Published in final edited form as:

Pharmacoepidemiol Drug Saf. 2013 January ; 22(1): 55–63. doi:10.1002/pds.3361.

Generic Alendronate Use among Medicare Beneficiaries: Are Part D Data Complete?

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Abstract

Background—Generic alendronate was approved in the United States on February 6, 2008. Medicare beneficiaries might pay for generic alendronate out-of-pocket without having claims submitted, resulting in misclassification of generic alendronate use in Medicare data.

Objectives—To estimate the completeness of generic alendronate use in 2008 Medicare Part D data; to identify factors associated with staying on branded alendronate versus switching to a generic product.

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Disclosure: This research was supported by a contract between UAB and Amgen, Inc. Only the authors had access to the Medicare data used. The analysis, presentation and interpretation of the results were solely the responsibility of the authors.

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Statistical analysis: Yun, Matthews, Smith

Obtaining Funding: Curtis, Saag, Kilgore, Morrisey, Delzell

Administrative, technical, or material support: Matthews, Smith, Saag, Kilgore, Morrisey, Curtis, Delzell, Study supervision: Curtis, Saag, Delzell

Financial Disclosures

HY: research support from Amgen

JRC: Grant support from the NIH (AR053351) and AHRQ (R01HS018517). Research grant: Amgen, Eli Lilly, Merck, Novartis, Proctor & Gamble, Roche; Consulting fees: Merck, Amgen, Eli Lilly, Roche, Novartis

KGS: Research grant: Eli Lilly, Novartis, Merck, Amgen; Consulting fees: Eli Lilly, Novartis, Merck, Amgen

MLK: research support from Amgen

PM: research support from Amgen and served an advisory board for Amgen. Consulting fees: Amgen

WS: research support from Amgen

RM: research support from Amgen

NW: research support from Amgen

MAM: research support from Amgen

ED: research support from Amgen

Methods—We identified Medicare beneficiaries highly adherent (medication possession ratio 80%) with branded alendronate during 1/1/06-2/6/07 (“2007 cohort”) and during 1/1/07-2/6/08 (“2008 cohort”). The outcome was medication status at the end of follow-up (12/31/2007 or 12/31/2008), classified as continued branded alendronate, switched to generic alendronate, switched to another bisphosphonate or presumed discontinued bisphosphonate therapy. Cox regression estimated the hazard ratio (HR) for discontinuation in 2008 compared to 2007. Multinomial logistic regression identified factors associated with medication status for the 2008 cohort.

Results—Among 15,310 subjects using branded alendronate in the 2008 cohort, 81% switched to generic alendronate. The proportion presumably discontinuing bisphosphonate therapy was 8.9% in 2008 compared to 7.7% in the 2007 cohort (adjusted HR, 1.15; 95% confidence interval, 1.05, 1.26). Factors associated with staying on branded alendronate in 2008 were higher income, eligibility for a low income subsidy and use of Fosamax® plus vitamin D.

Conclusion—Evaluation of Medicare prescription drug data suggests that the amount of missing claims for generic alendronate in 2008 was not substantial, and misclassification of exposure in studies examining alendronate use post generic product availability should be minimal.

Keywords

Generic drugs; alendronate; Medicare Part D; medication adherence

INTRODUCTION

The Food and Drug Administration (FDA) approved alendronate sodium for the prevention and treatment of postmenopausal osteoporosis in 1995.¹ In February 2008, Merck & Company's patent expired for its branded alendronate product, Fosamax®, and generic alendronate products were approved for marketing in the United States. Generic alendronate became available at retail pharmacies for as little as \$9 for a 30-day supply compared to \$48 per 30-day supply for Fosamax®. Subsequently, sales volumes for branded alendronate dropped dramatically, with Fosamax® losing 84% of its market share from retail stores and 94% of its market share from mail-order pharmacies during the first 30 days after the launch of generic products.²

Coverage of prescription drugs under Medicare Part D offers considerable potential for evaluating the utilization, safety and effectiveness of generic compared to branded drugs. However, the validity of such research depends in part on the completeness of claims for low-cost generic drugs such as alendronate. Because of the much lower cost of generic compared to branded products, patients may purchase generic alendronate out-of-pocket without submitting claims to their insurance plan. Medicare beneficiaries might choose to do so because they may be close to entering, and attempting to avoid, the prescription drug coverage gap (“donut hole”), in which they may have to pay for all prescription drugs, or because their copayment cost may be greater than the out-of-pocket cost of generic alendronate. In these circumstances, Medicare data might not include all prescriptions filled for generic alendronate. This problem would result in misclassification of exposure to generic alendronate in research on comparative effectiveness, adherence, aggregate drug

utilization and expenditures and might provide policy makers with biased estimates of alendronate use.

