ACE Inhibitor and ARB Medication Use among Medicaid Enrollees with Diabetes

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Objective: To examine ace-inhibitor (ACEI) and angiotensin receptor blockers (ARB) prescription and adherence patterns by race in diabetic public aid recipients.

Design, Participants, and Measures: We analyzed prescription records of 27,529 adults aged 18–64 with diabetes who had at least one clinical indication for receiving an ACEI/ARB prescription and were enrolled in the State of Illinois public aid program during 2007. We calculated proportion of days covered (PDC) to assess adherence. Multivariate models adjusted for age, sex, ACEI/ARB indication, and any significant interaction terms.

Results: Only 47.4% of individuals with at least one indication for ACEI/ARB had filled an ACEI/ARB prescription. African American men were more likely than Caucasian men to ever fill an ACEI/ARB prescription (adjusted odds ratio, [AOR] [95% CI] 1.69 [1.55–1.83]). Hispanic English and Spanish speaking men were also more likely than Caucasian men to ever fill an ACEI/ARB prescription (AOR [95% CI] 1.37 [1.16–1.62] and 1.27 [1.05–1.53], respectively). Similarly, African American and Hispanic English and Spanish speaking women were more likely than Caucasian women to ever fill an ACEI/ARB prescription (AOR [95% CI] 1.70 [1.59–1.81], 1.55 (1.36–1.76), and 1.98 (1.73–2.28), respectively. However, African Americans and Hispanics were less likely than Caucasians to achieve a PDC≥80%. Compared to Caucasians, Hispanic Spanish speakers were the least likely to be adherent (AOR [95% CI] .49 [.41–.58]). Furthermore, older individuals were more likely to achieve a PDC≥80% than younger individuals.

Conclusion: African Americans and Hispanics with diabetes receiving public aid in Illinois were more likely than Caucasians to have filled at least one ACEI/ARB prescription. However, they were less adherent with these medications. Future studies should assess barriers to medication adherence in this population. (*Ethn Dis*. 2013;23[2]:189–195)

Key Words: ACE inhibitor, angiotensin receptor blockers, diabetes

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Introduction

Diabetes currently affects more than 26 million Americans[1] and is the leading cause of kidney failure in the United States, accounting for almost 45% of new cases of end stage renal disease (ESRD) in 2007.[2] Diabetes disproportionately impacts African Americans and Hispanics with an age-adjusted prevalence of 11.0% and 10.7%, respectively, compared to 7.0% in Caucasians.[3] Hispanics also have a higher age-adjusted incidence rate of diabetes compared to African American and Caucasians (11.5 vs 8.0 and 8.0, respectively).[3] Furthermore, ethnic minorities have higher rates of diabetic complications compared to Caucasians.[4,5] In particular, the rate of ESRD is almost three times higher in African Americans and Hispanics.[6] The reasons behind these racial differences in ESRD are not fully understood, but may involve complex factors including socioeconomic status, access to care, disease management and other behavioral and genetic factors.[7]

Angiotensin converting enzyme inhibitors (ACEI) and angiotensin receptor blockers (ARB) have well-documented effects in delaying the progression of diabetic kidney disease and decreasing proteinuria in both type 1 and type 2 diabetes.[8–13] For this reason, the American Diabetes Association clinical practice guidelines recommend that pharmacologic therapy for patients with diabetes and hypertension include an ACEI/ARB.[14] Despite these known benefits, inadequate numbers of persons with clinical indications for ACEI/ARB use these agents. For example, in a survey of 742 older adults with diabetes, only 43% received ACEI/ARB medication, though an estimated 92% had guideline indications for such therapy.[15] Given the beneficial effects of ACEI/ARB use on delaying the progression of ESRD, the unequal rates of ESRD diagnoses among racial and ethnic minority groups may in part be due to variability by ethnicity in the use of ACEI/ARB.

It has been widely established that minorities receive fewer and lower quality services compared to Caucasians.[16,17] African American and Hispanic Medicare beneficiaries aged ≥65 use 10% to 40% fewer medications than Caucasians with the same illnesses.[16] These findings suggest that inadequate medication use may contribute to differences in diabetic outcomes. A review of patients with diabetes enrolled in the Kaiser Permanente Northern California Diabetes registry showed no significant difference in the rate of ACEI/ARB use among different ethnic groups.[18] However, among high-risk groups, African Americans with albuminuria were less likely to be prescribed an ACEI/ARB. It remains unclear what racial differences exist in ACE-inhibitor and ARB use between different ethnic groups, particularly among public aid populations.

