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Ethnic Disparities in Adherence to Antihypertensive Medications in Medicare Part D Beneficiaries

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Abstract

BACKGROUND—Nonadherence to antihypertensive medication is common and leads to adverse health outcomes. The Medicare Part D prescription drug program has decreased cost and increased access to medications, thus potentially improving medication adherence.

OBJECTIVES—To determine the level of adherence and characteristics of Part D beneficiaries associated with higher levels of antihypertensive medication adherence.

DESIGN—Retrospective analysis using Medicare claims and Part D event files for 2007.

PARTICIPANTS—Medicare Part D enrollees with prevalent uncomplicated hypertension who filled at least one antihypertensive prescription in 2006 and two prescriptions in 2007.

MEASUREMENTS—Medication adherence was defined by an average Medication Possession Ratio (MPR) of 80% or greater. Potential factors associated with adherence evaluated included age, sex, race/ethnicity, socioeconomic factors, comorbidity, medication use, copay, being in the coverage gap, and number of unique prescribers.

RESULTS—Among 168,522 Medicare Part D enrollees with prevalent uncomplicated hypertension receiving antihypertensive medicines in 2007, overall adherence was 79.5%. In univariate analysis, adherence varied significantly by most patient factors. In multivariable analysis, decreased odds of adherence persisted for blacks (OR 0.53, 95% CI 0.51–0.55), Hispanics (OR 0.58, 95% CI 0.55–0.61) and other non-white races (OR 0.80 95% CI 0.75–0.85) compared to whites. Increased comorbidity and concurrent medication use were also associated with reduced adherence. Adherence was significantly different across several geographic regions.

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CONCLUSION—We identified a number of associations with patient factors and medication adherence to antihypertensive drugs, with significant differences in adherence by ethnicity. Improving adherence could have significant public health implications and could improve outcomes specific to hypertension as well as improved cost and healthcare utilization.

Keywords

medication adherence; ethnic disparities; Medicare Part D

INTRODUCTION

Hypertension is a common chronic problem affecting older adults, and uncontrolled hypertension is largely asymptomatic. Poor antihypertensive medication adherence is prevalent, leading to failure to achieve blood pressure targets, exacerbations of disease, increased hospitalizations and emergency room visits, higher costs, and increased mortality.[1,2] Patient factors associated with antihypertensive nonadherence have been identified in studies using administrative claims data. These include demographic factors, size and complexity of medication regimen, comorbid illness, and cost.[3,4]

The Medicare Part D benefit, in effect since January 2006, provides all Medicare enrollees with potential coverage for drugs. Part D coverage has increased drug utilization while reducing cost to the patient.[5,6] While Part D coverage has been associated with reduced cost-related nonadherence in survey studies of Medicare beneficiaries,[7] few studies have used Part D event files to determine adherence rates to medications for chronic conditions.

Hypertension is more prevalent, more likely uncontrolled, and more commonly associated with adverse outcomes in blacks.[8] Prior studies have demonstrated reduced adherence in black persons compared to white persons with hypertension,[5,9,10] and reduced adherence for Hispanics compared to non-Hispanic whites.[11] Some potential reasons for these differences could be health beliefs, relationship with healthcare providers, or socioeconomic factors. However, there is evidence that ethnic differences in adherence may be due to cost, rather than other factors.[9] Improved access to medications, such as that afforded by the Part D program, could improve medication adherence and diminish differences in adherence,[12] including ethnic disparities, identified in previous studies. Our purpose was to determine current patient factors associated with medication adherence in Medicare Part D beneficiaries with hypertension.

METHODS

Data Sources

We used Medicare claims and Medicare Part D event files for a 5% sample of Medicare beneficiaries for 2006 and 2007. Beneficiaries are selected using the eighth and ninth digits of the health insurance claim number by the Centers for Medicare & Medicaid Services. Medicare denominator files were used for demographic factors, and diagnosis codes from outpatient visits were obtained from the outpatient statistical analysis files for Part B claims and carrier files for physician claims. Part D event files were used to determine medication use, including date, medication name, strength, quantity dispensed, days' supply, copay, cost, and de-identified prescriber information.

Study Subjects

We selected beneficiaries who were 66 years or older on January 1, 2007, to confirm medical conditions in 2006 claims files. We included those who had continuous Part A and

B coverage without HMO enrollment for all of 2006 and 2007, and who had prescription events in Part D files in 2006 and 2007 (n=319,359). We excluded persons with fewer than 12 months of Part D enrollment in 2007 (n=1111).

