

Association of VA Payment Reform for Dialysis with Spending, Access to Care and Outcomes for Veterans with End-Stage Kidney Disease

Supplemental Materials

Supplemental Materials: Table of Contents

Supplemental Figure 1. Timeline of VA policy implementation

Supplemental Figure 2. CONSORT diagram of patient cohort

Supplemental Table 1. Full set of baseline characteristics of Veterans receiving at least one dialysis treatment through VA-financed Community Care dialysis (n=24,870)

Supplemental Materials: Technical specification of regression specification and full model results

Supplemental Table 2. Policy intervention and mean total payment for VA Community Care dialysis* (n=7,368,282 claims)

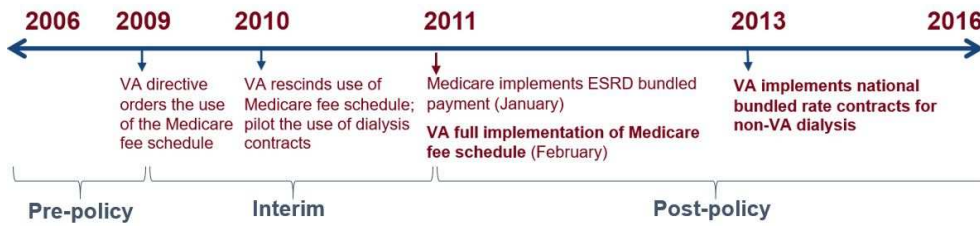
Supplemental Table 3. Policy intervention and supply at VA region-Quarter level: Number of participating VA Community Care dialysis facilities* (n=901 VA region-quarters)

Supplemental Table 4. Veterans' VA Community Care Dialysis Facilities' Quality Indicators* (n=4,784 VAMC quarters)

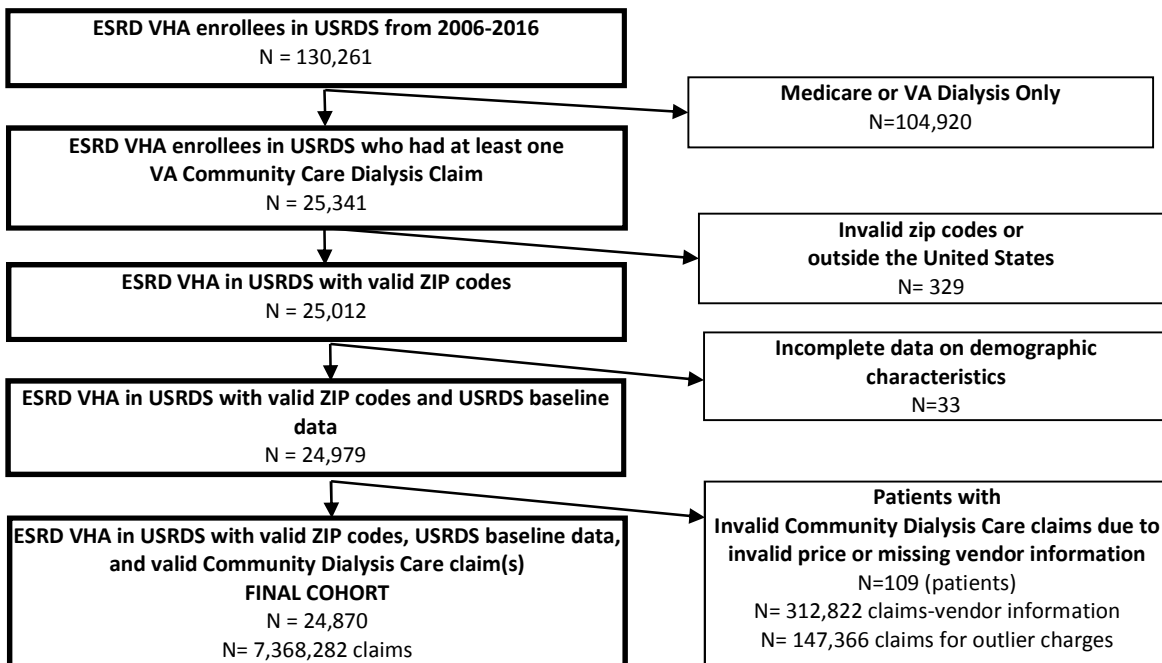
Supplemental Table 5. Policy intervention and Veterans' median distance from home (miles) to participating VA Community Care dialysis facility (n=7,261,246 claims)

