolled in 2005, 26 subjects in 2006, and 16 subjects in 2007, for a total of 2019 subjects. 1995 subjects with complete data and information for the purpose of the study were included in the analysis. Details about the methods and procedures of the ULISSE project have been previously published (18).

Data collection

Italian NH residents participating in the ULISSE project underwent a standardized comprehensive evaluation protocol using the Italian version of the Resident Assessment Instrument Minimum Data Set (RAI-MDS) for NH care (19). The RAI-MDS, currently recommended by the Italian Geriatrics Society, has been previously validated and is currently in use among Italian nursing homes (20). At baseline, participants underwent a comprehensive geriatric assessment of functional and cognitive status evaluated by means of the seven point MDS activities of daily living hierarchy (21) and the 6 point MDS cognitive performance scale (CPS), respectively (22). Additional standardized geriatric assessments were used, including a full list of medical diagnoses coded according to the ICD-9 system (23), detailed data on long-term medications used in the past 90 days, and the Cumulative Illness Rating Scale (CIRS) to quantify comorbidity (24), an ad-hoc designed questionnaire to collect data on NH characteristics. For the purpose of the present study, participants with osteoporosis were identified based on a diagnosis reported in the dedicated section of the RAI-MDS for NH. Fragility fractures were identified as those occurring at typical sites (i.e. wrist, lumbar spine, hip, humerus, radius and ulna) after the age of 60 years. Fractures secondary to traumatic accidents or cancer were excluded. Among the participants with fragility fractures, those reporting a hip fracture were included in the "Hip Fracture" independent of the presence of any other fracture, while those with any other fracture type were included in the "Other Fracture" group. Data on prescription medications were obtained from medical records. Drug information, such as name, form, starting time, dosage, and frequency of administration, were recorded for each resident. Drugs were coded using the Anatomical and Therapeutic Classification system (25). All participants included in the study were on long-term drug treatment, which was defined as the continuation of the same drug therapy for 6 months prior to baseline evaluation.

Statistical analysis

Table I shows the main characteristics of the NH residents participating in the ULISSE project. Data are presented for the entire sample and classified as "Normal", subjects without diagnosis of osteoporosis and/or previous fracture, as "Osteoporosis", those with diagnosis of osteoporosis without previous fracture, and "Hip fracture", those with previous hip fracture independent of previous diagnosis of osteoporosis, and "Other fracture", subjects with any other fracture and independent of previous diagnosis of osteoporosis. Table 2 reports the characteristics of the participants according to on-going anti-osteoporotic treatment. In both Table 1 and Table 2, variables with normal distribution were summarized by mean and standard deviation, or by proportion and percentage. Statistical differences were tested using Student's t-test, ANOVA with Bonferroni correction, or Chi-square test as appropriate. Correlates of anti-osteoporotic drug treatment among NH residents were identified based on a multivariate regression model using GLM procedure (Table 3). A probability value of <0.05 was considered statistically significant. All statistical analyses were conducted using SAS version 9.13 (SAS Institute, Cary, NC, USA).

Results

The baseline characteristics of the study sample (n=1995) are presented in Table I. The majority of participants were women (n=1413, 71%), aged 80 years or older (n=1343, 67%), with a mean BMI of 23.53kg/m2 and mean MDS-ADL score of 15.46 (median=17; interquartile range 5-25). A large portion of subjects were dependent on bed mobility (n=878, 44.01%) and on bed-to-chair transfers (n=922, 46.22%), and had a severe level of CPS-based cognitive impairment (n=815, 41.65%), independent of a ICD-9 based diagnosis of dementia. Residents had a high level of multimorbidity, as shown by the number of diseases (3.97±2.37), and the CIRS score (8.09±2.01), and the average number of drugs (4.97±2.87). The prevalence of diseases and conditions affecting NH residents are listed in Table 1. After hypertension (45.16%), dementia (43.76%) was the most prevalent disease, followed by heart disease (25.86%), COPD (22.56%), depression (19.60%), diabetes (16.99%), falls and syncope (12.88%). Concerning the prevalence of bone-related diseases, 366 (18.35%) residents had osteoporosis (82.14% women; 75.69% octogenarians), 369 (18.50%) had at least one fragility hip fracture (82.14% women and 79.95% octogenarians), and 20 (1.00%) had other fractures. Many residents with hip fracture (262; 71.00%) did not have a clinical diagnosis of osteoporosis. Including hip and other fragility fractures, osteoporosis was the third most common chronic