The main objective of the present study was to assess the completeness of Part D prescription data on generic alendronate in 2008 for Medicare beneficiaries. We studied beneficiaries who had been adherent users of branded alendronate for at least one year. As a comparator population, and under the assumption that users of branded risedronate might be less likely to switch to generic alendronate, we also examined apparent discontinuation among adherent users of risedronate, another bisphosphonate that did not have a generic formulation available. We studied adherent users because absence of filled prescriptions for alendronate, compared to the non-adherent, is more likely to reflect missing prescriptions rather than discontinuation. We hypothesized that the extent of missing prescriptions for generic alendronate should be small if apparent discontinuation of alendronate among adherent users was similar in 2007 to that in 2008, and if substantial switching from branded to generic alendronate occurred in 2008 among adherent users. As a secondary objective, we evaluated factors associated with staying on branded alendronate versus switching to a generic product because of the relatively high cost of branded compared to generic alendronate for patients and health care systems.

METHODS

Data sources and design

We used data from 2006 through 2009 for a 5% random sample of Medicare beneficiaries, obtained from the Centers for Medicare and Medicaid Services Chronic Condition Data Warehouse.³ The data included demographic and insurance coverage information on individual beneficiaries and their claims for services from institutional and non-institutional providers and for prescription drugs. We identified medications of interest using Part D data on prescription fills. The institutional review board of the University of Alabama at Birmingham approved the study. To evaluate discontinuation of alendronate in 2007 and 2008, we identified two cohorts, one comprising beneficiaries treated before generic alendronate became available (the 2007 cohort) and the other comprising beneficiaries treated after the market launch of generic alendronate (the 2008 cohort). Each cohort included users of alendronate and was restricted to beneficiaries with “full coverage”: that is, they had traditional fee-for-services and Part D Medicare coverage and were not enrolled in a Medicare Advantage plan. For each cohort, we computed the medication possession ratio (MPR) during a 13-month baseline period, defined below. MPR is a widely used adherence measure, typically defined as the sum of the days of supply of medication divided by the total number of days between the first prescription date and either the end of the measurement period or the last day of supply during the measurement period.⁴ In this study, we computed MPR using the total days in the baseline period as the denominator and capped MPRs at 1.0.

The 2007 cohort included beneficiaries who had full coverage during a baseline period from January 1, 2006, through February 5, 2007, and during a follow-up period from February 6, 2007, through December 31, 2007, and who had an alendronate MPR $\geq$ 80% during the baseline period. Similarly, the 2008 cohort included beneficiaries who had full coverage

during the baseline period from January 1, 2007, through February 5, 2008, and during the follow-up period from February 6, 2008, through December 31, 2008, and who had an alendronate MPR $\geq 80\%$ during the corresponding baseline period (Figure 1). The 2007 cohort was about half as large as the 2008 cohort. This difference was due mainly to the lower proportion of beneficiaries with continuous Part D enrollment during the baseline period that started in January 2006 for the 2007 cohort. Part D coverage started in 2006, and beneficiaries enrolled gradually, rather than immediately in January, during that year.⁵ Therefore, continuous coverage under Part D was generally less common in 2006 than in subsequent years.

We used procedures similar to those above to identify 2007 and 2008 cohorts of adherent risedronate users. Comparison of discontinuation in the 2008 to 2007 cohorts allowed us to determine if a within-calendar-year temporal pattern existed that might not be related to licensure of the generic product.

To evaluate trends in apparent discontinuation of alendronate and in switching from branded to generic alendronate in 2007-2009, we selected 2007 cohort members with full coverage through the end of 2009. In each month of follow-up, we identified beneficiaries who switched from branded to generic alendronate or who discontinued bisphosphonate therapy.