We examined ACEI/ARB prescription and adherence patterns by race and age in diabetic patients enrolled in the State of Illinois public aid program during 2007.

The use of medications requires both prescriptions by providers as well as adherence by patients. Therefore, disparities in diabetic outcomes by ethnic group may be related to either prescribers' under-prescribing ACEI/ARB or patients' failure to fill these medications. We examined ACEI/ARB prescription and adherence patterns by race and age in diabetic patients enrolled in the State of Illinois public aid program during 2007. Since, primary Spanish language is a potential barrier to adequate care in Hispanics and may represent a contributing cause of disparities in Hispanics with CKD,[19] we examined differences in ACEI/ARB use in Hispanics by primary language. We also investigated differences between young and middle-aged adults in adherence, as adherence often increases with age.[20]

METHODS

Using claim data, we identified 147,234 patients with diabetes, determined by The International Classification of Diseases, 9th Revision (ICD-9) code 250.xx, and enrolled in the State of Illinois public aid program during 2006 or 2007. We restricted our analysis to 39,226 individuals aged 18–64 who were public aid eligible for all 365 days of the fiscal year. We identified 27,529 individuals who had indications for ACEI/ARB use, including hypertension (ICD-9 401.XX; 405.XX; 997.91, v81.1), hypertensive heart disease (402.XX); heart failure (428.XX), coronary artery disease (414.XX; 412.0), kidney disease (294.4; 403.X; 404.X; 250.4; 585.X; 586; 583.9), and albuminuria (791.0). We excluded individuals aged >65 because these enrollees become eligible for Medicare and billing data were incomplete for these individuals.

The Illinois Department of Health and Family Services utilized the following racial categories: Caucasian, African American, Hispanic, Asian American, Pacific Islander, Native American, and other. Furthermore, Hispanic individuals were identified as Spanish-speaking and non-Spanish-speaking based on their reported language preference on public aid enrollment.

We generated a list of brand-name and generic ACEI/ARB medications available in the United States. The Illinois public aid preferred drug list provided a list of formulary antihypertensive medications.[21] We also generated a list of non-preferred agents.[22] We created an ACEI/ARB proportion of days covered (PDC) variable based on the prescriptions filled in 2007; the variable is the proportion of days in the measurement period covered by prescription claims for the same medication or another in its therapeutic category.[23–25] The PDC calculation assumes that patients are taking the medication as prescribed and that any prescription fill falling completely within the time period of interest is fully utilized by the patient. Any medication fills whose coverage falls outside of this time period is truncated at the completion of the period, thus precluding a fill at the end of the study from falsely elevating the PDC. The first prescription fill of 2007 was designated as the start date for the PDC time interval. In these analyses, patients who attained an ACEI/ARB PDC of .80 or greater were considered adherent.

ANALYSIS

Statistical analyses were performed using the statistical programming SAS (version 9.2, SAS Institute, Inc., Cary, NC). Basic descriptive statistics (mean ± standard deviation and %) were reported. Logistic regression models were used to evaluate associations between race and ACEI/ARB use and age and ACEI/ARB use. Models were constructed for two dependent variables: 1) at least one prescription fill for ACEI/ARB; and 2) ACEI/ARB adherence with PDC of .80 or higher. Independent variables included in the logistic regression analysis were race, age, sex, and indication for ACEI/ARB. Race was our primary risk factor. Therefore, we also tested for two-way interaction between race and sex and race and age for both outcomes. The interaction terms were kept in the model if the *P* of interaction terms was less than .05. The LOGISTIC procedure was mainly used for the analysis.

RESULTS

Group Characteristics

A total of 27,529 individuals were included for analyses (Table 1). Caucasians comprised 39.7%, African Americans 48.6%, English-speaking Hispanics 6.4%, and Spanish-speaking Hispanics 5.3%. Including all racial groups, 47.4% of the cohort had filled at least one prescription for an ACEI or ARB. For ACEI/ARB indication, 58.6% of individuals had hypertension, 6.0% had hypertensive heart disease, 12.4% had coronary artery disease, 10.7% had heart failure, and 12.3% had kidney disease.

