Karnofsky Performance Score and Its Use in Risk Adjustment of Transplant Outcomes in the United States

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SCIENTIFIC REGISTRY OF TRANSPLANT RECIPIENTS

Disclosure

- All authors are employees of MMRF, the Scientific Registry of Transplant Recipients (SRTR) contractor.
- No conflicts of interest exist relevant to the current presentation.

Background

- The Organ Procurement and Transplantation Network requires reporting of Karnofsky Performance Status (KPS) at the time of transplant for adult recipients.
- KPS scores range from 0% (dead) to 100% (normal, no complaints, no evidence of disease) in 10% increments.
- Historically, these data have been used by the Scientific Registry of Transplant Recipients (SRTR) to risk-adjust center-specific transplant outcomes.
- However, the consistency of how the KPS is applied by different transplant programs, a factor that may bias subsequent risk adjustment, has not been examined.

Karnofsky Performance Status

Karnofsky Score	Description
100	**Normal no complaints**; no evidence of disease.
90	Able to carry on **normal activity**; minor signs or symptoms of disease.
80	**Normal activity with effort**; some signs or symptoms of disease.
70	**Cares for self**; unable to carry on normal activity or to do active work.
60	**Requires occasional assistance**, but is able to care for most of his personal needs.
50	**Requires considerable assistance** and frequent medical care.
40	**Disabled**; requires special care and assistance.
30	**Severely disabled**; hospital admission is indicated although death not imminent.
20	**Very sick**; hospital admission necessary; active supportive treatment necessary.
10	**Moribund**; fatal processes progressing rapidly.

Why does the SRTR care about KPS?

Ideally, case mix adjusters should be measured consistently across centers in order for case mix adjustment to be equitable.

Scenario #1: Risk adjusted outcomes will look better compared to unadjusted outcomes.

KPS in the Renal Disease Literature

Association of Nutritional Markers With Physical and Mental Health Status in Prevalent Hemodialysis Patients From the HEMO Study

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Table 2. Functional Health Status Estimates for HEMO Study Baseline Patients and General US Population

	HEMO Study (N = 1,545 for KI, N = 1,423 for SF-36)	General US Population* (N = 2,474[20])
KI	80.6 ± 16.7	–
(range)	(40-100)	
PCS	36.0 ± 10.0†	50.0 ± 10.0
(range)	(11-65)	(8-73)
MCS	49.8 ± 10.9	50.0 ± 10.0
(range)	(11-73)	(10-74)

Note. Results are presented as mean ± SD (range) when applicable.
*Results are presented for PCS and MCS only. General US population results for the KI have not been determined.
†$P < .001$ comparing HEMO study subjects' PCS scores with those of general US population.

