

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

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

DESIGN: Retrospective cohort study.

SETTING: Medicare claims and Part D event files.

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 as an average medication possession ratio of 80% or greater. Potential factors associated with adherence evaluated were age, sex, race or ethnicity, socioeconomic factors, comorbidity, medication use, copayments, being in the coverage gap, and number of unique prescribers.

RESULTS: Overall adherence was 79.5% of 168,522 Medicare Part D enrollees with prevalent uncomplicated hypertension receiving antihypertensive medicines in 2007. In univariate analysis, adherence varied significantly according to most patient factors. In multivariable analysis, lower odds of adherence persisted for blacks (odds ratio (OR)0.53, 95% confidence interval (CI)0.510.55), Hispanics (OR0.58, 95% CI0.550.61), and other non-white races (OR0.80 95% CI0.750.85) than for whites. Greater comorbidity and concurrent medication use were also associated with poorer adherence. Adherence was significantly different across several geographic regions.

CONCLUSION: A number of associations were identified between patient factors and adherence to antihypertensive drugs, with significant differences in adherence according to ethnicity. Improving adherence could have significant public health implications and could improve outcomes specific to hypertension, as well as improving cost and healthcare utilization. *J Am Geriatr Soc* 60:1298–1303, 2012.

Key words: medication adherence; ethnic disparities; Medicare Part D

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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, hospitalizations and emergency department visits, higher costs, and mortality.^{1,2} Factors associated with antihypertensive nonadherence have been identified in studies using administrative claims data and 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 use while reducing costs to the beneficiary.^{5,6} Although Part D coverage has been associated with lower 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 to be uncontrolled, and more commonly associated with adverse outcomes in blacks.⁸ Prior studies have demonstrated, in persons with hypertension, poorer adherence in blacks than whites^{5,9,10} and poorer adherence in Hispanics than non-Hispanic whites.¹¹ Some potential reasons for these differences could be health beliefs, relationship with

healthcare providers, and socioeconomic factors, but there is evidence that ethnic differences in adherence may be due to cost, rather than other factors.⁹ Better access to medications, such as the Part D program affords, could improve medication adherence and diminish differences in adherence,¹² including ethnic disparities, identified in previous studies. The purpose of the current study was to determine current patient factors associated with medication adherence in Medicare Part D beneficiaries with hypertension.

METHODS

Data Sources

Medicare claims and Medicare Part D event files for a 5% sample of Medicare beneficiaries for 2006 and 2007 were used. The Centers for Medicare and Medicaid Services selected beneficiaries using the eighth and ninth digits of the health insurance claim number. 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 (PDE) files were used to determine medication use, including date, medication name, strength, quantity dispensed, days' supply, copayment, cost, and de-identified prescriber information.

Study Subjects

Beneficiaries aged 66 and older on January 1, 2007, were selected to confirm medical conditions in 2006 claims files. Beneficiaries who had continuous Part A and B coverage without health maintenance organization enrollment for all of 2006 and 2007 and who had prescription events in PDE files in 2006 and 2007 were included (n319,359). Persons with fewer than 12 months of Part D enrollment in 2007 were excluded (n1,111).

Persons with prevalent uncomplicated hypertension, defined as at least one outpatient claim from the Standard Analytical Files (SAF) or National Claims History (NCH) in 2006 and at least one outpatient claim from SAF or NCH in 2007 for uncomplicated hypertension (401.xx),¹³ were selected, and those who had two or more claims for complicated hypertension (402.xx405.xx, n38,125) were excluded. Persons who were hospitalized or in a nursing home in 2007 were excluded (n66,201), as were residents of the U.S. Territories or unknown residence (n324).

Adherence to antihypertensive medications, including alpha-blockers, angiotensin-converting enzyme (ACE) inhibitors, angiotensin receptor blockers (ARBs), beta-blockers, calcium channel blockers, diuretics, and vasodilators was evaluated. 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 two events for the same antihypertensive medication in 2007 were included. Medications were excluded from the adherence calculation if there was a dosage change (only one claim for a specific dosage (n206)). Finally, persons whose adherence level was higher than 143% (n2,160) were excluded because this would require an unlikely situation of filling a 30-day prescription every 21 days. The final population

included 168,522 persons. The University of Texas MD Anderson institutional review board approved this study.

Dependent Variable

The primary outcome measure was antihypertensive medication adherence, using the average medication possession ratio (MPR) per beneficiary. MPR was calculated for each antihypertensive medication for each participant according to the following formula:

$$\text{MPR} = \frac{\text{number of days' supply dispensed between the first and last fill dates}}{\text{days' supply on last fill date}} / \text{number of days between the first and last fill dates.}$$

All MPR values were averaged for each antihypertensive medication for each beneficiary to generate the average MPR. MPR was also calculated for each therapeutic class of antihypertensive medication to report the average MPR in the most commonly used therapeutic classes. Adherent persons were defined as those who had an average MPR of 80% or greater.¹⁴

