SCIENTIFIC REGISTRY OF TRANSPLANT RECIPIENTS

Offer acceptance CUSUMs (and pretransplant expected workbooks)

Andrew Wey, PhD
Jon Snyder, PhD

Disclosures

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.

My presentation does/does not include discussion of off-label or investigational use, and I do/do not intend to reference unlabeled/unapproved uses of drugs or products in my presentation.

Disclosures – SRTR

The views expressed do not necessarily reflect the official policies of the U.S. Department of Health and Human Services nor does mention of trade names, commercial practices, or organizations imply endorsement by the U.S. Government.

Outline

1. Background

2. Offer acceptance CUSUMs

- What are they?
- Where do you find them?
- How do you use them?

3. Pretransplant expected worksheets

- What are they?
- How do you use them?

Download the Example Pretransplant Expected Workbook

We created artificial data for a live demo of the pretransplant expected workbooks. If you want to follow along, you can download them from the TQI website.

Background

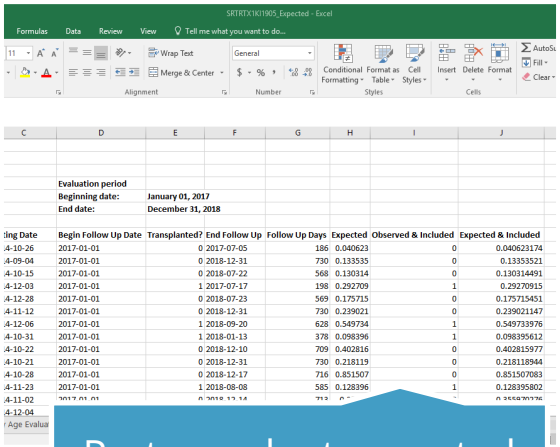
The SRTR contract:

"**The Contractor shall provide data review tools, expected survival worksheets** and OPO yield calculator to assist transplant programs and OPOs in monitoring performance**.**

The Contractor shall release updated CUSUM charts monthly for 1 year patient and graft survival for all kidney, heart, lung, and liver programs. The updated charts shall be posted to the SRTR secure website… **In consultation with HRSA, the Contractor shall develop CUSUM charts for additional metrics to monitor outcome and system performance.**"

During the past 3 Years, SRTR has developed:

Offer acceptance CUSUMs



Pretransplant expected workbooks

Donor yield CUSUMs for organ procurement organizations

Offer acceptance

Offer acceptance characterizes whether a program accepts deceased donor offers at a higher or lower rate than the national acceptance rate for similar offers.

Offer acceptance practices impact allocation efficiency: Above average acceptance practices were associated with higher organ yield (more transplants per donor) in kidney, liver, lung, and heart transplant.

Offer acceptance impacts the probability of waitlist mortality: Transplant candidates listed at programs with above average offer acceptance have a lower probability of dying on the waiting list.

Where to find offer acceptance information?

Program-specific Report (PSR) (Public Site)	Offer Acceptance CUSUM (Secure Site)	OPO Offer Acceptance Report (Secure Site)
• Summarizes acceptance practices over a year. • Includes figures to illustrate acceptance relative to other programs	• Provides a trajectory of acceptance practices over time and a separate summary of recent acceptance practices within certain subgroups	• Summarizes the acceptance practices of programs for certain types of offers that may be hard-to-place

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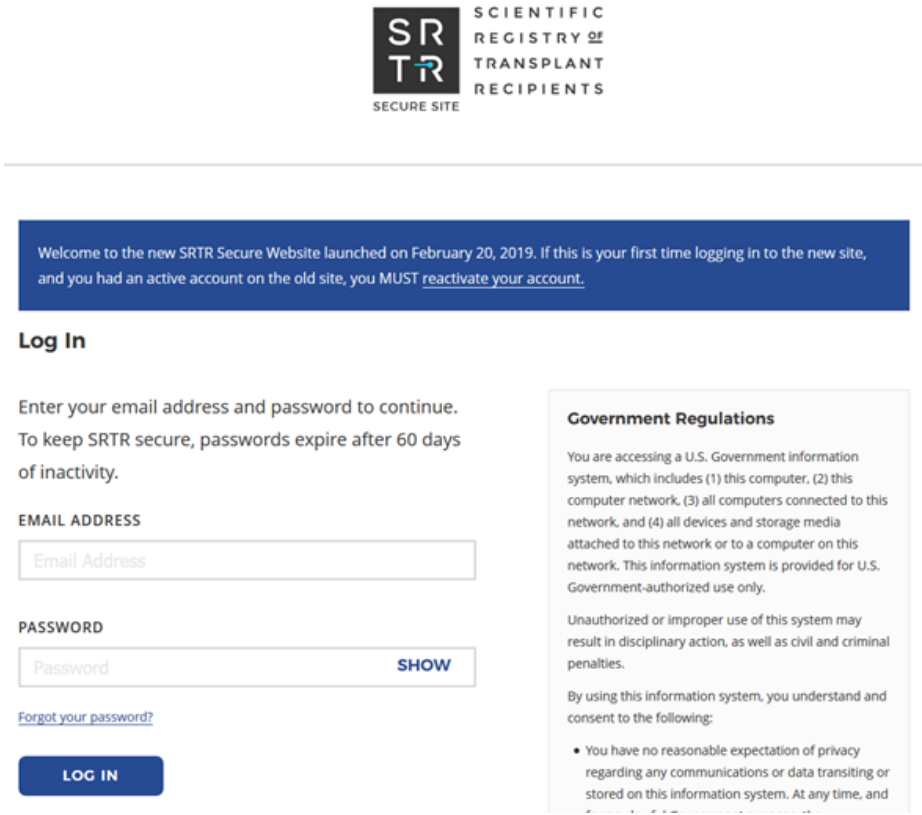
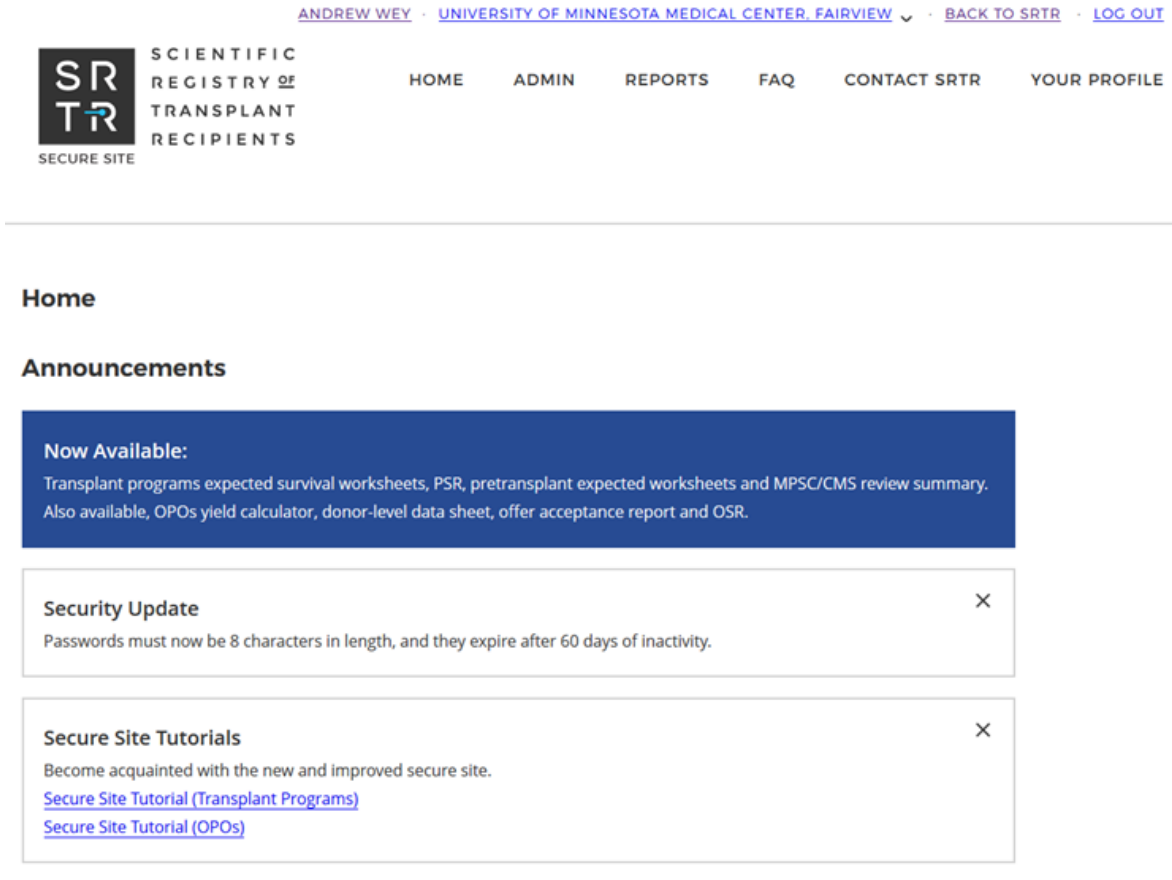
Where to find the CUSUMs?