Medication exposure

The exposures of interest were alendronate and risedronate. We identified these medications using NDC, brand name, generic name, days supplied and dosage information from Part D claims.

Outcome

The outcome of interest was medication status at the end of follow-up, categorized as stayed on branded alendronate or risedronate, switched to generic alendronate, switched to another bisphosphonate or discontinued. We defined discontinuation in both cohorts as no bisphosphonate fill in the last 90 days of follow-up.

Covariates

Demographic characteristics determined at the start of follow-up in each cohort were age, gender, race, geographic region and income. We estimated beneficiaries' income using their Census block group of residence and the corresponding median income.⁶ We identified subjects with low income subsidy at any time during the baseline based upon their part D drug cost-sharing benefit and developed data on all other covariates using inpatient, outpatient hospital, physician and drug claims during the 12-month baseline period. Medical conditions of interest included glucocorticoid-related disease, bone disease, diabetes, renal disease, fall related conditions, depression, stroke, chronic obstructive pulmonary disease. We used ICD-9 diagnosis codes from inpatient and physician encounter claims to classify subjects according to history of these conditions. Medications identified using claims for prescriptions filled, included anticonvulsants, antidepressants, antipsychotics, antihypertensive, lipid-lowering drugs, non-steroidal anti-inflammatory drugs, and steroids.

Analysis

To determine if switching from branded to generic alendronate in 2008 was substantial, we computed the proportion of the 2008 cohort that switched by the end of the year, as well as proportions in other medication status categories. Cox regression models estimated the hazard ratio for discontinuing bisphosphonates in the 2008, post-generic alendronate market launch, cohort compared to the 2007, pre-market launch, cohort. A multivariable-adjusted hazard ratio of 1.0 would suggest that all beneficiaries classified as having discontinued in the 2008 cohort truly discontinued. A hazard ratio greater than 1.0 would suggest misclassification of discontinuation (i.e., patients may have paid out of pocket without having a claim filed but appeared to have discontinued bisphosphonates in our data).

To evaluate trends in switching from branded to generic alendronate and longer-term alendronate discontinuation trends in 2007-2009, we determined the proportion of beneficiaries who switched from branded to generic alendronate and the proportion discontinuing bisphosphonate therapy in each month of follow-up.

We used multinomial logistic regression to identify factors associated with staying on branded alendronate, switching to generic alendronate, switching to another bisphosphonate or discontinuing bisphosphonate therapy as of the end of follow-up for the 2008 cohort. For this analysis, the referent category was switching to generic alendronate due to the large number of subjects in this group.

RESULTS

The 2007 cohort included 8,421 alendronate and 4,559 risedronate users, and the 2008 cohort included 15,310 alendronate and 8,021 risedronate users (Table 1). Overall, these cohorts were similar in age, gender, race/ethnicity, median income, rural/urban location and MPR during baseline. The mean age was 78 years for alendronate users and 79 for risedronate users. In each cohort, the patients were mainly female, and the proportions of white, African American, Asian and Hispanic beneficiaries were similar. In both 2007 and 2008 cohorts, risedronate users were more likely than alendronate users to reside in the South and less likely to reside in the Midwest.

In 2008, the median monthly total drug cost of generic alendronate declined markedly between February (median, \$67.31; first quartile (Q1), \$58.86; third quartile (Q3), \$70.85) and December (median, \$21.46; Q1, \$16.55; Q2, \$36.44) in 2008. In contrast, monthly patient payment amounts did not undergo a marked decline during the same time. The median monthly patient payment amount was \$2.25 (Q1, \$1.00; Q3, \$7.00) in February 2008 compared to \$2.00 (Q1, \$0.00; Q3, \$5.00) in December 2008.