Independent Variables

Demographic variables, including age, sex, and race or ethnicity, were evaluated as potential predictors of adherence. Eligibility for the low-income subsidy was included. Geographic region was determined from beneficiaries' ZIP codes, which were linked with census data to determine aggregate measures of socioeconomic status,¹⁵ including percentage with a high school education and median family income in the census tract. Comorbidity was determined using the Elixhauser index and expressed as the number of comorbidities in the index.¹⁶ In addition, whether a beneficiary had depression¹⁷ or dementia¹⁸ was ascertained, because these conditions could be important predictors of adherence. Hypertension and depression were removed from the total number of comorbidities according to the Elixhauser index. The number of unique medications in 2007 was determined for each beneficiary based on the unique generic name in PDE files. Copayment was determined from PDE files for each blood pressure medication and for all medications for 2007. Persons who entered 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

The association between adherence (defined as average MPR80%) and patient factors, including demographic characteristics, socioeconomic status, comorbidity, number of medications, copayment, entering the coverage gap, and number of unique prescribers, was investigated. Potential associations between patient factors and adherence were first evaluated using univariate logistic regression. In a multivariable logistic regression model, patient factors associated with the odds of being adherent were determined. Variables associated with adherence with $P < .1$ in the multivariable model were included in univariate analyses. Sex was included regardless of its significance in univariate analysis, because it is frequently related to

adherence and could also be related to comorbidity and medication number. Education and income were explored using quartile analysis, and the median was used as a cut-off for high versus low in multivariable analysis. Although $P < .05$ was used as a criterion for statistical significance in the models, given the sample size, the magnitude and clinical significance of the results were focused on. SAS version 9.2 was used for all analyses (SAS Institute, Inc., 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 of 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 than whites, and Hispanics had 42% lower odds of adherence than whites. Significant differences existed across geographic regions as well. Having more comorbid conditions, more medications, and more unique prescribers were associated with lower odds of adherence.

Because persons who entered the gap had greater adherence, a sensitivity analysis was performed 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 a less than 10% difference was found in the coefficient estimates between the two models. The use of cumulative cost instead of total copayment was also investigated as a predictor of adherence, and similar results were found. A separate multivariable analysis was conducted in which persons who entered the coverage gap in 2007 were excluded, and a less than 10% difference was found in the coefficient estimates between models for adherence. Because of unexpected geographic differences in adherence, adherence was reevaluated in a multilevel model including participant factors and unique hospital referral region (HRR). No substantial variability attributable to the level of the HRR was found (data not shown).

DISCUSSION

Generally high levels of adherence to antihypertensive medications were found in Medicare Part D beneficiaries. Predictors of lower adherence included nonwhite race, greater comorbidity, more medications, and more unique

Table 1. Characteristics of the Sample of 168,522 Part D Beneficiaries with Uncomplicated Hypertension and Adherence to Antihypertensive Medication

Characteristic	Value
Age, mean, median (range)	76.1, 75.0 (66 107)
Sex, n (%)	116,942 (69.4)
Race or ethnicity, n (%)	
Non-Hispanic white	137,981 (81.9)
Black	14,249 (8.5)
Hispanic	9,656 (5.7)
American Indian/Alaskan Native	563 (0.3)
Asian/Pacific Islander	4,950 (2.9)
Other	882 (0.5)
Unknown	241 (0.1)
Low-income subsidy, n (%)	40,741 (24.2)
Division, n (%) ^a	
East North Central	27,970 (16.6)
East South Central	13,688 (8.1)
Middle Atlantic	20,407 (12.1)
Mountain	7,189 (4.3)
New England	10,079 (6)
Pacific	17,964 (10.7)
South Atlantic	35,746 (21.2)
West North Central	17,192 (10.2)
West South Central	18,287 (10.9)
Percentage in census tract with <12 years education, n (%)	
<12.2	41,473 (25.3)
12.2 18.5	40,877 (24.9)
18.6 27.0	40,786 (24.9)
27.1	40,712 (24.8)
Median family income in census tract, \$, n (%)	
<31,000	36,229 (22.1)
31,000 37,999	42,412 (25.9)
38,000 48,999	42,033 (25.7)
49,000	43,187 (26.4)
Number of comorbidities (excluding hypertension and depression), n (%)	
0 1	77,996 (46.3)
2 3	61,405 (36.4)
4	29,121 (17.3)
Diagnosis of depression, n (%)	13,495 (8.0)
Diagnosis of dementia, n (%)	8,451 (5.0)
Number of medications, mean (range)	8.9 (152)
Total copayment in 2007, \$, meanSD	626.90801.5
In coverage gap in 2007, n (%)	60,476 (35.9)
Number of unique prescribers in 2007, meanSD	3.12.0

^a Based on U.S. 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. SD standard deviation.

prescribers. Significant regional differences in medication adherence were also found.

These results indicate that, although Part D enrollees have high adherence, substantial ethnic disparities exist. Persons at higher risk of nonadherence are those who have higher medical complexity—greater comorbidity and more

Table2. Adherence Level in the Most Commonly Used Therapeutic Classes of Antihypertensive Medications

Therapeutic Class	Population Taking Medication,%	Average Medication Possession Ratio ^a
Beta-blocker	44.4	90.2
Diuretic	40.4	86.3
ACE inhibitor	33.4	91.5
Calcium channel blocker	31.9	92.5
ARB	15.6	90.5
ARB and diuretic	10.9	89.2
ACE inhibitor and diuretic	6.3	91.4

^a (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.