SRTR secure site:
https://securesrtr.transplant.hrsa.gov

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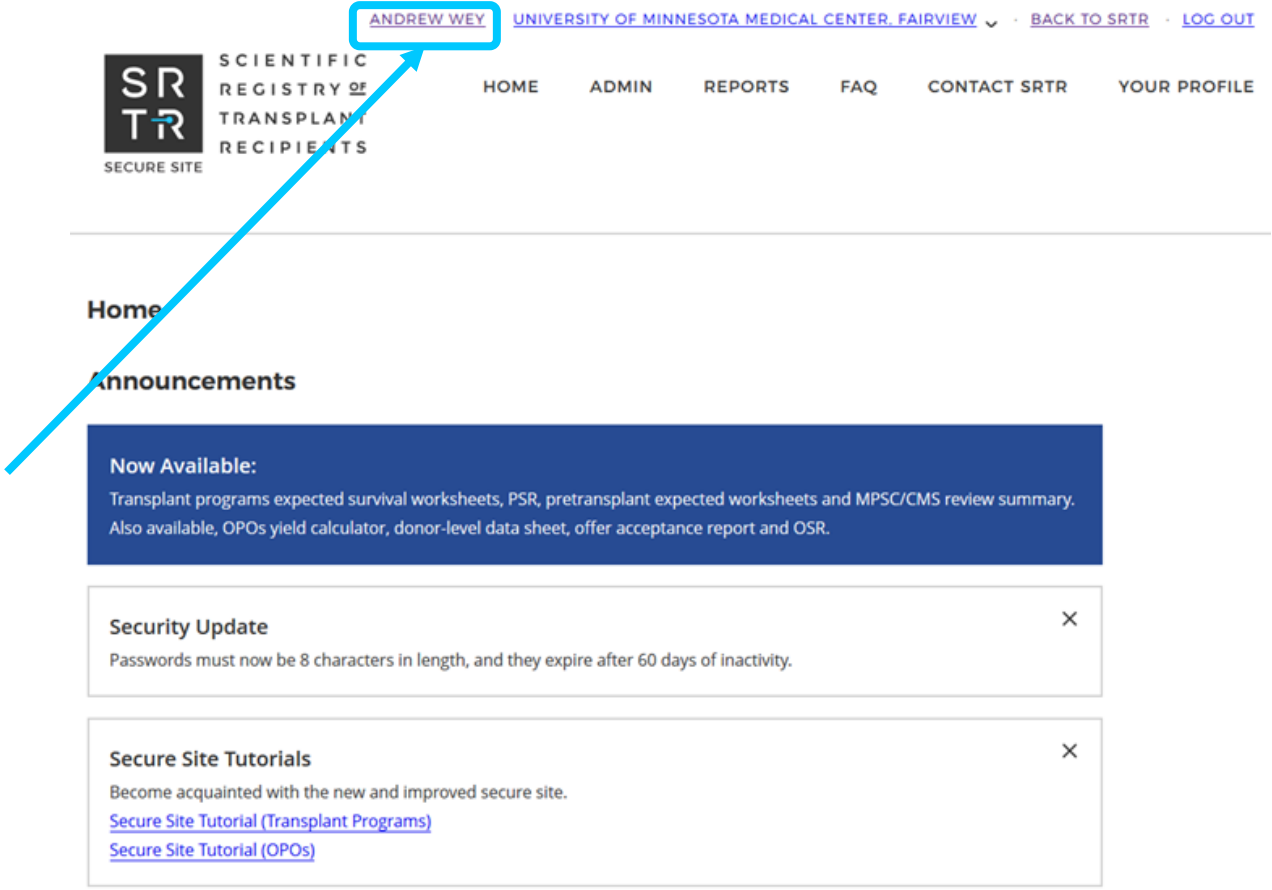
Announcements
Now Available:
Transplant programs expected survival worksheets, PSR, pretransplant expected worksheets and MPSC/CMS review summary.
Also available, OPOs yield calculator, donor-level data sheet, offer acceptance report and OSR.
Security Update
Passwords must now be 8 characters in length, and they expire after 60 days of inactivity.
Secure Site Tutorials
Become acquainted with the new and improved secure site.
Secure Site Tutorial (Transplant Programs)
Secure Site Tutorial (OPOs)

