Supplemental Online Content

Koukounas KG, Thorsness R, Patzer RE, et al. Social risk and dialysis facility performance in the first year of ESKE treatment choices model. *JAMA*. doi:10.1001/jama.2023.23649

eReferences

This supplemental material has been provided by the authors to give readers additional information about their work.

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eMethods

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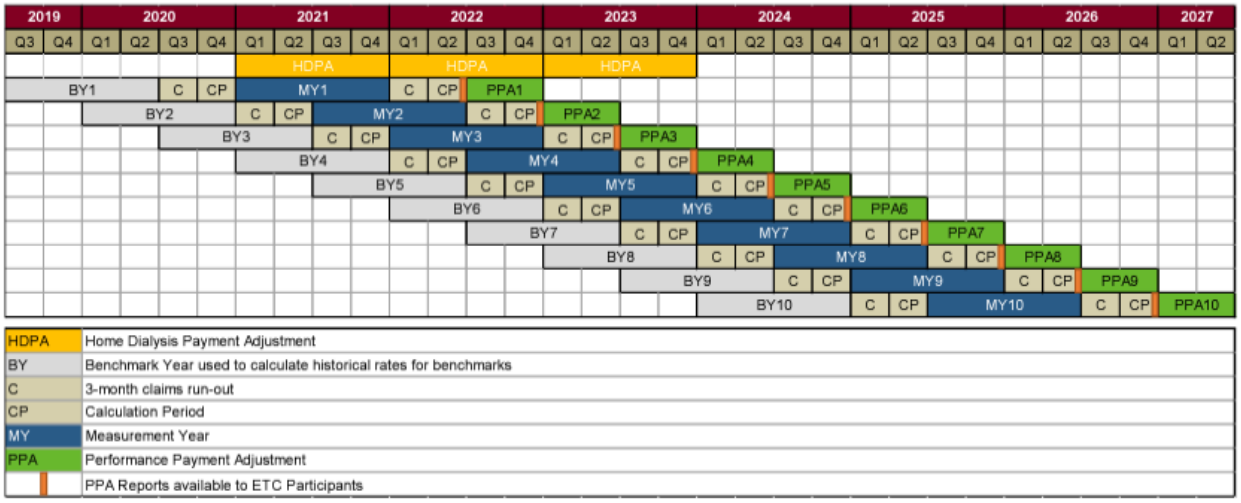
eMethods

Model Timeline[1–3]

CMS proposed the ETC model on July 10th, 2019, as part of the Specialty Care Models to Improve Quality of Care and Reduce Expenditures rule. The model received public comments through Sept. 16th, 2019 and was published as part of Final Rule 85 61114 on Sept. 18th, 2020. The model went into effect on Jan. 1st, 2021. In July 2021, ETC model changes were proposed to address health equity concerns as part of the ESRD Prospective Payment System (PPS) Notice of Proposed Rulemaking. The changes received public comment through August 31st, 2021, and were finalized through the CY 2022 End-Stage Renal Disease Prospective Payment System Final Rule on Oct. 29th, 2021. These adjustments to the model's scoring and benchmarking methodology were implemented on Jan. 1st, 2022, such that the first year of the model did not utilize these changes.[1] The model is set to run between Jan. 1st, 2021, and June 30th, 2026, with payment periods corresponding to 6 months after each annual measurement period. Thus, payment periods for the ETC model will extend from July 1st, 2022, to June 30th, 2027.