Table 1
Main Characteristics of the Italian NH Residents Participating in the U.L.I.S.S.E. Project

	Total (n:1995, 100%)	Normal (n:1351, 67.72%)	Osteoporosis (n:255, 12.78%)	Hip fracture (n:369, 18.50%)	Other fractures (n:20, 1.00%)	p
Demographic and functional-related variables						
Age, yrs (mean±SD)	83.30±8.20	82.42±8.40	84.50±7.62	85.59±7.34	84.88±6.94	<.0001
Age class, n (%)						<.0001
60-70	139 (6.97)	118 (8.73)	12 (4.71)	9 (2.44)	0 (0)	
70-80	513 (25.71)	395 (29.24)	50 (19.61)	65 (17.62)	3 (15.00)	
>80	1343 (67.32)	838 (62.03)	193 (75.69)	295 (79.95)	17 (85.00)	
Females n (%)	1413 (71.08)	894 (66.37)	207 (82.14)	301 (81.57)	11 (55.00)	<.0001
BMI, kg/m2 (mean±SD)	23.53±4.90	23.82±4.77	23.46±5.14	22.49±5.08	23.54±4.83	<.0001
Smoking						0.0132
Never smoking, n (%)	1535 (80.41)	1014 (78.48)	201 (82.72)	306 (86.20)	14 (73.68)	
Former smoking, n (%)	238 (12.47)	169 (13.08)	28 (11.52)	38 (10.70)	3 (15.79)	
Smokers, n (%)	136 (7.12)	109 (8.44)	14 (5.76)	11 (3.10)	2 (10.53)	
MDS-ADL score, (mean±SD)	15.46±10.27	14.76±10.46	16.04±10.33	17.61±9.28	15.90±8.89	<.0001
Dependence in						
Bed mobility, n (%)	878 (44.01)	544 (40.27)	124 (48.63)	200 (54.20)	10 (50.00)	<.0001
Transfer to and from bed and chair, n (%)	922 (46.22)	572 (42.34)	126 (49.41)	214 (57.99)	10 (50.00)	<.0001
CPS score class, n (%)						0.3698
0-1	590 (30.15)	383 (28.91)	89 (35.46)	111 (30-75)	7 (35.00)	
2-4	552 (28.21)	371 (28.00)	69 (27.49)	105 (29.09)	7 (35.00)	
>5	815 (41.65)	571 (43.09)	93 (37.05)	145 (40.17)	6 (30.00)	
Desease-related variables						
Number of diseases, (mean±SD)	3.97±2.37	3.50±2.13	5.29±2.51	4.80±2.56	3.10±1.86	<.0001
CIRS score, (mean ±SD)a	8.09±2.01	7.74±2.03	10.17±1.83	8.02±2.03	8.03±1.48	0.0706