Supplemental Table 6. One-year mortality for Veterans receiving at least one VA Community Care Dialysis Treatment+ (n=22,262 Veterans)

Supplemental Figure 1. Timeline of VA policy implementation



Supplemental Figure 2. STROBE Figure of Patient Cohort



Supplemental Table 1. Full set of baseline characteristics of Veterans receiving at least one dialysis treatment through VA-financed community-based dialysis (n=24,870)

	Pre-Period 2006-2008 n=6240		Interim Period 2009-2010 n=5409		Post Period 2011-2016 n=13221		Total n=24870		P Value ⁺
	mean	sd	mean	sd	mean	sd	mean	sd	
Age	63	10.97	64.12	10.63	65.23	10.25	64.43	10.56	<0.0001
Gagne Comorbidity Score*	2.65	2.13	2.78	2.23	3.21	2.36	2.97	2.29	<0.0001
Mortality Score~	0.11	0.07	0.11	0.07	0.11	0.07	0.11	0.07	0.1996
	Freq	%	Freq	%	Freq	%	Freq	%	
Male	6139	98.38	5301	98.00	12893	97.52	24333	97.84	<0.0001
Race									0.039
White, non-Hispanic	3505	56.17	3011	55.67	7564	57.21	14080	56.61	
Black	2108	33.78	1813	33.52	4327	32.73	8248	33.16	
Hispanic	483	7.74	466	8.62	1036	7.84	1985	7.98	
Other	144	2.31	119	2.20	294	2.22	557	2.24	
Insurance ^{a,c}									
Medicaid	817	13.09	731	13.51	1823	13.79	3371	13.55	0.459
Medicare	5007	80.24	4354	80.50	11198	84.70	20559	82.67	<0.0001
Employer-Based	572	9.17	387	7.15	666	5.04	1625	6.53	<0.0001
Other	1073	17.20	946	17.49	2586	19.56	4605	18.52	<0.0001
VHA Reliance									
No VA	354	5.67	260	4.81	367	2.78	981	23.48	<0.0001
0-50%	673	10.79	586	10.83	1455	11.01	2714	10.91	
>50%	5213	83.54	4563	84.36	11399	86.22	21175	85.14	
Distance from home to nearest VAMC with outpatient dialysis ≤30 miles	2814	45.10	2450	45.29	5684	42.99	10948	44.02	0.001
eGFR									<0.0001
<10	2800	44.87	2118	39.16	5660	42.81	10578	42.53	
10 to 15	2625	42.07	2371	43.83	5395	40.81	10391	41.78	

