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TRANSPLANT  
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# Making Sense of SRTR Risk Adjustment Models

Jon Snyder, PhD

Andrew Wey, PhD

Nicholas Salkowski, PhD

# Objectives

- Background and Overview - Snyder
- Pretransplant Models - Wey
- Posttransplant Models - Salkowski

# Why risk adjust?



**Program  
A**

Survival: 95%



**Program  
B**

Survival: 85%

# Why risk adjust?



**Program  
A**

Survival: 95%



**Program  
B**

Survival: 85%

# Why risk adjust?



## Kidney Program

**A**

Survival: 95%

Average Recipient Age: 40



## Kidney Program

**B**

Survival: 85%

Average Recipient Age: 55

# Why risk adjust?



## Kidney Program

**A**

Survival: 95%

Average Recipient Age: 40



## Kidney Program

**B**

Survival: 85%

Average Recipient Age: 55

# Why risk adjust?



## Kidney Program

**A**

Survival: 95%

Average Recipient Age: 40

Average KDPI: 25%



## Kidney Program

**B**

Survival: 85%

Average Recipient Age: 55

Average KDPI: 75%

# Why risk adjust?



## Kidney Program

**A**

Survival: 95%

Average Recipient Age: 40

Average KDPI: 25%



## Kidney Program

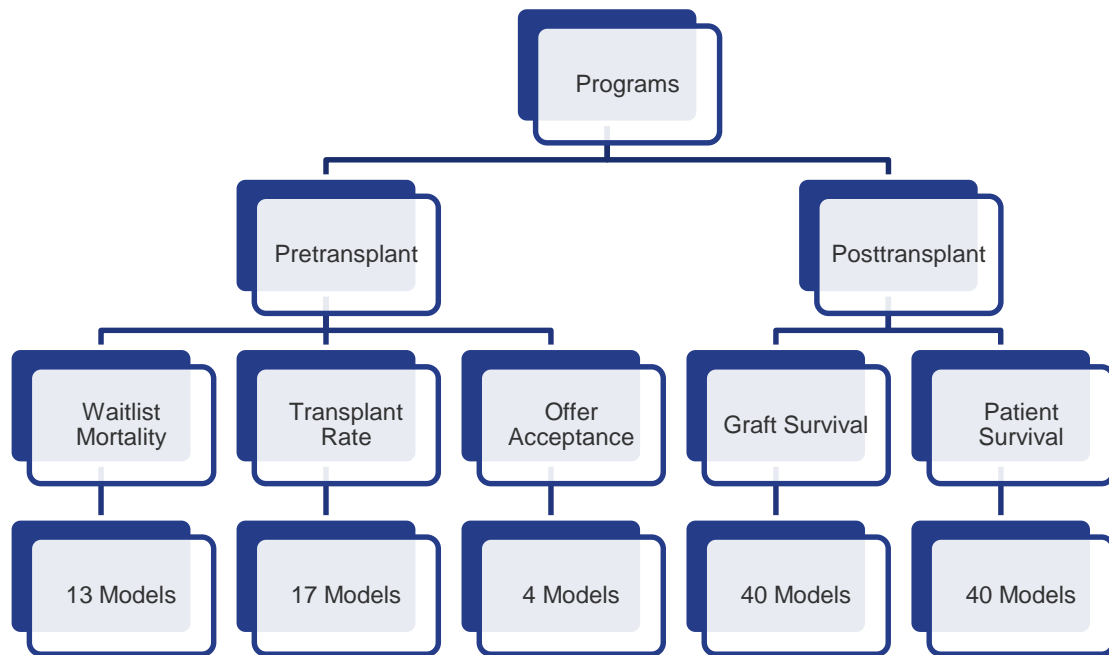
**B**

Survival: 85%

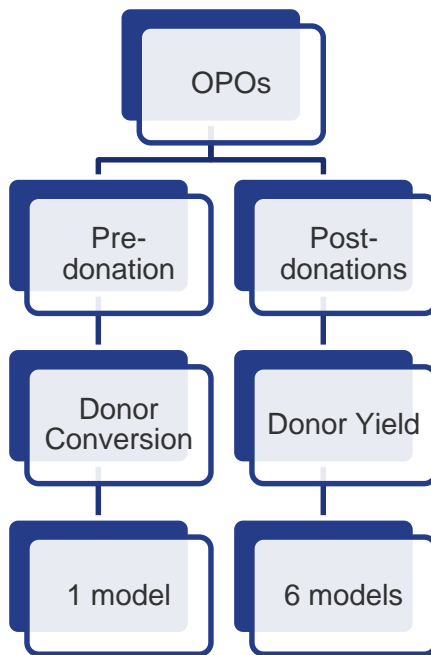
Average Recipient Age: 55

Average KDPI: 75%

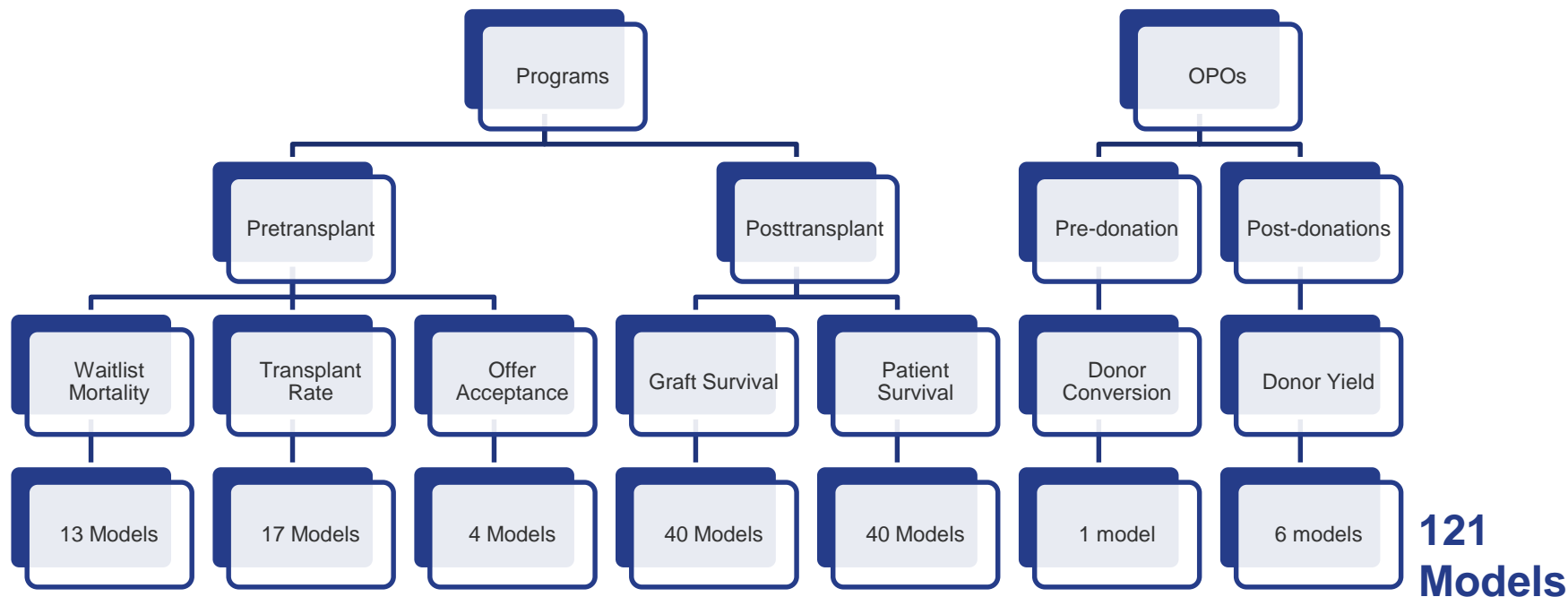
# SRTR Risk Adjustment Model Family Tree



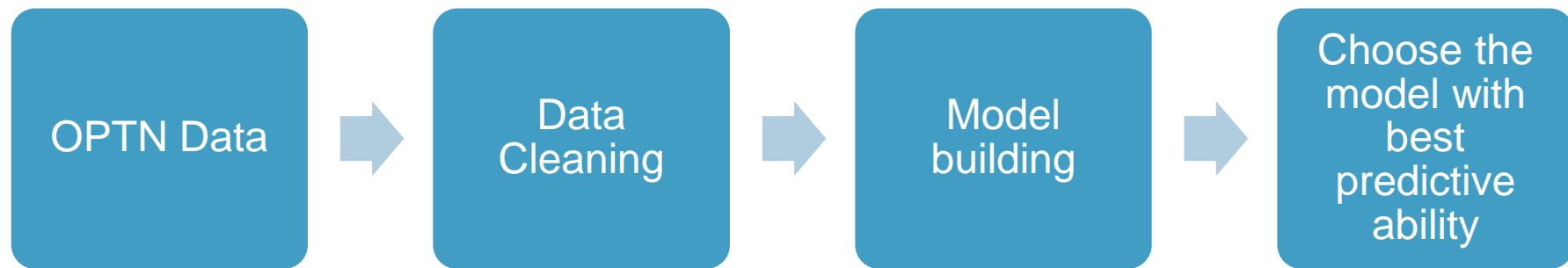
# SRTR Risk Adjustment Model Family Tree



# SRTR Risk Adjustment Model Family Tree



# The Process for Building Models



Snyder JJ, Salkowski N, Kim SJ, Zaun D, Xiong H, Israni AK, Kasiske BL. Developing statistical models to assess transplant outcomes using national registries: The process in the United States Transplantation. 2016;100:288-294.