Test for Interaction

We found a positive interaction between race and sex for the outcome filling at least one ACEI/ARB prescription (P=.0010). There was no interaction between race and sex for the outcome achieving a PDC≥80%.

There was no interaction between age and race for either outcome.

Filling at Least One ACEI/ARB Prescription

Table 2 shows the characteristics of individuals by ACEI/ARB prescription status. Compared to individuals who filled at least one ACEI/ARB prescription, individuals who did not fill at least one prescription were 40.2% male, $P<.0001$. Additionally, there were differences in racial and age distributions by ACEI/ARB filling status ($P<.0001$). Table 3 shows the odds ratio for filling at least one ACEI/ARB prescription. Compared to Caucasian men, minority men were significantly more likely to fill an ACEI/ARB prescription. Similar differences were observed among women. Compared to Caucasian women, African American and Hispanic English- and Spanish-speaking women were more likely to fill an ACEI/ARB prescription (Adjusted Odds Ratio [AOR] [95% CI] 1.70 [1.59–1.81], 1.55 [1.36–1.76], and 1.98 [1.73–2.28], respectively). Additionally, the odds of filling an ACEI/ARB prescription increased for each advancing age category. Individuals aged 50–64 had the highest odds of filling at least one ACEI/ARB prescription compared to individuals aged 19–29 (AOR [95% CI] 1.80 [1.52–2.13]).

ACEI/ARB Adherence (PDC ≥ to 80%)

Table 4 shows characteristics of individuals by PDC status. We observed differences in age and racial distribution by PDC status ($P<.0001$). African Americans, Hispanic English-speakers and Hispanic Spanish-speakers were all significantly less likely to achieve a PDC≥80% compared to Caucasians (Table 5). Hispanic Spanish speakers had the lowest likelihood of achieving a PDC≥80% (AOR [95% CI] .49 [.41–.58]). Furthermore, the odds of attaining a PDC>80% were higher with each advancing age category, although these differences were statistically significant only for individuals aged 40–49 and 50–64 compared to individuals aged 18–29 (AOR [95% CI] 1.78 [1.33– 2.40] and 2.57 [1.92–3.43], respectively).

Table 1. Characteristics of Illinois adult public aid beneficiaries with diabetes ages 18–64 (*N*=27,529)

Variable	*n* (%)
Race	
Caucasian	10,925 (39.7)
African American	13,388 (48.6)
Hispanic	
English speaking	1,770 (6.4)
Spanish speaking	1,446 (5.3)
Age	
18–29	627 (2.3)
30–39	2,208 (8.0)
40–49	6,544 (23.8)
50–64	18,150 (65.9)
Sex,	
Male	10,590 (38.5)
Female	16,939 (61.5)
At least one ACE-I or ARB prescription fill	
Yes	13,052 (47.4)
No	14,477 (52.6)
Indications for ACEI/ARB[a]	
Hypertension	16,130 (58.6)
Hypertensive heart disease	1,646 (6.0)
Coronary artery disease	3,420 (12.4)
Heart failure	2,941 (10.7)
Kidney disease	3,392 (12.3)

[a] Individuals can have one or more indication for ACEI/ARB.

DISCUSSION

Our study found that African American and Hispanic public aid recipients with diabetes aged 18–64 were more

Table 2. Characteristics of adult Illinois public aid beneficiaries with diabetes, aged 18-64 by ACEI/ARB prescription status (*N*= 27,529)

	Filled ≥1 ACEI/ARB	No fills of ACEI/ARB	
	n (%)	*n* (%)	*P*
Race (%)			<.0001
Caucasian	4,333 (33.2)	6,592 (45.5)	
African American	7,066 (54.1)	6,322 (43.7)	
Hispanic			
English speaking	870 (6.7)	900 (6.2)	
Spanish speaking	783 (6.0)	663 (4.6)	
Age			<.0001
18–29	223 (1.7)	404 (2.8)	
30–29	990 (7.6)	1,218 (8.4)	
40–49	2,992 (22.9)	3,552 (24.54)	
50–64	8,847 (67.8)	9,303 (64.3)	
Sex			<.0001
Male	4,775 (36.6)	5,815 (40.2)	
Female	8,277 (63.4)	8,662 (59.8)	