>15	815	13.06	920	17.01	2166	16.38	3901	15.69	
BMI									<0.0001
<18.5	183	2.93	144	2.66	322	2.44	649	2.61	
18.5-24	1780	28.53	1399	25.86	3448	26.08	6627	26.65	
25-29	2015	32.29	1606	29.69	3852	29.14	7473	30.05	
>29	2262	36.25	2260	41.78	5599	42.35	10121	40.70	
Primary Cause									<0.0001
Diabetes	3237	51.88	2756	50.95	6627	50.12	12620	50.74	
Hypertension	1595	25.56	1459	26.97	3687	27.89	6741	27.10	
Glomerulonephritis	481	7.71	389	7.19	833	6.30	1703	6.85	
Other/Uncertain	927	14.86	805	14.88	2074	15.69	3806	15.30	
Prior healthcare utilization (1-year prior to dialysis initiation) <small>a,b,c</small>									
Previous Nephrology Care	4094	65.61	3441	63.62	8449	63.91	15984	64.27	0.057
Previous Kidney Transplant	579	9.28	365	6.75	352	2.66	1296	5.21	<0.0001
Hospitalization	3013	92.90	3304	92.01	16385	89.04	22702	89.97	<0.0001
Institutionalization	147	2.36	157	2.90	569	4.30	873	3.51	<0.0001
Hospice	13	0.21	18	0.33	40	0.30	71	0.29	0.394
First Access Type									<0.0001
Arterial venous fistula/graft	1596	25.58	1359	25.12	3377	25.54	6332	25.46	
Catheter	4274	68.49	3761	69.53	8781	66.42	16816	67.62	
Other/Uncertain	370	5.93	289	5.34	1063	8.04	1722	6.92	
PTSD	390	6.25	384	7.10	1169	8.84	1943	7.81	<0.0001
Severe Mental Illness [^]	158	2.53	159	2.94	439	3.32	756	3.04	0.002
Depression	861	13.80	918	16.97	2608	19.73	4387	17.64	<0.0001
Employment status ^a :									<0.0001
Full/part time	559	8.96	388	7.17	809	6.12	1756	7.06	
Retired	4575	73.32	4029	74.49	9860	74.58	18464	74.24	
Not employed	1065	17.07	954	17.64	2259	17.09	4278	17.20	
<i>missing</i>	41	0.66	38	0.70	293	2.22	372	1.50	

Urban residence ^{a,b}	5437	87.13	4762	88.04	11641	88.05	21840	87.82	0.161
US Region ^{a,b} :									<0.0001
Midwest	1342	21.51	1121	20.72	2507	18.96	4970	19.98	
Northeast	616	9.87	427	7.89	1137	8.60	2180	8.77	
South	3010	48.24	2688	49.69	6899	52.18	12597	50.65	
West	1272	20.38	1173	21.69	2678	20.26	5123	20.60	
Comorbid condition ^{a,b,c} :									
Diabetes	4073	65.27	3691	68.24	9342	70.66	17106	68.78	<0.0001
Hypertension	6002	96.19	5207	96.27	12903	97.59	24112	96.95	<0.0001
CHF	1770	28.37	1532	28.32	3682	27.85	6984	28.08	0.685
COPD	1318	21.12	1283	23.72	3735	28.25	6336	25.48	<0.0001
PVD	1049	16.81	900	16.64	2140	16.19	4089	16.44	0.497
Mental health	1494	23.94	1436	26.55	3961	29.96	6891	27.71	<0.0001
Anemia	2693	43.16	2488	46.00	6949	52.56	12130	48.77	<0.0001
Arrhythmias	729	11.68	854	15.79	2969	22.46	4552	18.30	<0.0001
Cerebrovascular disease	951	15.24	913	16.88	2442	18.47	4306	17.31	<0.0001
Coagulopathy	154	2.47	260	4.81	890	6.73	1304	5.24	<0.0001
Dementia	25	0.40	49	0.91	202	1.53	276	1.11	<0.0001
HIV	84	1.35	52	0.96	158	1.20	294	1.18	0.156
Ischemic heart disease	1409	22.58	1128	20.85	2378	17.99	4915	19.76	<0.0001
Liver or mild liver disease	422	6.76	444	8.21	1426	10.79	2292	9.22	<0.0001
Metastatic cancer	31	0.50	43	0.79	141	1.07	215	0.86	<0.0001
Other cancer/any tumor	785	12.58	824	15.23	2152	16.28	3761	15.12	<0.0001
Myocardial infarction	280	4.49	282	5.21	1014	7.67	1576	6.34	<0.0001
Other neurological disorders	245	3.93	378	6.99	1475	11.16	2098	8.44	<0.0001
Paralysis	137	2.20	137	2.53	461	3.49	735	2.96	<0.0001
Pulmonary-circulatory disorder	0	0.00	1	0.02	2	0.02	3	0.01	0.594
Rheumatoid disease	65	1.04	74	1.37	221	1.67	360	1.45	0.002
Hypothyroidism	476	7.63	479	8.86	1493	11.29	2448	9.84	<0.0001

