

# Use and costs of ACEIs, ARBs, and Renin Inhibitors in U.S. adult dialysis patients with Medicare Part D in 2007

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## Introduction

- Use of angiotensin-converting enzyme inhibitors (ACEIs) and angiotensin receptor blockers (ARBs) in dialysis patients was associated with improved survival and reduced cardiovascular (CV) morbidity in several small, open-label randomized clinical trials.
- Despite the need for large, well-designed trials to confirm these findings, use of ACEIs and ARBs is likely widespread, as suggested by studies predating the advent of the Medicare Part D drug benefit.
- Because the majority of US dialysis patients have Medicare coverage (and Part D eligibility), analyses of drug use in Part D-enrolled patients likely well-characterizes current practice patterns.
- We investigated the prevalence of ACEI, ARB, and renin inhibitor (RI) use in Medicare dialysis patients, along with the relative odds of use for demographic and clinical variables.
- We also estimated related patient and Medicare costs.

## Methods

- From USRDS data, we identified point-prevalent, adult (≥18 years) dialysis patients, alive on January 1, 2007.

## Methods (cont'd)

- We further required both survival and continuous dialysis therapy during all of 2007.
- In patients with Medicare as primary payer, we defined CV conditions and procedures from ICD-9-CM codes on Medicare claims: atrial fibrillation (A-fib), acute myocardial infarction (AMI), congestive heart failure (CHF), cerebrovascular accident or transient ischemic attack (CVA/TIA), peripheral arterial disease (PAD), percutaneous coronary intervention (PCI), and coronary artery bypass graft (CABG).
- Data were linked with 2007 Part D enrollment and drug event data from the CMS' Chronic Condition Warehouse.
- Patients with continuous enrollment in either a standalone or Medicare Advantage Part D plan during all of 2007 were retained.
- We analyzed drug event data for ACEIs, ARBs, and RIs, as identified by National Drug Codes in the First DataBank drug database.
- We used logistic regression to estimate odds ratios of ACEI and ARB use, adjusted for demographics, ESRD network, CV comorbidity, and low-income subsidy (LIS) status.
- We calculated out-of-pocket (OOP) costs per user and gross drug costs per member per month (PMPM).

## Results

- The cohort of adult dialysis patients with continuous Part D coverage in 2007 (n=168,055) was 42% black and 48% female, with mean age 59.6 yr and mean ESRD duration 4.3 yr.
- ACEI use predominated over ARBs, and RI were rarely used in 2007 (Table 1).
- Use of ACEIs was highest in patients of age < 65 years; in blacks, American Indians, and Alaska Natives; and in those in dialysis organizations (Table 1).
- Use of ARBs was highest in females and Asian/Pacific Isl's (Table 1).
- Use of ACEIs and ARBs was higher in patients with DM or hypertension as primary ESRD cause, and in those receiving LIS (Table 1).
- RIs were infrequently used (0.2%).
- There was considerable variation in crude use across ESRD Networks: ACEIs: from 30.3% to 42.8%; ARBs: from 16.3% to 27.0%.
- The odds of receiving an ACEI or an ARB varied considerably across the Networks, even after adjustment for demographics, CV comorbidity, and LIS status (Figures 1 and 2).
- Patients with CHF, CVA/TIA, CABG or PCI had higher adjusted odds of receiving an ACEI or ARB than those without these conditions or procedures (Figures 3 and 4).

Table 1. Prevalence of use (≥ 1 prescription) of ACEIs, ARBs, and RIs within demographic, dialysis provider, and low income subsidy (LIS) strata