Our study found that African American and Hispanic public aid recipients with diabetes aged 18–64 were more likely than Caucasians to have received at least one prescription for ACEI/ARB medication in Illinois.

likely than Caucasians to have received at least one prescription for ACEI/ARB medication in Illinois. However, Caucasians were more likely to be adherent over a one-year period than either minority group. These findings remained significant despite adjustment for age and sex. This suggests that ACEI/ARB underuse among minority groups is less likely related to provider prescription behaviors. Instead, underuse may more likely be attributable to adherence-related individual factors of public aid enrollees (though providers likely indirectly influence patient behavior).[26]

Differences in adherence levels by ethnicity have been identified in other population studies. For example, among Veterans from six Western VA medical centers where medication access is comparable, African Americans were less adherent to antihypertensives than Caucasians.[27] Another study of Medicaid enrollees with diabetes showed African Americans had lower adherence rates to hypoglycemic medications than Caucasians.[28] However, relationships between adherence and ethnicity are likely more complicated, as other studies have shown mixed results that vary among study populations.[29,30]

Contributing reasons for differences in medications adherence may include cost, beliefs towards medication therapy, medication regimen complexity, as well as others.[31,32] In this population, cost-related non-adherence is unlikely to explain these differences as enrollees have comparable income levels and co-pay options. We considered beliefs toward medication therapy to be a potential contributor to these findings. For example, African Americans may express greater reluctance in increasing therapy complexity[33] and concern for medication harmfulness.[34] Alternatively, differences in adherence may reflect low levels of health literacy in minority populations, especially among Spanish-speaking Hispanics.[35] Although evidence suggests that lower health literacy reduces adherence levels,[36,37] our results did not incorporate differences in education level or health literacy. Other unmeasured factors, such as depression, may further contribute to lower adherence rates.[38]

Table 3. The odds of filling at least one ACEI/ARB[a]

	OR (95% CI)
Men	
Caucasian	1.00
African American	1.69 (1.55–1.83)
Hispanic	
English speaking	1.37 (1.16–1.62)
Spanish speaking	1.27 (1.05–1.53)
Women	
Caucasian	1.00
African American	1.70 (1.59–1.81)
Hispanic	
English speaking	1.55 (1.36–1.76)
Spanish speaking	1.98 (1.73–2.28)
Age	
18–29	1.00
30–39	1.47 (1.22–1.77)
40–49	1.57 (1.32–1.86)
50–64	1.80 (1.52–2.13)

[a]Adjusted for age, sex, age x sex, and indication for ACEI/ARB.

Table 4. Characteristics of adult Illinois public aid beneficiaries with diabetes ages 18-64 by PDC>80% status (*N*=12,160)

	PDC≥80%	PDC <80%	
	n (%)	*n* (%)	*P*
Race (%)			<.0001
Caucasian	3,099 (38.2)	1,016 (25.1)	
African American	4,060 (50.0)	2,463 (60.9)	
Hispanic			
English speaking	516 (6.4)	282 (7.0)	
Spanish speaking	448 (5.5)	282 (7.0)	
Age			<.0001
18–29	93 (1.1)	101 (2.5)	
30–29	464 (5.7)	419 (10.4)	
40–49	1,701 (20.9)	1,030 (25.5)	
50–64	5,865 (72.2)	2,493 (61.7)	
Sex			.11
Male	2,999 (36.9)	1,433 (35.4)	
Female	5,124 (63.1)	2,610 (64.6)	

Table 5. The Odds of Achieving a PDC >80%[a]

	OR (95% CI)
Race	
Caucasian	1.00
African American	.55 (.50–.60)
Hispanic	
English speaking	.64 (.54–.75)
Spanish speaking	.49 (.41–.58)
Age	
18–29	1.00
30–29	1.20 (.88–1.65)
40–49	1.78 (1.33–2.40)
50–64	2.57 (1.92–3.43)

[a]Adjusted for age, sex, and indication for ACEI/ARB.

