SUPPLEMENTARY MATERIAL

Medicare's New Prospective Payment System on Facility Provision of Peritoneal Dialysis

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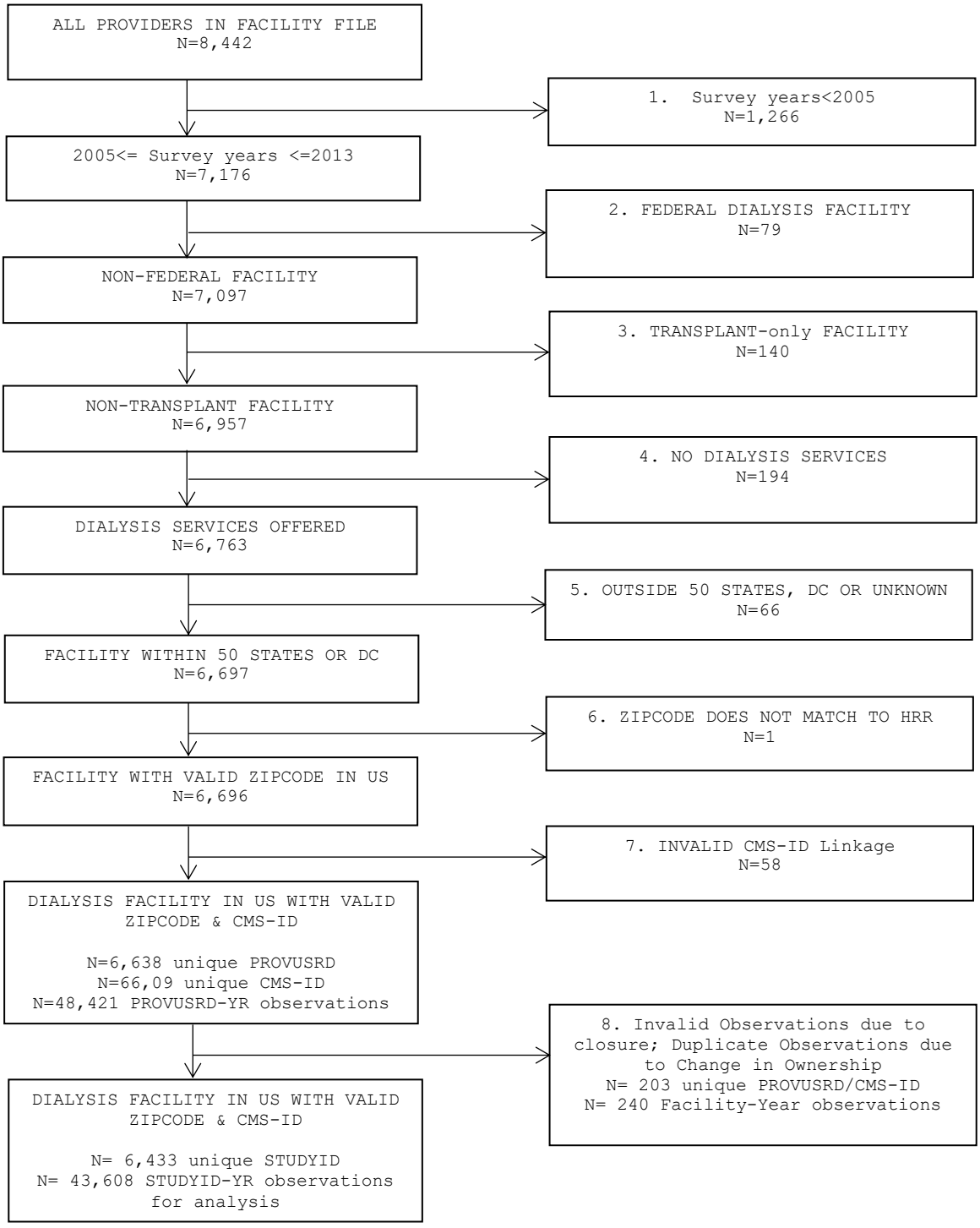
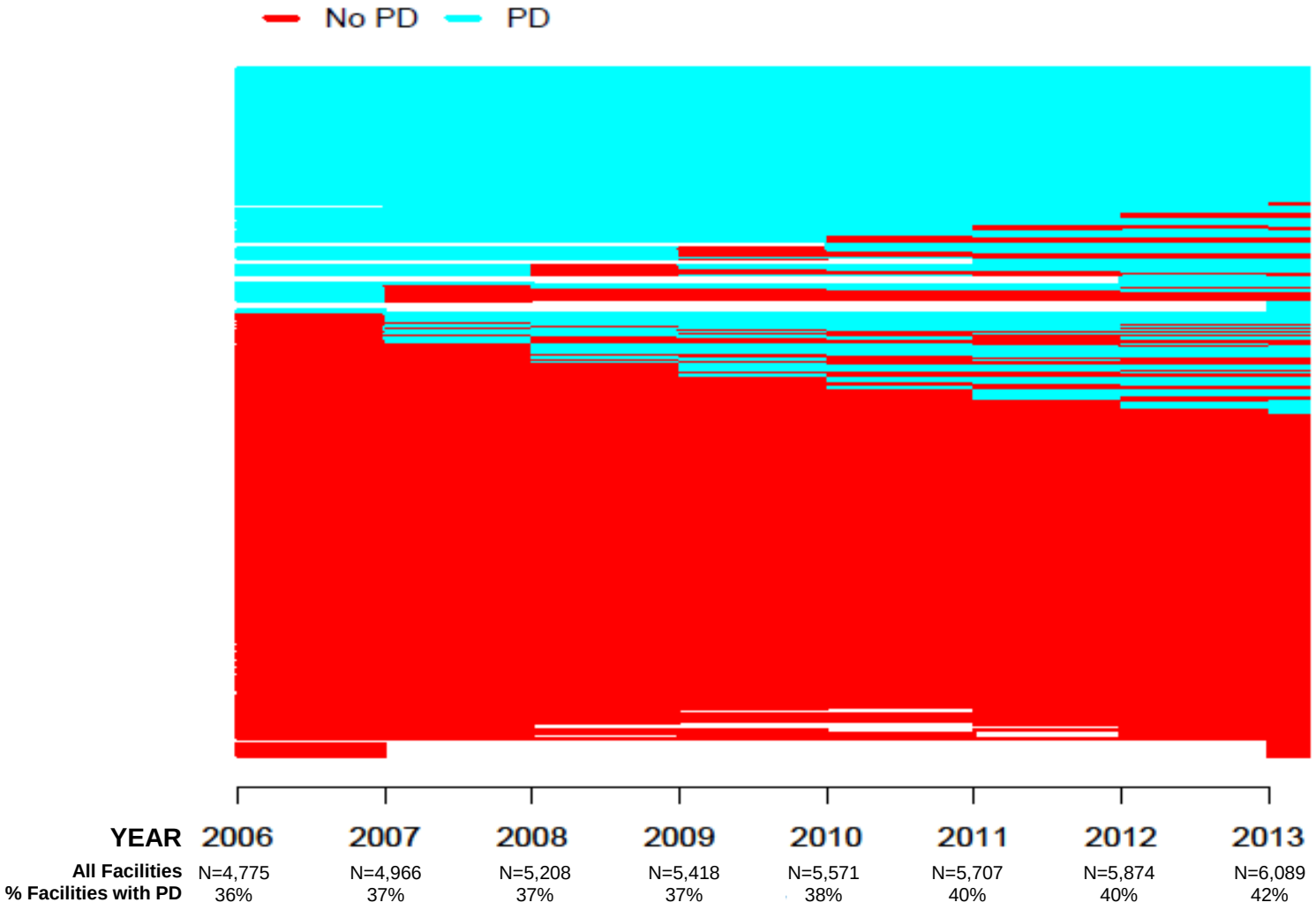
Supplemental Material Contents

