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Use of Osteoporosis Medications in Older Nursing Facility Residents

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Abstract

Introduction—Epidemiologic studies demonstrated that 70 – 85% of nursing home residents have osteoporosis. Few studies report comprehensive information about treatment of osteoporosis in nursing facilities.

Objective—To determine the prevalence osteoporosis treatment and identify resident characteristics associated with the use of anti-resorptive medications or supplements indicated to treat osteoporosis in nursing homes.

Methods—The study design was cross-sectional. The Systematic Assessment of Geriatric Drug Use via Epidemiology database provided the data. From this database, 186,221 residents were identified as newly admitted to nursing facilities in Kansas, Maine, Missouri, Ohio, and South Dakota between 1998 and 2000. The outcome measure was the use of anti-resorptive medications (alendronate, risedronate, calcitonin, estrogen, raloxifene) or supplements (calcium with vitamin D) indicated for treatment of osteoporosis. The independent variables included demographic, health status and fracture risk factors.

Results—Of the overall sample, 9.1% received anti-resorptive medications and/or supplements indicated for osteoporosis treatment. The most commonly used treatment was the combination of calcium and vitamin D (5.0%). Calcitonin (2.5%) use exceeded that of any other anti-resorptive. Multivariable logistic regression analyses revealed that a diagnosis of osteoporosis and female gender were strongly associated with being more likely to receive an osteoporosis treatment (OR 6.34 with 95% CI 6.11–6.64 and OR 2.67 with 95% CI 2.53–2.83 respectively). The number of medications residents received was also strongly associated with receiving osteoporosis treatment. Being black and having four or more active diagnoses were strongly associated with lower odds of receiving treatment (OR 0.63 with 95% CI 0.57–0.68 and OR 0.71 with 95% CI 0.68–0.74 for 4 to 6 diagnoses).

Discussion—Newly admitted nursing facility residents infrequently received an indicated osteoporosis treatment, including calicum with vitamin D, despite the expected high prevalence of osteoporosis in this setting. Few demographic, health status and fracture risk factors were strongly associated with receiving indicated treatment.

Keywords

osteoporosis; nursing home; drug utilization; aged

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INTRODUCTION

Most nursing facility residents have osteoporosis, and disease prevalence estimates range from 70–85% among women and men.[1,2] Osteoporotic bones are more susceptible to fractures especially in the nursing facility setting where falls occur frequently.[2–6] Osteoporotic fractures may further compromise the function, independence, and quality of life of nursing facility residents.[7–10] Osteoporosis medications may reduce the rate of fractures in this population.[11–13]

Previous studies demonstrated low osteoporosis treatment rates among elderly patients before and after they suffered a hip fracture.[14,15] Few studies have examined the use of osteoporosis medications in a large sample of nursing facility residents.[16] One study of over 1,400 white women in Maryland nursing facilities reported that less than 10% received any osteoporosis medications, including calcium supplementation.[2] This study was limited by its lack of inclusion of male or black residents, and the data it obtained came from a single, mid-Atlantic state. Given this background, the objectives of this study were to determine the prevalence of osteoporosis treatment and to identify demographic, health status and fracture risk factors associated with the use of osteoporosis medications among newly admitted nursing facility residents.

METHODS

Study Design and Data Source

The design of the study was cross-sectional. The Systematic Assessment of Geriatric Drug Use via Epidemiology (SAGE) database provided the data for analysis. The SAGE database has been described in detail elsewhere.[17,18] Briefly, the database represented a combination of five independent data sources including the Minimum Data Set (MDS), Version 2.0.[19] The MDS is a uniform resident assessment instrument mandated for use in all Medicare and Medicaid-certified nursing homes.[20,21] The MDS provided information about resident demographics, health status (which included level of function), and fracture risk factors. The reliability and validity of the MDS and the summary rating scales derived from MDS items have been studied extensively.[22–29]

The medication data came from Section U of the MDS. It captured use of up to 18 medications over the seven days prior to the MDS assessment; it was used in a limited number of states until the end of the year 2000. Medication data included generic and brand names of the medications given, routine and as-needed use, the dose, route, frequency, and total number of times each medication was given. All medication data was coded according to the Medi-Span Therapeutic Classification Systems (Wolters Kluwer Health).[30] The SAGE database medication information has been shown to be reliable and valid.[17,18] This study was exempted from review by the Brown University Institutional Review Board.