One other explanation for these findings may relate to continuity of care of enrollees. In a related study of statin use, follow-up visits with a provider who wrote an initial prescription for the statin predicted continued future therapy and adherence with less gaps in use.[39] When race is considered, minority groups are less likely than Caucasians to see the same provider on an ongoing basis and receive consistent care.[40–42] Individuals seeing different providers and receiving more episodic rather than scheduled care may demonstrate inconsistent medication use or inadequate refilling of medication. In our study, individuals initially prescribed ACEI/ARB therapy by a provider may not have returned to see the same provider for refills, but instead saw different providers. This may have resulted in inconsistent refill patterns and lower proportions of days covered, though frequency of provider visits may be comparable or greater. Previously, we included provider visits in separate models to reflect ambulatory care utilization (unpublished). However, this variable did not explain differences by ethnic group. Furthermore, we did not have data to identify the number of different providers seen by individual Medicaid enrollees. Thus, we were unable to assess the impact of continuity of care. Future investigation of similar data will be important for comparison, as most enrollees now participate in Illinois Health Connect, where primary care providers are routinely identified for their medical homes.[43]

Preference for Spanish language was a significant factor for non-adherence among Hispanics. Other investigators have demonstrated Hispanics with established cardiovascular risk factors who speak Spanish at home have worse control of cardiovascular risk factors.[44] Differences in medication adherence among Hispanics may contribute to differences in health outcomes. We believe that a language barrier might reduce the ability to understand prescription instructions and navigate the health system for chronic care management. The language barrier effects vary greatly depending on factors such as patient-provider language concordance.[45]

In contrast with adherence, we found that African Americans and Hispanics were more likely to fill at least one prescription for ACEI/ARB. This is similar to another study of hypertensive patients from 62 practices in the Southeastern United States where African Americans received more antihypertensive medications than Caucasians including ACEI/ARB.[46] In contrast, another study conducted in a managed care population with diabetes showed no differences by race or ethnicity.[15] Of note, this population had a higher overall rate of ACE inhibitor and ARB use (59–63%, and included only seniors) compared with our public aid study (47% adults aged <65). Overall, the lower use of ACEI/ARB medication remains less than desired for those with diabetes.

We also found differences in adherence to ACEI/ARB by age. Other studies including older age groups have shown similar associations between older age and adherence in diabetes, hypertension, hyperlipidemia, and stroke.[20,47–49] An analysis of individuals with diabetes enrolled in Medicare Part D demonstrated that age<65 predicted non-adherence to oral hypoglycemic, ACEI/ARB, and statin medications ($P<.001$).[20] Furthermore, evaluation of post-discharge medication adherence among patients with cardiovascular disease showed a 1% absolute increase in adherence for every 10-year increase in age.[50] Possible explanations for lower adherence among younger individuals include less experience with medication use, lack of knowledge regarding diabetic complications or a false sense of imperviousness to these complications, and an increased number of responsibilities that interfere with medication adherence, such as work and childcare.[49–51]

There is a clear need to improve ACEI/ARB adherence for low-income minority populations. Provider efforts should consider ways to address negative beliefs that may deter consistent use of antihypertensive medications. Recruiting social support may be an effective strategy, such as through community health workers.[52,53] Efforts to improve literacy ratings on medication bottles are ongoing.[54] Case management approaches and medication therapy management (MTM) clinics are becoming more prevalent in addressing medication use and adherence.

There are a number of limitations to acknowledge. First, our claims data reflect medications filled by pharmacies, but do not reflect actual medication use by enrollees. We did not capture prescriptions created by providers (that

remained unfilled), as well as medications filled but not taken. Second, our co-morbid condition diagnoses provided a general direction for ACEI/ARB indication, however, diagnosis claims data are variable in the database and limit accuracy. For example, providers rarely consistently code encounters with diagnoses of proteinuria. Also, we lacked information on other confounding variables that influenced adherence, such as income, education, health literacy level and depression. Thirdly, we were unable to consider relative or absolute contraindications for ACEI/ARB (eg, angioedema, cough, hyperkalemia). The risk of angioedema is known to be greater among African Americans, however, the absolute risk remains low.[55] Lastly, these findings are limited to public aid enrollees in Illinois and may not be generalizable to other populations and regions of the United States.

In summary, African American and Hispanics with diabetes receiving public aid in Illinois were more likely than Caucasians to have ever filled ACEI/ARB medication, but less adherent over the course of one year. Strengths of this study include a large sample size of public aid enrollees, significant representation of minority groups, and estimation of adherence based on medication fill claims. Future studies should further evaluate the factors that may explain these racial differences in adherence and the clinical implications.

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