Ulcer disease	24	0.38	25	0.46	108	0.82	157	0.63	<0.0001
Valvular disease	368	5.90	430	7.95	1613	12.20	2411	9.69	<0.0001
Weight loss	21	0.34	30	0.55	194	1.47	245	0.99	<0.0001
Inability to ambulate/transfer	302	4.84	259	4.79	643	4.86	1204	4.84	<0.0001
Amputation	281	4.50	226	4.18	562	4.25	1069	4.30	0.638

*P value resulting from T-test or Chi Square between the pre and post period groups

*Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

^Bipolar Disorder or Schizophrenia

~predicted risk of death within one year of starting dialysis

Supplemental Materials: Technical specification of regression specification and full model results

We first define our primary empirical model. Let y denote a generic outcome, $t = 1$ to 44 denote the quarters from quarter 1 of 2006 through quarter 4 of 2016. In addition, t_1 and t_2 are time trends defined below:

- $t_1 = t$ if $t \leq 20$ and $t_1 = 0$ otherwise. Similarly, $t_2 = t$ if $t > 20$ and $t_2 = 0$ if $t \leq 20$. We note that the variable t_1 is called Pre-policy time and the variable t_2 is called Post-policy time in the results presented below.
- Int_{2011q1} if an indicator variable equal to 1 if $t \geq 21$ (corresponding to the first quarter of 2011) and X_i denote individual specific covariates.

All our regression results presented below and the rest of the paper stem from the following basic regression model.

$$y_{it} = \alpha_0 + \alpha_1 t_1 + \alpha_2 t_2 + \alpha_3 Int_{2011q1} + \alpha_4 X_i + u_{it}$$

In addition to the aforementioned model includes fixed effects (indicator variables for all quarters 2-44), and all standard errors are clustered within an individual. Although alternate specifications of the model were tried (including one that included just a single overall time trend and one that included a separate indicator shift in the fourth quarter of 2013 (corresponding to the introduction of the national dialysis contracts), we found this specification best fit the graph in Figure 1. More specifically, our regression specification was driven by the observed plot in Figure 1 which exhibited a change (reduction) in the mean and also a slight change in the trend beginning in the first quarter of 2011.

Supplemental Table 2. Policy intervention and mean total payment for VA Community Care dialysis* (n=7,368,282 claims)

Supplemental Table 3. Policy intervention and supply at VA region-Quarter level: Number of participating VA Community Care dialysis facilities* (n=901 VA region-quarters)

Supplemental Table 4. Veterans' VA Community Care Dialysis Facilities' Quality Indicators* (n=4,784 VAMC quarters)

Supplemental Table 5. Policy intervention and Veterans' median distance from home (miles) to participating VA Community Care dialysis facility (n=7,261,246 claims)

Supplemental Table 6. One-year mortality for Veterans receiving at least one VA Community Care Dialysis Treatment* (n=22,262 Veterans)

Supplemental Table 2. Policy intervention and mean total payment for VA Community Care dialysis* (n=7,368,282 claims)