We selected persons with prevalent uncomplicated hypertension, defined as at least one outpatient claim from SAF or NCH in 2006 and at least one outpatient claim from SAF or NCH in 2007 for uncomplicated hypertension (401.xx)[13] and excluded those who had 2 or more claims for complicated hypertension (402.xx–405.xx, n=38,125). We excluded persons who were hospitalized or in a nursing home in 2007 (n=66,201). We also excluded residents of the US Territories or unknown residence (n=324).

We evaluated adherence to antihypertensive medications, including alpha-blockers, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), beta-blockers, calcium channel blockers, diuretics, and vasodilators. We included stable antihypertensive medication users, defined as persons with prevalent uncomplicated hypertension with at least one Part D event for any antihypertensive medication in 2006 and at least 2 events for the same antihypertensive medication in 2007. We excluded medications from the adherence calculation if there was a dosage change, i.e., only one claim for a specific dosage (n=206). Finally, we excluded persons whose adherence level was higher than 143% (n=2160), because this would require an unlikely situation of filling a 30-day prescription every 21 days. Our final population included 168,522 persons. The University of Texas MD Anderson Institutional Review Board approved this study.

Dependent Variable

Our primary outcome measure was antihypertensive medication adherence, using the average Medication Possession Ratio (MPR) per beneficiary. We calculated MPR for each antihypertensive medication per subject according to the following formula:

> MPR = (number of days' supply dispensed between the first and last fill dates – days' supply on last fill date) / number of days between the first and last fill dates.

We averaged all MPR values together for each antihypertensive medication for each beneficiary to generate the average MPR. We also calculated MPR for each therapeutic class of antihypertensive medication to report the average MPR in the most commonly used therapeutic classes. We defined adherent persons as those who had an average MPR of 80% or greater.[14]

Independent Variables

We evaluated demographic variables, including age, sex, and race/ethnicity as potential predictors of adherence. We included eligibility for the low-income subsidy. Geographic region was determined from beneficiaries' zip codes, which were linked with Census data to determine aggregate measures of socioeconomic status,[15] including percent with a high school education and median family income in the census tract. Comorbidity was determined using Elixhauser's index and expressed as the number of comorbidities in the index.[16] In addition, we ascertained whether a beneficiary had depression[17] or dementia,[18] as these conditions could be important predictors of adherence. We removed hypertension and depression from the total number of comorbidities according to Elixhauser's index. We determined the number of unique medications in 2007 for each beneficiary based on the unique generic name in PDE files. Copay was determined from PDE files for each blood pressure medication and for all medications for 2007. Persons who went into the coverage gap (the “doughnut hole”) were determined from the beneficiary phase variable in PDE files. The number of unique prescribers was determined from the unique identifier assigned to each prescriber in PDE files.

Statistical methods

We investigated the association of adherence (defined as average MPR 80% or greater) with patient factors, including demographic characteristics, socioeconomic status, comorbidity, number of medications, copay, entering the coverage gap, and number of unique prescribers. We first evaluated potential associations of patient factors with adherence using univariate logistic regression. In a multivariable logistic regression model we determined patient factors associated with the odds of being adherent. In the multivariable model, we included variables associated with adherence with a $P<0.1$ in univariate analyses. We included sex regardless of its significance in univariate analysis, as it is frequently related to adherence and could also relate to comorbidity and medication number. We explored education and income with quartile analysis and used the median as a cut off for high versus low in multivariable analysis. Although we used $P<0.05$ as a criterion for statistical significance in our models, given the sample size, we focused on the magnitude and clinical significance of our results. We used SAS version 9.2 for all analyses (SAS Institute, Cary, NC).

RESULTS

Of 168,522 Medicare beneficiaries with uncomplicated hypertension with blood pressure medications filled through the Medicare Part D program in 2007, 79.5% were adherent, with an average MPR of 80% or greater. Table 1 shows the characteristics of the study population. Table 2 shows the most commonly used therapeutic classes, with the frequency and average MPR for each class. Beta blockers and diuretics were the most commonly prescribed drugs, with a higher average MPR for beta blockers. Combinations between diuretics and ACE inhibitors or ARBs were also common, with a higher average MPR than diuretics alone.