Study Sample and Setting

The study sample included 186,221 unique residents at admission to 1,606 nursing facilities in Kansas, Maine, Mississippi, South Dakota, and Ohio between January 1998 and December 2000. Residents were excluded if admitted for terminal care or if they had a medical condition that may have altered calcium and bone metabolism (e.g. cancer, hyperparathyroidism).

Outcome Measure

The primary outcome variable was defined as the use of an anti-resorptive medication and/or of supplements indicated for the treatment of osteoporosis in nursing facility residents. The anti-resorptive medications included in this study had received Food and Drug Administration

(FDA) approval for an osteoporosis indication, were available by the end of the year 2000, *and* were recommended by the National Institutes of Health Consensus Statement and the American Association of Clinical Endocrinologists during the study period.[31,32] A dichotomous outcome variable was created to represent assignment of the sample either to the "indicated for treatment" group or to the referent group. "Indicated for treatment" meant that a resident received one or more of the following: an oral bisphosphonate (alendronate or risedronate), raloxifene, estrogen, calcitonin, and/or calcium *with* vitamin D supplementation. The referent group included the absence of use of these osteoporosis medications and the combination of supplements indicated for treatment.

Independent Variables

Based on the published literature, three domains of potential predictors of osteoporosis medication use were identified: demographic data, health status, and fracture risk factors.[1,2,4,31,33–43] Demographic data included a dichotomous variable for gender and categorical variables for age and race. Health status included dichotomous variables for a history of weight loss and a history of non-malignant gastrointestinal disease as well as categorical variables for the number of active diagnoses, the number of medications, cognitive impairment (using Cognitive Performance Scale scores where 0 – 1, 2 – 4, and 5 – 6 represented limited, moderate, and severe cognitive impairment respectively), and physical function (based on the number of daily functions requiring assistance).[22,25,26] Fracture risk factors included dichotomous variables for a history of osteoporosis, a history of fractures, a history of falls, and the use of medications (i.e. corticosteroids, heparin, phenytoin, thyroid medications) known to increase the risk of osteoporosis.

Statistical Analyses

Descriptive statistics (proportions) were applied to all independent variables. The use of medications and supplements "indicated for treatment" of osteoporosis was described by therapeutic class and combination of medications. Multivariable analyses were conducted using logistic regression to estimate the effects of the independent variables on the dichotomous outcome measure (any use of osteoporosis agents indicated for treatment).[44] SAS 9.1 (SAS Institute Inc, Cary, NC) software was used to calculate adjusted odds ratios with 95% confidence intervals for the individual demographic, health status, and fracture risk factors included in the final model.

RESULTS

Table 1 details the characteristics of the sample. The majority of the population was female, white, and between the ages of 75 and 84. More than a third of residents were 85 or older. Nearly half of residents had four or more active diagnoses. Twelve percent of residents had a documented diagnosis of osteoporosis or history of any type of fracture.

Overall, 9.1% of residents received an anti-resorptive medication or a combination of calcium and vitamin D supplements indicated for treatment of osteoporosis. Table 2 shows that the most commonly prescribed treatment indicated for osteoporosis was calcium and vitamin D supplementation together. Nearly 6% of newly admitted residents took at least one anti-resorptive medication; calcitonin was the most commonly prescribed. Only 25% of those taking any anti-resorptive agent also received calcium with vitamin D.

