Aligning Pediatric Waiting List and Posttransplant Outcomes with the Adult Lung Allocation Score

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Introduction

- The Organ Procurement and Transplantation Network (OPTN) is moving toward a continuous distribution framework for lung allocation.

- This framework includes measures of waitlist urgency and posttransplant survival, as computed in the lung allocation score (LAS).

- Currently, candidates aged 0-11 years are excluded from the LAS models and instead classified on the waitlist as Pediatric Priority I (more urgent) or II (less urgent).

- These patients don't have a measure of waitlist urgency or posttransplant survival to contribute to continuous allocation score.

- Giving children a waitlist urgency and posttransplant survival measure in the continuous distribution framework allows children increased access to donor organs.

- We computed these values in children to put children on the "same footing" in a continuous distribution framework in a data-driven way.

Methods

- Using SRTR data, we constructed a cohort of candidates 0-11 years on the lung waiting list September 12, 2010-January 31, 2019, the largest cohort available at the time of analysis.

- The Pediatric Priority score was introduced on September 12, 2010.

Methods (cont'd)

- Heart-lung candidates and candidates with no Pediatric Priority score were excluded.

- The model-fitting method was similar to LAS methods, except that we limited the models to one covariate: Pediatric Priority I vs. II.

- Waitlist candidates were followed for up to a year, censored at the earliest of January 31, 2020, waitlist removal, or the date when the candidate aged into the LAS system.

- Outcome was death on the waiting list within 1 year.

- Transplant recipients aged 0-11 years who underwent transplant September 12, 2010-January 31, 2019, were followed up to 1 year.

- Outcome was death within 1 year of transplant.

- For each cohort, we fit a Cox proportional hazards model for the effect of Pediatric Priority I vs. II on the risk of 1-year mortality.

- Each model generated a baseline survival function and coefficient estimate associated with Pediatric Priority I.

- These were used to compute area under the curve (AUC) for the waitlist and posttransplant models.

- The value of waitlist AUC (WLAUC) is interpreted as the predicted number of days a patient would survive on the waiting list.

- The value of the posttransplant AUC (PTAUC) is interpreted as the number of predicted days of survival in the first posttransplant year.

- We computed LAS(p)=

$$100*[PTAUC-2*WLAUC +730]/1095$$

Table 1: Characteristics of candidates and recipients aged 0-11 years

Characteristic	Level	Waiting list		Transplant recipients	
		N	%	N	%
All		271	100	136	100
Age at listing/transplant	<1	58	21.4	27	19.9
	1-5	66	24.4	39	28.7
	6-11	147	54.2	70	51.5
Sex	Female	141	52.0	75	55.2
	Male	130	48.0	61	44.8
Diagnosis	CF	63	23.3	34	25.0
	Pulmonary HTN	56	20.7	24	17.7
	Pulmonary fibrosis	27	10.0	13	9.6
	Other	125	46.1	65	47.8
Year of listing/transplant	2005-2009	8	3.0	0	0
	2010-2014	164	60.5	77	56.6
	2015-2018	99	36.5	59	43.4
Time on the list*	≤ 30 days	46	17.0	26	19.1
	31-90 days	83	30.6	55	44.4
	91 days-6 months	46	17.0	25	18.4
	6-12 months	49	18.1	22	16.2
	> 12 months	47	17.3	8	5.9
Initial Pediatric Priority	I	133	49.1	76	55.9
	II	138	52.9	60	44.1
Final Pediatric Priority	I	146	53.9	79	58.1
	II	125	46.1	57	41.9
Died on waiting list		51	18.8	NA	NA
Died within 1 year of transplant		NA	NA	22	16.2

Table 2: Estimates of survival days by Pediatric Priority

	N	WLAUC (Days)	PTAUC (Days)	LAS(p)
Priority I	133	247	333	52.0
Priority II	138	325	328	37.3
Overall	271	286	331	44.5