Results for univariate and multivariate analysis of the odds of adherence are shown in Table 3. All characteristics were significantly associated with adherence in univariate analysis except for sex and having a diagnosis of dementia. In unadjusted analyses, the average MPR was 81.5% for whites, 67.8% for blacks, 69.3% for Hispanics, and 77.1% for other ethnicities. In the multivariable model, age and sex were not predictive of adherence. Blacks had 47% lower odds of adherence and Hispanics had 42% lower odds of adherence compared to whites. Significant differences existed across geographic regions as well. Having higher numbers of comorbid conditions, higher numbers of medications, and higher numbers of unique prescribers were associated with decreased odds of adherence.

Due to the fact that persons who went into the gap had higher adherence, we performed a sensitivity analysis including only persons who had at least 9 months of prescription data (270 days between the first and last fill dates for any blood pressure medication), and found <10% difference in the coefficient estimates between the two models. We also investigated the use of cumulative cost instead of total copay as a predictor of adherence, and found similar results. We conducted a separate multivariable analysis in which we excluded persons who went into the coverage gap in 2007, and found <10% difference in the coefficient estimates between models for adherence. Due to unexpected geographic differences in adherence, we re-evaluated adherence in a multilevel model including patient factors and unique hospital referral region (HRR). We did not find substantial variability attributable to the level of the HRR (data not shown).

DISCUSSION

We found generally high levels of adherence to antihypertensive medications among Medicare Part D beneficiaries. Predictors of lower adherence included non-white race and

higher comorbidity, as well as increasing medication number, and higher numbers of unique prescribers. We also found significant regional differences in medication adherence.

Our results indicate that while Part D enrollees have high adherence, there are still substantial ethnic disparities that exist. Persons at higher risk of nonadherence remain those who have higher medical complexity – greater comorbidity and higher medication number. In addition, having a higher number of prescribers was associated with lower adherence, suggesting that fragmentation of care might be an important predictor. Such patients might be appropriate to target for systematic screening of nonadherence by primary care physicians prior to adding or changing medication.

Similar to our findings, in a study of Medicare Advantage enrollees, obtaining Part D coverage was associated with a 13.5% increase in medication adherence to an average of 78% for persons with hypertension.[20] In a study of Part D beneficiaries with diabetes mellitus, adherence rates were considerably lower than those in our study, with 59.2% of persons taking an ACEI or ARB having good adherence.[21] However, adherence was defined by proportion of days covered (PDC), in which the days of observation in the denominator for the adherence calculation was a fixed value independent of prescription fill dates, which tends to estimate a lower adherence than MPR.[22]

Prior studies using claims data have shown racial and ethnic differences in antihypertensive medication adherence. Blacks were 38% more likely and Hispanics were 45 % more likely to be nonadherent to an ACEI or ARB compared to whites.[21] For first-fill nonadherence, compared to non-Hispanic whites, Hispanics had an odds ratio for nonadherence of 1.74 (95% CI 1.20–2.52) and other races had an odds ratio of 1.87 (95% CI 1.28–2.72).[23] A VA study showed that black patients were less adherent than white patients to antihypertensives, but this difference was among those younger than 55 years.[24] In the context of prior studies, our findings have significant clinical and policy implications. Improving access to medications and reducing cost by providing Part D coverage may not adequately reduce ethnic disparities in medication adherence.

Other studies of healthcare provision have demonstrated regional differences in care and in outcomes, for example, coronary artery disease, cerebrovascular disease, and diabetes. A study of VA patients taking insulin or oral hypoglycemic showed significant racial, rural/urban, and regional variation in medication adherence, with differences in MPR of around 2% across different geographic regions.[25] Regional differences from this study should be followed up to determine whether this represents systematic differences in care or a spurious finding.

While copay and the coverage gap were not primary interests of our study, we found that higher cumulative copay and entering the gap both were associated with increased adherence. Nonadherent persons who permanently switch or discontinue a medication may have a higher MPR than persons who have poor adherence but continued intermittent medication use. Persons who pay higher copays will enter the gap sooner, at which point medications may be changed as well. Other studies of Part D enrollees using different methods, including the use of survey data, have shown reduction in costs and increased drug utilization as a result of part D.[26,27] In addition, studies have demonstrated that going into the coverage gap results in less adherence and switching to less expensive drug classes.[28,29]

A strength of our study is the evaluation of adherence in fee-for-service Medicare beneficiaries. Other studies evaluating adherence and Part D have used Medicare Advantage data, which may have different plan benefits, premiums, and copays that impact adherence. In addition, studies that have evaluated cost-related nonadherence have used survey data,

which may be helpful in estimating the effect of cost, but less helpful in evaluating adherence.