Your name should appear here



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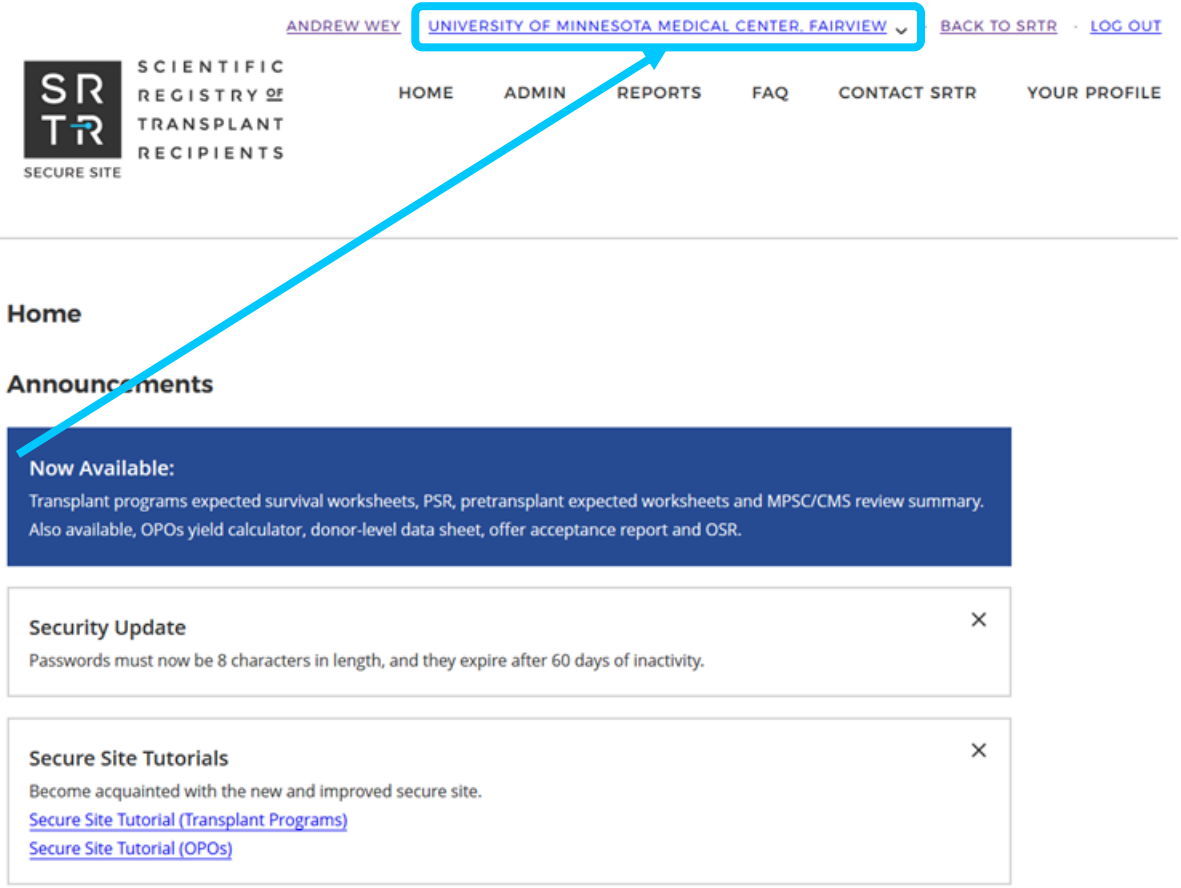
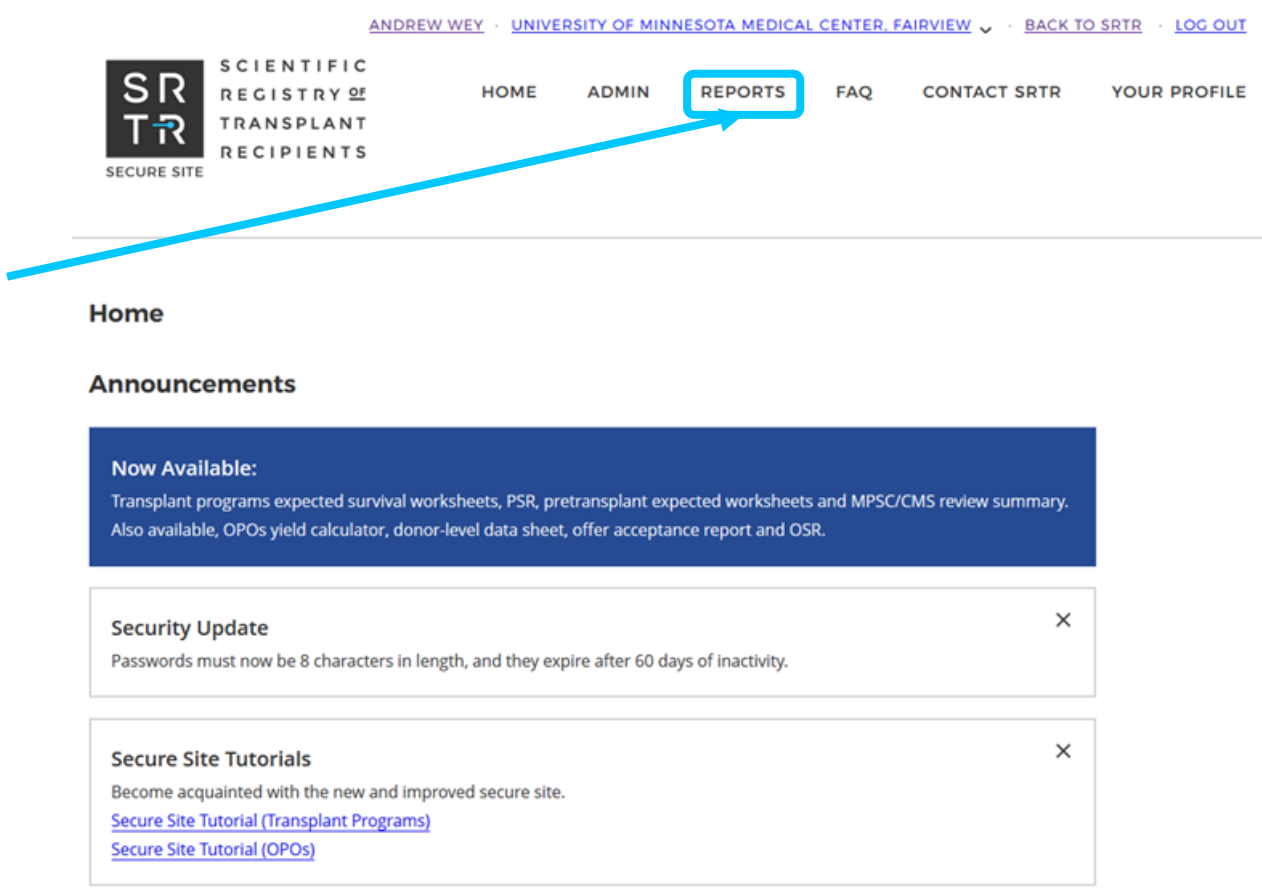
Note: Subsequent examples are NOT from the University of Minnesota