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# Posttransplant Risk- Adjustment Models


Nicholas Salkowski, PhD

# Risk Adjustment Models Available Under “Reports and Tools”

The screenshot displays the SRTR website's header and navigation menu. The header includes the SRTR logo, the text 'SCIENTIFIC REGISTRY OF TRANSPLANT RECIPIENTS', and a section titled 'FIND & COMPARE TRANSPLANT PROGRAMS' with a search bar and a 'SEARCH' button. The navigation menu features links for 'ABOUT SRTR', 'ABOUT THE DATA', 'REPORTS & TOOLS', 'NEWS & MEDIA', 'REQUESTING SRTR DATA', and 'CONTACT US'. The 'REPORTS & TOOLS' dropdown menu is open, listing various reports. A blue circle highlights the 'Risk Adjustment Models' section, which includes links for 'Posttransplant Outcomes', 'Waiting List', 'Offer Acceptance', and 'OPOs'. The main content area shows a banner for 'Over 24,000 transplants have been performed this year.' and a link to 'Spring 2018 PSRs Updated'.

**SRTR** SCIENTIFIC REGISTRY OF TRANSPLANT RECIPIENTS

**FIND & COMPARE TRANSPLANT PROGRAMS**

Select Organ  Search by Postal Code or Program Name (optional) **SEARCH**

**ABOUT SRTR** **ABOUT THE DATA** **REPORTS & TOOLS** **NEWS & MEDIA** **REQUESTING SRTR DATA** **CONTACT US**

**Over 24,000 transplants have been performed this year.**

**Spring 2018 PSRs Updated**

About SRTR Reports  
SRTR/OPTN Annual Data Report  
Program-Specific Reports  
Organ Procurement Organization Reports  
**Risk Adjustment Models: Posttransplant Outcomes**  
**Risk Adjustment Models: Waiting List**  
**Risk Adjustment Models: Offer Acceptance**  
**Risk Adjustment Models: OPOs**  
PSR Reporting Timeline

# SRTR Risk Adjustment Model Documentation: Posttransplant Outcomes

Choose a PSR Release Date:

January 2018

Heart, Kidney, Liver, and Lung

Kidney-Pancreas and Pancreas

Choose a transplant type:

- ☒ Heart
- ☐ Kidney
- ☐ Liver
- ☐ Lung

Choose an outcome:

- ☒ Graft Survival
- ☐ Patient Survival

Choose an age group:

- ☒ Adult (18+)
- ☐ Pediatric (<18)

Choose a donor type:

- ☒ Deceased Donor

Model Elements

Model Coefficients

Model Element Plots

Baseline Cumulative Hazard

Other Elements

Additional info

Every PSR cycle, the SRTR refits the models for graft and patient survival. Many potential predictors were considered, and these elements were found to produce the best predictive model. Other potential predictors that were not found to improve the model can be found on the "Other Elements Considered" tab.

Note: the list of predictors may include indicators for multiorgan transplant types. The SRTR is building new models so that multiorgan transplants can be included in future risk-adjusted outcomes, although they are not currently included in the data presented in the program-specific reports.

Show 50 entries

Search:

| Element Type | Element                     |
|--------------|-----------------------------|
| Candidate    | Candidate Diabetes Type     |
| Candidate    | Candidate Highest Education |
| Candidate    | Candidate Race              |
| Donor        | Donor Age (yr)              |
| Donor        | Donor BMI                   |



# The Model Elements Table:

Model Elements

Model Coefficients

Model Element Plots

Baseline Cumulative Hazard

Other Elements

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| Candidate    | Candidate Race              |
| Donor        | Donor Age (yr)              |
| Donor        | Donor BMI                   |
| Donor        | Donor BUN                   |
| Donor        | Donor Cause of Death        |

Contains a list of all factors currently included in the risk adjustment model.

# The Model Coefficients Table:

[Model Elements](#) [Model Coefficients](#) [Model Element Plots](#) [Baseline Cumulative Hazard](#) [Other Elements](#) [Additional info](#)

This table shows the coefficients for each level of the risk adjusters included in the model. These coefficients are from a Cox proportional hazards model. To better understand the relationship between each element and modeled risk, click on the 'Model Element Plots' tab. To download a .CSV file of the model, click the button above.

Note: the list of predictors may include indicators for multiorgan transplant types. The SRTR is building new models so that multiorgan transplants can be included in future risk-adjusted outcomes, although they are not currently included in the data presented in the program-specific reports.

Coefficients:

[Download .CSV File](#)

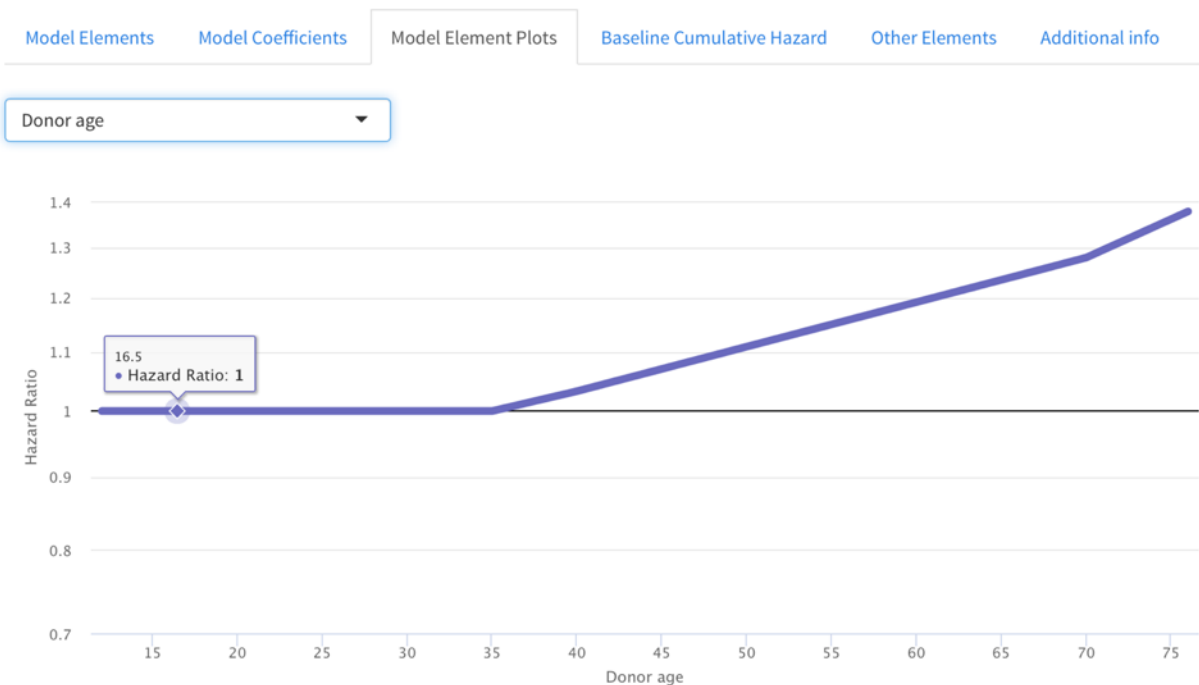
Show 50 entries

Search:

| Element                     | Level              | Coefficient |
|-----------------------------|--------------------|-------------|
| Candidate Diabetes Type     | None               | 0.000000    |
| Candidate Diabetes Type     | Type I             | 0.000000    |
| Candidate Diabetes Type     | Type II            | 0.055544    |
| Candidate Diabetes Type     | Type Other/Unknown | 0.000000    |
| Candidate Diabetes Type     | Missing            | 0.000000    |
| Candidate Highest Education | Grade School/None  | 0.233273    |
| Candidate Highest Education | High School        | 0.000000    |

Contains the actual statistical model along with a downloadable CSV file if you would like to work with the model directly.