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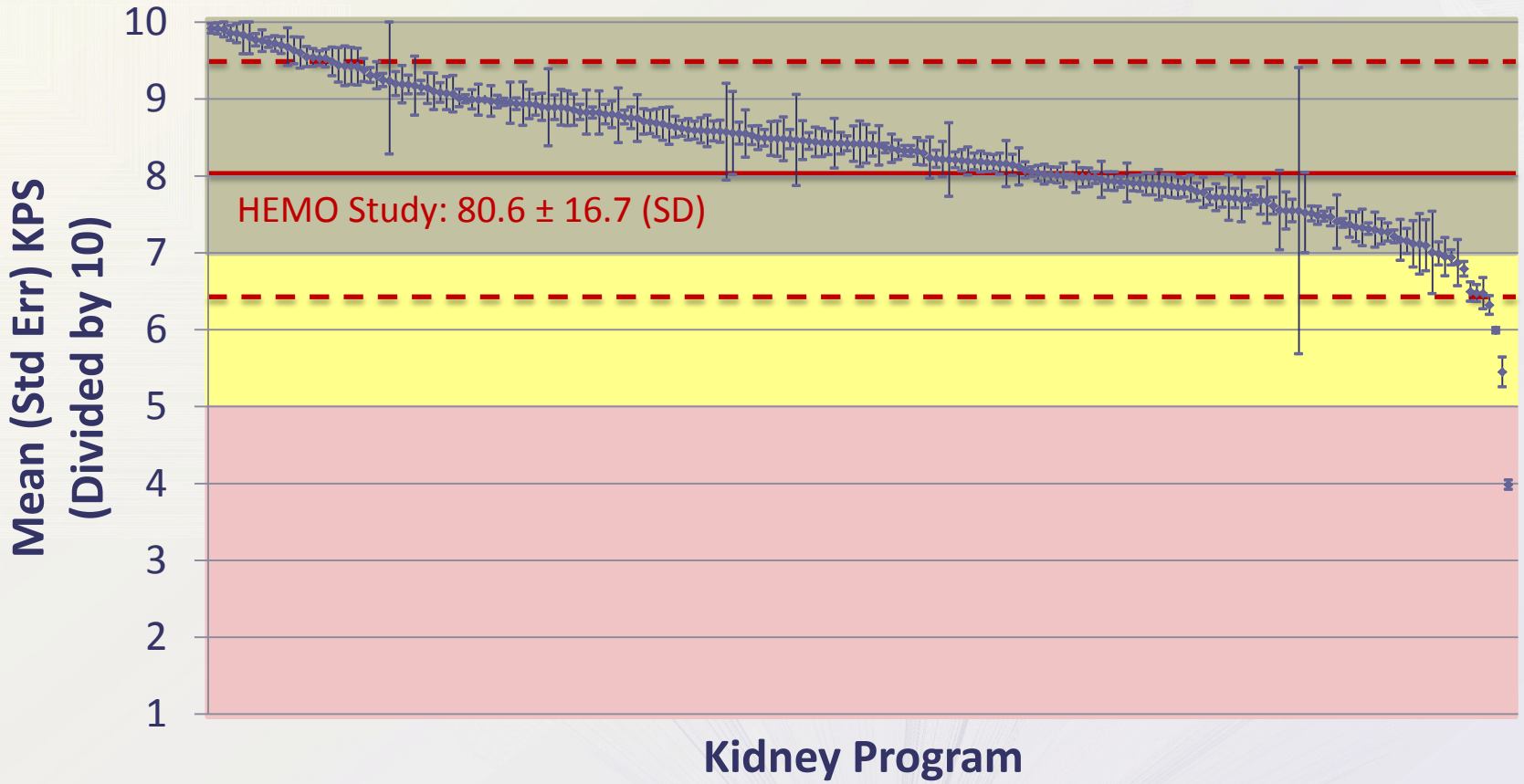
Mean KPS by Kidney Program, Adult Kidney Recipients March 2008 – September 2010



*Only programs with >10 transplants during the time period are displayed.