Of 8,421 alendronate users in the 2007 cohort, 7.7% appeared to discontinue bisphosphonate use by the end of the year, 89.7% continued their branded product and 2.6% switched to another bisphosphonate (Table 2). Of 15,310 alendronate users in the 2008 cohort, 8.9% appeared to discontinue bisphosphonate therapy, 9.2% continued branded alendronate, 80.8% switched to a generic product, and 1.1% switched to another bisphosphonate. Univariate Cox regression showed that the crude hazard ratio for discontinuation of

alendronate in 2008 compared to 2007 was 1.16 (95% confidence interval (CI), 1.05 – 1.27); similarly, the crude hazard ratio for discontinuation of risedronate in 2008 compared to 2007 was 1.01 (95% CI, 0.89-1.14). After adjusting for potential confounders, the hazard ratio for discontinuation was 1.15 (95% CI, 1.05 – 2.26) for the 2008 compared to the 2007 cohort of alendronate users, and the hazard ratio for discontinuation of risedronate was 1.04 (95% CI, 0.92 – 1.18) for the 2008 compared to the 2007 cohort of risedronate users.

The 2007 cohort of alendronate users included 7,740 beneficiaries with follow-up through the end of 2009. Time trends in apparent discontinuation of alendronate and in switching among these patients indicated that immediately following the licensure of generic alendronate, a substantial proportion of Medicare beneficiaries using branded alendronate switched to a generic product (Figure 2). Increases over time in apparent discontinuation of bisphosphonates were small, indicating minimal potential for missed claims for generic product prescription fills.

Taking Fosamax® plus vitamin D at the start of follow-up was strongly associated with staying on branded alendronate in the 2008 cohort. Of 2,074 beneficiaries using Fosamax® plus vitamin D at follow-up start, 37% switched to a generic product, 51% continued branded alendronate, 3% switched to another branded bisphosphonate, and 9% appeared to discontinue bisphosphonate therapy (data not displayed in a table). In contrast, 88% of subjects taking Fosamax® (without vitamin D) at the start of follow-up in 2008 switched to a generic drug, while only 3% continued branded alendronate, 1% switched to another branded bisphosphonate, and 9% discontinued therapy. After multivariable adjustment and with those who switched to generic alendronate as the reference group, multinomial logistic regression analysis of the 2008 alendronate cohort found that factors associated with staying on branded alendronate included taking Fosamax® plus vitamin D at the start of follow-up (adjusted odds ratio (OR), 49.69; 95% confidence interval (CI), 42.85-57.63), residence in income areas with a median household income of at least \$75,000 (OR, 1.40; 95% CI, 1.07-1.83), and being eligible for a low income subsidy (adjusted OR, 1.54; 95% CI, 1.13-2.10) (Table 3). Comorbidities and medications were not associated with staying on branded alendronate. Fosamax® plus vitamin D use during the baseline was also significantly associated with discontinuation of bisphosphonates (adjusted OR, 2.57; 95% CI, 2.16-3.06) and switching to other branded bisphosphonate other than alendronate (adjusted OR, 10.59; 95% CI, 7.65-14.64).

DISCUSSION

The primary objective of this research was to assess the completeness of identification of generic alendronate use in Medicare prescription drug claims data. We found evidence that, among Medicare beneficiaries previously adherent with branded alendronate therapy, failure to file claims for generic alendronate is likely to have occurred as much as 15% of the time in 2008, when substantial switching from branded to generic products occurred. This estimation of a 15% higher rate of apparent discontinuation of alendronate in 2008 compared to 2007 suggests that studies using Medicare Part D data will miss a modest amount of use of generic alendronate. Alternative interpretations are that generic alendronate users were more likely to discontinue than branded alendronate users or that a

temporal trend in discontinuation of alendronate due to unknown factors, such as the economic recession, existed. Our observation of a smaller (4%), statistically non-significant increase in discontinuation of risedronate in 2008 compared to 2007 suggests that claims data on risedronate prescriptions in 2008 are complete. These results are reassuring to researchers conducting alendronate-related effectiveness and utilization studies using Medicare Part D data.