	Estimate	CI	
Shift in intercept in post-policy period	-197.07	-210.02	-184.11
Pre-policy time	13.20	12.01	14.39
Post-policy time	-2.70	-2.88	-2.51
<i>Covariates</i>			
Age	0.09	-0.21	0.40
Gagne Comorbidity Score*	1.88	0.51	3.25
Mortality Score~	0.09	-60.43	60.62
Male	14.72	0.99	28.46
Race			
White, non-Hispanic vs. Black	5.43	-0.59	11.46
White, non-Hispanic vs. Hispanic	-9.83	-17.20	-2.46
White, non-Hispanic vs. Other	-11.32	-25.03	2.40
Medicaid	1.20	-4.94	7.35
VHA Reliance			
No VA vs 0-50%	2.05	-10.81	14.92
No VA vs >50%	0.65	-9.65	10.95
Distance from home to nearest VA outpatient dialysis ≤30 miles	6.19	0.79	11.60
eGFR			
<10 vs. 10-14	2.04	-2.83	6.91
<10 vs. >15	4.19	-4.21	12.58
BMI			
>29 vs. <18.5	-13.65	-18.91	-8.38
>29 vs. 18.5-24	-14.78	-20.43	-9.14
>29 vs. 25-29	-7.09	-21.78	7.60
Primary Cause			
Diabetes vs. Hypertension	-2.12	-7.34	3.10
Diabetes vs. Glomerulonephritis	-9.14	-18.53	0.25
Diabetes vs. Other/Uncertain	-0.07	-7.98	7.84
Previous Nephrology Care	-3.25	-9.11	2.60
First Access Type			
Arterial venous fistula/graft vs. Catheter	-2.04	-7.15	3.07
Arterial venous fistula/graft vs. Other	-127.10	-135.64	-118.56
PTSD	5.00	-5.36	15.35
Severe Mental Illness^	-0.62	-14.64	13.40
Depression	0.57	-6.03	7.18

* with VAMC fixed effects and person-level clustering

** Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

^ Bipolar Disorder or Schizophrenia

~ predicted risk of death within one year of starting dialysis

Notes: 1. Adjusted model results shown here reflect adjustments for the entire set of characteristics listed in Supplemental Table 2.

2. From the model intercept and a linear time trend, we are able to estimate that the average dialysis payment in the last quarter of 2010 was \$447. The shift in the intercept (coefficient α_3) in the equation shown in Supplemental material is -197. Combining the two estimates gives us the 44 % reduction (fall from 447 to 250).

Supplemental Table 3. Policy intervention and supply at VA region-Quarter level: Number of participating VA Community Care dialysis facilities* (n=901 VA region-quarters)

	Estimate	95% CI	
Shift in intercept in post-policy period (2011-2016)	-4.15	-10.17	1.88
Indicator for interim period (2009-2010)	-0.31	-4.22	3.59
Pre-policy time (2006-2008)	1.50	0.88	2.11
Post-policy time (2011-2016)	0.75	0.35	1.16
<i>Covariates</i>			
Age	-0.64	-3.04	1.77
Gage Comorbidity Score**	-2.44	-11.60	6.72
White vs. Non-white	-0.55	-0.87	-0.23
Male vs. Female	-0.01	-2.08	2.06
Medicaid user vs. Non-Medicaid User	-0.25	-0.59	0.10
High VA User vs. No/Low VA User	-0.32	-1.21	0.56
Lives ≤30 miles from VA outpatient dialysis vs. Not	-0.24	-0.47	-0.01
High eGFR (>15) vs. Low	-0.11	-0.58	0.36
High BMI (>29) vs. Low	0.79	-0.71	2.28
Diabetes primary cause vs. Not	-0.17	-0.81	0.48
Previous nephrology care vs. Not	0.23	-0.15	0.61
ATF/Graft vs. Not	-0.23	-0.67	0.20
PTSD vs. No PTSD	-0.33	-0.97	0.32
Severe Mental Illness vs. No SMI [^]	0.42	-0.37	1.21
Depression vs. No depression	-0.10	-0.42	0.22

* with VA region-level clustering where VA region is defined by designated Veterans Integrated Service Network

** Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

[^] Bipolar Disorder or Schizophrenia

Note: Adjusted model results shown here reflect adjustments for the entire set of characteristics listed in Supplemental Table 2.