Go to: REPORTS

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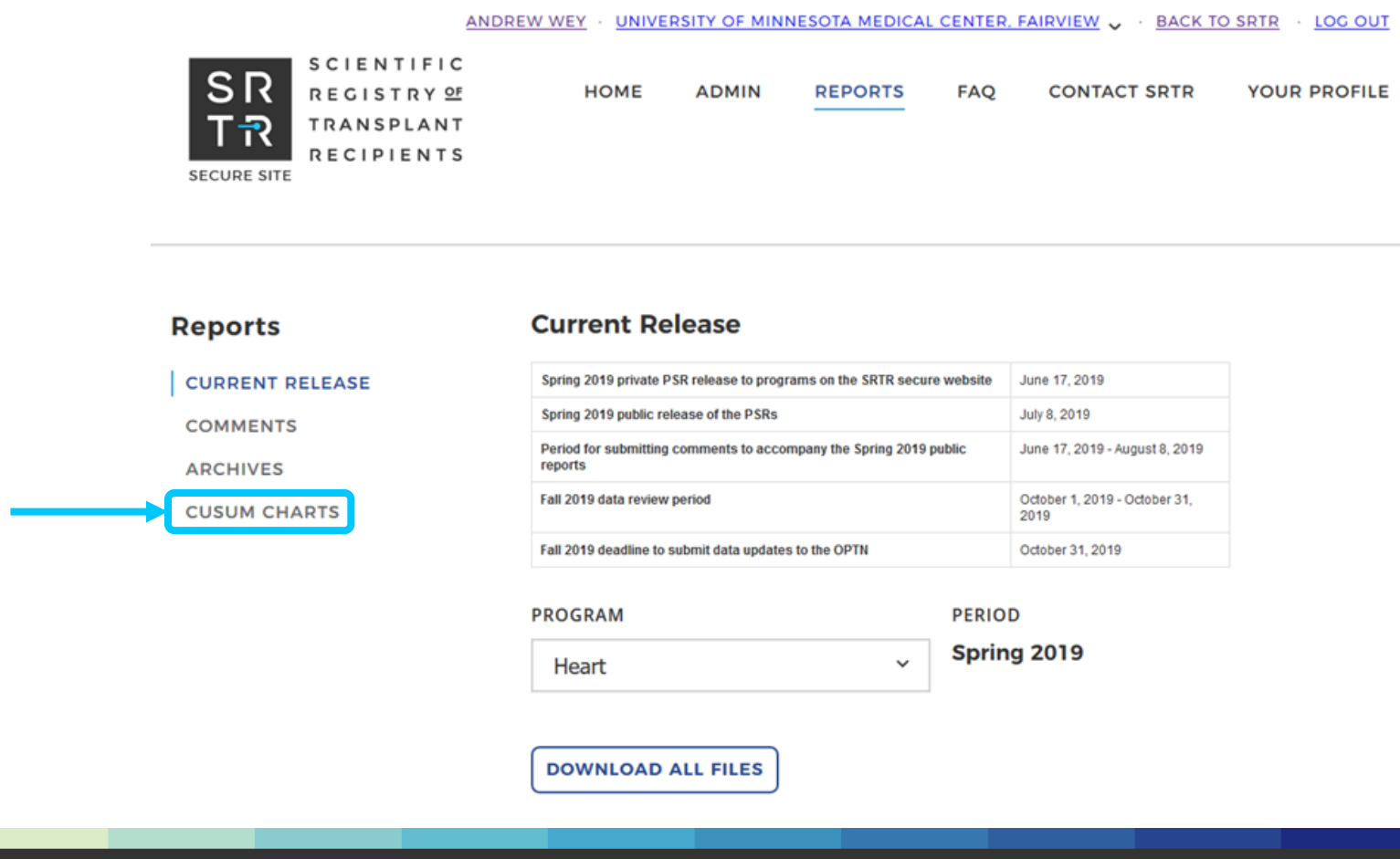
ARCHIVES
CUSUM CHARTS
Current Release
Spring 2019 private PSR release to programs on the SRTR secure website | June 17, 2019
Spring 2019 public release of the PSRs | July 8, 2019
Period for submitting comments to accompany the Spring 2019 public reports | June 17, 2019 - August 8, 2019
Fall 2019 data review period | October 1, 2019 - October 31, 2019
Fall 2019 deadline to submit data updates to the OPTN | October 31, 2019
PROGRAM
Heart
PERIOD
Spring 2019
DOWNLOAD ALL FILES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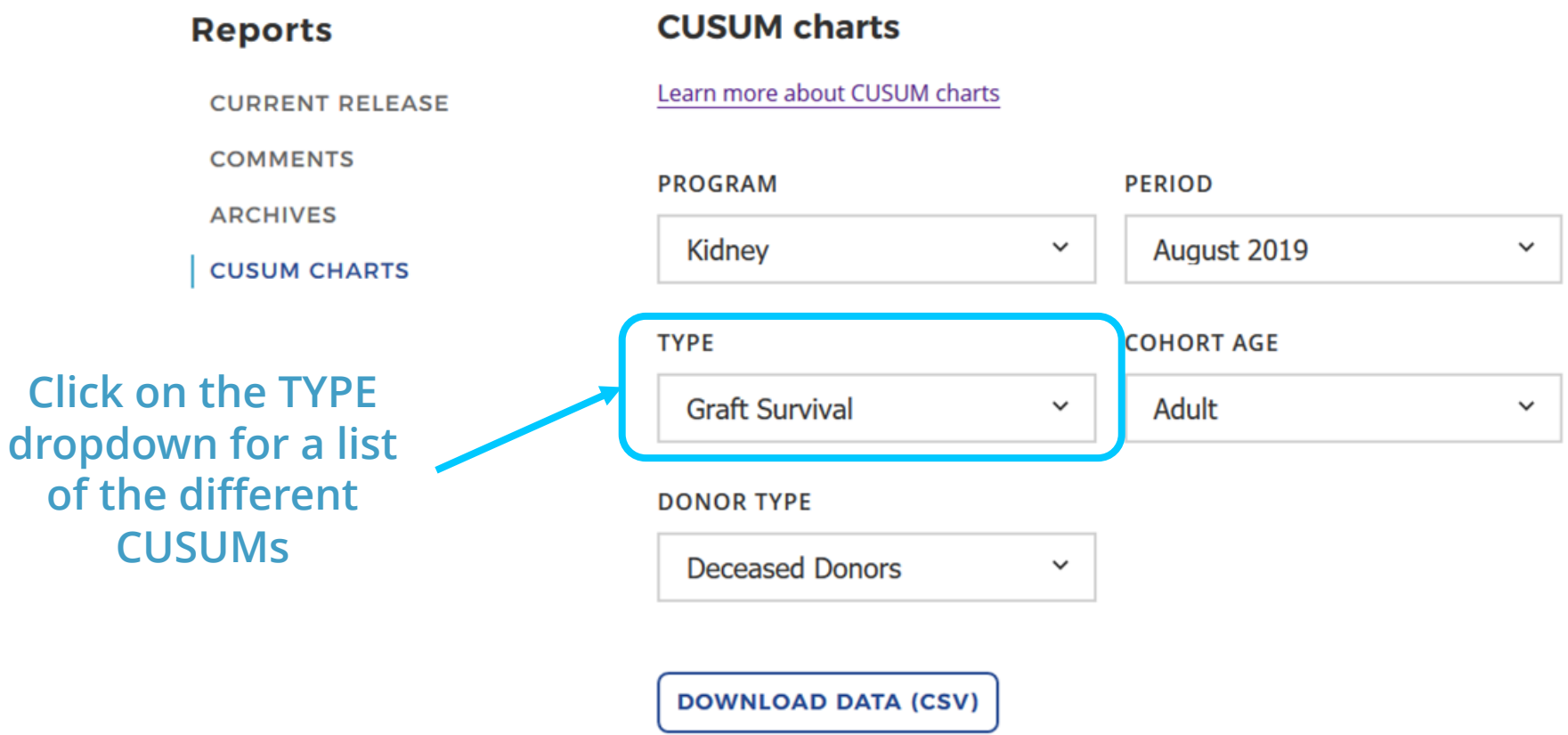
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COMMENTS
ARCHIVES
CUSUM CHARTS
CUSUM charts
Learn more about CUSUM charts
PROGRAM
Kidney
PERIOD
August 2019
TYPE
Graft Survival
COHORT AGE
Adult
DONOR TYPE
Deceased Donors
DOWNLOAD DATA (CSV)
Click on the TYPE dropdown for a list of the different CUSUMs