The ETC model utilizes three different period types to classify time. The first is "Benchmark Year" (BY), which is used to construct the benchmark rates against which model participants will be compared. The second is "Measurement Year" (MY), which refers to the period during which the performance of ETC facilities is tracked and measured. Finally, "Performance Payment Adjustment Period" (PPA) refers to the period during which financial penalties and bonuses are awarded based on the facility's scoring and performance in the corresponding MY. BYs are 12-month periods that occur 18 months prior to the start of each MY, and PPAs are 6-month periods that occur 6 months after each MY. The 6 months between each BY, MY and PPA are used to allow for 3 months of claims runout and 3 months of calculation. Finally, model years overlap for 6 months of every year, such that after July 1st, 2021, there are two MYs running concurrently at any given time. This is done to ensure that the PPAs occur in succession without gaps. A visualization of the ETC model schedule, taken from CMS, is shown below.[3]

eFigure 1: Visual Representation of the Timeline for CMS' ETC Model (2019 – 2027)[a]



[a] Image obtained from CMS' End-Stage Renal Disease Treatment Choices (ETC) Model Performance Payment Adjustment Report User Guide (Measurement Years 1–2)

Patient attribution

Patient attribution was completed using a methodology developed in a prior analysis, summarized here.[4] Data from incident kidney failure patients were gathered from CMS Form 2728, the ESRD Medical Evidence Report, which is completed for nearly all patients initiating dialysis treatment. The objective of this form is to collect patient sociodemographic and clinical information at time of treatment initiation. Data from January 1, 2017 through June 30th, 2020 was utilized, and limited to reflect adults (≥18 years at treatment initiation) who were not institutionalized (dialysis setting was not a SNF/Long Term Care Facility), receiving treatment in a Medicare-certified and publicly-reported dialysis facility in the United States which served 11 or more incident patients throughout this entire time period (Jan 2017 – Jun 2020). These criteria were aligned with CMS' ETC Model inclusion criteria.[2,3]

Facility Social Risk

Facility social risk scoring was completed using a methodology developed in a prior analysis, summarized here.[4] Using patient characteristic data from CMS 2728 for years 2017-2020, facilities were characterized by their incident patient composition to identify facilities in the highest quintile of proportion of incident patients who were:

1. Non-Hispanic Black (highest quintile: ≥ 55.7% of incident patients; 438 of 2,191 facilities in highest quintile)
2. Hispanic (highest quintile: ≥ 16.3% of incident patients; 438 of 2,191 facilities in highest quintile)
3. Uninsured or covered by Medicaid (highest quintile: ≥ 43.6% of incident patients; 436 of 2,191 facilities in highest quintile)
4. Residents of a census block group (hereafter referred to as "neighborhoods") with high social disadvantage (highest quintile: ≥ 51.1% of incident patients; 438 of 2,191 facilities in highest quintile). Incident patient mailing addresses were geocoded using ArcGIS World Geocoder (version 10.5.1) and geolocated within census block groups. We used the 2018 Area Deprivation Index to identify neighborhoods with a deprivation score of >80 (the highest quintile of area deprivation), which we classified as the most socially disadvantaged neighborhoods.[4–6]

Our composite score of social risk measured whether a facility was in zero, 1 or 2 or more of these categories.

