

Is Medicare getting what it pays for in kidney transplant outcomes?

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Introduction

- A recent Institute of Medicine report, titled *Best Care at Lower Cost: The Path to Continuously Learning Health Care in America*, stated that more than \$750 million was wasted by the U.S. healthcare system in 2009.
- The relationship between cost and kidney allograft failure has not been investigated in the US.
- Therefore, we describe the cost of kidney transplantation to Medicare, and the potential drivers of increased cost. We also explore the association between cost and kidney allograft failure.

Methods

- The study population included adult Medicare kidney recipients transplanted between 1/1/2007 and 6/30/2009. We excluded those without Medicare as Primary Payer and small transplant centers with less than 3.69 expected allograft failures. The expected allograft failures were determined from the publically reported Program Specific Reports created by the Scientific Registry of Transplant Recipients (SRTR, www.srtr.org).

- Allograft failure is defined as return to dialysis, re-transplantation, or patient death. Follow-up was censored at allograft failure.
- Using Medicare claims from the United States Renal Data System, we determined Part A and B costs for the first year post transplant.
- The expected cost was obtained from multiple linear regression models adjusted for recipient, donor and transplant characteristics, region of country, and the local wage index, for transplant recipients of deceased donor kidneys and then for recipients of living donor kidneys. The cost to Medicare was presented as payment per patient per year (PPPY in U.S. dollars). The relative cost for each transplant center was obtained by comparing observed and expected cost for recipients of deceased and living donor kidneys.
- Using the SRTR program-specific reports, we determined the observed/expected allograft failure for all kidney transplant centers. We determined the correlation coefficient between relative cost and observed/expected allograft failure for all kidney transplant centers in the study.

Results

- Among 20,757 transplants at 165 centers, the mean observed cost was \$65,366 (IQR=\$55,094-71,624).
- For deceased (Table 1) and living donor (Table 2) kidney recipients, higher cost was associated with several factors.
- The relative cost was 0.99 (IQR=0.88-1.08).
- The mean observed/expected allograft failure was 1.03 (IQR=0.61-1.37).
- There was no correlation between relative cost and observed/expected allograft failure (r=0.10, p=0.20; Figure 1).

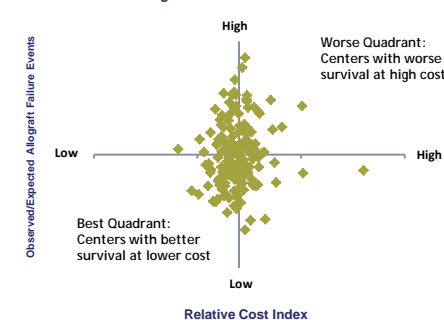
Table 1: Characteristics, Medicare Cost, and Parameter Estimate from Adjusted Regression Model for Kidney Transplant Recipients of Deceased Donors. Model also Adjusted by Region of the Country, Year of Transplant and Local Wage Index (PPPY=payment in U.S. dollars, per patient per year)

Variable	Freq (%)	Medicare Cost in first yr PostTX (PPPY)	Reference	Parameter Estimate in U.S. Dollars	Standard Error	P-value
Overall Intercept	NA	NA	NA	40,826	3,344	<.0001
Donor age in years	NA	NA	1 yr increase	135	33	<.0001
Donor race: black	14.4	73,368	white	2,892	1,164	0.013
Donor race: other race	15.4	67,236	white	-916	1,140	0.4214
Cold time: 20-<30	27.0	69,196	< 20	1,471	918	0.109
Cold time: 30+	9.2	82,408	< 20	9,630	1,422	<.0001
Cold time: missing	8.1	69,219	< 20	-240	1,496	0.8727
No kidney pumped	68.2	67,759	missing	1,827	944	0.0528
Donor creatinine: >=1.5	19.3	71,269	< 1.5	944	1,006	0.3481
Donor-Recipient weight ratio: >1	45.1	68,336	<= 1	-1,905	900	0.0342
Donor-Recipient weight ratio: missing	3.3	72,889	<= 1	1,441	3,372	0.6692
Donor history of DM: No	92.1	68,233	yes or missing	-4,158	1,490	0.0053
Donor history of HTN: yes	29.0	74,796	Non	1,161	1,046	0.267
Donor history of HTN: missing	0.7	59,337	Non	-9,980	4,830	0.0388
DCD donor: yes	12.7	72,634	Non	4,378	1,267	0.0005
Donor cause of death: cerebrovascular/stroke	42.0	72,134	Non	225	907	0.8043
Deceased donor meets expanded donor criteria	22.2	78,053	Non	2,978	1,324	0.0245
HLA ADR mismatch: 4	25.9	68,434	<= 3	2,548	1,082	0.0185
HLA ADR mismatch: 5	31.6	70,831	<= 3	3,435	1,046	0.001
HLA ADR mismatch: 6	15.4	71,506	<= 3	4,109	1,275	0.0013
PRA > 30	19.5	73,232	<= 30	-3,646	1,412	<.0001
PRA missing	66.1	67,652	<= 30	-56	1,129	0.9749
Previous organ transplant: yes	13.7	71,997	1 yr increase	19	35	0.5795
Recipient age in years	NA	NA	increase	19	35	0.5795
Female	38.3	69,251	male	1,617	852	0.0579
Recipient race: black	37.3	73,138	white	2,047	931	0.0279
Recipient race: other	8.4	62,423	white	-6,010	1,484	<.0001
Primary cause of ESRD:						
DM	29.0	76,561	other	2,982	1,413	0.0349
HTN	26.3	67,795	other	-515	1,159	0.6566
GN	21.4	64,390	other	-545	1,167	0.6405
BMI: < 10 or missing	5.6	69,760	10-<25	-2,433	2,671	0.3624
BMI: 25-<30	32.9	67,742	10-<25	-1,043	1,014	0.3036
BMI: 30+	31.3	71,567	10-<25	1,195	1,113	0.2832
On dialysis for 5+ years	40.6	72,775	< 5 years	5,942	879	<.0001
Preemptive: yes	4.0	59,201	Non	-6,025	2,035	0.0031
Preemptive: missing	0.7	73,458	Non	7,684	4,667	0.0997
HCV positive	5.9	79,216	Non	7,145	1,675	<.0001
Comorbidities in 6 months prior to transplant:						
Atherosclerotic heart disease	31.9	76,617	Non	4,227	935	<.0001
CHF	25.5	76,929	Non	3,872	943	<.0001
Cerebrovascular accident/transient ischemic attack	8.0	80,256	Non	5,864	1,449	<.0001
Peripheral vascular disease	24.3	78,630	Non	4,902	942	<.0001
Other cardiac disease	22.4	76,190	Non	4,866	965	<.0001
Chronic obstructive pulmonary disease	9.7	74,552	Non	1,562	1,327	0.2392
Gastrointestinal bleeding	3.6	80,811	Non	5,856	2,088	0.005
Liver disease	7.8	73,609	Non	1,267	1,464	0.3869
Dysrhythmia	18.9	78,746	Non	6,227	1,035	<.0001
Cancer	4.5	77,351	Non	4,560	1,882	0.0154
Diabetes	45.1	75,461	Non	5,621	1,107	<.0001
Length of stay 6 months prior transplant: > 6 days	11.6	79,862	<= 6 days	4,590	1,281	0.0003