Reports

- CURRENT RELEASE
- COMMENTS
- ARCHIVES
- CUSUM CHARTS

CUSUM charts

Learn more about CUSUM charts

PROGRAM: Kidney

PERIOD: August 2019

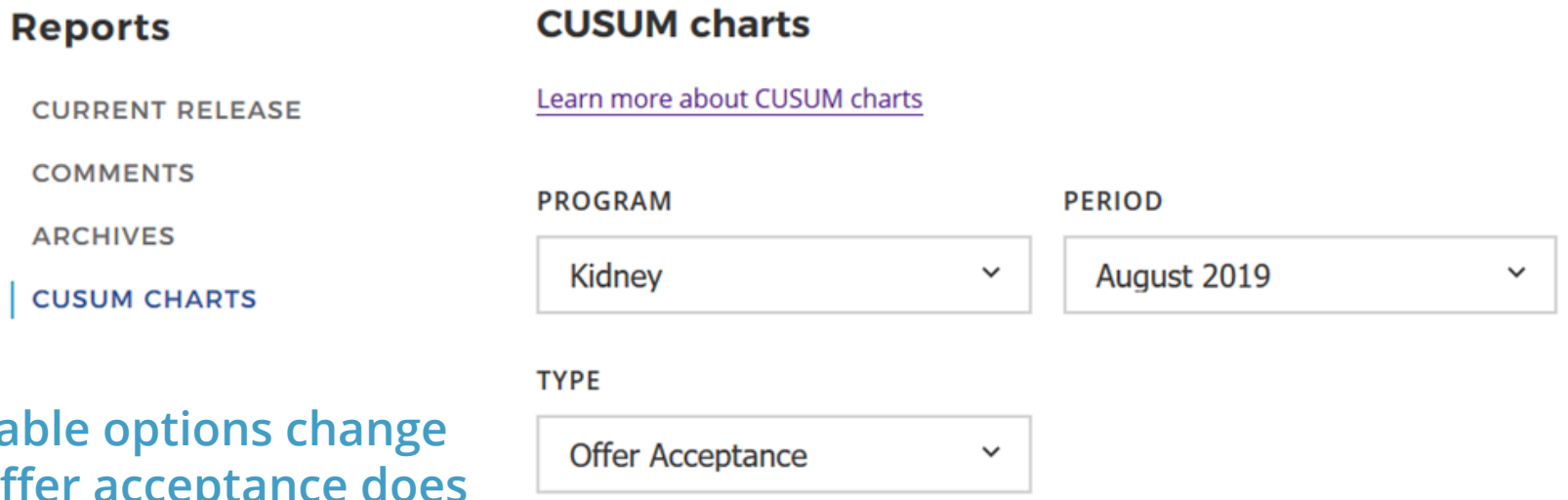
TYPE: Graft Survival

COHORT AGE: Adult

- Graft Survival
- Patient Survival
- Offer Acceptance

DOWNLOAD DATA (CSV)

Choose Offer Acceptance



The available options change because offer acceptance does not depend on donor type or age

How to use the CUSUMs?

Expected – Observed CUSUM

Moving **up** indicates **below** average acceptance

Moving **down** indicates **above** average acceptance

How to use the CUSUMs?

Expected – Observed CUSUM

This program accepted 7.5 fewer offers than expected during the four month cohort.

Was this meaningfully below average?

The one-sided CUSUM can help answer this question

How to use the CUSUMs?

One-Sided CUSUM

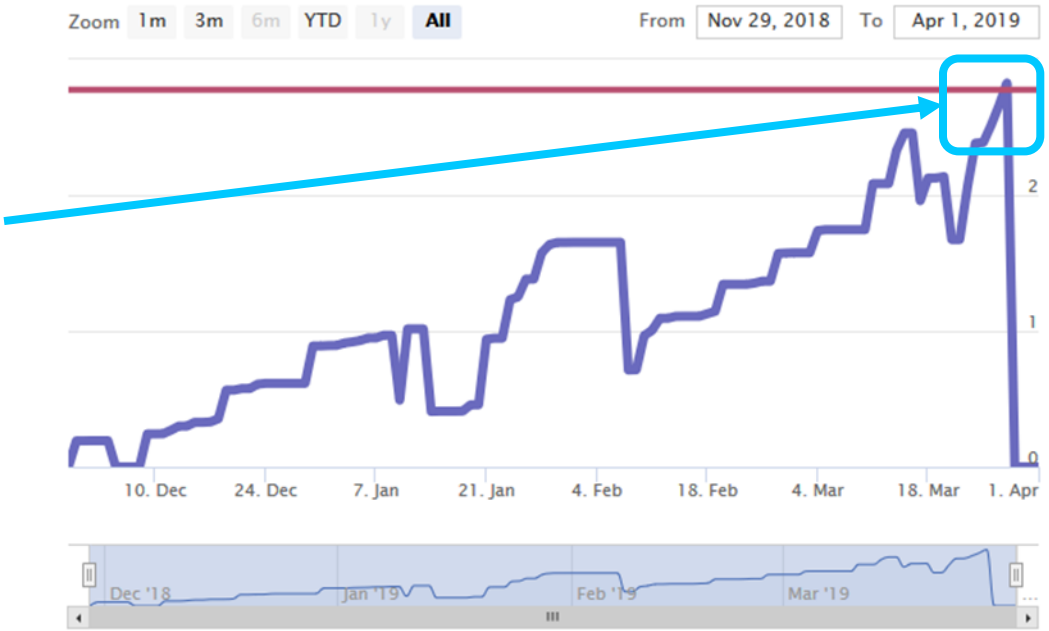
This CUSUM helps determine whether a program had 'out of control' acceptance for a period of time.