	N	% ACEI	% ARB	% ACEI or ARB	% RI
<b>Age</b>					
18-44 yr	29,664	38.4	18.9	50.5	0.239
45-64 yr	68,020	38.8	20.7	52.6	0.225
65-74 yr	39,879	36.8	21.3	51.4	0.243
75+ yr	30,492	31.6	19.3	45.8	0.184
<b>Race</b>					
White	85,069	35.6	19.3	48.9	0.223
Black	71,135	38.6	20.4	52.1	0.218
Am. Indian/ Alaska Native	2,664	40.6	15.5	50.6	0.075
Asian/Pacific Isl.	7,827	34.7	30.4	57.2	0.371
Other or unk.	1,360	39.4	24.6	55.8	0.074
<b>Sex</b>					
Men	87,249	37.4	17.8	49.3	0.186
Women	80,806	36.5	22.9	52.2	0.266
<b>Primary ESRD cause</b>					
Diabetes	72,821	39.8	22.6	55.1	0.216
Hypertension	48,708	36.9	19.9	50.5	0.298
Glomeruloneph.	18,878	34.2	18.7	47.0	0.207
Cystic kidney	4,103	31.4	17.4	43.5	0.219
Other or unk.	23,545	31.4	15.3	41.9	0.115
<b>ESRD duration</b>					
< 0.5 yr	15,005	37.8	21.5	52.2	0.213
0.5-0.9 yr	18,637	38.3	20.9	52.2	0.241
1.0-1.9 yr	29,900	37.6	21.0	51.7	0.221
≥ 2.0 yr	104,513	36.4	19.7	50.0	0.195
<b>Dialysis unit affiliation</b>					
LDO	97,519	38.4	20.3	51.9	0.259
SDO	9,913	37.0	21.9	52.2	0.182
Hospital-based	26,994	34.2	18.5	47.3	0.111
Independent	25,692	35.6	22.1	50.6	0.261
<b>Dialysis unit profit status</b>					
For-profit	120,106	37.7	20.9	51.8	0.258
Not-for-profit	35,867	36.1	19.4	49.5	0.153
<b>Dialysis unit size</b>					
Quartile 1	15,058	35.8	18.9	48.6	0.199
Quartile 2	25,043	37.0	19.8	50.1	0.264
Quartile 3	42,195	37.4	20.3	51.1	0.223
Quartile 4	77,822	37.2	20.9	51.6	0.229
<b>Low income subsidy (LIS)</b>					
No LIS	45,698	31.9	17.8	44.9	0.153
LIS	122,357	38.8	21.2	52.9	0.251

Figure 1. Adjusted odds ratios of ACEI use across ESRD Networks (referent: Network 18, So. CA)

Figure 2. Adjusted odds ratios of ARB use across ESRD Networks (referent: Network 18, So. CA)

Figure 3. Adjusted odds ratios of ACEI use for cardiovascular conditions and procedures (present vs. not)

Figure 4. Adjusted odds ratios of ARB use for cardiovascular conditions and procedures (present vs. not)

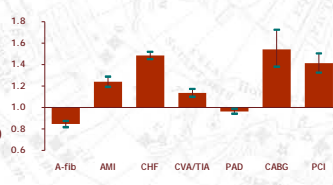
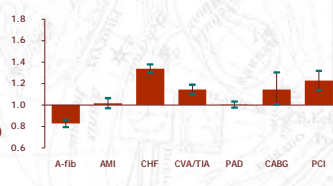
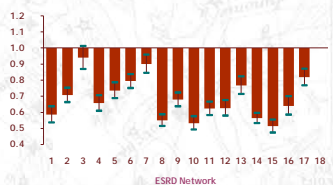
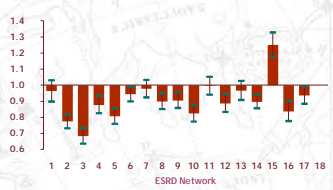


Figure 5. Distribution of use of individual ACEI agents

Figure 6. Distribution of use of individual ARB agents

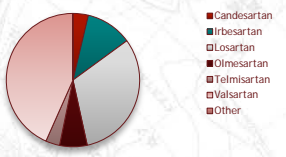
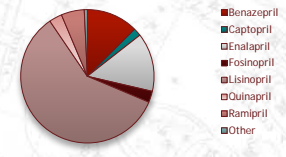
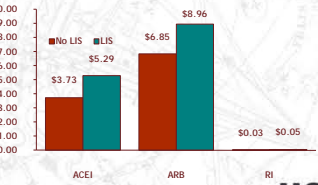
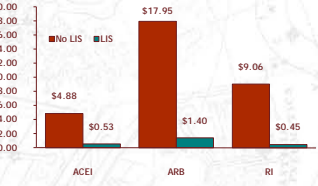


Figure 7. Out of pocket costs per user per month, stratified by LIS status

Figure 8. Gross costs per member per month, stratified by LIS status



## Results (cont'd)

- Lisinopril was the predominant ACEI, and losartan and valsartan were the predominant ARBs in use (Figures 5 and 6).
- OOP costs per user per month for ARBs were about 3 to 4 times greater than corresponding OOP costs for ACEIs (Figure 7).
- Gross drug costs PMPM for both ACEIs and ARBs were roughly 30% to 40% higher in patients receiving LIS than in patients not receiving LIS (Figure 8).

## Conclusions

- ACEIs were used more commonly than ARBs in dialysis patients with Part D.
- OOP costs for ARBs were more than three times the OOP costs for ACEIs, although generic ARBs were not available in 2007.
- Large variability was observed in the use of ACEIs and ARBs across ESRD networks, despite adjustment. Use may be influenced by particular Part D plan characteristics in each Network.
- Renin inhibitors were not widely used, but aliskiren was only approved in March 2007.
- Further research will examine other factors that impact use and variation in use of these agents in dialysis pts.