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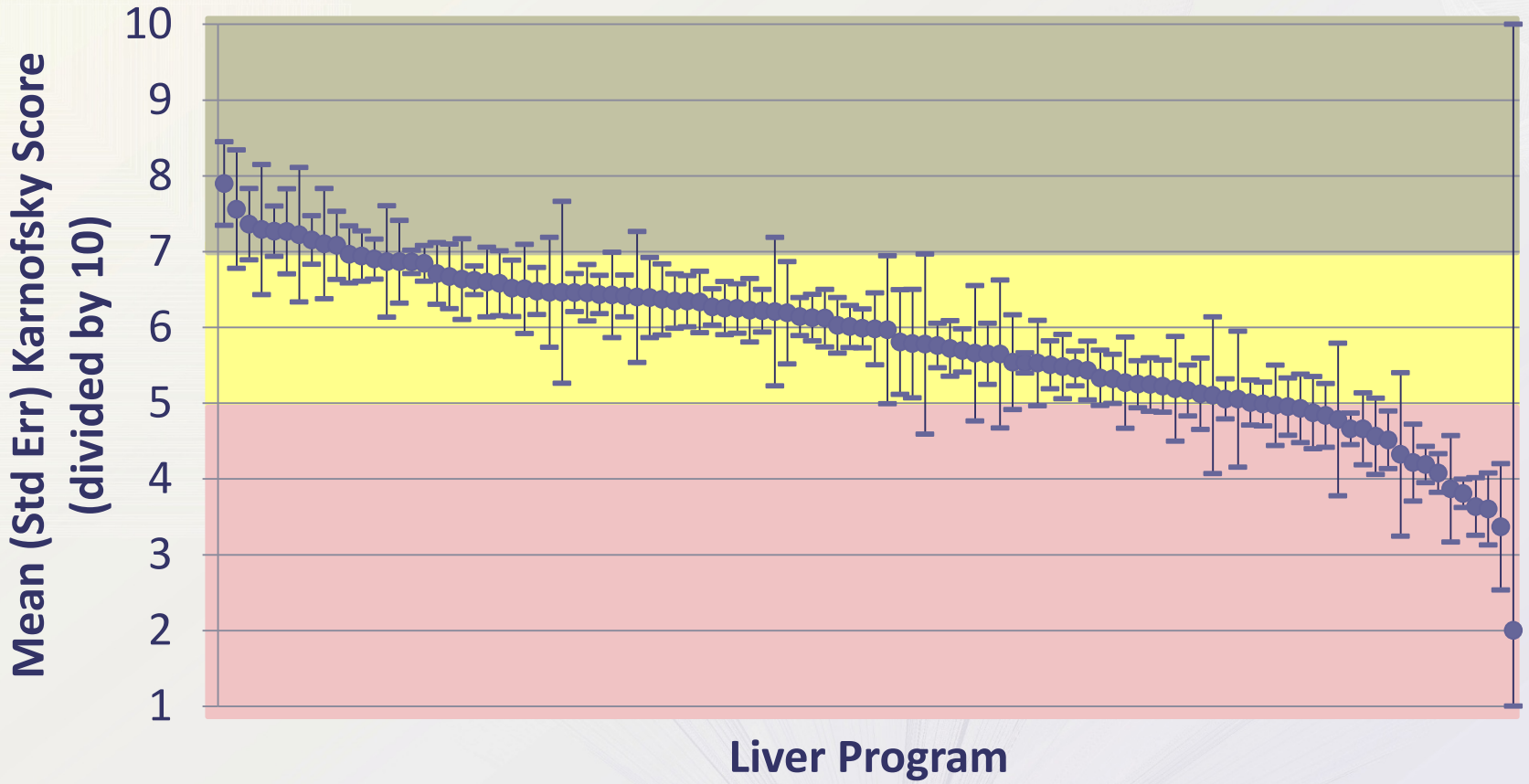
Mean KPS by Liver Program, Adult Liver Recipients March 2008 – September 2010



*Only programs with >10 transplants during the time period are displayed.