Osteoporosis, n (%)	366 (18.35)	----	255 (100)	107 (29.00)	4 (20.00)	<.0001
Dementia, n (%)	873 (43.76)	580 (42.93)	113 (44.31)	173 (46.88)	7 (35.00)	0.4761
Hypertension, n (%)	901 (45.16)	610 (45.15)	132 (51.76)	153 (41.46)	6 (30.00)	0.0387
COPD, n (%)	450 (22.56)	287 (21.24)	81 (31.76)	77 (20.87)	5 (25.00)	0.0024
Cancer, n (%)	149 (7.47)	96 (7.11)	24 (9.41)	26 (7.05)	3 (15.00)	0.3357
Depression, n (%)	391 (19.60)	253 (18.73)	60 (23.53)	76 (20.60)	2 (10.00)	0.2075
Heart Disease, n (%)	517 (25.86)	344 (25.46)	69 (26.67)	97 (26.29)	7 (35.00)	0.7760
Falls and syncopes, n (%)	257 (12.88)	138 (10.21)	47 (18.43)	62 (16.80)	10 (50.00)	<.0001
Gastric or duodenal ulcers, n (%)	14 (0.70)	10 (0.74)	3 (1.18)	1 (0.27)	0 (0)	0.5772
Rheumatoid Arthritis, n (%)	36 (1.80)	17 (1.26)	8 (3.14)	11 (2.98)	0 (0)	0.0444
Diabetes, n (%)	339 (16.99)	238 (17.62)	41 (16.08)	57 (15.45)	3 (15.00)	0.6419
Renal Failure, n (%)	137 (6.87)	98 (7.25)	13 (5.10)	25 (6.78)	1 (5.00)	0.7518
Drug-related variables						
Number of medications, (mean ±SD)	4.97±2.87	4.91±2.80	5.63±3.06	4.78±2.89	4.35±3.32	0.8744
Bisphosphonates, n (%)	87 (4.36)	----	47 (18.43)	39 (10.57)	1 (5.00)	<.0001
Vitamin D, n (%)	45 (2.26)	16 (1.18)	17 (6.67)	12 (3.25)	0 (0)	<.0001
Calcium, n (%)	129 (6.47)	45 (3.33)	40 (15.69)	43 (11.65)	1 (5.00)	<.0001
Calcium and Vitamin D, n (%)	23 (1.15)	9 (0.67)	5 (1.96)	9 (2.44)	0 (0)	0.0198
Bisphosphonates and calcium, n (%)	33 (1.65)	----	18 (7.06)	15 (4.07)	0 (0)	<.0001
Bisphosphonates and Vitamin D, n (%)	13 (0.65)	----	8 (3.14)	5 (1.36)	0 (0)	<.0001
Bisphosphonates, calcium and Vitamin D, n (%)	5 (0.25)	----	1 (0.39)	4 (1.08)	0 (0)	0.0030
Steroids, n (%)	126 (6.32)	69 (5.11)	25 (9.80)	30 (8.13)	2 (10.00)	0.0113