If the blue line reaches the red line, then the program's acceptance was statistically below average.

How to use the CUSUMs?

One-Sided CUSUM

In this example, the program's offer acceptance was significantly below average.



How to use the CUSUMs?

Expected – Observed CUSUM

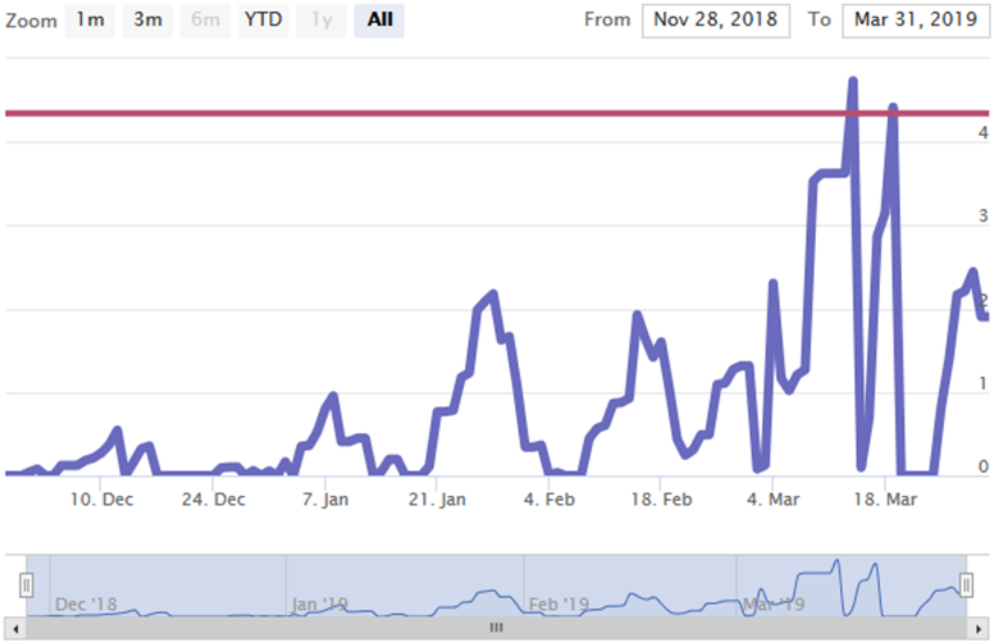
This is a large program with relatively average acceptance during the first 3 months.

How important is the suddenly below average acceptance during the last month?

How to use the CUSUMs?

One-Sided CUSUM

The acceptance was extremely below average during the last month and caused the CUSUM to signal twice.



How to use the CUSUMs?

Offer acceptance table

We also provide a table summarizing the offer acceptance for certain types of offers, e.g., offers from DCD donors.

Across donor characteristics

Donor Characteristics	History of Acceptance	Number of Offers	Number of Acceptances	Expected Acceptances	Offer Acceptance Ratio
Overall	Average	68	2	2.15	0.96
DCD Donor	Average	34	1	0.32	1.29
PHS Increased Infectious Risk	Somewhat Below Average	15	0	0.66	0.75
HCV+	Somewhat Below Average	6	0	0.40	0.83
Donor Age (> 40)	Somewhat Below Average	44	0	0.54	0.79
Over 50 Offers	Somewhat Below Average	55	0	0.24	0.89
Over 500 Miles Away	Average	30	0	0.09	0.96
Weekend	Average	18	1	0.76	1.09

Questions on offer acceptance CUSUMs?

…Pretransplant expected workbooks are next…

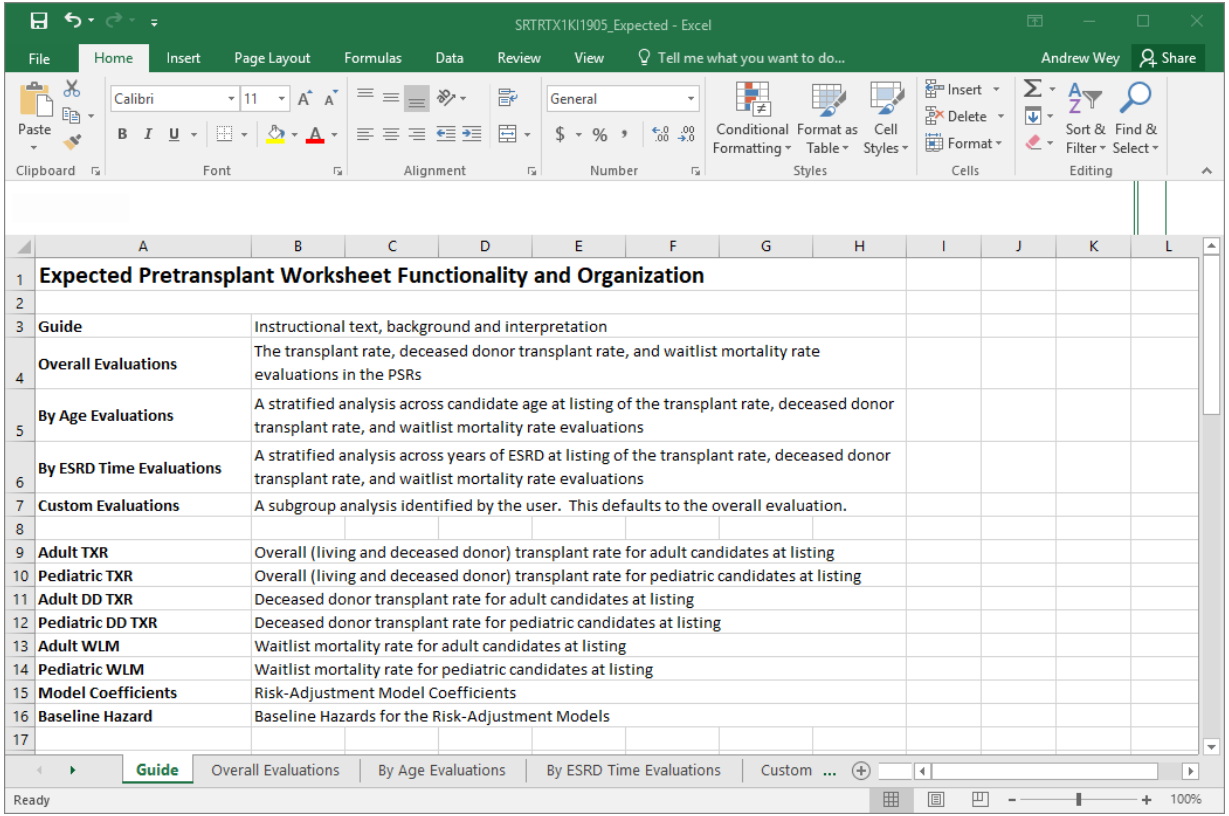
What are pretransplant expected workbooks?