# The Model Element Plots:



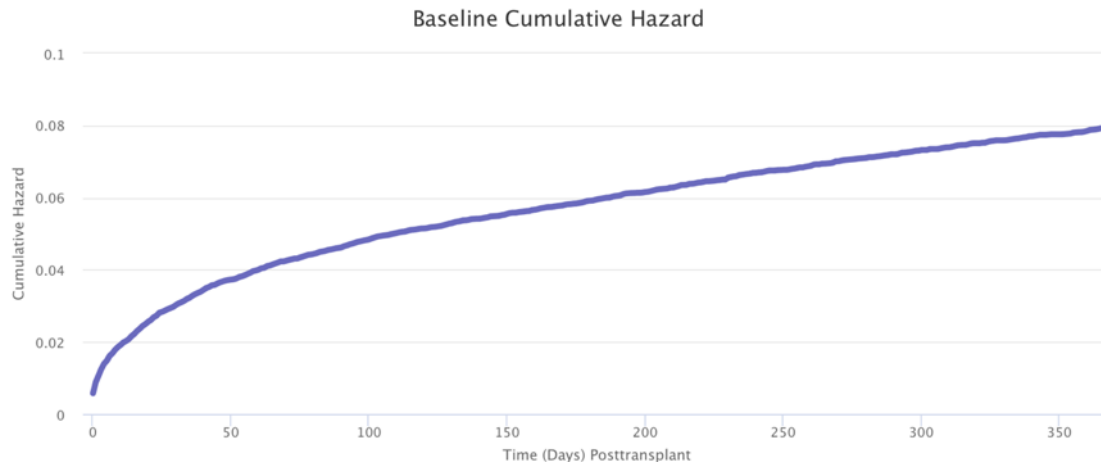
Allows you to visualize the relationship between the element and predicted risk of graft failure or death.

# The Baseline Cumulative Hazard:

[Model Elements](#)[Model Coefficients](#)[Model Element Plots](#)[Baseline Cumulative Hazard](#)[Other Elements](#)[Additional info](#)

Baseline Hazard:

[Download .CSV File](#)



Needed by a statistician if working with the actual model. The function is provided as a downloadable CSV file.

# The Other Elements Tab:

[Model Elements](#)[Model Coefficients](#)[Model Element Plots](#)[Baseline Cumulative Hazard](#)[Other Elements](#)[Additional info](#)

Many potential predictors of graft survival were considered, and the elements that were found to produce the best predictive model can be found on the "Model Elements" tab. The predictors listed here were not found to improve the model, but may be included in future models.

Show 50 entries

Search:

| Element Type | Excluded Element                            |
|--------------|---|
| Candidate    | Candidate history of portal vein thrombosis |
| Candidate    | Candidate last SRTR MELD/PELD given         |
| Donor        | Donor blood type                            |
| Donor        | Donor clinical lung infection               |
| Donor        | Donor ethnicity                             |
| Donor        | Donor history of cancer                     |
| Donor        | Donor log(INR)                              |
| Donor        | Donor other infection                       |

Provides a listing of other elements considered during model development but not found to add predictive value.

# Additional Info tab:

[Model Elements](#)[Model Coefficients](#)[Model Element Plots](#)[Baseline Cumulative Hazard](#)[Other Elements](#)[Additional info](#)

## Additional Model Information

This document contains additional information that you may find useful in understanding how the SRTR calculates certain variables used in the models.

Provides additional information about the model.

### Body Mass Index (BMI)

SRTR calculates recipient and donor body mass index (BMI) using height (cm) and weight (kg) as follows:

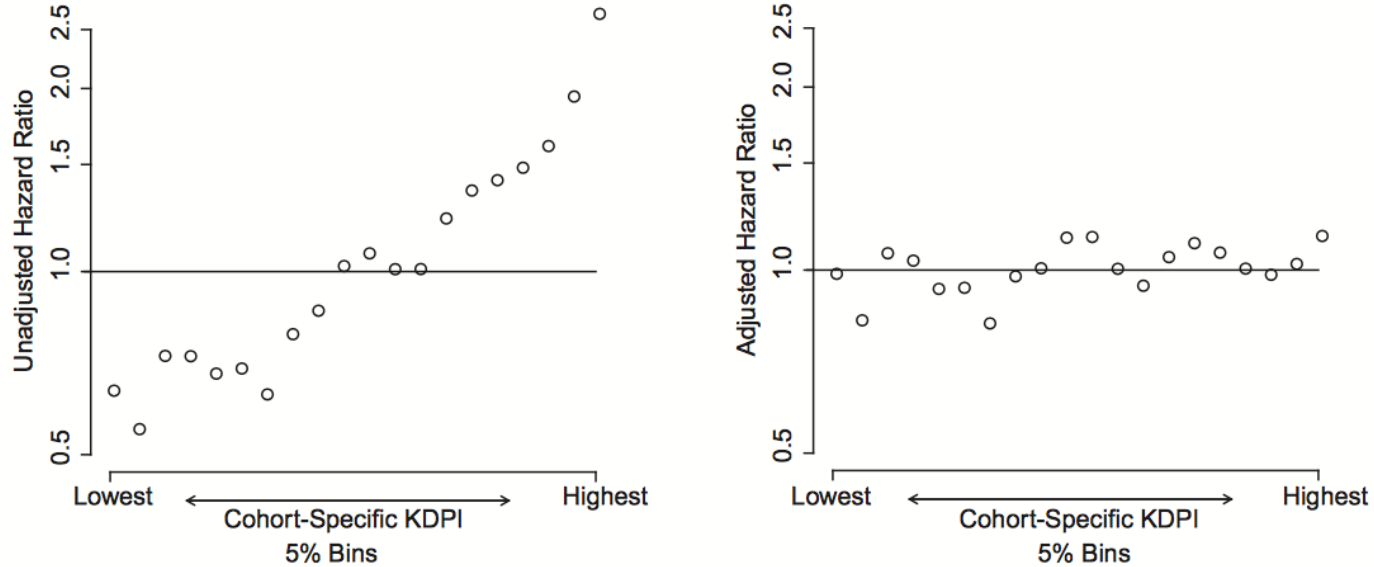
$$BMI = \frac{weight(kg)}{height(m)^2}$$

### Race and Hispanic/Latino Ethnicity

SRTR considers racial groups separately from Hispanic Ethnicity. Racial groupings are collected within the UNet<sup>SM</sup> system include the following:

- American Indian or Alaska Native
- Asian

# How well to the models account for measured risk?



Snyder, et al. Effects of High-Risk Kidneys on Scientific Registry of Transplant Recipients Program Quality Reports. Am J Transplant 2016;16:2646-53.

# Risk Adjustment

The SRTR uses risk-adjusted models when:

- There are enough events to build a model
- There are available factors that predict the outcome

So, some models aren't risk-adjusted. For example:

- Pediatric Kidney Deceased-Donor 1-Year Graft Survival isn't adjusted because no predictors were identified
- Pediatric Kidney Deceased-Donor 1-Year Survival Patient Survival isn't adjusted because there are few events

# Multiple Adjustments

Usually, risk adjusted models include more than one predictor, which can make interpretation complicated.

We often get questions like “Everybody knows that patients in group X have worse outcomes, but the adjustment for X says that X is protective. What’s wrong with the model?”

Of course, the models adjust for many things in addition to X, and a protective effect for X doesn’t mean that patients in group X do better, only that they do better than expected based on all the other factors in the model.

# Combining Models

For Kidney and Liver programs, the expected number of events is calculated separately for each donor type (deceased or living), then the sum of the expected events is used for the overall evaluation.

# Adult and Pediatric Recipients

The SRTR has implemented a new definitions for adult and pediatric recipients:

- An *adult recipient* is a transplant recipient who was 18 or older when *listed* at the transplant program which performed the transplant
- A *pediatric recipient* is a transplant recipient who was 17 or younger when *listed* at the transplant program which performed the transplant

The old definitions were based on the age at transplant, rather than the age at listing. Switching to the age at listing allows the SRTR to use similar definitions for posttransplant and pretransplant metrics, and also helps patients identify programs who only list pediatric candidates.



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# Pretransplant Risk- Adjustment Models

Andrew Wey, PhD  
Sally Gustafson, MS

# What pretransplant models are published by SRTR?

SRTR currently publishes pretransplant models for:

- Waitlist mortality rates
- Overall and deceased donor transplant rates
- Offer acceptance practices

We will cover frequently asked questions about (1) the concepts measured by the models and (2) the data used in the models.