Linkage to CMS Performance Data

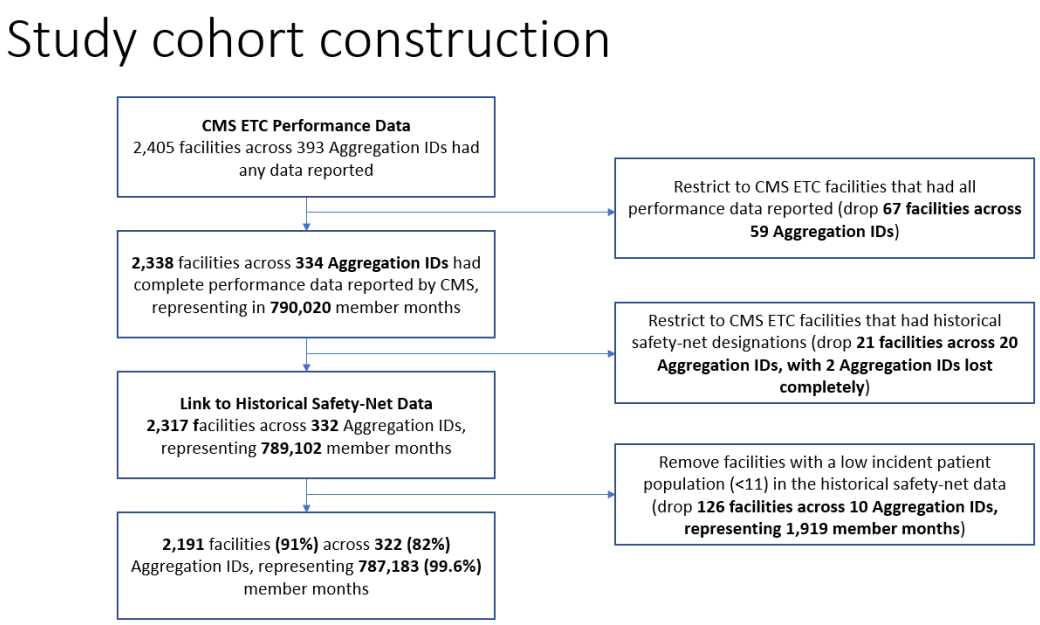
In early 2023, CMS released detailed performance data for Model Year (MY) 2021 of the End-Stage Renal Disease (ESRD) Treatment Choices Model.[7] Data were provided at the aggregation-group level, with the ability to link between these aggregation groups and participant facilities or managing clinicians. CMS describes an aggregation group as including "all ESRD facilities owned in whole or in part by the same legal entity located in the [hospital referral region] in which the ESRD facility is located."[3] For the purposes of our analysis, we linked CMS'

aggregation-level performance data to attributed dialysis facilities using the CMS Certification Number (CCN).

CMS published data included information on Performance Payment Adjustment (PPA), Modality Performance Score (MPS), home dialysis and transplant rates, as well as the underlying components of each rate for each aggregation group.[7] Each aggregation group was assigned an annual PPA, which ranged from a penalty of -5% to a bonus of +4%, based on their MPS. The MPS represents a composite, weighted score from 0 to 6 based both achieved and improved rates of home dialysis and kidney transplant/waitlisting. While achievement scores are based on meeting thresholds defined by benchmark rates from non-participating ESRD facilities, improvement scores are historically self-referential. To develop each aggregation group's MPS, CMS sums together the higher of achievement or improvement score for each of home dialysis and transplant, weighting home dialysis scores higher to likely reflect the increased difficulty of rapidly improving transplant rates.[3]

A flow chart shown below demonstrates the linkage and exclusion methodology applied in the construction of our ultimate study cohort. All CMS aggregation-groups, and thus underlying facilities, with reported MPS and PPA data were initially retained, and the vast majority (99.2%) were matched to our historical incident patient data in order to evaluate social risk characteristics. A final sample-size exclusion was applied following this linkage to remove any facilities with a low incident patient population (<11) between 2017-2020, to align with CMS' ETC model inclusion criteria.[3]

eFigure 2: Flow Chart of the Study Cohort Construction and Sample Size Limitations



Patient Outcomes

The primary outcomes of interest included modality performance scoring (MPS), home dialysis and living-donor transplant rates, and financial adjustments (PPA), stratified by composite social risk score and by quintile of social risk characteristic. In line with CMS' methodology, reported outcomes were applied at the aggregation-group level, such that each facility within the aggregation group received the same outcomes.