Data are presented as mean±standard deviation or proportion and percentages, as appropriate. Statistical differences are tested using the ANOVA analysis of variance or Chi-square test, as appropriate; MDS-ADL score: MDS-ADL Long Form Scale (score 0-28); CPS: Cognitive Performance Scale; CIRS: Cumulative Illness Rating Scale; COPD: Chronic Obstructive Pulmonary Disease; a. Log-transformed values were then back-transformed for data presentation.

Table 2
Characteristics of the Italian NH Residents Participating in the U.L.I.S.S.E. Project according to Antifracture Drug Treatment

Variables	Antifracture drug treatment		p
	Treated (n=87)	Not Treated (n=541)	
Age, yrs (mean±SD)	83.91±6.98	85.34±7.52	0.0979
Female, n (%)	75 (86.21)	436 (80.89)	0.2118
BMI, kg/m2(mean±SD)	23.77±4.49	22.74±5.21	0.0904
MDS-ADL score (0-28), (mean±SD)	14.46±9.69	17.32±9.72	0.0116
Bed mobility, n (%)	37 (42.53)	288 (53.23)	0.0636
Transfer to and from bed and chair, n (%)	41 (47.13)	300 (55.45)	0.1479
CPS class (score>5), n (%)	17 (19.54)	222 (41.04)	0.0001
Number of diseases, (mean ±SD)	5.05±2.33	4.98±2.59	0.8068
Number of medications, (mean ±SD)	6.24±2.54	4.95±3.01	0.0002
Osteoporosis, n (%)	74 (85.06)	292 (53.97)	<.0001
Hip fracture, n (%)	39 (44.83)	330 (61.00)	0.0045
Depression, n (%)	23 (26.44)	114 (21.07)	0.2608
Dementia, n (%)	29 (33.33)	259 (47.87)	0.0115
COPD, n (%)	22 (25.29)	136 (25.14)	0.9763
Diabetes, n (%)	10 (11.49)	88 (16.27)	0.2550
Rheumatoid arthritis, n (%)	3 (3.45)	16 (2.96)	0.8041
Cancer, n (%)	9 (10.34)	42 (7.76)	0.4133
Renal failure, n (%)	3 (3.45)	35 (6.47)	0.2726
Gastric or duodenal ulcers, n (%)	0 (0)	4 (0.74)	0.4211
Falls and syncopes, n (%)	11 (12.64)	101 (18.67)	0.1730
Steroids, n (%)	12 (13.79)	43 (7.95)	0.0735

diseases among Italian NH residents in this study, with a mean prevalence of 32.28% (Table 1).

Compared to normal residents, those with osteoporosis and hip fracture were older (84.50±7.62 and 85.59±7,respectively), had a higher MDS-ADL disability (16.04±10.33 and 17.61±9.28, respectively), including dependence on bed mobility and bed-to-chair transfers, higher multimorbility (5.29±2.51 and 4.80±2.56, respectively) despite a similar rate of polypharmacy (5.63±3.06 and 4.78+2.89, respectively). Residents grouped as osteoporotic or hip fractured had dementia (113; 44.31% and 173; 46.88%), falls and syncope(47;18.43% and 62;16.80%) as prevalent comorbid conditions. Concerning antifracture treatment, 87(4.36%) residents received specific drugs, with 129 (6.47%) and 45 (2.26%) on calcium or vitamin D supplementation, and 5 (0.25%) receiving antiresorptive drug plus supplements of calcium and vitamin D (Table I). Concerning the pattern of antiresorptive drug use, the majority of residents receive clodronate (n=61, 70.11%), followed by alendronate (n=17, 19.54%), risedronate (n=7, 8.05%), neridronate (n=1, 1.15%) and etidronate (n=1, 1.15%). 5 (0.8%) of 624 (31.27%) residents with a clinical diagnosis of osteoporosis and/or related hip fragility fractures received a complete osteoprotective therapy, while 86 (13.78%) residents were treated with bisphosphonates alone, 29 (4.64%) with vitamin D, and 83 (13.30%) calcium supplement alone.

Table 2 shows the characteristics of NH residents categorized according to antiosteoporotic drug use. Compared to those untreated, the majority of residents taking these drugs had a clinical diagnosis of osteoporosis (85.06%), and approximately one out of two had hip fracture (44.83%). The majority of residents with CPS-based severe cognitive impairment (n=222, 92.8%) and dementia (n=259, 90.0%) treatment despite their diagnosis (Table 2).

Independent of age, sex, BMI and disability score, residents affected by osteoporosis were more likely to receive an antiosteoporotic drug (β=0.20, SE=0.04, p<0.0001), while there was no association between hip fracture and treatment (β=0.20, SE=0.04, p<0.0001)(Table 3, Model 1). Residents with severe CPS-based cognitive impairment (β=-0.08, SE=0.03, p=0.0218), not those having a diagnosis of dementia in the clinical chart (β=-0.04, SE=0.03, p=0.1457), and residents

Table 3
Correlates of Antifracture Drug Treatment among the Italian NH Residents Participating in the U.L.I.S.S.E. Project

