



Evaluating Outcomes in Multi-Organ Liver Transplant Recipients

Jon J. Snyder, PhD, Nicholas Salkowski, PhD, David Zaun, MS, Bryn Thompson, MPH, Jessica Zeglin, MPH, David Schladt, MS, John Lake, MD, W. Ray Kim, MD, Ajay K. Israni, MD, MS, and Bertram L. Kasiske, MD, FACP

Scientific Registry of Transplant Recipients, Minneapolis Medical Research Foundation, Minneapolis, Minnesota, USA

Introduction

- Historically, transplant program evaluations performed by the Scientific Registry of Transplant Recipients (SRTR) in the US have included only single-organ transplant recipients, except for simultaneous pancreas-kidney (SPK) and simultaneous heart-lung recipients.
- Recognizing the absence of publicly available data on multi-organ transplants in the program-specific reports (PSRs), the SRTR Technical Advisory Committee recommended that SRTR explore ways to evaluate multi-organ transplant outcomes.
- Because simultaneous liver-kidney (SLK) transplants are the second-most common after SPK, we began by considering ways to evaluate multi-organ liver transplant outcomes.
- Working with the Membership and Professional Standards Committee (MPSC) of the Organ Procurement and Transplantation Network (OPTN), we considered various approaches to evaluating program performance, including a combined single- and multi-organ evaluation, or separate single- and multi-organ evaluations.

Methods

- We evaluated program performance by 1) including multi-organ liver transplants with the single-organ transplants, and 2) evaluating performance on multi-organ transplants independently from single-organ transplants, and 3) removing non-SLK multi-organ from consideration.
- All deceased-donor liver transplants performed 7/1/2011-12/31/2013 were included (N=14131, note that data were updated from the abstract which presented data using transplants 1/1/2011-6/30/2013).
- For single-organ liver transplants, expected outcomes were estimated using the standard SRTR risk adjustment models.
- For multi-organ recipients, the model was refit on the multi-organ cohort with additional adjusters for whether the transplant was an SLK or another type of multi-organ transplant.
- Bayesian hazard ratios were estimated and programs were hypothetically identified for review if they met the newly adopted MPSC screening algorithm [$P[HR>1.2]>0.75$ or $P[HR>2.5]>0.1$].

Results

- 8% of liver transplants were SLK (N=1135) and 1% were other types of multi-organ liver transplants (N=110, Table 1 & Table 2).
- 124 programs performed at least 1 liver transplant (single- or multi-organ) during the observation period. When analyzing all 1st-year graft failures at these programs, 10 (8.1%) would meet hypothetical review criteria (Figure 1 & Table 3).
- If analyzing SLK recipients separately, 104 programs performed at least 1 SLK transplant. Of these 9 (8.7%) would meet hypothetical review criteria based on 1st-year liver graft survival (Figure 2, left panel, and Table 3).
- Analyzing single-organ transplants separately (as is current practice) would identify 10 of 124 programs (8.1%, Figure 2, right panel and Table 3).
- 16 programs were identified for either SLK or single-organ outcomes (Table 3).
- 3 of 124 (2%) programs were identified for SLK, single-organ, and combined outcomes (Table 3, **).
- 9 of 124 (7%) programs would be identified using either approach 1 or approach 2 (Table 3, * or **).

Table 1.

Single- and Multi-organ liver transplants performed 7/1/2011-12/31/2013

Transplant Type	N (%)	Graft Failures (% of transplants that fail)
Single-Organ Liver	12,886 (91%)	1,414 (11%)
SLK	1,135 (8%)	149 (13%)
Other multi-organ liver	110 (<1%)	23 (21%)
Total	14,131 (100%)	1,586 (11%)

Figure 1.

Program outcomes evaluations by combining single- and multi-organ recipients into one evaluation cohort.

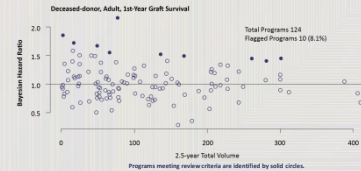


Table 2.

Other types (non-SLK) of multi-organ liver transplants performed 7/1/2011-12/31/2013

Multi-organ combination	N	(%)
Liver-pancreas-intestine	46	42%
Liver-heart	41	37%
Liver-Lung	12	11%
Liver-Kidney-Pancreas-Intestine	8	7%
Liver-Kidney-Heart	2	2%
Liver-Pancreas	1	1%

Figure 2.

Program outcomes evaluations by analyzing single-organ and SLK recipients separately, excluded other types of multi-organ.

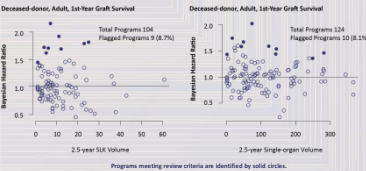


Table 3.

Comparison of outcomes by combined (approach 1) vs. separate (approach 2) multi-organ evaluations. Only programs identified by at least 1 of the methods are shown.

*Programs identified by both approaches.

**Programs identified for both SLK and single-organ outcomes (N=3).

Program	Transplant Volume			Approach 1: Combined Evaluation		Approach 2: SLK and Single-Organ Reviewed Separately			
	Single-organ transplants (N)	Multi-organ transplants (N)	SLK transplants (N)	Combined single- and multi-organ hazard ratio	Identified for review on combined cohort?	SLK hazard ratio	Identified for SLK outcomes?	Single-organ hazard ratio	Identified for single-organ outcomes?
A*	282	19	19	1.45	Yes	1.19	No	1.46	Yes
B**	250	11	11	1.45	Yes	1.93	Yes	1.36	Yes
C	240	41	19	1.41	Yes	0.82	No	1.36	No
D	236	7	7	1.22	No	2.17	Yes	1.11	No
E	194	33	25	1.08	No	1.83	Yes	0.92	No
F	180	26	23	1.26	No	1.80	Yes	1.14	No
G*	144	24	24	1.49	Yes	1.12	No	1.54	Yes
H	142	3	3	1.41	No	0.84	No	1.44	Yes
I	139	5	5	1.18	No	1.63	Yes	1.08	No
J*	122	14	14	1.52	Yes	0.90	No	1.59	Yes
K	84	6	6	1.01	No	1.71	Yes	0.85	No
L**	73	4	4	2.16	Yes	1.73	Yes	2.03	Yes
M*	54	12	12	1.55	Yes	1.70	Yes	1.39	No
N*	49	0	0	1.67	Yes	NA	No	1.67	Yes
O	43	3	3	1.49	No	0.83	No	1.59	Yes
P*	16	1	1	1.72	Yes	0.98	No	1.75	Yes
Q**	1	1	1	1.85	Yes	1.45	Yes	1.44	Yes

Conclusions

- If using a combined cohort that includes ALL multi-organ recipients:
 - 10 programs identified
 - 7 programs potentially missed
 - 5 programs with poor SLK outcomes covering 66 SLK transplant recipients
 - 2 programs with poor liver-alone outcomes covering 185 liver-alone transplants.
- If evaluating SLK and liver-alone cohorts separately:
 - 16 programs identified
 - 1 program potentially missed
 - This program had poor outcomes on 41 other multi-organ recipients that were not evaluated in approach 2.
- SRTR is continuing to work with the MPSC and the SRTR Technical Advisory Committee to explore options for public reporting of multi-organ liver outcomes and potential review by the MPSC.

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Dr. Lake and Dr. Kim are affiliated with the liver transplant programs at the University of Minnesota & Stanford University, respectively. The authors have no other conflicts to report.

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