SRTR recently integrated 5-tier assessments for adjusted deceased donor transplant and waitlist mortality rate ratios, and the public website specifically emphasizes the importance of the transplant rate evaluation to patient mortality after listing.

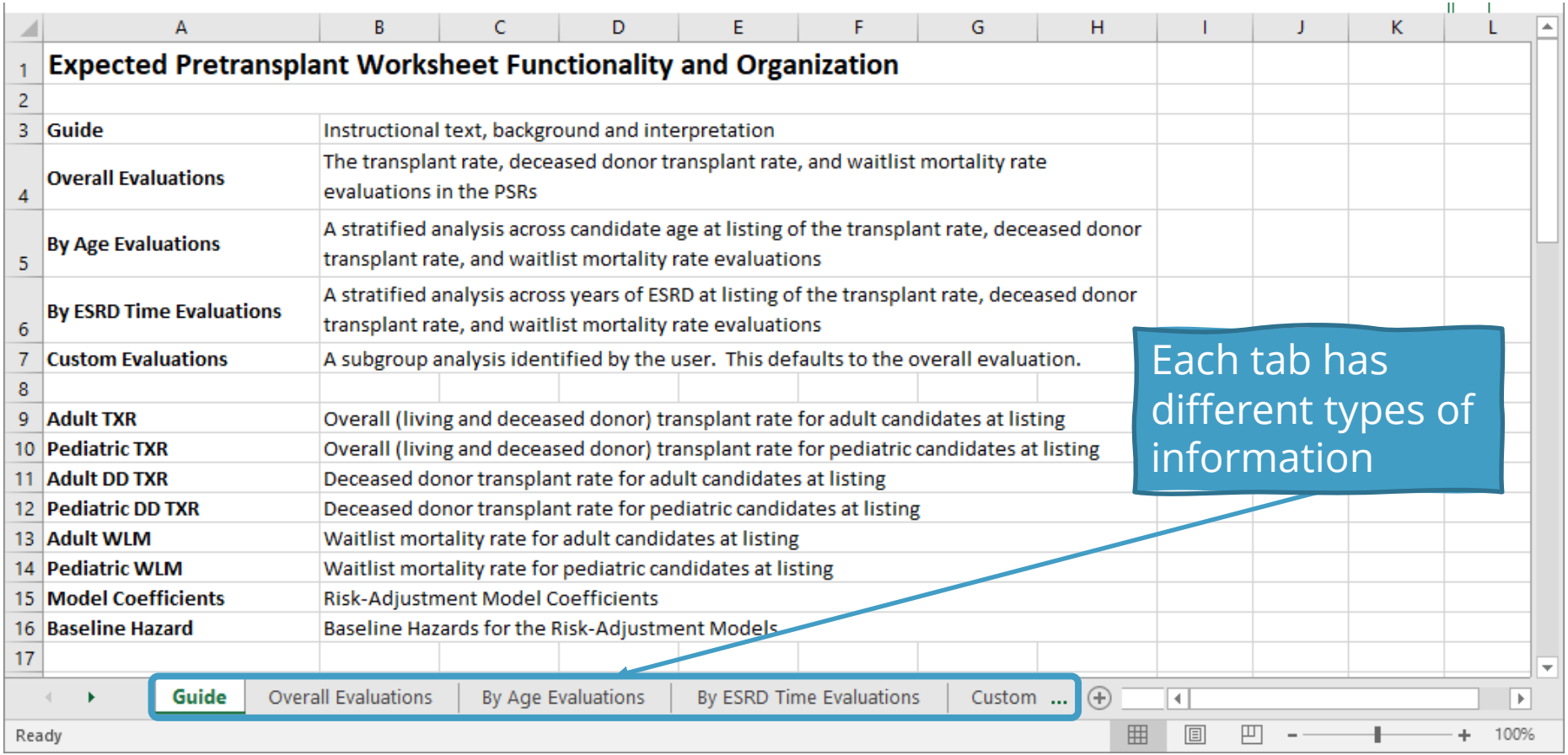
What are pretransplant expected workbooks?

- SRTR has historically provided Excel workbooks for transplant programs to perform their own analyses on their posttransplant outcomes.
- At the 2018 Transplant Quality Institute, there was strong support for **pretransplant expected workbooks** to help understand the transplant and waitlist mortality rate evaluations.
- In November 2018, HRSA gave approval for SRTR to develop pretransplant expected workbooks.
- In June 2019, SRTR released pretransplant expected workbooks for kidney, liver, lung, and heart transplant on the SRTR secure site.

How to use pretransplant expected workbooks?



	A	B
1	**Expected Pretransplant Worksheet Functionality and Organization**	
2		
3	**Guide**	Instructional text, background and interpretation
4	**Overall Evaluations**	The transplant rate, deceased donor transplant rate, and waitlist mortality rate evaluations in the PSRs
5	**By Age Evaluations**	A stratified analysis across candidate age at listing of the transplant rate, deceased donor transplant rate, and waitlist mortality rate evaluations
6	**By ESRD Time Evaluations**	A stratified analysis across years of ESRD at listing of the transplant rate, deceased donor transplant rate, and waitlist mortality rate evaluations
7	**Custom Evaluations**	A subgroup analysis identified by the user. This defaults to the overall evaluation.
8		
9	**Adult TXR**	Overall (living and deceased donor) transplant rate for adult candidates at listing
10	**Pediatric TXR**	Overall (living and deceased donor) transplant rate for pediatric candidates at listing
11	**Adult DD TXR**	Deceased donor transplant rate for adult candidates at listing
12	**Pediatric DD TXR**	Deceased donor transplant rate for pediatric candidates at listing
13	**Adult WLM**	Waitlist mortality rate for adult candidates at listing
14	**Pediatric WLM**	Waitlist mortality rate for pediatric candidates at listing
15	**Model Coefficients**	Risk-Adjustment Model Coefficients
16	**Baseline Hazard**	Baseline Hazards for the Risk-Adjustment Models
17		