Supplemental Figure 1. Dialysis Facility Sampling Frame



Supplemental Figure 2. Patterns of PD Provision in US Dialysis Facilities, by year



Note: This figure illustrates the longitudinal pattern of offering PD services for each dialysis facility in the study cohort, where each line represents dialysis facility (Tueller, Van Dorn, and Bobashev 2016). Grouped together based on PD provision at the start of our observation period, the lines describe patterns of PD services over time. In addition, the facility sample is not fixed and this figure accounts for changes in facility ownership over time and reflect the extent of facility closures and new entries in the US dialysis market in 2006-2013 (where the white areas in the figure reflect a period in which facilities were not operating).

Supplemental Statistical Model Information

Model Fit and Covariance Structure: In our model specification, we examined different discontinuity regression models that included a model with different slopes for the pre- and post-PPS payment periods (i.e., this is a similar approach as interaction between the pre- and post and time, just a different model specification).We assessed the mean structure of time examining different models for the discontinuity regression that included the simplest model with an intercept shift for PPS to a more complex model with separate slopes for the pre and post-PPS that included quadratic and cubic terms for time. We determined the "best" covariance structure by fitting models with different covariance structures, including compound symmetry, autoregressive (1), unstructured and included log odds ratio structure for PD provision outcome, for the serial correlation between time points. QIC (Quasilikelihood under the Independence model Criterion) were assessed to determine the best-fit covariance and mean structure for model (1). The best fit mean structure for both the logistic model for PD provision and negative binomial model for PD census had an intercept shift at 2011 with a linear slope across all time points. For the final model we assessed the adequacy of mean structure for time using cumulative sums of residuals computing an omnibus test ("supermum" test) (2).