Supplemental Table 4. Veterans' VA Community Care Dialysis Facilities' Quality Indicators* (n= 4,784 VAMC quarters)

	Standardized Hospitalization Rate				Standardized Mortality Rate			
	Estimate	95% CI		P Value	Estimate	95% CI		P Value
Shift in intercept in post-policy period	0.025	-0.040	0.091	0.444	0.006	-0.059	0.071	0.853
Indicator for interim period	0.010	-0.038	0.059	0.670	-0.006	-0.052	0.039	0.780
Pre-policy time	-0.001	-0.006	0.003	0.594	0.000	-0.005	0.004	0.893
Post-policy time	-0.001	-0.003	0.002	0.591	-0.002	-0.004	0.001	0.221
<i>Covariates</i>								
Age	0.007	0.000	0.013	0.048	0.000	-0.005	0.005	0.971
Gage Comorbidity Score**	0.018	-0.007	0.044	0.155	-0.008	-0.029	0.013	0.458
White vs. Non-white	-0.001	-0.002	0.000	0.027	-0.002	-0.003	-0.001	0.003
Male vs. Female	0.000	-0.004	0.004	0.938	-0.001	-0.004	0.001	0.270
Medicaid user vs. Non-Medicaid User	0.000	-0.002	0.001	0.538	0.000	-0.002	0.001	0.543
High VA User vs. No/Low VA User	0.000	-0.001	0.002	0.640	-0.001	-0.002	0.000	0.134
Lives ≤30 miles from VA outpatient dialysis vs. Not	0.001	0.001	0.002	0.001	0.000	-0.001	0.000	0.529
High eGFR (>15) vs. Low	0.000	-0.001	0.001	0.487	0.000	-0.001	0.001	0.827
High BMI (>29) vs. Low	0.002	-0.002	0.006	0.361	0.000	-0.002	0.003	0.682
Diabetes primary cause vs. Not	-0.001	-0.002	0.000	0.080	-0.001	-0.002	0.000	0.061
Previous nephrology care vs. Not	-0.001	-0.002	0.001	0.330	0.000	-0.002	0.001	0.424
ATF/Graft vs. Not	0.000	-0.002	0.001	0.532	0.000	-0.001	0.001	0.819
PTSD vs. No PTSD	-0.001	-0.002	0.001	0.473	0.000	-0.001	0.001	0.833
Severe Mental Illness vs. No SMI [^]	0.001	-0.001	0.003	0.299	0.001	-0.001	0.003	0.205
Depression vs. No depression	0.000	-0.001	0.001	0.968	0.000	-0.001	0.001	0.858

* with VAMC-level clustering

** Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

[^] Bipolar Disorder or Schizophrenia

Notes: 1. Adjusted model results shown here reflect adjustments for the entire set of characteristics listed in Supplemental Table 2.

2. Variables represent the mean value among Veterans in a given VAMC or proportion of patients in a VAMC with a given value of a variable.

3. Estimates presented here reflect the change in the outcome for a 1 unit change in the independent variable. Example: For standardized hospitalization rate (SHR), coefficient on AGE is 0.007. This implies that a 10 year increase in age will result in a 0.07 increase in the SHR. With a mean SHR of 0.94, a 10 year increase in age (e.g., 50 to 60 years) results in a 7.5 % increase in SHR ($\left(\frac{0.07}{0.94}\right) \times 100$).

Supplemental Table 5. Policy intervention and Veterans' median distance from home (miles) to participating VA Community Care dialysis facility (n=7,261,246 claims)