# Q1: Don't programs with high transplant rates have low waitlist mortality rates?

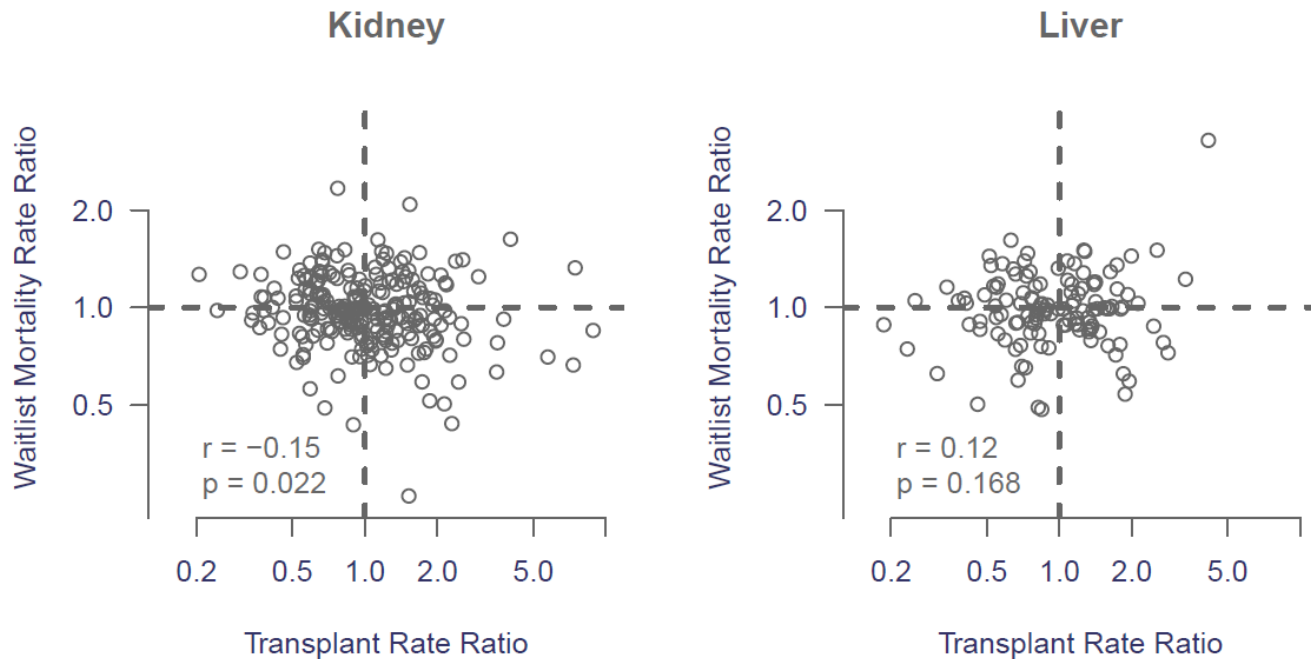
Intuitively, programs with high transplant rates are more likely to transplant their candidates before they die on the waiting list.

However, the waitlist mortality rate does not measure the probability of dying on the waiting list. Instead, it is measuring the probability of waitlist mortality on a single day given a candidate was alive at the beginning of the day.

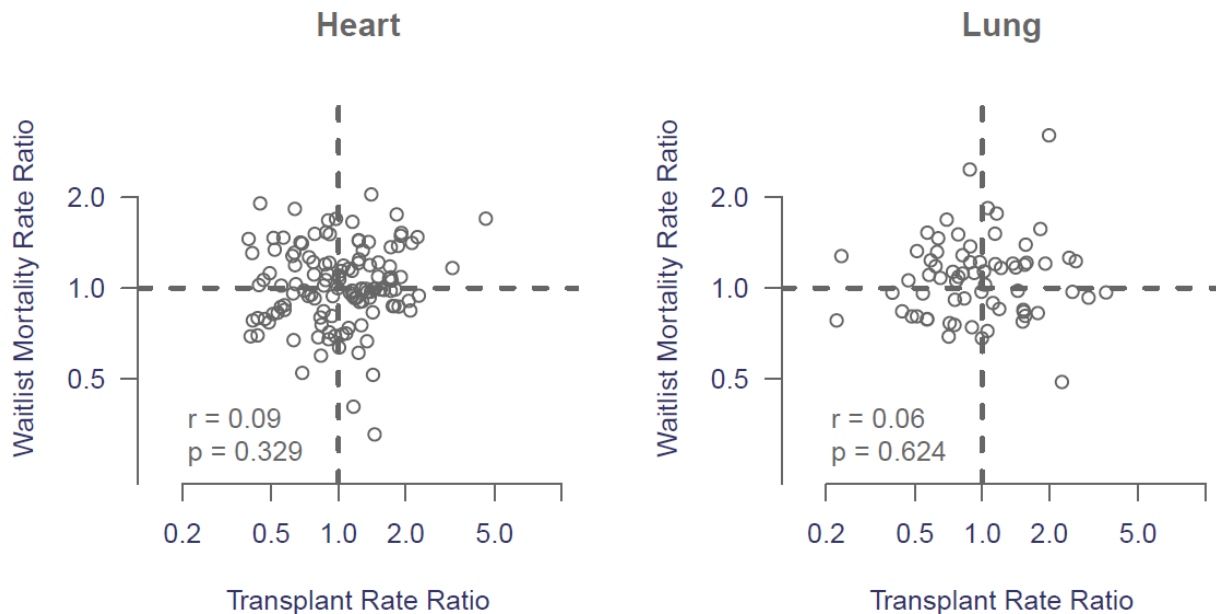
There is no inherent or mathematical reason for a program with a high transplant rate to have a low waitlist mortality rate.

Wey et al., "Program-specific transplant rate ratios: Association with allocation priority at listing and posttransplant outcomes," *American Journal of Transplantation*, 2018.

# Q1: Don't programs with high transplant rates have low waitlist mortality rates?



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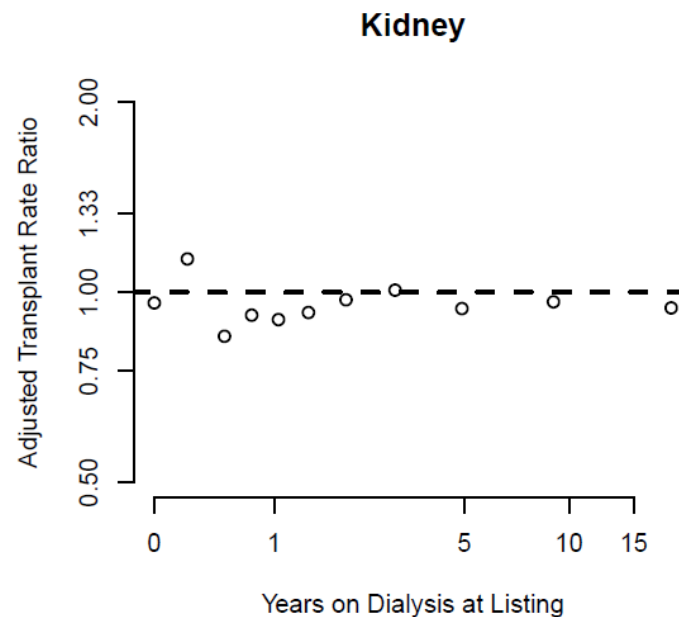
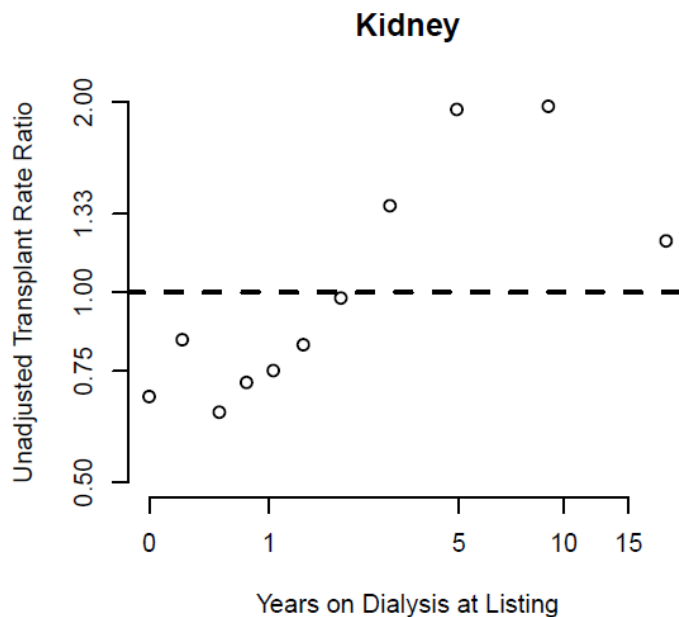
# Q1: Don't programs with high transplant rates have low waitlist mortality rates?