The outcome measures used in this study were calculated by CMS, and obtained from the agency's publicly-accessible detailed Year 1 model results. The equations used by CMS to calculate each metric are shown below.[3]

eFigure 3: Rate Calculations Utilized by CMS for ETC Model Scoring[a]

Home Dialysis Rate

$$\text{Home Dialysis Rate} = \frac{\text{Number of attributed ESRD Beneficiary months in MY using home dialysis} + \left(0.5 * \text{Number of attributed ESRD Beneficiary months in MY using self dialysis}\right) + \left(0.5 * \text{Number of attributed ESRD Beneficiary months in MY using nocturnal dialysis}\right)}{\text{Total number of attributed ESRD Beneficiary months in MY}}$$

Category	Quintile	Numerator (n)	Denominator (N)
non-Hispanic Black	Highest	81	438
	Others	221	1753
Medicaid/Uninsured	Highest	76	436
	Others	226	1755
Living in a Disadvantaged Neighborhood	Highest	68	438
	Others	234	1753
Hispanic	Highest	59	438
	Others	243	1753

Transplant Rate

$$Transplant\ Rate = \frac{Risk\ Adjusted}{Transplant\ Waitlist\ Rate\ in\ MY} + \frac{Living\ Donor}{Transplant\ Rate\ in\ MY}$$

$$\frac{Risk\ Adjusted}{Transplant\ Waitlist\ Rate\ in\ MY} = \frac{\frac{Observed\ Transplant}{Waitlist\ Rate\ in\ MY}}{\frac{Expected\ Transplant}{Waitlist\ Rate\ in\ MY}} * \frac{Reference\ Transplant}{Waitlist\ Rate\ in\ BY}$$

$$\frac{Living\ Donor}{Transplant\ Rate\ in\ MY} = \frac{Number\ of\ Living\ Donor\ Transplant}{\frac{Beneficiary\ months\ for\ ESRD\ Beneficiaries\ in\ MY}{Total\ Number\ of}}$$
$$attributed\ ESRD\ Beneficiary\ months\ in\ MY$$

Modality Improvement Score (MPS)

$$MPS = 2 * \begin{pmatrix} The\ higher\ of\ the \\ home\ dialysis\ achievement\ score\ or \\ (home\ dialysis\ improvement\ score + \\ Health\ Equity\ Bonus^{18}) \end{pmatrix} + \begin{pmatrix} The\ higher\ of\ the \\ transplant\ achievement\ score\ or \\ (transplant\ improvement\ score + \\ Health\ Equity\ Bonus^{19}) \end{pmatrix}$$

[a] Images obtained from CMS' End-Stage Renal Disease Treatment Choices (ETC) Model Performance Payment Adjustment Report User Guide (Measurement Years 1–2)

The higher of the achievement or improvement score is selected for each of the home dialysis and transplant rates and added together. The score is weighted such that home dialysis scoring constitutes two-thirds of the final MPS, while transplant constitutes one-third.[3] Each MPS corresponds to a specific PPA, which gradually increases over time. A table below demonstrates the PPAs for dialysis facilities associated with each MPS.[3]

eTable 1: CMS' Proposed Performance Payment Adjustments by MPS Score Across Model Years[a]

MPS	Performance Payment Adjustment (PPA) Period				
	MY 1 and 2	*MY 3 and 4*	*MY 5 and 6*	*MY 7 and 8*	*MY 9 and 10*
≤ 6.0	+ 4.0%	+ 5.0%	+ 6.0%	+ 7.0%	+ 8.0%
≤ 5.0	+ 2.0%	+ 2.5%	+ 3.0%	+ 3.5%	+ 4.0%
≤ 3.5	0.0%	0.0%	0.0%	0.0%	0.0%
≤ 2.0	- 2.5%	- 3.0%	- 3.5%	- 4.5%	- 5.0%
≤ 0.5	- 5.0%	- 6.0%	- 7.0%	- 9.0%	- 10.0%

[a] Table adapted from CMS' End-Stage Renal Disease Treatment Choices (ETC) Model Performance Payment Adjustment Report User Guide (Measurement Years 1–2)

Beginning in 2022 (MY 3), CMS will apply a health equity adjustment to the MPS to account for the proportion of Medicare beneficiaries who are dually enrolled (DE) in Medicaid or receive low-income subsidies (LIS).[3] To do so, CMS will stratify the aggregation groups into those with ≥50% beneficiaries who are DE/LIS, compared to those with less than 50% such beneficiaries. Each stratum will receive separate thresholds against which they are scored, in order to account by proxy for sociodemographic case-mix. Scores obtained in 2021 (MY 1 and 2) do not incorporate this adjustment.