	Median Regression		
	Estimate	95% CI	
Shift in intercept in post-policy period	-1.23	-3.11	0.86
Indicator for interim period	-1.12	-3.11	0.87
Pre-policy time	-0.44	-0.64	-0.24
Post-policy time	-0.12	-0.16	-0.67
<i>Covariates</i>			
Age	-0.06	-0.09	-0.02
Gagne Comorbidity Score*	0.18	0.03	0.32
Mortality Score~	-8.17	-15.04	-1.30
Male	0.82	-0.91	2.55
Race			
White, non-Hispanic vs. Black	-2.21	-2.84	-1.59
White, non-Hispanic vs. Hispanic	-5.22	-6.11	-4.33
White, non-Hispanic vs. Other	-3.38	-5.18	-1.57
Medicaid	0.56	-0.23	1.36
VHA Reliance			
No VA vs 0-50%	-1.93	-3.53	-0.33
No VA vs >50%	0.60	-0.76	1.96
Distance from home to nearest VA outpatient dialysis ≤30 miles	-15.13	-15.66	-14.61
eGFR			
<10 vs. 10-14	-0.50	-1.07	0.67
<10 vs. >15	-1.73	-2.61	-0.85
BMI			
>29 vs. <18.5	0.48	-0.13	1.08
>29 vs. 18.5-24	0.76	0.09	1.42
>29 vs. 25-29	-1.68	-3.40	0.03
Primary Cause			
Diabetes vs. Hypertension	-0.71	-1.34	-0.08
Diabetes vs. Glomerulonephritis	-0.74	-1.74	0.27
Diabetes vs. Other/Uncertain	0.22	-0.61	1.05
Previous Nephrology Care	0.08	-0.56	0.71
First Access Type			
Arterial venous fistula/graft vs. Catheter	-1.54	-2.13	-0.95
Arterial venous fistula/graft vs. Other	8.50	7.33	9.67
PTSD	0.89	-0.11	1.89
Severe Mental Illness^	2.75	1.21	4.30
Depression	0.68	-0.04	1.41

^ Bipolar Disorder or Schizophrenia

* Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

~ predicted risk of death within one year of starting dialysis

Note: Adjusted model results shown here reflect adjustments for the entire set of characteristics listed in Supplemental Table 2.

Supplemental Table 6. One-year mortality for Veterans receiving at least one VA Community Care Dialysis Treatment⁺ (n=22,262 Veterans)

	Estimate	95% CI	
Shift in intercept in post-policy period (2011-2016)	-0.01	-0.04	0.01
Pre-policy time (2006-2008)	0.00	0.00	0.00
Post-policy time (2011-2016)	0.00	0.00	0.00
<i>Covariates</i>			
Age	0.00	0.00	0.00
Gagne Comorbidity Score**	-0.01	-0.02	-0.01
Male	-0.03	-0.06	0.00
Race			
White, non-Hispanic vs. Black	0.04	0.03	0.05
White, non-Hispanic vs. Hispanic	0.05	0.03	0.07
White, non-Hispanic vs. Other	0.00	-0.03	0.03
Medicaid	-0.01	-0.03	0.00
VHA Reliance			
No VA vs 0-50%	-0.01	-0.04	0.01
No VA vs >50%	-0.03	-0.05	-0.01
Distance from home to nearest VA outpatient dialysis ≤30 miles	-0.01	-0.02	0.00
eGFR			
<10 vs. 10-14	-0.01	-0.02	0.00
<10 vs. >15	-0.04	-0.05	-0.02
BMI			
>29 vs. <18.5	-0.01	-0.02	0.00
>29 vs. 18.5-24	-0.03	-0.04	-0.02
>29 vs. 25-29	-0.05	-0.07	-0.02
Primary Cause			
Diabetes vs. Hypertension	0.00	-0.01	0.01
Diabetes vs. Glomerulonephritis	0.00	-0.02	0.01
Diabetes vs. Other/Uncertain	-0.03	-0.04	-0.02
Previous Nephrology Care	0.02	0.01	0.03
First Access Type			
Arterial venous fistula/graft vs. Catheter	-0.06	-0.07	-0.05
Arterial venous fistula/graft vs. Other	-0.02	-0.04	0.00
PTSD	0.01	0.00	0.03
Severe Mental Illness [^]	-0.02	-0.04	0.01
Depression	0.00	-0.01	0.01

* with VAMC fixed effects; Veterans who started dialysis between pre and post periods were dropped from analysis

** Weighted score computed from Medicare, VA, and Fee Basis Claims in the year prior to starting dialysis

[^] Bipolar Disorder or Schizophrenia

Note: Adjusted model results shown here reflect adjustments for the entire set of characteristics listed in Supplemental Table 2.