Model Estimates: To provide an estimate of the overall bundled payment effect (odds ratio [OR] for PD provision and incidence rate ratio [IRR] for PD census) in models with interactions, we estimated the difference in weighted means on the transformed scale (logit for PD provision and log for PD census) between the pre-bundled payment period (2006-2010, using the models' slope parameters) and post-period (2011-2013, using the models' intercept and slope parameters) across selected interaction variables of interest (i.e. urban or chain affiliation)at mean levels of the remaining covariates in the model.) Similarly, predicted probabilities and counts were estimated for interactions of the policy period and the explanatory variables of interest with remaining covariates fixed at mean levels (see Table 2). We used ESTIMATE statements in PROC GENMOD to generate parameter estimates of interest and then used these estimates and the associated model based covariance estimates in %NLESTIMATE macro to get confidence intervals using model based standard errors.

References Cited:

1. Pan W: Akaike's information criterion in generalized estimating equations. *Biometrics*, 57**:** 120-125, 2001.
2. Fitzmaurice GM, al. e: *Applied longitudinal analysis*, Hoboken, NJ, Wiley, 2011.

Supplemental Table 1. GEE model estimates, model based standard errors, 95% confidence intervals and p-values for longitudinal logistic regression model for binary outcome of provision of PD services for years 2006 – 2013 with lagged time-varying covariates (BF indicates between facility decomposition of continuous covariate and WF indicates within facility). These are estimates from model with non-centered covariates.

Note: The study sample consisted of n=6,433 unique dialysis facilities operating between 2006-2013. For regression models, the analytic sample is n=6,194 unique facilities due to the one-year lag of explanatory variables (which dropped the first-year observation for n=229 facilities that opened after 2005).

Parameter	Estimate	Standard Error	95% Confidence Limits		Pr > |Z|
Intercept	-4.7121	0.6922	-6.0687	-3.3555	<.0001
Facility year	0.0376	0.0093	0.0195	0.0558	<.0001
Post policy period	0.2489	0.0606	0.1301	0.3677	<.0001
Urban location	0.4566	0.0742	0.3112	0.6020	<.0001
Urban location * Post policy period	-0.2328	0.0398	-0.3109	-0.1547	<.0001
Chain affiliation	-0.0931	0.0405	-0.1724	-0.0138	0.0214
Chain affiliation * Post policy period	0.1294	0.0409	0.0493	0.2095	0.0015
% PD facilities (BF)	0.0491	0.0024	0.0443	0.0538	<.0001
% PD facilities (WF)	-0.0008	0.0010	-0.0027	0.0011	0.3918
Competition, chain-based (BF)	0.0157	0.0056	0.0047	0.0268	0.0052
Competition (BF) * Post policy period	-0.0015	0.0009	-0.0032	0.0002	0.0832
Competition, chain-based (WF)	-0.0016	0.0012	-0.0040	0.0009	0.2048
Competition (BF) ^ 2	-0.0002	0.0001	-0.0003	-0.0000	0.0061
Facility size (BF)	0.0080	0.0028	0.0024	0.0136	0.0050
Facility size (BF) ^2	0.0001	0.0000	0.0000	0.0001	0.0062
Facility size (BF) ^3	-0.0000	0.0000	-0.0000	-0.0000	0.0016
Facility size (BF) * Post policy period	-0.0013	0.0004	-0.0020	-0.0006	0.0002
Facility size (WF)	0.0059	0.0006	0.0048	0.0070	<.0001
Facility size (WF) ^2	0.0000	0.0000	-0.0000	0.0000	0.0980
Freestanding unit	-0.1261	0.0695	-0.2623	0.0102	0.0698
Ownership change	0.0608	0.0552	-0.0474	0.1689	0.2708
US region: Midwest	0.1110	0.0907	-0.0667	0.2887	0.2207
Northeast	-0.1007	0.1092	-0.3148	0.1134	0.3567
South	0.2128	0.0834	0.0493	0.3762	0.0107
West (reference)	0.0000	0.0000	0.0000	0.0000	
ESRD Incidence (BF)	0.0111	0.0333	-0.0542	0.0763	0.7397
ESRD Incidence (WF)	-0.0431	0.0182	-0.0788	-0.0073	0.0182
% White ESRD (BF)	0.0087	0.0023	0.0041	0.0133	0.0002