There are a number of limitations of our study. First, we cannot determine whether stopping medication is intentional on the part of a patient, and whether nonadherence may have resulted from a prescriber's instructions. Our study sample was derived from a select group with stable, uncomplicated hypertension. We did not include nursing home residents whose adherence might be affected by nursing staff medication administration. Similarly, we excluded hospitalized persons because we could not account for the many events affecting adherence during hospitalization. Our measure of MPR may overestimate adherence, as we are unable to account for medication discontinuation. In addition, medication use data in the doughnut hole may be unreliable due to inconsistent data transmission. Loss of data could also occur for participants in cash-only discount programs, such as Walmart's or Target's $4 prescription program. Finally, we did not determine whether access to pharmacies or type of pharmacy was associated with adherence. The use of retail as opposed to mail order pharmacies for 90-day prescriptions has been shown to increase adherence.[30]

The implications of our findings are that non-white racial and ethnic groups had lower adherence levels, suggesting that unmeasured barriers need to be overcome to improve medication use in these populations. In addition, patients who have hypertension who also have high levels of comorbidity and concurrent medication use may need tailored interventions to assess and improve adherence. The finding that adherence varied significantly by geographic region is interesting and should be investigated further. Whether adherence correlates with clinical outcomes such as hospitalization and increased healthcare utilization is unknown for this population. Additionally, the accepted threshold of 80% adherence should be reexamined to determine whether this is the actual threshold at which clinical outcomes related to hypertension worsen for the Part D population. The role of the healthcare provider in adherence is also of interest. Persons with higher numbers of providers were less likely to be adherent, and the specialty and practice characteristics of providers could help guide interventions to improve antihypertensive adherence at the patient level.

Our study identified a number of persistent associations between patient factors and medication adherence to antihypertensive drugs. Improving adherence could have significant public health implications and could improve outcomes specific to hypertension as well as improved cost and healthcare utilization.

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Table 1

Characteristics of the Sample of 168,522 Part D Beneficiaries with Uncomplicated Hypertension and Percent Adherent to Antihypertensive Medication

Variable	Category	Number (%)
Age in years, mean (median, min-max)		76.1 (75.0,66–107)
Sex	Female	116942 (69.4%)
Race/Ethnicity	Non-hispanic white	137981 (81.9%)
	Black	14249 (8.5%)
	Hispanic	9656 (5.7%)
	American Indian/ Alaskan Native	563 (0.3%)
	Asian/ Pacific Islander	4950 (2.9%)
	Other	882 (0.5%)
	Unknown	241 (0.1%)
Low Income Subsidy		40741 (24.2%)
Division[†]	East North Central	27970 (16.6%)
	East South Central	13688 (8.1%)
	Middle Atlantic	20407 (12.1%)
	Mountain	7189 (4.3%)
	New England	10079 (6%)
	Pacific	17964 (10.7%)
	South Atlantic	35746 (21.2%)
	West North Central	17192 (10.2%)
	West South Central	18287 (10.9%)
Percent in Census Tract with <12 Years	0 – 12.2	41473 (25.3%)
Education	12.2–18.6	40877 (24.9%)
	18.6–27.1	40786 (24.9%)
	27.1+	40712 (24.8%)
Median Family Income in Census Tract	0–31,000	36229 (22.1%)
	31,000–38,000	42412 (25.9%)
	38,000–49,000	42033 (25.7%)
	49,000+	43187 (26.4%)
Number of Comorbidities (excluding hypertension and depression)	0–1 comorbidity	77996 (46.3%)
	2–3 comorbidities	61405 (36.4%)
	4+ comorbidity	29121 (17.3%)
Diagnosis of Depression		13495 (8.0%)
Diagnosis of Dementia		8451 (5.0%)
Number of Medications, mean (range)		8.9 (1–52)
Total Copay in 2007 in US dollars, mean (+/− SD)		$626.90 (+/− $801.5)
In Coverage Gap in 2007		60476 (35.9%)
Number of Unique Prescribers in 2007, mean (min-max)		3.1 (+/−2.0)