The present study found that staying on branded alendronate compared to switching to a generic was associated with taking Fosamax® plus vitamin D at the start of follow-up, living in a high income area and receiving a low income subsidy. Our observation of a strong association between taking Fosamax® plus vitamin D and staying on a branded product could be due to the fact that both physicians and patients believed that Fosamax® plus vitamin D is more effective than generic alendronate, thus reducing the desire to switch to the latter. Fosamax® plus D is currently under a patent that prevents any generic product of the same type from being manufactured. The active ingredients include alendronate and cholecalciferol. Randomized controlled trials have concluded that the combination therapy of alendronate plus cholecalciferol provided equivalent or better efficacy in preventing fractures compared to alendronate only therapy.^{7,8} An observational study also has reported that alendronate with cholecalciferol was more cost-effectiveness than alendronate-only therapy.⁹ Our findings also indicate that among Fosamax® plus D users, switching to a generic product is the least likely alternative - less common than staying on their current therapy, switching to another branded anti-osteoporosis medication or discontinuing therapy.

Medicare low-income subsidies offer substantial assistance for the Part D premium, deductibles, copayments and costs in the coverage gap. In 2008, depending on income, individuals deemed eligible for low income subsidies only pay \$1.05 or \$2.25 for generic drugs and \$3.10 or \$5.60 for branded drugs.¹⁰ Our finding that beneficiaries eligible for a low income subsidy in were more likely to continue their branded alendronate than to switch to a generic product is consistent with the literature that beneficiaries with a low income subsidy are more likely to continue drug therapies for conditions such as hypertension, diabetes and coronary artery disease.¹¹

Our results also imply that patients residing in the highest income area (>75,000) are more likely to continue their branded alendronate than to switch to generic alternatives. The low switching rate may be because the high income patients are less sensitive to the cost, which can be supported by Federman' study that higher income Medicare beneficiaries are less likely to receive generic cardiovascular drugs.¹²

Our study has several strengths. We evaluated the completeness of generic alendronate prescriptions recorded in administrative data with a methodological approach that could be used to assess the completeness of claims for other newly approved, inexpensive generic drugs in Medicare and other data systems. All analyses used objective Medicare Part D prescription claims instead of self-reports.

The main limitation of the study pertains to its restricted generalizability, stemming from several aspects of its design. First, the study was restricted to highly adherent medication

users. Thus, our results may not be generalizable to poorly adherent Medicare beneficiaries who were using alendronate or to non-Medicare populations. However, our restriction to highly-adherent users allowed estimation of an upper bound on the extent of misclassification of generic alendronate users as discontinued, under the assumption that apparent discontinuation of alendronate among beneficiaries highly adherent with branded alendronate at the time of the market launch of generic products would reflect missing claims rather than true discontinuation. Second, the study evaluated discontinuation only during the first year after the approval of generic alendronate. The apparent discontinuation patterns that we observed may change as the time-on-market of the generic drug increases. Third, we studied only one therapeutic class. Although our results may not be generalizable to all other therapeutic classes, our methodological approach for evaluating the completeness of claims for generic alendronate may prove useful for research on other low cost generic drugs.

Another limitation was our lack of a gold standard to validate the methods we used to estimate the extent of missing claims for generic alendronate. Future validation could be done using linkages between Part D claims and patient self-reports on pharmacy use or data from a retail pharmacy database with claims for prescriptions filled by all payers, including claims from discount programs.

In summary, among adherent users of branded alendronate, claims for generic alendronate in 2008 in Medicare Part D appear to be at least 85% complete, so missing claims should not affect the analysis of the safety and effectiveness of generic drugs. Further investigation is needed to determine if estimated completeness changes with longer availability and possibly lower prices of generic alendronate and among those with lower adherence. To reduce health costs and provide access to medications for seniors, we need to better understand why beneficiaries choose to stay on branded, and not switch to generic products.

Acknowledgments

Funding: This research was supported by a contract between UAB and Amgen, Inc. Only the authors access to data. The analysis, presentation and interpretation of the results were solely the responsibility of the authors.

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Key points

- Among Medicare beneficiaries previously adherent with branded alendronate therapy, missing claims for generic alendronate in 2008 in Medicare Part D do not appear to be substantial. Therefore, Medicare part D data can be used for analysis of the utilization, safety and effectiveness of generic drugs.
- Our approach to evaluating the completeness of generic alendronate prescriptions recorded in administrative data could possibly be used to assess the completeness of claims for other newly approved, inexpensive generic drugs in Medicare and other data systems.