Table 3 shows the results of the multivariable analysis. Being female and having a diagnosis of osteoporosis were variables strongly associated with increased odds of receiving a medication indicated for osteoporosis treatment. The number of medications residents received also was strongly associated with receiving osteoporosis treatment. Two factors, having four

or more active diagnoses and being black, were strongly associated with lower odds of receiving osteoporosis treatment.

DISCUSSION

This is one of the first studies to examine how medications indicated for treatment of osteoporosis were used in a large, broad, multi-state sample of nursing facility residents. This study found that less than 10% of residents used one or more medications indicated for osteoporosis treatment. This is consistent with the findings from Chandler et al.,[2] but less than the 20% reported by Jachna et al., in a study of Kansas nursing facility residents receiving a Medicaid benefit. [16] This study also found that nasal calcitonin was the most commonly used anti-resorptive agent. This is somewhat disconcerting because calcitonin has been shown to be only marginally effective for vertebral fracture prevention and ineffective at preventing hip and other cortical bone fractures.[45,46] Moreover, few residents who used anti-resorptive agents took them in conjunction with calcium and vitamin D. Data from the original trials of each of the anti-resorptive agents showed that they achieved fracture reduction efficacy when used concurrently with calcium and vitamin D.[47–50] *It is important to note that there is emerging evidence that even those receiving vitamin D received inadequate amounts.*[51–54]

This study is also one of the few that examined the association between several factors and the use of medications indicated for treatment of osteoporosis. One notable finding was that osteoporosis medication use was disproportionate across gender and race. Of potential concern is that the risk of osteoporosis and fractures among blacks and men has been shown to increase sharply after age 75.[34] Similarly, the Kansas investigators showed that residents who were African American were half as likely to receive an anti-resorptive agent.[16] What are some possible explanations for this finding? Perhaps osteoporosis medication prescribing habits reflected perceptions that being black or male was uncommonly associated with osteoporosis even though prevalence studies of osteoporosis in nursing facilities have suggested otherwise. [1] Perhaps provider characteristics or cultural beliefs—neither of which were measured—accounted for the racial and gender differences seen.

Health status factors influencing the use of indicated treatment warranted mention. Multiple comorbidities suggested lower odds of receiving an indicated treatment. One potential explanation is that other medical conditions may have been more symptomatic or apparent and prescribers favored treating them instead of osteoporosis.[56] Not surprisingly, the use of osteoporosis medications was increased in those with a history of diagnosed osteoporosis. The finding that polypharmacy was associated with a greater likelihood of receiving treatment is counterintuitive but consistent with the findings of Jachna et al.[16]

Several limitations are worth noting. First, these findings were based on medication use from 1998 to the end of 2000. Second, several historical events, including the evolution of practice guidelines and recommendations,[57,58] the findings of the Women's Health Initiative regarding estrogen use,[59] FDA approval of two new anti-resorptive agents now available,[60, 61] and wider dissemination of knowledge about the disease, may have changed the manner and frequency with which osteoporosis medications have been prescribed since then. Third, these analyses were not able to control for some factors that potentially increased or decreased the risk of osteoporosis (e.g., BMI) because this information was not uniformly collected. Fourthly, causal relationships could not be identified in cross-sectional analyses. Finally, these findings may not be generalized beyond the 5 states studied.

CONCLUSION

This study raises important questions about medication under-use for osteoporosis in the nursing facility setting. Newly admitted nursing facility residents infrequently received an indicated osteoporosis treatment. Few demographic, health status and fracture risk factors were strongly associated with receiving indicated treatment. Moreover, when residents were treated, the choice of agents was often suboptimal. Future longitudinal research is needed to examine residents' preferences for treatment in order to inform interventions that optimize osteoporosis treatment.

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TABLE 1

Demographic, Health Status, and Fracture Risk Characteristics of newly admitted Nursing Facility Residents (N = 186,221).