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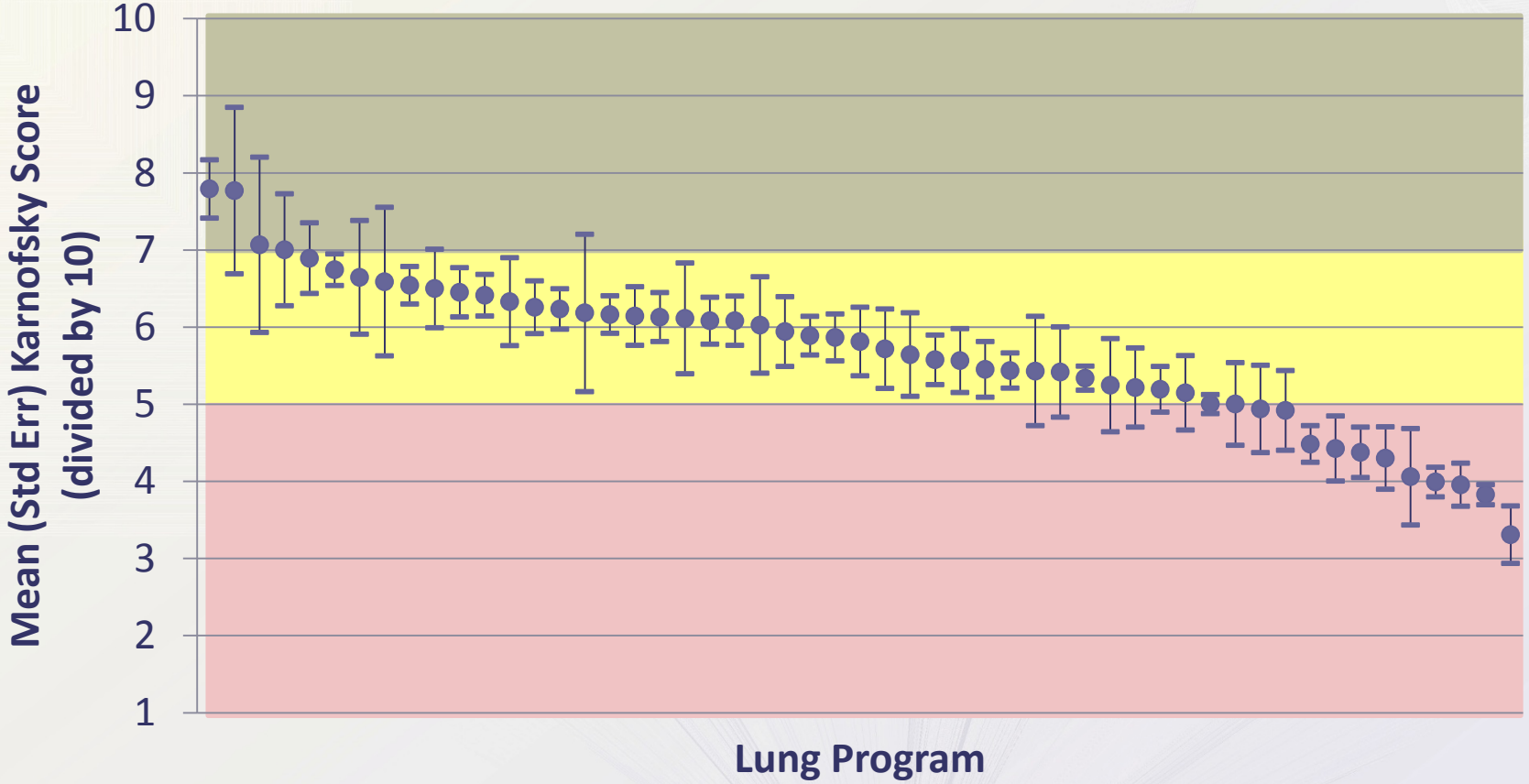
Mean KPS by Lung Program, Adult Lung Recipients March 2008 – September 2010



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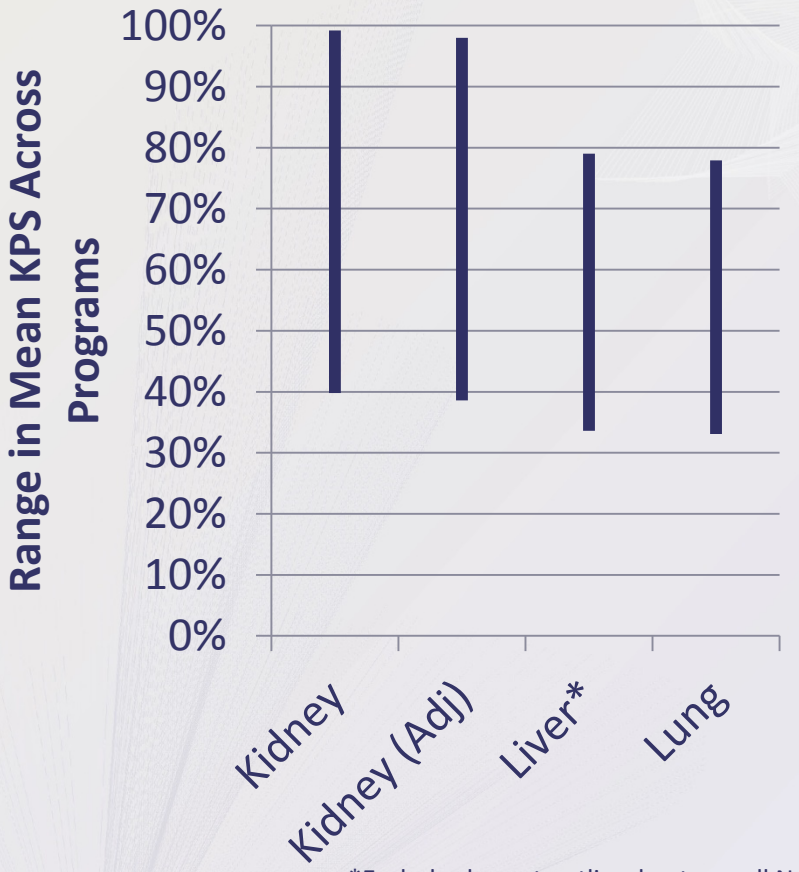
Range of Mean KPS Across Programs