ACE=angiotensin-converting enzyme; ARB=angiotensin receptor blocker.

Table3. Adherence (Medication Possession Ratio 80%) to Antihypertensive Medication

Characteristic	Odds Ratio (95% Confidence Interval)	
	Unadjusted	Adjusted ^a
Age (5-year increase)	1.02 (1.011.03)	1.01 (1.001.02)
Sex (female vs male)	0.99 (0.961.01)	1.00 (0.971.02)
Race (reference white)		
Black	0.48 (0.460.50)	0.53 (0.510.55)
Hispanic	0.51 (0.490.54)	0.58 (0.550.61)
Other	0.76 (0.720.81)	0.80 (0.750.85)
Low-income subsidy	0.77 (0.750.79)	1.09 (1.051.13)
Division (reference West South)		
East North Central	1.47 (1.401.54)	1.31 (1.251.37)
East South Central	1.10 (1.041.15)	1.03 (0.981.09)
Middle Atlantic	1.32 (1.261.39)	1.23 (1.171.29)
Mountain	1.15 (1.081.23)	1.04 (0.971.11)
New England	1.58 (1.481.68)	1.40 (1.311.49)
Pacific	1.06 (1.011.11)	1.01 (0.961.07)
South Atlantic	1.14 (1.101.19)	1.10 (1.061.15)
West North Central	1.72 (1.631.81)	1.50 (1.421.59)
Percentage with high school education (high vs low)	0.78 (0.760.80)	0.93 (0.910.96)
Median family income (high vs low)	1.19 (1.171.22)	1.03 (1.001.06)
Comorbidity (reference 1 conditions)		
23 conditions	0.94 (0.920.97)	0.90 (0.880.93)
4 conditions	0.78 (0.760.80)	0.78 (0.750.80)
Depression	0.92 (0.880.96)	0.88 (0.860.90)
Dementia	0.97 (0.921.03)	—
Number of medications (5 vs 14)	0.97 (0.941.00)	0.91 (0.870.94)
Total copayment (increase in increments of \$200)	1.06 (1.061.07)	1.04 (1.031.04)
In the coverage gap in 2007	1.50 (1.461.53)	1.53 (1.481.58)
Number of unique prescribers (3 vs <2)	0.94 (0.910.96)	0.88 (0.860.90)

Statistically significant results shown in bold.

^a Adjusted for all other variables in the table.

medications. In addition, having more prescribers was associated with lower adherence, suggesting that fragmentation of care might be an important predictor. Such individuals might be appropriate to target for systematic screening of nonadherence by primary care physicians before adding or changing medications.

Similar to these 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 in our study, with 59.2% of persons taking an ACE inhibitor or ARB having good adherence,²¹ but adherence was defined according to proportion of days covered, 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 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 45% more likely to be nonadherent to an ACE inhibitor or ARB than whites.²¹ For first-fill nonadherence, compared with non-Hispanic whites, Hispanics had an OR for nonadherence of 1.74 (95% CI 1.202.52) and other races had an OR of 1.87 (95% CI 1.282.72).²³ A Department of Veterans Affairs study showed that black veterans were less adherent than white veterans to antihypertensives, but this difference was in participants younger than 55.²⁴ In the context of prior studies, the findings of the current study 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, in the quality of care for coronary artery disease, cerebrovascular disease, and diabetes mellitus. A study of veterans taking insulin or oral hypoglycemic medications showed significant racial, rural versus urban, and regional variation in medication adherence, with differences in MPR of approximately 2% between 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.

Although copayment and the coverage gap were not primary interests of the study, higher cumulative copayment and entering the gap were associated with greater 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 copayments 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 greater drug utilization as a result of part D.^{26,27} In addition, studies have demonstrated that entering the coverage gap results in less adherence and switching to less-expensive drug classes.^{28,29}

A strength of the current 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 copayments that affect 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 this study. First, whether stopping medication was intentional on the part of an individual and whether nonadherence may have resulted from a prescriber's instructions could not be determined. The study sample was derived from a select group with stable, uncomplicated hypertension. Nursing home residents, whose adherence nursing staff medication administration might affect, were not included. Similarly, hospitalized persons were excluded because the many events affecting adherence during hospitalization could not be accounted for. The measure of MPR may overestimate adherence, because it was not possible to account for medication discontinuation. In addition, medication use data in the doughnut hole may be unreliable because of 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, whether access to pharmacies or type of pharmacy was associated with adherence was not determined. The use of retail pharmacies as opposed to mail order for 90-day prescriptions has been shown to increase adherence.³⁰

The implications of these findings are that nonwhite 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, individuals who have hypertension who also have high levels of comorbidity and concurrent medication use may need customized interventions to assess and improve adherence. The finding that adherence varied significantly according to geographic region is interesting and should be investigated further. Whether adherence correlates with clinical outcomes such as hospitalization and greater healthcare use 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 more 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.

This 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 decreasing costs and increasing healthcare use.

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