	Antifracture drug treatment							
	Model 1[a] (n=628)		Model 2[b] (n=628)		Model 2[c] (n=628)		Model 3[d] (n=628)	
	β+SE	P	β+SE	P	β+SE	P	β+SE	P
Osteoporosis	0.2053±0.04	<.0001	0.1979±0.04	<.0001	0.1910±0.04	<.0001	0.1721±0.04	<.0001
Hip fracture	0.0816±0.04	0.0601	0.0747±0.04	0.0845	0.0691±0.04	0.1103	0.0259±0.04	0.5575
Age Class 0	Ref.		Ref.		Ref.		Ref.	
Age Class 1	0.0598±0.08	0.4680	0.0557±0.08	0.4989	0.0623±0.08	0.4468	-0.0182±0.08	0.8335
Age Class 2	0.0014±0.04	0.7257	0.0122±0.04	0.7598	0.0192±0.04	0.6307	0.0218±0.04	0.5933
Sex	0.0518±0.04	0.1929	0.0603±0.04	0.1301	0.0601±0.04	0.1294	0.0740±0.03	0.0631
BMI	0.0040±0.01	0.1693	0.0039±0.01	0.1899	0.0037±0.01	0.2102	0.0031±0.01	0.2930
MDS-ADL score, quartiles								
I (0-5)	Ref.		Ref.		Ref.		Ref.	
II (5-17)	0.0128±0.04	0.7673	0.0249±0.04	0.5675	0.0323±0.04	0.4581	0.0526±0.04	0.2404
III (7-25)	0.0008±0.04	0.9840	0.0109±0.04	0.8008	0.0261±0.04	0.5518	0.0158±0.04	0.7226
IV (>25)	-0.0435±0.04	0.3292	-0.0269±0.04	0.5669	0.0079±0.05	0.8752	-0.0093±0.05	0.8565
Falls and syncopes	----	----	-0.0731±0.03	0.0549	-0.0784±0.03	0.0388	-0.0547±0.3	0.1561
Dementia (ICD-9 code)	----	----	-0.0469±0.03	0.1457	----	----	----	----
CPS class (score>5)	----	----	----	----	-0.0833±0.03	0.0218	-0.0707±0.03	0.0542
RAI- MDS use	----	----	----	----	----	----	0.0748+0.03	0.0134

a. osteoporosis, hip fracture, age classes, sex, BMI, MDS-ADL score quartiles; b. osteoporosis, hip fracture, age classes, sex, BMI, MDS-ADL score quartiles, falls/syncopes, ICD-9 diagnosis of dementia; c. osteoporosis, hip fracture, age classes, sex, BMI, MDS-ADL score quartiles, falls/syncopes, high degree of cognitive impairment CPS-based; d. osteoporosis, hip fracture, age classes, sex, BMI, MDS-ADL score quartiles, falls/syncopes, high degree of cognitive impairment CPS-based, RAI-MDS use in clinical management

with history of falls and syncope(β=-0.08, SE=0.03; p=0.0388) were less likely to receive treatment (Table 3, Model 2 and 3). Residents clinically managed based on a multidimensional geriatric instrument, i.e. RAI-MDS, were more likely to receive treatment (β: 0.07, SE: 0.03; p: 0.0134), especially when a history of falls, syncope, severe cognitive impairment were detected (Table 3, Model 4).

Discussion

This study investigated the prevalence of osteoporosis, fragility fractures and osteoprotective drug therapy in a large sample of elderly Italian NH residents. We found that osteoporosis is under-reported and under-diagnosed, even when fragility fractures were sustained. Furthermore, this study revealed a trend of under-treatment of osteoporosis among NH residents, even once clinical diagnosis is established. These data further support the notion that osteoporosis and fragility fractures are neglected conditions among residents of Italian NHs. Our sample revealed an osteoporosis prevalence rate of approximately 18%, which is consistent with the trend among European NHs (8-21%) (6,7), but far lower than that of USA NHs (70-85%) (2,4,5). After reviewing patient medical records, we found that osteoporosis and related-fractures were the third most common disease affecting Italian NH residents in this sample. Furthermore, Italian NH residents have high rate of condition-specific undertreatment. Only 2 out of 5 patients with a clinical diagnosis of osteoporosis and 1 out of 4 persons with fragility fractures received at least one osteoprotective drug, and only 0.39% and 1.08% received calcium or vitamin D plus an antiosteoporotic drug, respectively. The majority of treated residents received clodronate, a bisphosphonate with the poorest level of evidence for anti-hip fracture efficacy (26).