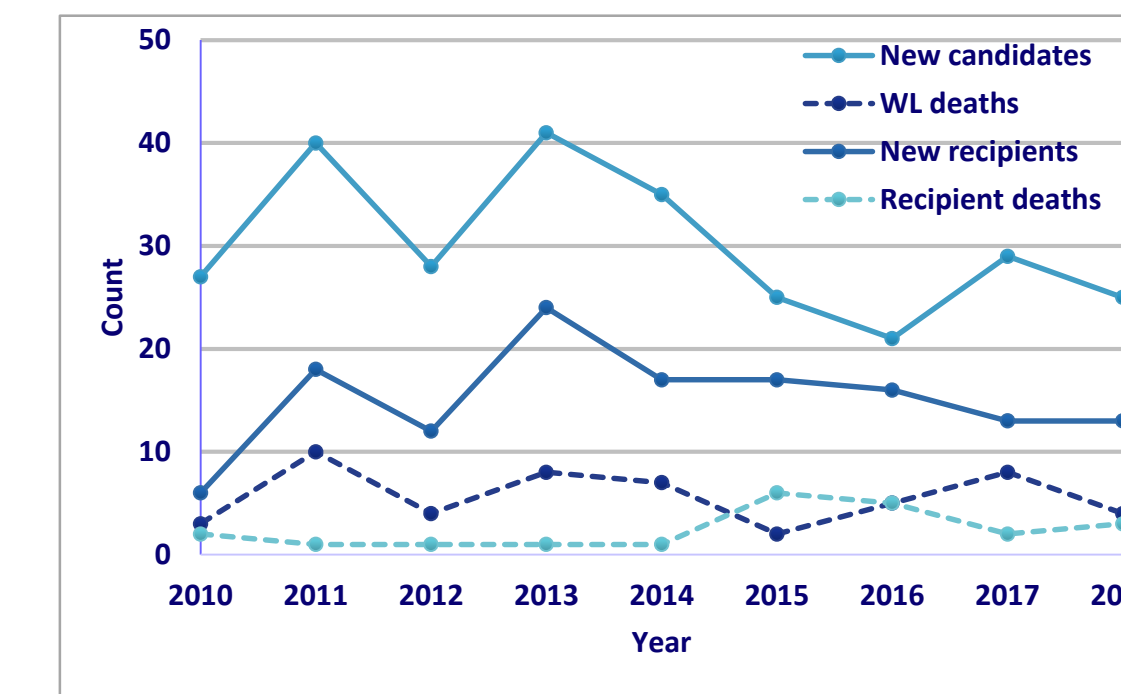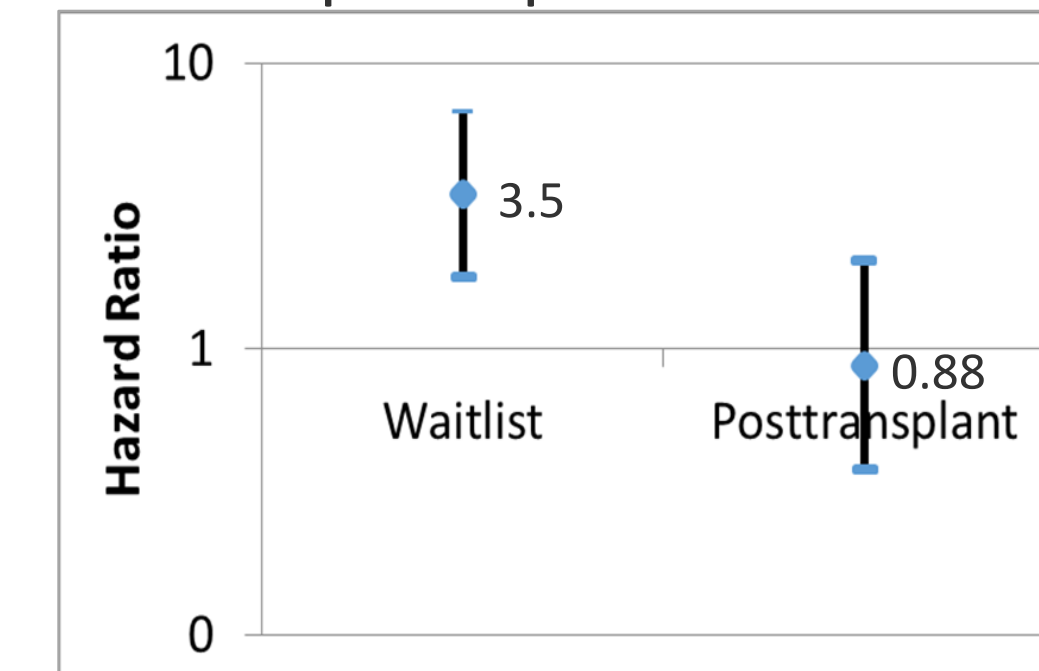**Figure 1: Counts of patients and deaths within 1 year**

Figure 2: Effect of Pediatric Priority I on waitlist and posttransplant survival models

Results

- The number of candidates and recipients was small, reflecting low volumes of children aged 0-11 years on the lung waiting list.

- Figure 1 shows that 21-41 candidates entered the cohort annually from 2010 to 2018, and 2-10 per year died waiting.

- Six to 24 candidates underwent transplant per year, and 1 to 6 per year died within a year of transplant.

- Of 271 candidates ever active on the waiting list September 12, 2010-January 31, 2019, 136 (50.2%) underwent transplant during that period; 51 (18.8%) died within a year of entering the cohort (Table 1).

- Most candidates (54.2%) were aged 6-11 years when they entered the cohort, and 21.4% were infants. Recipient age distributions were similar.

- Diagnoses were varied, with nearly half of candidates and recipients classified as "other."

- Nearly half of candidates were initially classified as Pediatric Priority I, and slightly over half had a final Pediatric Priority score of I.

- Among recipients, 55.9% were initially classified as Pediatric Priority I, with 58.1% Pediatric Priority I at transplant.

- The risk of waitlist death was 3.5 times higher among Pediatric Priority I children than in those in Pediatric Priority II (Figure 2). The cohort was small, and 95% confidence limits on the hazard ratio were wide: HR= 3.50 (1.80-6.79), P=0.0002.

Results (cont'd)

- Pediatric Priority I was not a significant predictor of 1-year posttransplant death: HR=0.88 (0.38-2.03), P=0.76.

- Estimates of WLAUC for Pediatric Priority I children was 247 days, compared with 325 days for Pediatric Priority II children (Table 2).

- An LAS equivalent for children that weights WLAUC twice as heavily as PTAUC generated LAS values of 52.0 for Pediatric Priority I children and 37.3 for Pediatric Priority II children.

Summary & Conclusions

- Pediatric Priority I status was a significant predictor of 1-year waitlist mortality but not 1-year posttransplant mortality in children aged 0-11 years.

- WLAUC and PTAUC values computed for children provide a waitlist urgency and posttransplant outcome measure for children within the continuous distribution context, improving their access to lung donors.

- Additional access will be given to children via pediatric boost points and other factors in a continuous allocation score.

Authors have no conflicts of interest to disclose.