Risk-adjusted transplant and waitlist mortality rate ratios are not associated with each other. Therefore, they measure different processes of transplant program care, and it possible to have good outcomes for both.

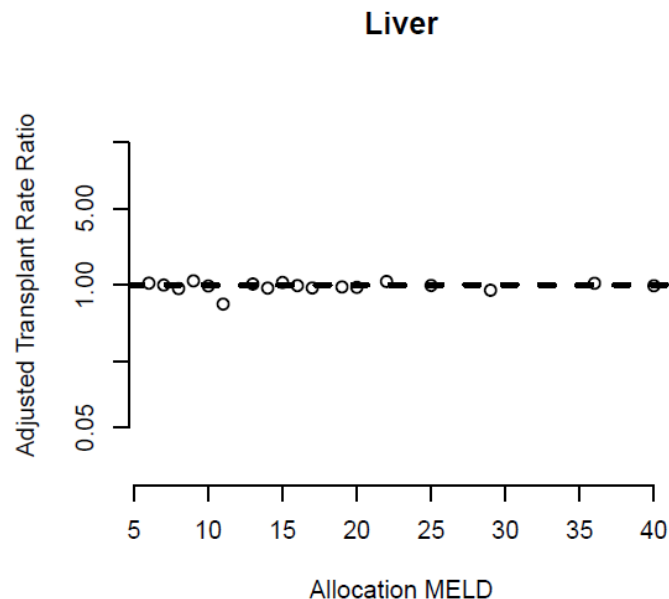
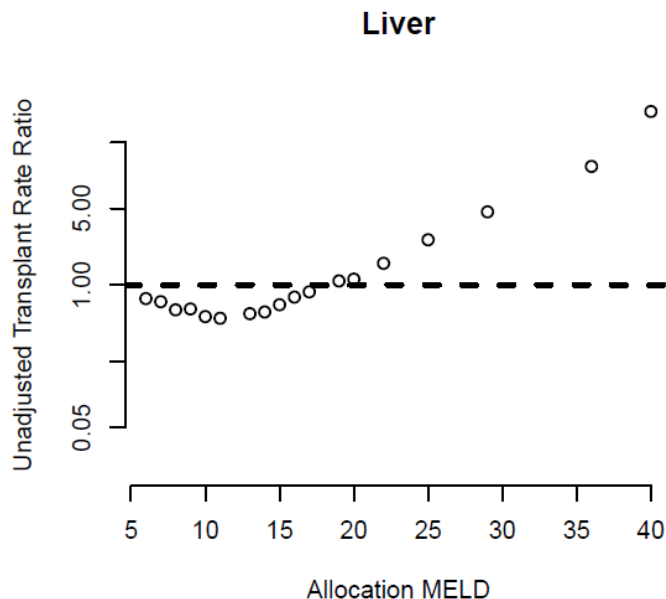
## Q2: Can I improve my transplant rate ratio by listing candidates with high allocation priority?

There is a common perception that programs that list candidates with higher allocation priority will have better transplant rate ratios. In general, this is not true because the models adjust for components of allocation priority.

## Q2: Can I improve my transplant rate ratio by listing candidates with high allocation priority?

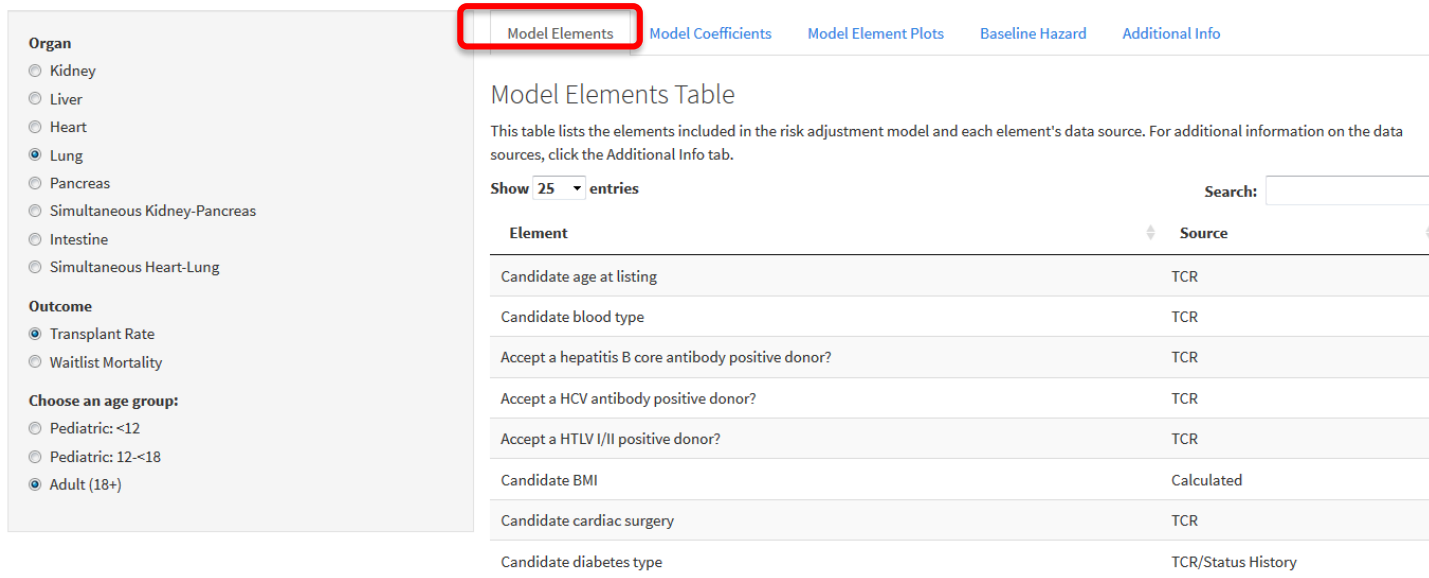


## Q2: Can I improve my transplant rate ratio by listing candidates with high allocation priority?



# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models



**Model Elements** | Model Coefficients | Model Element Plots | Baseline Hazard | Additional Info

**Organ**

- ☐ Kidney
- ☐ Liver
- ☐ Heart
- ☒ Lung
- ☐ Pancreas
- ☐ Simultaneous Kidney-Pancreas
- ☐ Intestine
- ☐ Simultaneous Heart-Lung

**Outcome**

- ☒ Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

- ☐ Pediatric: <12
- ☐ Pediatric: 12-<18
- ☒ Adult (18+)

### Model Elements Table

This table lists the elements included in the risk adjustment model and each element's data source. For additional information on the data sources, click the Additional Info tab.

Show **25** entries

Search:

| Element  | Source             |
|--|--------------------|
| Candidate age at listing                           | TCR                |
| Candidate blood type                               | TCR                |
| Accept a hepatitis B core antibody positive donor? | TCR                |
| Accept a HCV antibody positive donor?              | TCR                |
| Accept a HTLV I/II positive donor?                 | TCR                |
| Candidate BMI                                      | Calculated         |
| Candidate cardiac surgery                          | TCR                |
| Candidate diabetes type                            | TCR/Status History |

# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

**Organ**

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**Outcome**

- ☒ Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

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Model Elements   **Model Coefficients**   Model Element Plots   Baseline Hazard   Additional Info

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**Choose an age group:**

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Model Elements   Model Coefficients   Model Element Plots   Baseline Hazard   **Additional Info**

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- ☐ Simultaneous Heart-Lung

**Outcome**

- ☒ Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

- ☐ Pediatric: <12
- ☐ Pediatric: 12-~18
- ☒ Adult (18+)

Model ElementsModel CoefficientsModel Element PlotsBaseline HazardAdditional Info

### Additional Model Information

#### Multi-organ Candidates

The status of waiting for a non-lung transplant is determined by being listed on a non-lung waiting list within 30 days of listing on the lung waiting list. Similarly, the status of having undergone non-lung transplant is determined up to 30 days after placement on the lung waiting list.

Waiting for a heart includes heart and heart-lung listings. Waiting for a kidney-pancreas includes kidney-pancreas and pancreas listings. Waiting for a liver includes liver and intestine listings.

The variable for having undergone heart transplant includes heart and heart-lung transplants. The variable for having undergone kidney-pancreas transplant includes kidney-pancreas and pancreas transplants. The variable for having undergone liver transplant includes liver and intestine transplants.

#### LAS (Lung Allocation Score)

For candidates listed before implementation of the LAS (May 4, 2005), the earliest non-missing LAS after listing is used. For candidates listed after implementation of the LAS, the LAS within 1 day of listing is used.