Our study adds to the literature by confirming that too few osteoporotic patients receive treatment before and after fracture, despite the availability of effective medications. Consistent with previous data, the likelihood of bisphosphonate prescription increases among NH patients with greater level of multimorbidity or polypharmacy (16, 17). Residents affected by osteoporosis and/or hip fracture have a higher likelihood of receiving antifracture medications, independent of their ability to ambulate (13, 17). Although the inability to walk could be considered a justification for exclusion of antiresorptive treatment, the probability of treatment was not modified by the inability of NH residents to move and stand-up. Additionally, NH residents with osteoporosis and/or hip fracture co-occurring with dementia were less likely to receive bisphosphonates. This observation deserves more attention considering that osteoporosis and dementia are commonly comorbid diseases in older NH residents, who are at highest risk for falls and hip fracture (27-29).

The reasons for these confounding medical practices remain

unknown. Guidelines specific to NH patients continue to strongly recommend specific pharmacological treatment, in addition to calcium and vitamin D supplementation, especially in those patients with previous fractures (30). Concerns regarding tolerability, adverse drug effects, and polypharmacy likely continue to discourage physician prescription of antifracture drugs to this frail elderly population. This is especially true regarding patients with dementia diagnoses, which reduces drug compliance, for example in the case of bisphosphonates, which need to be taken on an empty stomach and without food for about an hour. Though this could be less of a problem with the assistance of nurses. In addition,widely available osteoporosis medications, such as parenteral amino-bisphosphonate (i.e. zoledronic acid), are more easily administered, have fewer compliance issues, and strong evidence of efficacy. Although there is an abundance of evidence indicating the efficacy of antiosteoporotic drugs in NH patients, these individuals are generally excluded from randomized controlled trials (31), which leaves the risk-benefit ratio and cost-effectiveness unresolved in this population. The lower rate of antiosteoporotic drug use in NH residents with dementia may indicate that osteoporosis is often unrecognized in elderly individuals with dementia until a fracture occurs. Interestingly, the management of the NH residents based on RAI-MDS increases the probability of receiving antifracture treatment. Therefore these findings suggest that an implementation of use of osteoporosis drugs could be achieved by providing an adequate care and optimizing the management of chronic diseases and polypharmacy in nursing home residents.

We acknowledge certain limitations to the current the study. The study was not specifically developed to identify the prevalence of bone disease and related treatment. This is a secondary analysis of the data. The nature of the study limits our ability to report pertinent data, including information on BMD scan, vitamin D levels, morphometric vertebral fractures, and treatment duration. However, the study does have several strengths: (a) the drug information was collected from the medical records and charts of each resident and reflects the drugs effectively administered; (b) the findings of this study are generalizable, since the data were collected from a wide national sample of NH residents; (c) to our knowledge, this is the first study investigating the correlates of antifracture drugs administration among Italian NH residents.

In conclusion, though NH residents are at high risk for falls and fracture, their diagnosis of osteoporosis is generally under-recognized or affected by previous major fragility fracture. They do not receive antifracture treatment, especially when dementia co-occurs, independent of their degree of disability. The clinical management of NH residents based on comprehensive care may help physicians to recognize persons who deserve antifracture treatments. These findings highlight the urgent need for intervention trials to test strategies that address the efficacy, tolerability, and cost-effectiveness of antifracture medications in high-risk NH patients.

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