Figure 1.
Cohort diagram

Figure 2.
Time Trends in Switching and Apparent Discontinuation among Alendronate Users in 2007-2009

Table 1

Demographic and Other Characteristics of Patients in Alendronate and Risedronate Cohorts

		Alendronate		Risedronate	
		2007 Cohort	2008 Cohort	2007 Cohort	2008 Cohort
		N = 8,421	N = 15,310	N = 4,559	N = 8,021
Age, mean (SD), y		78 (7.3)	78 (7.3)	79 (7.5)	79 (7.6)
Gender *					
	Female	7,949 (94.4)	14,484 (94.6)	4,285 (94.0)	7,607 (94.8)
	Male	472 (5.6)	826 (5.4)	274 (6.0)	414 (5.2)
Race/ethnicity *					
	Black	279 (3.3)	448 (2.9)	172 (3.8)	233 (2.9)
	White	7,174 (85.2)	13,390 (87.5)	3,891 (85.4)	6,988 (87.1)
	Asian	541 (6.4)	861 (5.6)	257 (5.6)	451 (5.6)
	Hispanic	249 (3.0)	318 (2.1)	140 (3.1)	172 (2.1)
	Other	178 (2.1)	293 (1.9)	99 (2.2)	177 (2.2)
Geographic region *					
	Northeast	1,768 (21.0)	3,325 (21.7)	933 (20.5)	1,650 (20.6)
	Midwest	2,535 (30.1)	4,457 (29.1)	1,136 (24.9)	2,130 (26.6)
	South	2,518 (29.9)	4,575 (30.0)	1,737 (38.1)	2,806 (35.0)
	West	1,595 (18.9)	3,926 (19.1)	753 (16.5)	1,433 (17.9)
Median income *					
	0 - < 30,000	1,675 (19.9)	2,779 (18.2)	988 (21.7)	1,560 (19.5)
	30,000 - < 45,000	2,940 (35.0)	5,407 (35.5)	1,674 (36.8)	2,848 (35.7)
	45,000 - < 60,000	1,831 (21.8)	3,386 (22.2)	940 (20.7)	1,712 (21.4)
	60,000 - < 75,000	981 (11.7)	1,847 (12.1)	498 (11.0)	918 (11.5)
	75,000 +	973 (11.6)	1,832 (12.0)	447 (9.8)	950 (11.9)
Rural/urban *					
	Rural	2,782 (33.0)	5,237 (34.2)	1,638 (35.9)	2,810 (35.0)
	Urban	5,639 (67.0)	10,071 (65.8)	2,921 (64.1)	5,211 (65.0)
Medication possession ratio at follow-up start *					
	> 90%	4,476 (53.2)	8,349 (54.5)	2,380 (52.2)	4,399 (54.8)
	80% - 90%	3,945 (46.9)	6,961 (45.5)	2,179 (47.8)	3,622 (45.2)
Fracture during baseline *					
	Yes	216 (2.6)	383 (2.5)	107 (2.4)	184 (2.3)
	No	8,205 (92.4)	14,927 (97.5)	4,452 (97.6)	7,837 (97.7)

* Data displayed are number of beneficiaries (column %).

Table 2Alendronate Switching Patterns and Hazard Ratios for Discontinuation^{*} in 2007-2008

	Alendronate		Risedronate	
	2007 Cohort	2008 Cohort	2007 Cohort	2008 Cohort
	N = 8,421	N = 15,310	N = 4,559	N = 8,021
Medication status^{**}				
Stayed on branded product	7,557(89.7%)	1,409 (9.2%)	4,013 (88.0%)	6,301(78.6%)
Switched to generic		12,373 (80.8%)		808 (10.1%)
Switched to other bisphosphonates	216 (2.6%)	173 (1.1 %)	138 (3.0%)	184 (2.3%)
Discontinued bisphosphonates	648 (7.7%)	1,355 (8.9%)	408 (9.0%)	728 (9.1%)
Hazard ratio (95% CI) for discontinuation				
Crude	Ref	1.16(1.05-1.27)	Ref	1.01(0.89-1.14)
Adjusted [†]	Ref	1.15(1.05-1.26)	Ref	1.04(0.92-1.18)

* Discontinued was defined as no exposure in the last 90 days of follow-up.