For the components of the LAS, the first value recorded on or after the LAS date is used. If the LAS value is missing, then the TCR value is used. These variables are identified by TCR/Status History in the Source column of the Model Elements table.

#### Data Sources

The Source column in the Model Elements table identifies, if it exists, the location of the variable in the OPTN database. "TCR" corresponds to the Transplant Candidate Registration form. "Status History" variables are typically used in allocation and values may change over time. "TCR/Status History" variables are derived from either the Transplant Candidate Registration or Status History; the algorithm for selecting the source is described in the above LAS section. "Calculated" variables are derived from variables in the TCR or Status History.

# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

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# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

### Organ

- ☐ Kidney
- ☐ Liver
- ☐ Heart

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# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

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- ☐ Liver
- ☐ Heart
- ☒ Lung
- ☐ Pancreas
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**Outcome**

- ☒ Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

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Model ElementsModel CoefficientsModel Element PlotsBaseline HazardAdditional Info

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**LAS (Lung Allocation Score)**

For candidates listed before implementation of the LAS (May 4, 2005), the earliest non-missing LAS after listing is used. For candidates listed after implementation of the LAS, the LAS within 1 day of listing is used.

For the components of the LAS, the first value recorded on or after the LAS date is used. If the LAS value is missing, then the TCR value is used. These variables are identified by TCR/Status History in the Source column of the Model Elements table.

#### Data Sources

The Source column in the Model Elements table identifies, if it exists, the location of the variable in the OPTN database. "TCR" corresponds to the Transplant Candidate Registration form. "Status History" variables are typically used in allocation and values may change over time. "TCR/Status History" variables are derived from either the Transplant Candidate Registration or Status History; the algorithm for selecting the source is described in the above LAS section. "Calculated" variables are derived from variables in the TCR or Status History.

# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

Organ

☐ Kidney

☐ Liver

☐ Heart

Model Elements

Model Coefficients

Model Element Plots

Baseline Hazard

Additional Info

Additional Model Information

Multi-organ Candidates

LAS (Lung Allocation Score)

For candidates listed before implementation of the LAS (May 4, 2005), the earliest non-missing LAS after listing is used. For candidates listed after implementation of the LAS, the LAS within 1 day of listing is used.

For the components of the LAS, the first value recorded on or after the LAS date is used. If the LAS value is missing, then the TCR value is used. These variables are identified by TCR/Status History in the Source column of the Model Elements table.

☐ Pediatric: <12

☐ Pediatric: 12-<18

☒ Adult (18+)

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# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

**Organ**

- ☐ Kidney
- ☐ Liver
- ☐ Heart
- ☒ Lung
- ☐ Pancreas
- ☐ Simultaneous Kidney-Pancreas
- ☐ Intestine
- ☐ Simultaneous Heart-Lung

**Outcome**

- ☒ Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

- ☐ Pediatric: <12
- ☐ Pediatric: 12-<18
- ☒ Adult (18+)

Model ElementsModel CoefficientsModel Element PlotsBaseline HazardAdditional Info

### Additional Model Information

**Multi-organ Candidates**

The status of waiting for a non-lung transplant is determined by being listed on a non-lung waiting list within 30 days of listing on the lung waiting list. Similarly, the status of having undergone non-lung transplant is determined up to 30 days after placement on the lung waiting list.

Waiting for a heart includes heart and heart-lung listings. Waiting for a kidney-pancreas includes kidney-pancreas and pancreas listings. Waiting for a liver includes liver and intestine listings.

The variable for having undergone heart transplant includes heart and heart-lung transplants. The variable for having undergone kidney-pancreas transplant includes kidney-pancreas and pancreas transplants. The variable for having undergone liver transplant includes liver and intestine transplants.

**LAS (Lung Allocation Score)**

For candidates listed before implementation of the LAS (May 4, 2005), the earliest non-missing LAS after listing is used. For candidates listed after implementation of the LAS, the LAS within 1 day of listing is used.

For the components of the LAS, the first value recorded on or after the LAS date is used. If the LAS value is missing, then the TCR value is used. These variables are identified by TCR/Status History in the Source column of the Model Elements table.

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# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models

Organ

Model Elements

Model Coefficients

Model Element Plots

Baseline Hazard

Additional Info

### Multi-organ Candidates

The status of waiting for a non-lung transplant is determined by being listed on a non-lung waiting list within 30 days of listing on the lung waiting list. Similarly, the status of having undergone non-lung transplant is determined up to 30 days after placement on the lung waiting list.

Waiting for a heart includes heart and heart-lung listings. Waiting for a kidney-pancreas includes kidney-pancreas and pancreas listings. Waiting for a liver includes liver and intestine listings.

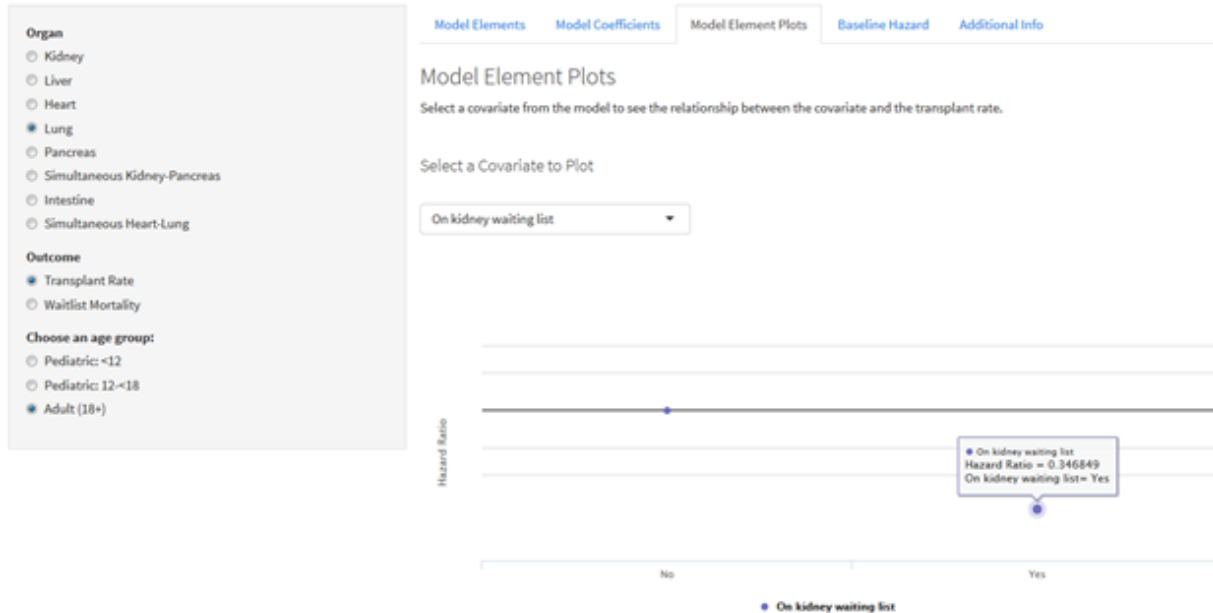
The variable for having undergone heart transplant includes heart and heart-lung transplants. The variable for having undergone kidney-pancreas transplant includes kidney-pancreas and pancreas transplants. The variable for having undergone liver transplant includes liver and intestine transplants.

### Data Sources

The Source column in the Model Elements table identifies, if it exists, the location of the variable in the OPTN database. "TCR" corresponds to the Transplant Candidate Registration form. "Status History" variables are typically used in allocation and values may change over time. "TCR/Status History" variables are derived from either the Transplant Candidate Registration or Status History; the algorithm for selecting the source is described in the above LAS section. "Calculated" variables are derived from variables in the TCR or Status History.