Table 2: Characteristics, Medicare Cost, and Parameter Estimate from Adjusted Regression Model for Kidney Transplant Recipients of Living Donors. Model also Adjusted by Region of the Country, Year of Transplant and Local Wage Index (PPPY=payment in U.S. dollars per patient per year)

Variable	Freq (%)	Medicare Cost in first yr PostTX (PPPY)	Reference	Parameter Estimate in U.S. Dollars	Standard Error	P-value
Overall Intercept	NA	NA	NA	52,010	4,783	<.0001
Donor age in years	NA	NA	1 yr increase	145	59	0.0148
Donor race: black	15.4	70,749	white	-900	3,521	0.7982
Donor race: other race	19.8	61,536	white	-2,695	1,900	0.156
Relationship with donor: yes	60.2	64,504	Non	650	1,756	0.7111
Relationship with donor: missing	0.04	27,782	Non	-32,947	31,426	0.2945
HLA ADR mismatch: 4	15.1	64,294	<= 3	-140	2,165	0.9486
HLA ADR mismatch: 5	17.1	67,395	<= 3	3,605	2,093	0.085
HLA ADR mismatch: 6	10.9	66,958	<= 3	3,134	2,409	0.1932
PRA > 30	14.0	82,660	<= 30	13,653	2,573	<.0001
PRA missing	72.6	61,538	<= 30	-1,117	1,945	0.5657
Previous organ transplant: yes	13.3	74,447	Non	595	2,510	0.8128
Recipient age in years	NA	NA	increase	-177	52	0.0007
Female	39.1	67,506	male	2,105	1,388	0.1294
Recipient race: black	18.2	70,547	white	1,899	3,281	0.5628
Recipient race: other	6.5	56,710	white	-5,670	2,813	0.0439
Primary cause of ESRD:						
DM	26.2	72,438	other	5,660	2,352	0.0161
HTN	20.3	62,442	other	1,470	1,949	0.4507
GN	24.0	62,670	other	497	1,800	0.7826
BMI: < 10 or missing	6.3	81,927	10-<25	13,787	2,833	<.0001
BMI: 25-<30	30.5	62,366	10-<25	1,733	1,646	0.2923
BMI: 30+	28.1	67,829	10-<25	5,178	1,704	0.0024
Vintage: 5+ years	18.1	74,242	< 5 years	4,586	2,149	0.0329
Preemptive: yes	14.6	55,869	Non	-4,586	1,959	0.0192
Preemptive: missing	3.5	60,754	Non	-4,060	3,589	0.2579
HCV positive	4.0	73,601	Non	475	3,370	0.8879
Comorbidities in 6 months prior to transplant:						
Atherosclerotic heart disease	30.4	69,918	Non	1,631	1,634	0.3184
CHF	22.7	75,026	Non	4,748	1,689	0.005
Cerebrovascular accident/transient ischemic attack	8.0	70,422	Non	-1,384	2,449	0.572
Peripheral vascular disease	21.1	76,602	Non	6,878	1,666	<.0001
Other cardiac disease	22.2	73,279	Non	2,500	1,652	0.1304
Chronic obstructive pulmonary disease	9.3	78,206	Non	11,655	2,273	<.0001
Gastrointestinal bleeding	3.5	77,038	Non	4,300	3,545	0.2252
Liver disease	7.1	72,290	Non	5,455	2,562	0.0333
Dysrhythmia	17.6	71,893	Non	4,770	1,795	0.0079
Cancer	6.1	73,335	Non	7,281	2,738	0.0078
Diabetes	40.3	70,898	Non	4,323	1,937	0.0257
Length of stay 6 months prior transplant: > 4 days	19.7	79,995	<= 4 days	9,387	1,776	<.0001

Figure 1: Variation in Cost of Transplantation & Allograft Failure Outcomes



Conclusions

- There was no association between the cost of transplant to Medicare and a center's all cause allograft failure during the first year post-transplant.
- Variation in cost and outcomes suggests a need to determine the most cost-effective practices to reduce costs.
- There are opportunities to improve the outcomes and reduce cost to Medicare by disseminating cost-effective practices.