We used two-tailed independent t-tests to compare reported outcomes of facilities with 1 or 2+ social risk metrics to facility groups with 0 social risk metrics, and to compare facilities in the highest quintile to those in other quintiles for each dimension of social risk.

To evaluate the influence of CMS' 2022 scoring adjustments, we identified aggregation groups in our sample within aggregation-groups that serve ≥50% beneficiaries who are uninsured or Medicaid-covered upon dialysis initiation, as a proxy for DE/LIS beneficiaries. We then calculated the percentage of underlying facilities in our sample that would be eligible for the health equity scoring adjustment, and how many of which are classified as having high social risk.

Data-Level Across Exposures & Outcomes

There are two primary levels of data used in our study: facility-level and aggregation-group level. Aggregation groups represents all ETC-assigned facilities with common ownership within the same HRR. For this study, analysis was done at the facility-level, to align with the level at which social risk scoring is conducted. As such, all aggregation-level outcome measures were allocated to each of the groups' underlying facilities, such that all facilities in the same aggregation group received the same values. The table below documents the level at which data is received and then subsequently used across each metric in the study.

eTable 2: Data Level Across Study Metrics

Type	Metric	Data Source	Level at Which Data is Received	Level at Which Data is Analyzed
Exposure	Composite Social Risk Metrics/Score	CMS Form 2728, (ESRD Medical Evidence Report)	Facility	Facility
Outcome	Home Dialysis Rate	CMS, ETC Model Year 1 Detailed Results	Aggregation Group	Facility
Outcome	Transplant Rates	CMS, ETC Model Year 1 Detailed Results	Aggregation Group	Facility
Outcome	Modality Performance Score (MPS)	CMS, ETC Model Year 1 Detailed Results	Aggregation Group	Facility
Outcome	Performance Payment Adjustment (PPA)	CMS, ETC Model Year 1 Detailed Results	Aggregation Group	Facility

Aggregation-Level Performance

To evaluate whether study outcomes changed dramatically when analysis was conducted at the aggregation group level, the paper's **Table** was re-created below at the aggregation-group level, which resulted in directionally similar results with lower significance levels due to sample size constraints.

eTable 3: Measures of Performance and Financial Adjustment for Aggregation Groups, by Composite Social Risk Score, for ETC[a] Model Year 1

	Composite Social Risk Score[b]		
	0	**1**	**2+**
Aggregation Groups, No. (%)	151 (45.5)	99 (30.7)	72 (22.4)
For-Profit Groups, No. (%)	122 (80.8)	81 (81.8)	58 (80.6)
Chain Groups, No. (%)	120 (79.5)	82 (82.8)	52 (72.2)
Existing Home Dialysis Program, No. (%)	138 (91.4%)	91 (91.9)	63 (87.5)
Baseline Average Rate of Home Dialysis (2017-2020)[c]	11.0 [9.7, 12.3]	13.0 [9.4, 16.5]	8.7 [6.9, 10.4]
Performance Summary, mean, [95% CI; p-value][d]			
Modality Performance Score (MPS)[e]	3.5 [3.2, 3.7]	3.2 [3.0, 3.5]	3.1 [2.7, 3.4]
Home Dialysis Rate Achieved, %	15.9 [14.4, 17.4]	16.1 [12.7, 19.4]	11.8 [9.7, 13.8 p=0.002]
Transplant Rate Achieved, %	19.2 [17.5, 20.9]	20.5 [18.0, 23.0]	19.8 [17.2, 22.4]
Transplant Rate Improved, %	16.1 [14.7, 17.5]	17.2 [15.1, 19.3]	16.7 [14.5, 18.9]
Financial Adjustments, No. (%), [95% CI; p-value][d]			
Groups with Financial Penalty	28 (18.5) [12.3, 24.8]	28 (28.3) [19.3, 37.3]	22 (30.6) [19.7, 41.4, p=0.04]
Groups with Financial Penalty and in an Aggregation Group with 50% or more uninsured/Medicaid-covered patients	0 (0.0)	2 (7.1) [-3.0, 17.3]	13 (59.1) [36.8, 81.4; p<0.001]
Groups with Financial Bonus	65 (43.0) [35.1, 51.0]	35 (35.4) [25.8, 44.9]	33 (45.8) [34.0, 57.6]
Groups with Largest Financial Bonus of +4%	7 (4.6) [1.2, 8.0]	7 (7.1) [1.9, 12.2]	0 (0.0)
Groups with Largest Payment Cut of -5%	4 (2.6) [0.1, 5.2]	4 (4.0) [0.1, 8.0]	8 (11.1) [3.7, 18.5]
Social Risk Status, No. (%)[f]			
Groups in the highest quintile of uninsured/Medicaid Patients	0 (0.0)	16 (16.2)	48 (66.7)