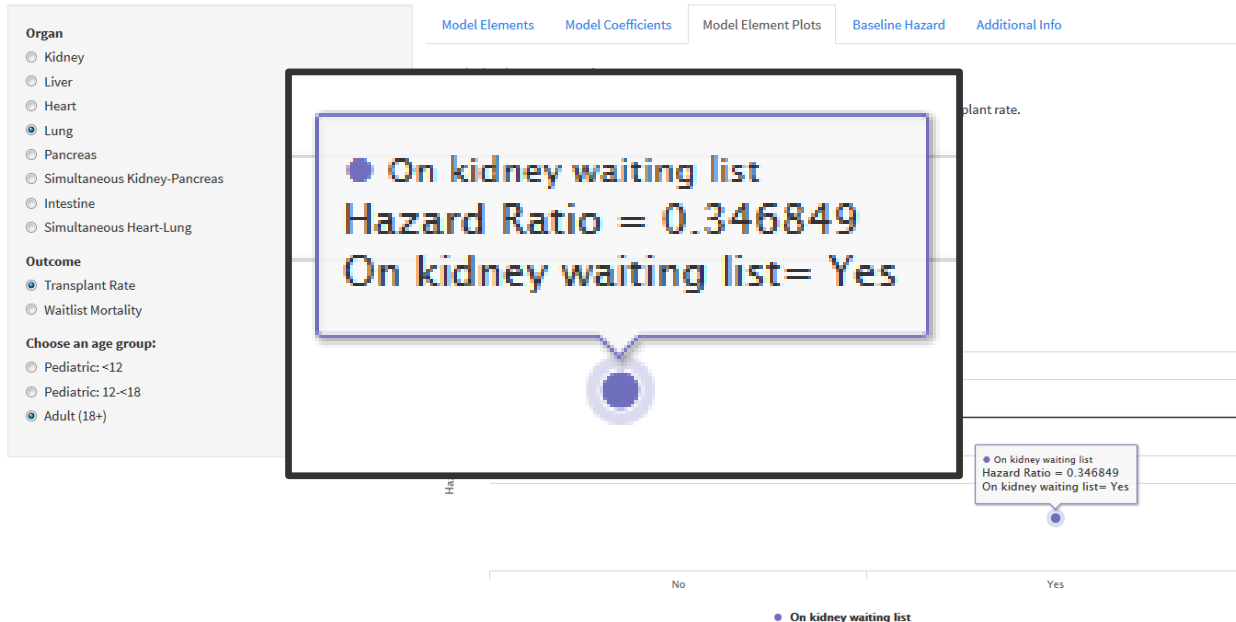
# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models



# Q3: Why are there different data sources for the waiting list models?

## SRTR Waiting List Risk Adjustment Models



# Q4: Why are waiting list models different for pancreas, kidney-pancreas, intestine, and heart-lung?

## SRTR Waiting List Risk Adjustment Models

**Organ**

- ☒ Kidney
- ☐ Liver
- ☐ Heart
- ☐ Lung
- ☐ Pancreas
- ☐ Simultaneous Kidney-Pancreas
- ☐ Intestine
- ☐ Simultaneous Heart-Lung

**Outcome**

- ☐ Transplant Rate
- ☒ Deceased Donor Transplant Rate
- ☐ Waitlist Mortality

**Choose an age group:**

- ☐ Pediatric (<18)
- ☒ Adult (18+)

Model Elements   [Model Coefficients](#)   [Model Element Plots](#)   [Baseline Hazard](#)   [Additional Info](#)

### Model Elements Table

This table lists the elements included in the risk adjustment model and each element's data source. For additional information on the data sources, click the Additional Info tab.

Show **25** entries   Search:

| Element                  | Source     |
|--------------------------|------------|
| Candidate age at listing | TCR        |
| Candidate blood type     | TCR        |
| Candidate BMI            | Calculated |
| Candidate diabetes type  | TCR        |
| Candidate education      | TCR        |
| Candidate ethnicity      | TCR        |
| Candidate sex            | TCR        |

# Q4: Why are waiting list models different for pancreas, kidney-pancreas, intestine, and heart-lung?

SRTR Waiting List Risk Adjustment Models

**Organ**

☐ Kidney

☐ Liver

☐ Heart

☐ Lung

☒ Pancreas

☐ Simultaneous Kidney-Pancreas

☐ Intestine


☐ Simultaneous Heart-Lung

**Outcome**

☒ Transplant Rate

☐ Waitlist Mortality

Transplant Rate Model

 Download

# Q4: Why are waiting list models different for pancreas, kidney-pancreas, intestine, and heart-lung?



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## Risk Model Documentation

Release Date: January 05, 2018 (Spring 2017 PSR Cycle)  
Based on Data Available: October 31, 2017

SRTR Program-Specific Report  
Feedback?: [SRTR@SRTR.org](mailto:SRTR@SRTR.org)  
1.877.970.SRTR (7787)  
<http://www.srtr.org>

### Pancreas Waitlist Transplant Rates, Deceased Donor Only (07/01/16–06/30/17)

| Characteristic             | Level       | Estimate | Std. Err. | P-Value |
|----------------------------|-------------|----------|-----------|---------|
| Age                        | 17 and less | 0.4542   | 0.7324    | 0.5352  |
|                            | 35–49       | 0.0175   | 0.2148    | 0.9349  |
|                            | 50–64       | –0.0072  | 0.2415    | 0.9764  |
|                            | 65+         | 0.3313   | 0.5323    | 0.5337  |
|                            | 18–34       | 0.0000   | (Ref.)    | (Ref.)  |
| Blood Type                 | A           | 0.2267   | 0.1728    | 0.1896  |
|                            | AB          | 0.3121   | 0.3971    | 0.4318  |
|                            | B           | 0.0838   | 0.2785    | 0.7635  |
|                            | O           | 0.0000   | (Ref.)    | (Ref.)  |
| Previous Tx                | Yes         | –0.3566  | 0.1636    | 0.0292  |
| Time From Listing To Start | > Median    | –1.5272  | 0.1952    | <0.0001 |



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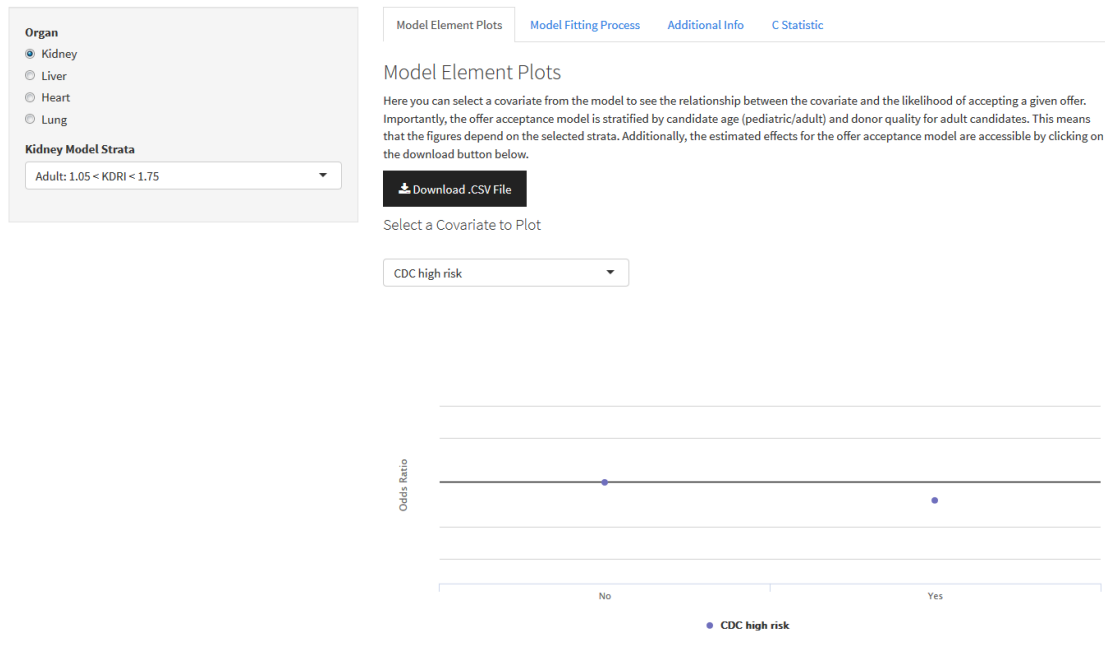
# Q4: Why are waiting list models different for pancreas, kidney-pancreas, intestine, and heart-lung?

SRTR updated the waiting list models for kidney, liver, lung, and heart in the January 2018 PSR cycle.

The pancreas, simultaneous kidney-pancreas, and intestine models are currently being updated. We anticipate previewing the models with the January 2019 release and integration of the models in the July 2019 release.