Characteristics	N	%
Demographic		
Female	130,030	69.8
Age:		
65 – 74	37,911	20.4
75 – 84	80,007	43.0
= 85	68,303	36.6
Race/Ethnicity		
White	168,076	90.3
Black	16,350	8.6
Other	1,795	0.96
Health Status		
History of Weight Loss	24,367	13.1
History of Any Gastrointestinal Disease	15,253	8.2
Number of Diagnoses		
0 – 3	94,599	50.8
4 – 6	76,283	41.0
> 6	15,337	8.2
Number of medications		
0 – 2	7,654	4.1
3 – 6	45,383	24.4
7 – 10	68,520	36.8
= 11	64,487	34.7
Cognitive impairment		
Limited	88,253	47.4
Moderate	80,582	43.3
Severe	17,386	9.3
Physical function limitations*		
0 – 1	20,722	11.1
2 – 3	123,195	66.2
4 – 5	42,304	22.7
Fracture Risk		
Diagnosis of osteoporosis	23,232	12.5
History of falls	76,911	41.3
History of fractures	22,450	12.1
Medication use		
Oral corticosteroid	16,932	9.1
Inhaled corticosteroid	5,982	3.2
Heparin	34,386	18.5
Phenytoin	6,573	3.5
Thyroid medication	24,668	13.2

*Represented by the number of daily functions requiring assistance.

TABLE 2

Use of medications "indicated for treatment" of osteoporosis among residents upon admission to a nursing facility (N = 186,221).

Medication Class	Number of Residents*	%*
Supplements		
Calcium with vitamin D alone	6,419	3.44
Anti-resorptive agents		
Calcitonin	4,681	2.51
Bisphosphonates	4,335	2.32
Estrogen	1,057	0.57
Raloxifene	898	0.48
Combination of multiple anti-resorptive agents, without calcium and vitamin D	299	0.002
Combination of anti-resorptive agent(s) with calcium and vitamin D	2,621	1.4

* Does not total to 9.1% (16,943) as some residents took more than one anti-resorptive agent.

TABLE 3

Multivariate predictors of odds of receiving a medication "indicated for treatment" of osteoporosis (N = 186,221).

Characteristics	**Adjusted Odds Ratio**	**(95% Confidence Interval)**
Demographic		
Female	2.67	(2.53 – 2.83)
Age		
65 – 74	1.0	(referent)
75 – 84	1.09	(1.04 – 1.14)
= 85	1.03	(0.98 – 1.09)
Race		
White	1.0	(referent)
Black	0.63	(0.57 – 0.68)
Other	0.95	(0.76 – 1.18)
Health Status		
History of Weight Loss	0.89	(0.84 – 0.94)
History of Any Gastrointestinal Disease	0.82	(0.77 – 0.87)
Number of Diagnoses		
0 – 3	1.0	(referent)
4 – 6	0.71	(0.68 – 0.74)
> 6	0.52	(0.49 – 0.56)
Number of Medications		
0 – 2	1.0	(referent)
3 – 6	6.18	(4.72 – 8.10)
7 – 10	13.2	(10.1 – 17.3)
= 11	23.9	(18.2 – 31.2)
Cognitive Impairment		
Limited	1.0	(referent)
Moderate	1.06	(1.02 – 1.10)
Severe	0.96	(0.89 – 1.05)
Physical Function		
0 – 1	1.0	(referent)
2 – 3	0.87	(0.82 – 0.92)
4 – 5	0.71	(0.66 – 0.76)
Fracture Risk		
Diagnosis of Osteoporosis	6.34	(6.11 – 6.64)
History of Falls	1.18	(1.13 – 1.22)
Effect	**Adjusted Odds**	**(95% Confidence Interval)**
History of Fracture(s)		
Any	1.39	(1.32 – 1.46)
Medication use:		
Oral Corticosteroids	1.07	(1.01 – 1.23)
Inhaled Corticosteroids	0.98	(0.90 – 1.08)
Heparin	0.98	(0.90 – 1.08)
Phenytoin	1.00	(0.91 – 1.12)
Any thyroid medications	1.05	(1.0 – 1.10)