	Composite Social Risk Score[b]		
	0	**1**	**2+**
Groups in the highest quintile of non-Hispanic Black Patients	0 (0.0)	28 (28.3)	36 (50.0)
Groups in the highest quintile of Hispanic Patients	0 (0.0)	33 (33.3)	31 (43.1)
Groups in the highest quintile of patients from disadvantaged neighborhoods	0 (0.0)	22 (22.2)	42 (58.3)
Groups in which 50% or more patients were uninsured/ Medicaid-covered at initiation	0 (0.0)	5 (5.1)	31 (43.1)

[a] End-Stage Renal Disease Treatment Choices (ETC) Model
[b] Composite social risk score represents the number of measures of social risk per facility, where a facility receives one "point" for being in the highest quintile of social risk for four categories identifying patient characteristics; all analyses in this table were conducted on the facility-level
[c] Identified from CMS Form 2728, which reflects data from incident kidney failure patients as they initiate home dialysis, and thus may not capture the entirety of home dialysis utilization data for the facilities measured
[d] Performance measures were reported at the level of the aggregation group. Two-tailed independent t-tests were used to develop p-values that reflect comparison to those facilities with a social risk score of 0.
[e] For Modality Performance Scoring (MPS), the highest score a facility could receive was 6 and the lowest was 0. Thus, a higher score reflects better model performance.
[f] Measures of social risk were assigned at the facility-level based on the characteristics of incident patients at that facility between 2017 and 2020. Social risk characteristics were obtained from information available on CMS Form 2728, completed for incident dialysis patients, from the years 2017-2020

For-Profit vs Not-For-Profit Stratification

Interest in how profit status among dialysis providers influenced financial penalization led us to conduct a separate, stratified analysis of model payment adjustments across profit status among dialysis providers. However, the low prevalence of not-for-profit organizations in the sample led to a low level of significant findings in our analysis.

eTable 4: Measures of Performance and Financial Adjustment for Facilities, by Composite Social Risk Score and For-Profit Status, for ETC[a] Model Year 1