- Mean KPS for kidney transplant recipients (N=39521) was 82.0% (STD 13.9%); means varied across centers from a high of 99.2% to a low of 39.8%.
- Inter-center variation remained after adjustment of mean KPS for age, gender, race, and primary cause of kidney failure (adjusted range: 98.0%-38.6%).
- For adult liver programs, mean KPS ranged from 79.0% to 20.0%.
- For adult lung programs, mean KPS ranged from 77.9% to 33.1%.



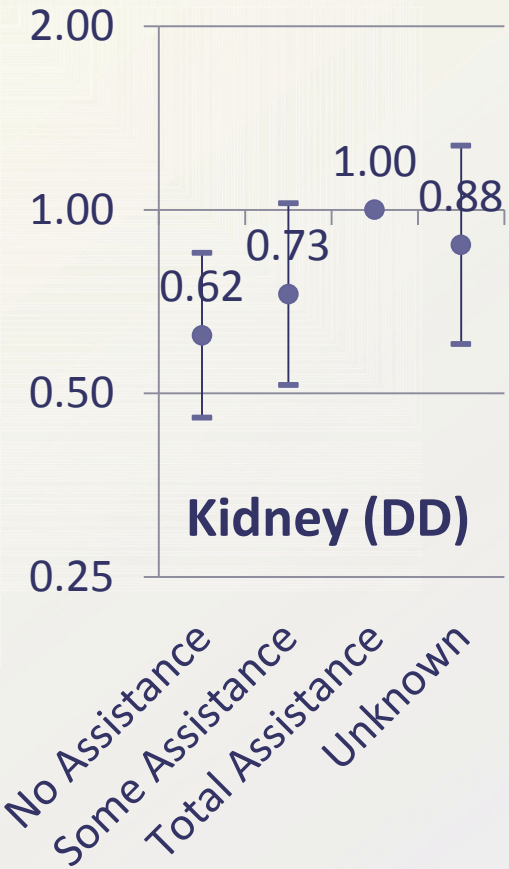
*Excludes lowest outlier due to small N.

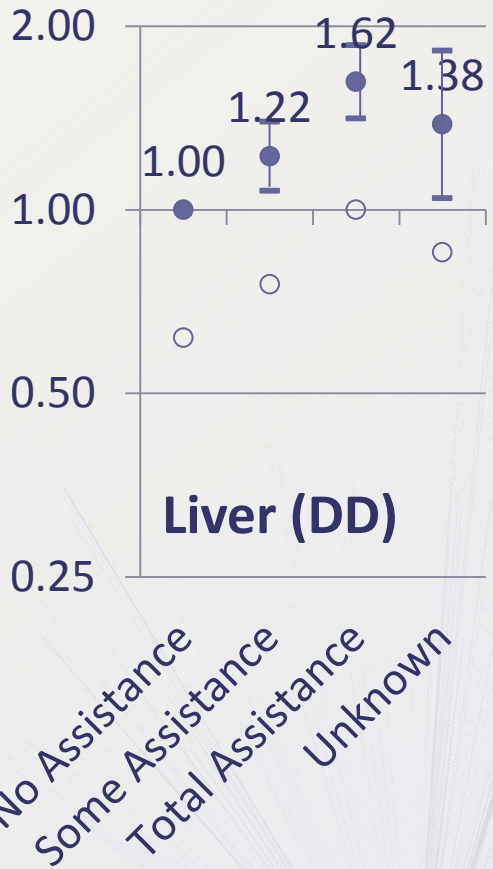
Use of Karnofsky Score in SRTR Risk Adjustment Models