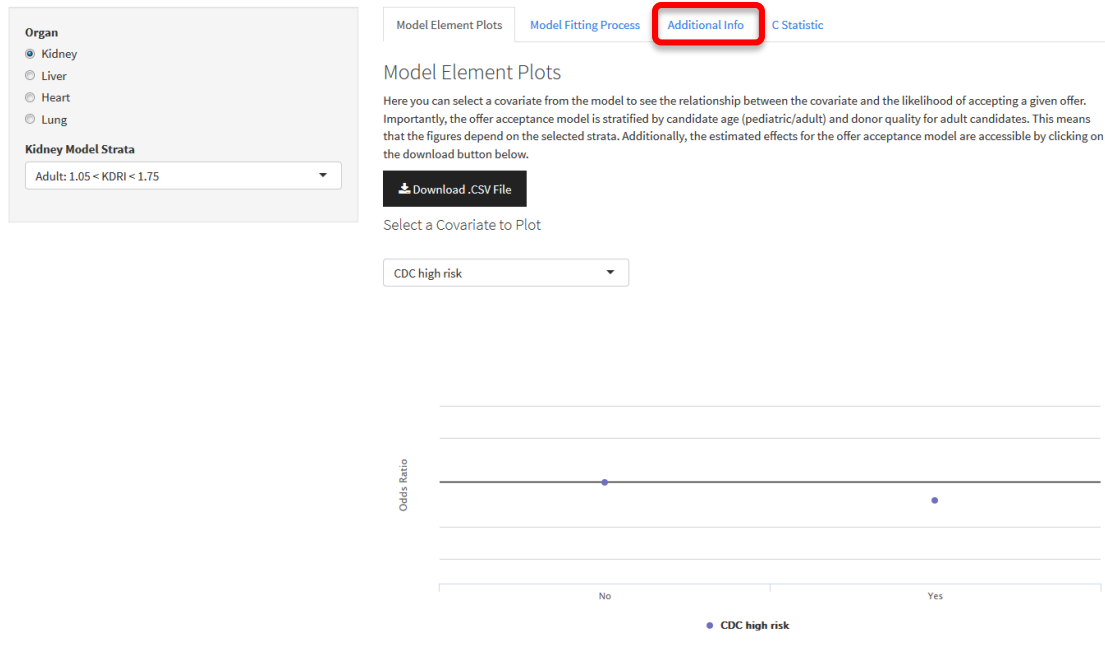
# Q5: Why are some acceptances not included in the offer acceptance reports?

SRTR Risk Adjustment Model Documentation: Offer Acceptance Models



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SRTR Risk Adjustment Model Documentation: Offer Acceptance Models



# Q5: Why are some acceptances not included in the offer acceptance reports?

SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

**Organ**

- ☒ Kidney
- ☐ Liver
- ☐ Heart
- ☐ Lung

**Kidney Model Strata**

Adult: 1.05 < KDRI < 1.75

[Model Element Plots](#) [Model Fitting Process](#) [Additional Info](#) [C Statistic](#)

**Match Run Data**

The kidney offer acceptance model was estimated with match run data for donors recovered between July 1, 2016 and June 30, 2017. Due to uncertainty regarding candidates who actually received offers, bypassed offers and offers after the last acceptance are removed. Additionally, match runs without an acceptance are not included in the final data set. Duplicated offers from the same donor are removed, and only the first offer to a candidate is kept.

**Multi-organ Transplant Candidates**

Offers to multi-organ transplant candidates are usually not evaluated. Kidney-pancreas candidates are the only exception because they must request kidney-alone offers due to the separate allocation policy for kidney-pancreas candidates.

**Alignment of Offers and Transplanted Kidneys**

Accepted kidneys are not always transplanted into the corresponding candidates. This can occur for candidate and/or donor reasons, e.g., the kidney was lower quality than expected or the candidate was unavailable. These are considered declined offers.

Kidneys can also be transplanted into candidates who did not appear on the match run. This typically represents 'local backup'; i.e., the intended recipient was unable to undergo transplant and the transplant was performed in a different candidate to avoid discard. In these situations, if the eventual recipient was not a multi-organ transplant candidate and was ABO compatible per kidney allocation policy, then this recipient was appended to the match run with the offer number equal to the previous maximum offer number plus one. For kidneys with no previous offers, the offer number was set to one.

**Calculated Panel Reactive Antibodies (cPRA)**

Candidate cPRA is determined from the candidate status history file. If the candidate was listed prior to the cohort, then the cPRA at the beginning of the cohort is used. Otherwise, the first cPRA after listing is used.

**Calculation of Body Surface Area (BSA)**

Body surface area is defined as the square root of weight in kilograms times height in centimeters divided by 3600.

# Q5: Why are some acceptances not included in the offer acceptance reports?

SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

Organ

☒ Kidney

☐ Liver

[Model Element Plots](#)

[Model Fitting Process](#)

[Additional Info](#)

[C Statistic](#)

Match Run Data

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SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

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[Model Element Plots](#) [Model Fitting Process](#) [Additional Info](#) [C Statistic](#)

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SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

## Organ

☒ Kidney

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[Model Element Plots](#)

[Model Fitting Process](#)

[Additional Info](#)

[C Statistic](#)

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SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

**Organ**

- ☒ Kidney
- ☐ Liver
- ☐ Heart
- ☐ Lung

**Kidney Model Strata**

Adult: 1.05 < KDRI < 1.75

[Model Element Plots](#) [Model Fitting Process](#) [Additional Info](#) [C Statistic](#)

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SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

## Organ

☒ Kidney

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[Model Element Plots](#)

[Model Fitting Process](#)

[Additional Info](#)

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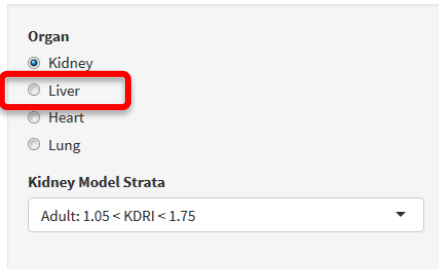
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# Q5: Why are some acceptances not included in the offer acceptance reports?

## SRTR Risk Adjustment Model Documentation: Offer Acceptance Models



**Organ**

☒ Kidney

☐ Liver

☐ Heart

☐ Lung

**Kidney Model Strata**

Adult: 1.05 < KDRI < 1.75

[Model Element Plots](#)

[Model Fitting Process](#)

[Additional Info](#)

[C Statistic](#)

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# Q5: Why are some acceptances not included in the offer acceptance reports?

## SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

**Organ**

☐ Kidney

☒ Liver

☐ Heart

☐ Lung

**Liver Model Strata**

Adult: Donor Age < 40

[Model Element Plots](#)

[Model Fitting Process](#)

[Additional Info](#)

[C Statistic](#)

### Match Run Data

The liver offer acceptance model was estimated with match run data for donors recovered between July 1, 2016 and June 30, 2017. Due to uncertainty regarding candidates who actually received offers, bypassed offers and offers after the last acceptance are removed. Additionally, match runs without an acceptance are not included in the final data set. Duplicated offers from the same donor are removed, and only the first offer to a candidate is kept.

### Multi-organ Transplant Candidates

Offers to multi-organ transplant candidates are not evaluated.

### Alignment of Offers and Transplanted Livers

Accepted livers are not always transplanted into the corresponding candidates. This can occur for candidate and/or donor reasons, e.g., the liver was lower quality than expected or the candidate was unavailable. These are considered declined offers.

Livers can also be transplanted into candidates who did not appear on the match run. This typically represents 'local backup'; i.e., the intended recipient was unable to undergo transplant and the transplant was performed in a different candidate to avoid discard. In these situations, if the eventual recipient was not a multi-organ transplant candidate, then the eventual recipient was appended to the match run with the offer number equal to the previous maximum offer number plus one. For livers with no previous offers, the offer number was set to one.

# Q5: Why are some acceptances not included in the offer acceptance reports?

SRTR Risk Adjustment Model Documentation: Offer Acceptance Models

**Organ**

- ☐ Kidney
- ☒ Liver
- ☐ Heart
- ☐ Lung

**Liver Model Strata**

Adult: Donor Age < 40

**Model Element Plots** **Model Fitting Process** Additional Info C Statistic

**Match Run Data**

The liver offer acceptance model was estimated with match run data for donors recovered between July 1, 2016 and June 30, 2017. Due to acceptance are removed. Additionally, donor are removed, and only the

**Multi-organ Transplant Candidates**

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## Q6: Can I get the offer data used in the acceptance reports?

Yes, SRTR began saving offer-level data for programs during the Summer 2018 cycle, which were publicly released on Tuesday (October 9, 2018). These files are large and not posted to the secure site. However, the files are available to programs on request.

# Upcoming changes to the pretransplant models

Waitlist mortality and transplant rate models are being developed for pancreas, kidney-pancreas, and intestine. We expect to include them in the July 2019 release.

An offer acceptance model is being developed for pancreas and kidney-pancreas. We expect to include them in the July 2019 release.

SRTR is actively developing models for candidate mortality after listing for each organ. At the earliest, these would be included January 2020 release.



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Best mode of contact:  
[SRTR@SRTR.org](mailto:SRTR@SRTR.org)



[@SRTRNews](https://twitter.com/SRTRNews)



[Scientific Registry of Transplant Recipients](https://www.linkedin.com/company/scientific-registry-of-transplant-recipients/)



[SRTR](https://www.youtube.com/SRTR)