** Data displayed under medication status are numbers of beneficiaries (column %)

[†] Adjusted for comorbidities, medications and dual eligible status. Comorbidities included glucocorticoid-related disease, bone disease, diabetes, renal disease, fall related conditions, depression, stroke, chronic obstructive pulmonary disease; medications included anticonvulsants, antidepressants, antipsychotics, antihypertensives, lipid-lowering drugs, nonsteroidal anti-inflammatory drugs, and steroids.

Table 3

Odds Ratios and 95% Confidence Intervals for Discontinuing Bisphosphonates, Continuing Branded Alendronate, and Switching to Other Branded Bisphosphonates versus Switching to Generic Alendronate Associated with Selected Variables in Alendronate 2008 Cohort Using Multinomial Regression

Parameter	Continuing branded alendronate vs. switching to generic alendronate OR (95% CI)	Discontinuing bisphosphonates vs. switching to generic alendronate OR (95% CI)	Switching to other branded bisphosphonates vs. switching to generic alendronate OR (95% CI)
Fosamax +D use at follow-up start			
No	Ref	Ref	Ref
Yes	49.30 (42.52-57.15)	2.58 (2.17-3.06)	10.59 (7.65-14.64)
Age			
65 70	Ref	Ref	Ref
70 75	1.05 (0.83-1.32)	0.89 (0.73-1.09)	0.92 (0.55-1.55)
75 80	1.13 (0.89-1.43)	0.91 (0.74-1.11)	0.88 (0.51-1.50)
80 85	1.13 (0.89-1.43)	0.91 (0.75-1.12)	0.86 (0.50-1.48)
85plus	0.98 (0.77-1.26)	1.05 (0.86-1.28)	1.19 (0.71-2.02)
Urban/rural			
Not urban core	Ref	Ref	Ref
Urban core	1.18(1.00-1.40)	1.22 (1.07-1.40)	1.75 (1.17 -2.64)
Race			
White	Ref	Ref	Ref
Black	0.98 (0.65-1.49)	1.14 (0.82-1.59)	0.71 (0.25-2.02)
Asian	0.68 (0.49-0.95)	0.55 (0.39-0.76)	1.61 (0.91-2.85)
Hispanic	1.01 (0.63-1.61)	0.76 (0.48-1.19)	1.89 (0.92-3.87)
Other	1.01 (0.62-1.63)	0.73 (0.46-1.17)	1.90 (0.84-4.32)
Gender			
Female	Ref	Ref	Ref
Male	1.03 (0.74-1.43)	1.27 (1.00-1.61)	1.52 (0.85-2.73)
Geographic region			
Northeast	Ref	Ref	Ref
Midwest	0.59 (0.48-0.73)	1.03 (0.88-1.23)	1.14 (0.69-1.88)
South	0.90 (0.74-1.08)	1.23 (1.04-1.45)	1.49 (0.94-2.35)
West	1.12 (0.90-1.39)	1.17 (0.97-1.41)	1.41 (0.86-2.30)
Median household income in the area of residence			
0 - < 30,000	Ref	Ref	Ref
30,000 - < 45,000	1.00 (0.82-1.23)	0.99 (0.83-1.17)	0.72 (0.48-1.10)
45,000 - < 60,000	1.17 (0.93-1.47)	1.05 (0.87-1.27)	0.64 (0.39-1.05)
60,000 - < 75,000	1.12 (0.85-1.46)	1.10 (0.88-1.37)	0.96 (0.57-1.63)
75,000+	1.40 (1.07-1.83)	1.20 (0.96-1.50)	0.72 (0.40-1.29)
Low income subsidy during baseline			
No	Ref	Ref	Ref
Yes	1.61 (1.12-2.32)	0.74 (0.54-1.01)	0.78 (0.33-1.82)

Note: Adjusted for comorbidities, medications and dual eligible status. Comorbidities included glucocorticoid-related disease, bone disease, diabetes, renal disease, fall related conditions, depression, stroke, chronic obstructive pulmonary disease; Medications included anticonvulsants, antidepressants, antipsychotics, antihypertensive, lipid-lowering drugs, nonsteroidal anti-inflammatory drugs, and steroids.