[†]Based on US Census Divisions[19] : East North Central: Indiana, Illinois, Michigan, Ohio, and Wisconsin; East South Central: Alabama, Kentucky, Mississippi, and Tennessee; Middle Atlantic: New Jersey, New York, and Pennsylvania; Mountain: Arizona, Colorado, Idaho, New Mexico, Montana, Utah, Nevada, and Wyoming; New England: Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, and Vermont;

Pacific: Alaska, California, Hawaii, Oregon, and Washington; South Atlantic: Delaware, District of Columbia, Florida, Georgia, Maryland, North Carolina, South Carolina, Virginia, and West Virginia; West North Central: Iowa, Nebraska, Kansas, North Dakota, Minnesota, South Dakota, and Missouri; West South Central: Arkansas, Louisiana, Oklahoma, and Texas

Table 2

Adherence Level in the Most Commonly Used Therapeutic Classes of Antihypertensive Medications

Therapeutic Class	Percent of Population Taking Medication	Average MPR†
Beta blockers	44.4%	90.2%
Diuretics	40.4%	86.3%
ACE Inhibitors	33.4%	91.5%
Calcium channel blockers	31.9%	92.5%
ARBs	15.6%	90.5%
ARB/Diuretic	10.9%	89.2%
ACE Inhibitor/Diuretic	6.3%	91.4%

† Average MPR = (number of days' supply dispensed between the first and last fill dates – days' supply on the last fill date) / number of days between the first and last fill dates.

Table 3

Unadjusted and Adjusted Odds of Adherence (MPR ≥80%) to Antihypertensive Medication[†]

Characteristic	Unadjusted Odds Ratio (95% Confidence Interval)	Adjusted Odds Ratio[*] (95% Confidence Interval)
Age (5-year increase)	**1.02 (1.01–1.03)**	1.01 (1.00–1.02)
Sex (female vs. male)	0.99 (0.96–1.01)	1.00 (0.97–1.02)
Race (White used as reference)		
Black	**0.48 (0.46–0.50)**	**0.53 (0.51–0.55)**
Hispanic	**0.51 (0.49–0.54)**	**0.58 (0.55–0.61)**
Other	**0.76 (0.72–0.81)**	**0.80 (0.75–0.85)**
Low Income Subsidy	**0.77 (0.75–0.79)**	**1.09 (1.05–1.13)**
Division (West South used as reference)		
East North Central	**1.47 (1.40–1.54)**	**1.31 (1.25–1.37)**
East South Central	**1.10 (1.04–1.15)**	1.03 (0.98–1.09)
Middle Atlantic	**1.32 (1.26–1.39)**	**1.23 (1.17–1.29)**
Mountain	**1.15 (1.08–1.23)**	1.04 (0.97–1.11)
New England	**1.58 (1.48–1.68)**	**1.40 (1.31–1.49)**
Pacific	**1.06 (1.01–1.11)**	1.01 (0.96–1.07)
South Atlantic	**1.14 (1.10–1.19)**	**1.10 (1.06–1.15)**
West North Central	**1.72 (1.63–1.81)**	**1.50 (1.42–1.59)**
Percent with High School Education (high vs. low)	**0.78 (0.76–0.80)**	**0.93 (0.91–0.96)**
Median Family Income (high vs. low)	**1.19 (1.17–1.22)**	1.03 (1.00–1.06)
Comorbidity (0–1 conditions as referencce)		
2 to 3 conditions	**0.94 (0.92–0.97)**	**0.90 (0.88–0.93)**
4 or more conditions	**0.78 (0.76–0.80)**	**0.78 (0.75–0.80)**
Depression	**0.92 (0.88–0.96)**	**0.88 (0.86–0.90)**
Dementia	0.97 (0.92–1.03)	—
Number of Medications (5+ vs. 1–4)	0.97 (0.94–1.00)	**0.91 (0.87–0.94)**
Total Copay (increase in increments of$200)	**1.06 (1.06–1.07)**	**1.04 (1.03–1.04)**
In the Coverage Gap in 2007	**1.50 (1.46–1.53)**	**1.53 (1.48–1.58)**
Number of Unique Prescribers (3+vs. 0–2)	**0.94 (0.91–0.96)**	**0.88 (0.86–0.90)**

[†] Statistically significant results shown in bold.

[*] adjusted for all other variables in the table