Parameter	Estimate	Standard Error	95% Confidence Limits		Pr > |Z|
% White ESRD (WF)	0.0095	0.0079	-0.0059	0.0249	0.2266
% ESRD age <65 (BF)	0.0130	0.0083	-0.0034	0.0293	0.1197
% ESRD age <65 (WF)	-0.0021	0.0070	-0.0159	0.0116	0.7602
% Employed ESRD (BF)	0.0114	0.0102	-0.0086	0.0314	0.2628
% Employed ESRD (BF)	-0.0300	0.0123	-0.0542	-0.0059	0.0148
PD prevalence (BF)	-0.0017	0.0013	-0.0041	0.0008	0.1772
PD prevalence (WF)	0.0013	0.0008	-0.0002	0.0028	0.0860
Hospital density (BF)	0.0001	0.0004	-0.0007	0.0009	0.7861
Hospital density (WF)	0.0008	0.0004	0.0000	0.0016	0.0387
Hospital density (WF) ^2	-0.0000	0.0000	-0.0000	-0.0000	0.0087
% Urban residents (BF)	-0.0105	0.0030	-0.0164	-0.0047	0.0004
% Urban residents (WF)	-0.0138	0.0232	-0.0592	0.0317	0.5534
Per capita income (BF)	0.0061	0.0054	-0.0045	0.0167	0.2574
Per capita income (WF)	-0.0077	0.0043	-0.0160	0.0006	0.0704

Supplementary Table 2. GEE model estimates, model based standard errors, 95% confidence intervals and p-values for longitudinal negative binomial regression model for PD census outcome s for years 2006 – 2013 with lagged time-varying covariates (BF indicates between facility decomposition of continuous covariate and WF indicates within facility). These are estimates from model with non-centered covariates.

Parameter	Estimate	Standard Error	95% Confidence Limits		Pr > |Z|
Intercept	1.9009	0.7126	0.5043	3.2975	0.0076
Facility year	0.0509	0.0064	0.0384	0.0633	<.0001
Post policy period	0.0324	0.0400	-0.0460	0.1108	0.4177
Urban location	-1.1727	0.0710	-1.3119	-1.0336	<.0001
Urban location * Post policy period	0.0783	0.0232	0.0328	0.1239	0.0007
Chain affiliation	-0.0387	0.0274	-0.0923	0.0149	0.1572
Chain affiliation * Post policy period	0.0377	0.0261	-0.0135	0.0889	0.1487
Freestanding unit	0.1316	0.0540	0.0257	0.2374	0.0149
% PD facilities (BF)	0.0212	0.0021	0.0171	0.0253	<.0001
% PD facilities (WF)	0.0007	0.0006	-0.0005	0.0019	0.2562
HD occupancy (BF)	-0.0378	0.0041	-0.0459	-0.0298	<.0001
HD occupancy (BF) * Post policy period	-0.0004	0.0005	-0.0013	0.0005	0.3587

Parameter	Estimate	Standard Error	95% Confidence Limits		Pr > |Z|
HD occupancy (WF)	0.0005	0.0003	-0.0000	0.0010	0.0760
HD occupancy (BF) ^2	0.0004	0.0000	0.0003	0.0005	<.0001
Competition, chain-based (BF)	0.0031	0.0017	-0.0002	0.0063	0.0639
Competition (BF) * Post policy period	-0.0009	0.0006	-0.0020	0.0002	0.1138
Competition, chain-based (WF)	-0.0011	0.0008	-0.0027	0.0005	0.1833
Ownership change	-0.0218	0.0323	-0.0851	0.0416	0.5010
US region: Midwest	-0.2626	0.0938	-0.4465	-0.0788	0.0051
Northeast	-0.4677	0.1082	-0.6797	-0.2558	<.0001
South	-0.2073	0.0886	-0.3809	-0.0337	0.0192
West (reference)	0.0000	0.0000	0.0000	0.0000	
ESRD Incidence (BF)	0.0257	0.0343	-0.0415	0.0928	0.4535
ESRD Incidence (WF)	-0.0264	0.0105	-0.0470	-0.0058	0.0121
% White ESRD (BF)	-0.0021	0.0024	-0.0068	0.0026	0.3784
% White ESRD (WF)	-0.0065	0.0053	-0.0170	0.0040	0.2254
% ESRD age <65 (BF)	0.0157	0.0085	-0.0010	0.0324	0.0658
% ESRD age <65 (WF)	-0.0112	0.0046	-0.0202	-0.0022	0.0149
% Employed ESRD (BF)	0.0123	0.0107	-0.0086	0.0332	0.2478
% Employed ESRD (BF)	-0.0167	0.0081	-0.0326	-0.0008	0.0397
Hospital density (BF)	-0.0003	0.0004	-0.0011	0.0005	0.4309
Hospital density (WF)	-0.0001	0.0002	-0.0006	0.0003	0.5095
% Urban residents (BF)	-0.0164	0.0030	-0.0223	-0.0105	<.0001
% Urban residents (WF)	-0.0509	0.0141	-0.0785	-0.0233	0.0003
Per capita income (BF)	-0.0043	0.0057	-0.0154	0.0068	0.4444
Per capita income (WF)	-0.0077	0.0027	-0.0130	-0.0024	0.0043
Scale	0.8658				