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# Program-Specific Survival From Listing

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# Disclosures

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I have no financial relationships to disclose within the past 12 months relevant to my presentation. The ACCME defines “relevant” financial relationships as financial relationships in any amount occurring within the past 12 months that create a conflict of interest.

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# Background

In the United States, posttransplant survival is historically the metric of choice for regulatory review and public reporting, despite the importance of access to transplant for optimal long-term patient outcomes. Posttransplant survival may fail to accurately describe the expected survival experience of a patient after listing.

Survival after listing offers an intuitive patient-relevant alternative to posttransplant survival.



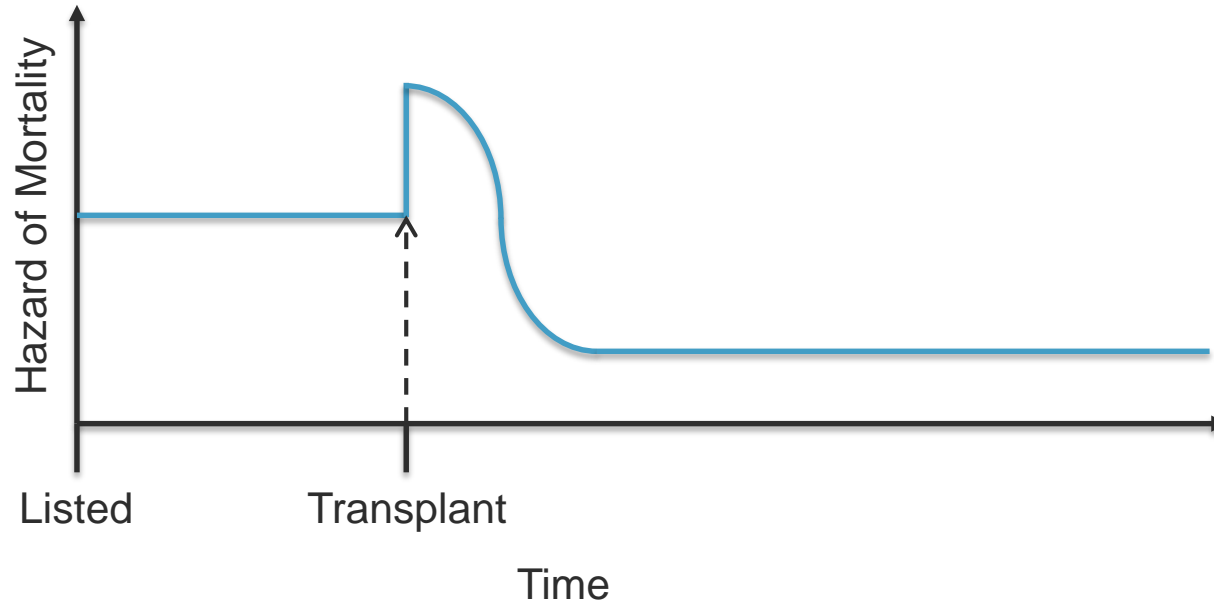
# What is Survival after Listing?

Survival after listing has direct relationships with the three primary pretransplant and posttransplant metrics reported by the SRTR:

- Waitlist mortality rate ratio: Corresponds to the relative hazard prior to transplant.
- Transplant rate ratio: The relative rate at which programs transition candidates from the relatively high hazard of waiting list to the relatively low hazard after transplant.
- Posttransplant survival hazard ratio: Corresponds to the relative hazard after transplant.



# What is Survival after Listing?



# Questions of Interest

We are particularly interested in two dimensions of survival after listing:

- Correlation with current pretransplant and posttransplant metrics: Conceptually, we expect that each of the current metrics will be associated with survival after listing. However, the relative strength of the association may differ across metrics and organs.
- Variability compared with current pretransplant and posttransplant metrics: Since the current metrics are relatively independent of each other and survival from listing conceptually averages over each metric, the variability in program-specific survival after listing may be lower than the current metrics.

# Estimation of Program-Specific Survival After Listing

Candidates were included if...

- Listed between July 1, 2011-June 30, 2016.
- Still alive on July 1, 2014.
- Only first listed candidates at a program.

Cox proportional hazards models estimated program effects with a log-Normal frailty term. A time-varying covariate for transplant was *not* included because higher transplant rate ratios should improve survival from listing due to better access to transplant.

The pretransplant and posttransplant outcomes were retrieved from the January 2017 release of the SRTR program-specific reports.



# Correlation (R-value) of Survival After Listing with Current Metrics

Organ	Waitlist Mortality Rate Ratio	Transplant Rate Ratio	Posttransplant Graft Survival
Kidney	0.55 (<0.001)	-0.31 (<0.001)	0.28 (<0.001)
Liver	0.43 (<0.001)	-0.55 (<0.001)	0.19 (0.032)
Lung	0.19 (0.121)	-0.13 (0.313)	0.32 (0.008)
Heart	0.54 (<0.001)	-0.27 (0.003)	0.47 (<0.001)



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# Standard Deviation of Program-Specific Metrics

Organ	Survival After Listing	Waitlist Mortality Rate Ratio	Transplant Rate Ratio	Posttransplant Graft Survival
Kidney	0.155	0.255	1.015	0.329
Liver	0.192	0.306	0.623	0.283
Lung	0.112	0.414	0.666	0.356
Heart	0.090	0.319	0.591	0.355

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# Overview of Results

Program-specific survival after listing was associated with the current pretransplant and posttransplant metrics included in the program-specific reports.

Program-specific survival after listing had lower variability than current metrics. This is not surprising because current metrics conceptually determine survival after listing and are relatively independent of each other.





# Going Forward

The association of current pretransplant and posttransplant metrics with prospective survival after listing provides an interesting avenue to investigate the relative utility of each metric.

SRTR is in the early stages of developing a modeling framework for survival after listing.



# Survival from Listing and Non-Proportional Hazards

Survival from listing analyses suffer from severe non-proportional hazards:

- Any factor associated with transplant rate likely suffers from non-proportional hazards.
- The *Cox proportional hazards* model is the most common statistical method for survival analysis.
- Time-dependent effects may alleviate non-proportional hazards but will significantly increase model complexity.
- Other survival analysis methods exist but have other limitations.
  - Quantile regression: Quantiles may not be defined