	Composite Social Risk Score[b]			
	0	1	2+	Total[e]
For-Profit Organizations No. (%) [95% confidence interval][c]				
Total Facilities	999 (93.3)	599 (95.2)	463 (94.3)	2,061 (94.1)
Modality Performance Score (MPS)[d]	3.6 [3.5, 3.6]	3.5 [3.4, 3.6; p=0.02]	3.4 [3.3, 3.5; p<0.001]	3.5 [p<0.001]
Home Dialysis Rate Achieved, %	16.1 [15.7, 16.6]	14.9 [14.3, 15.4; p<0.001]	14.2 [13.7, 14.7; p<0.001]	15.3 [p<0.001]
Transplant Rate Achieved, %	19.0 [18.5, 19.5]	19.3 [18.6, 19.9]	18.8 [18.1, 19.5]	19.0 [p=0.04]
Transplant Rate Improved, %	16.0 [15.5, 16.4]	16.2 [15.6, 16.7]	15.8 [15.2, 16.4]	16.0 [p=0.04]
Facilities with Financial Penalty	98 (9.8) [8.0, 11.7]	78 (13.0) [10.3, 15.7; p=0.047]	82 (17.7) [14.2, 21.2; p<0.001]	258 (13.5) [p<0.001]
Facilities with Financial Bonus	413 (41.3) [38.3, 44.4]	241 (40.2) [36.3, 44.2]	201 (43.4) [38.9, 47.9]	855 (41.5)
Facilities with Largest Financial Bonus of +4%	23 (2.3) [1.4, 3.2]	10 (1.7) [0.6, 2.7]	0 (0.0) [p=0.001]	33 (1.6) [p=0.01]
Facilities with Largest Payment Cut of -5%	4 (0.4) [0.0, 0.8]	6 (1.0) [0.2, 1.8]	9 (1.9) [0.7, 3.2; p=0.003]	19 (0.9) [p<0.001]
Not-For-Profit Organizations No. (%) [95% confidence interval][c]				
Total Facilities	72 (6.7)	30 (4.8)	28 (5.7)	130 (5.9)
Modality Performance Score (MPS)[d]	3.2 [2.8, 3.5]	3.1 [2.6, 3.7]	3.0 [2.4, 3.6]	3.1 [p<0.001]
Home Dialysis Rate Achieved, %	13.6 [11.1, 16.4]	11.4 [8.9, 13.9]	12.5 [9.4, 15.6]	12.9 [p<0.001]
Transplant Rate Achieved, %	19.6 [17.5, 21.6]	24.1 [19.3, 28.9; p=0.04]	19.4 [16.4, 22.4]	20.6 [p=0.04]
Transplant Rate Improved, %	16.5 [14.7, 18.2]	20.2	16.3 [13.8, 18.8]	17.3 [p=0.04]

		[16.2, 24.2; p=0.04]		
	Composite Social Risk Score[b]			
	0	1	2+	Total[e]
Facilities with Financial Penalty	25 (34.7) [23.5, 46.0]	10 (33.3) [15.4, 51.2]	9 (32.1) [13.7, 50.6]	44 (33.4) [p<0.001]
Facilities with Financial Bonus	27 (37.5) [26.0, 49.0]	12 (40.0) [21.4, 58.6]	13 (46.4) [26.7, 66.1]	52 (40.0)
Facilities with Largest Financial Bonus of +4%[e]	6 (8.3) [1.8, 14.9]	0 (0.0)	0 (0.0)	6 (4.6) [p=0.01]
Facilities with Largest Payment Cut of -5%[e]	3 (4.2) [-0.6, 8.9]	2 (6.7) [-2.8, 16.1]	3 (10.7) [-1.5, 22.9]	8 (6.2) [p<0.001]

[a] End-Stage Renal Disease Treatment Choices (ETC) Model
[b] Composite social risk score represents the number of measures of social risk per facility, where a facility receives one "point" for being in the highest quintile of social risk for four categories identifying patient characteristics; all analyses in this table were conducted on the facility-level
[c] Performance measures were reported at the level of the aggregation group and then assigned to all facilities within the same aggregation group. Two-tailed independent t-tests were used to develop p-values that reflect comparison to those facilities with a social risk score of 0.
[d] For Modality Performance Scoring (MPS), the highest score a facility could receive was 6 and the lowest was 0. Thus, a higher score reflects better model performance.
[e] P-value demonstrates the significance of difference between the values represented by the row amongst the for-profit and not-for-profit cohorts.

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