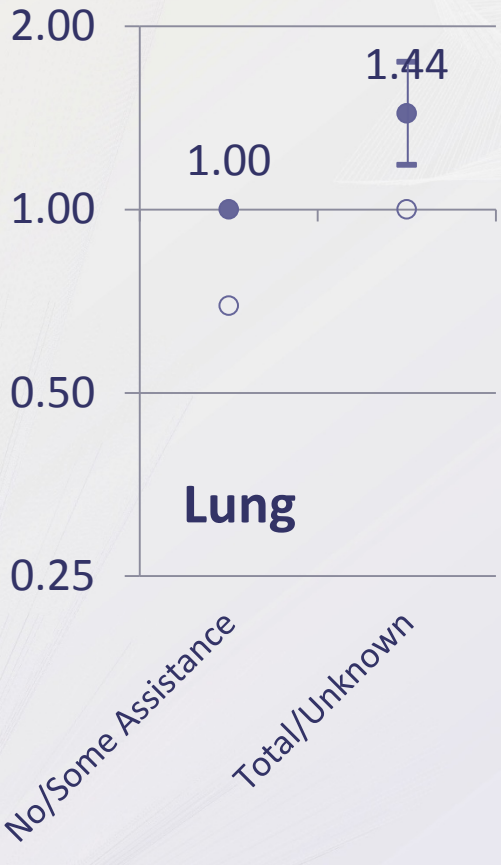
- KPS has been historically been used to risk adjust center-specific outcomes for the following models (14 models in total):

Organ	Age Group		Donor Type		Time Period		Outcome	
	Adult	Peds	DD	LD	1 yr	3 yr	Patient	Graft
Kidney	X		X		X		X	X
Liver	X		X		X	X	X	X
		X	X		X		X	X
	X			X		X	X	X
Lung	X		X		X	X	X	X

Adjusted Effect of KPS on 1-Year Graft Survival







○ = Rescaled estimates to allow comparison to the kidney figure.

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Effect on Center Flagging (July 2011 PSR Release)

Organ	Age Group		Time Period		Outcome		Flagged		
	Adult	Peds	1 yr	3 yr	Patient	Graft	With KPS (# that would not be flagged if KPS removed)	Without KPS (# that would not be flagged if KPS added)	Centers Affected
Kidney	X		X		X		9 (0)	11 (2)	2
	X		X			X	17 (1)	17 (1)	2
Liver	X		X		X		9 (1)	8 (0)	1
	X		X			X	5 (1)	5 (1)	2
		X	X		X		1 (0)	1 (0)	0
		X	X			X	2 (0)	3 (1)	1
Lung	X		X		X		5 (0)	5 (0)	0
	X		X			X	5 (0)	5 (0)	0

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HRSA Recommended Actions

- In 2011, HRSA recommended study of the use of KPS in risk adjustment models over concern of gaming.
- Data were reviewed by the SRTR Technical Advisory Committee in July of 2011 and recommendation was to remove KPS from kidney risk adjustment models due to concerns over the consistency of application of the KPS across programs.
- KPS remains in liver & lung adjustment models.
- SRTR continues discussions with OPTN/UNOS regarding education initiatives to determine whether KPS can be objectively applied across programs.

Conclusions

- These data reveal large variation in reported KPS across transplant programs, which is not attenuated by adjustment for recipient age, gender, race, and primary cause of disease.
- If the KPS is applied inconsistently across transplant programs, its use as a risk adjuster for center-specific outcomes may lead to biased results.
- Potential bias appears to effect only a few programs across organ types.
- Further study and education efforts may yield a more consistent measure of functional status that can be more reliably used in risk adjustment models.