Expected Pretransplant Worksheet Functionality and Organization
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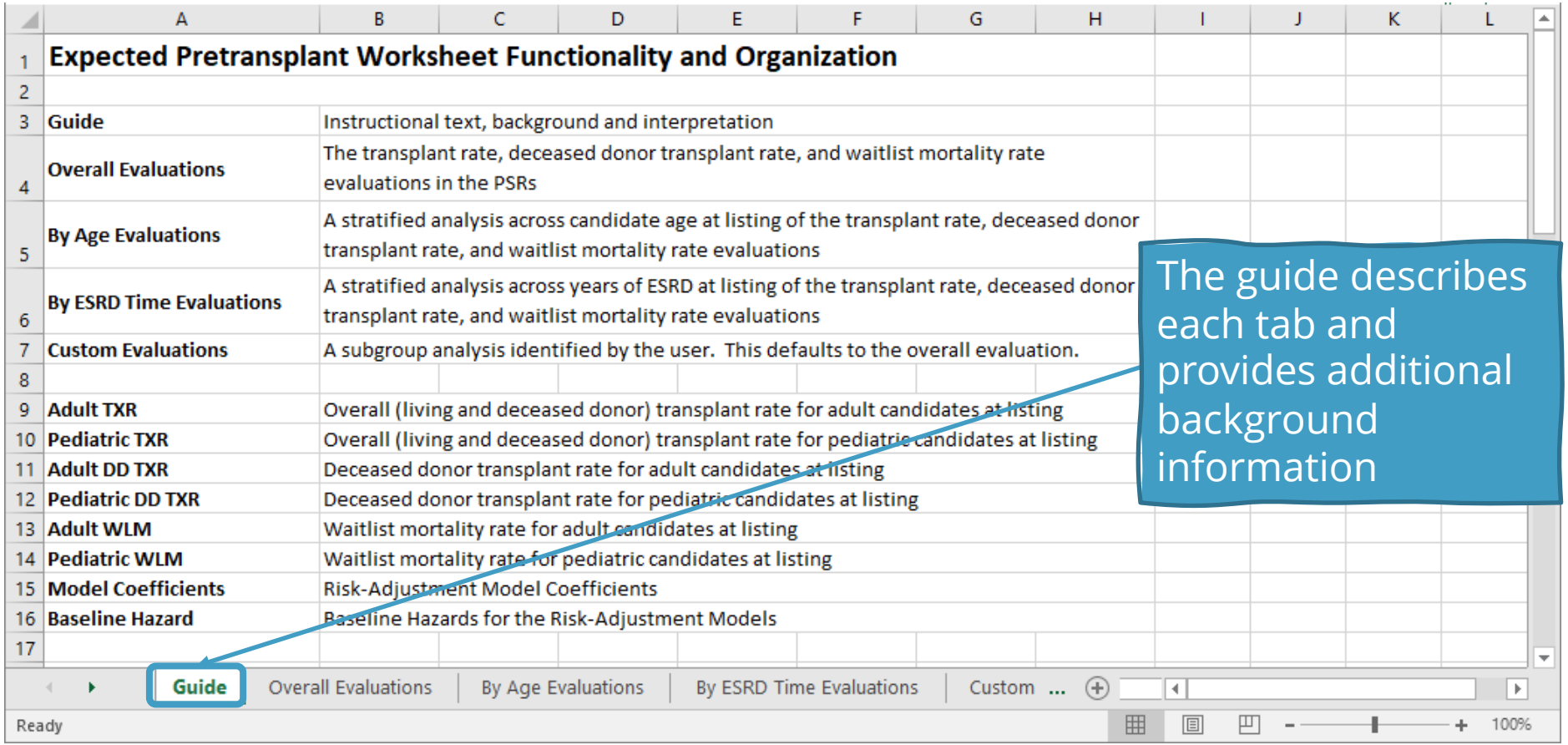
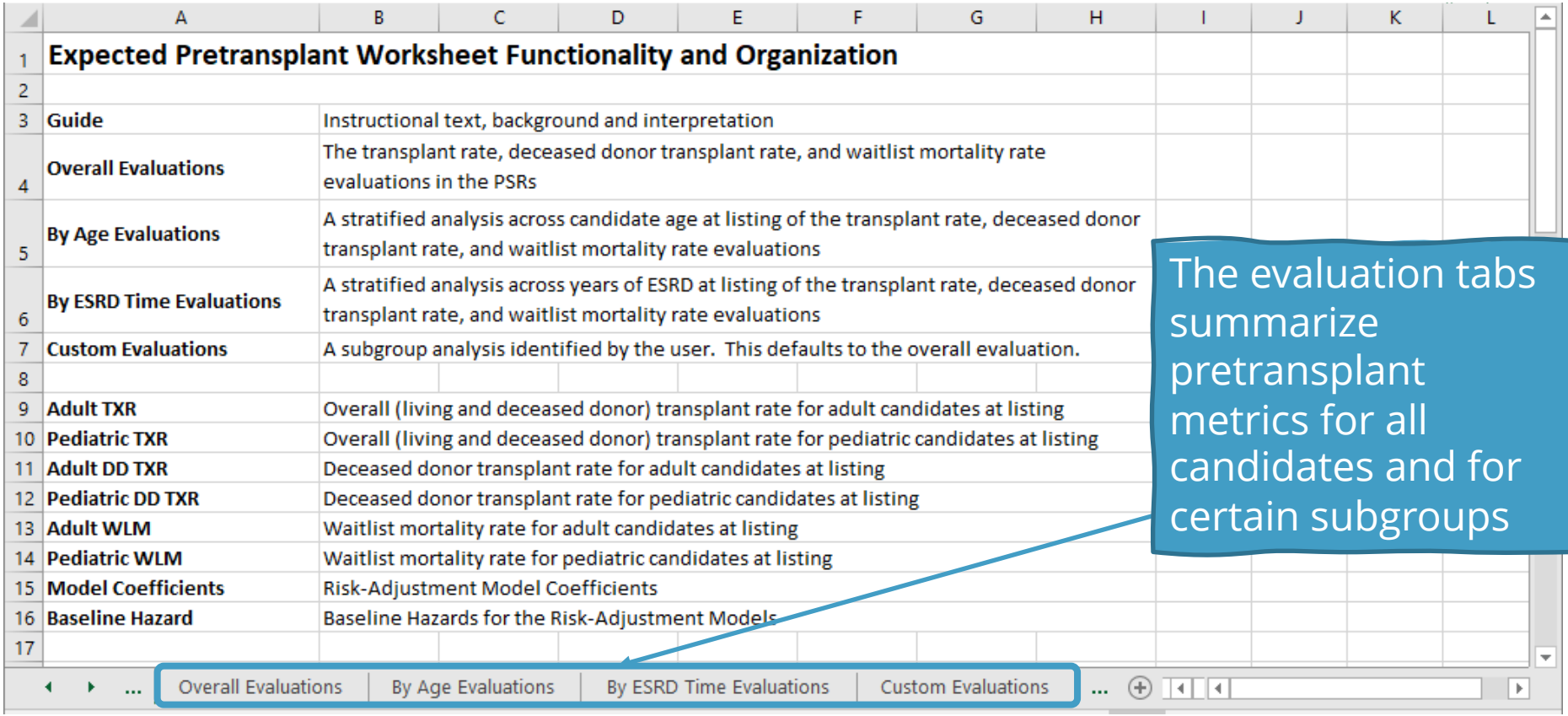
Risk-Adjustment Model Coefficients
Baseline Hazard
Baseline Hazards for the Risk-Adjustment Models
Each tab has different types of information
Guide
Overall Evaluations
By Age Evaluations
By ESRD Time Evaluations
Custom ...
Ready
100%



The guide describes each tab and provides additional background information



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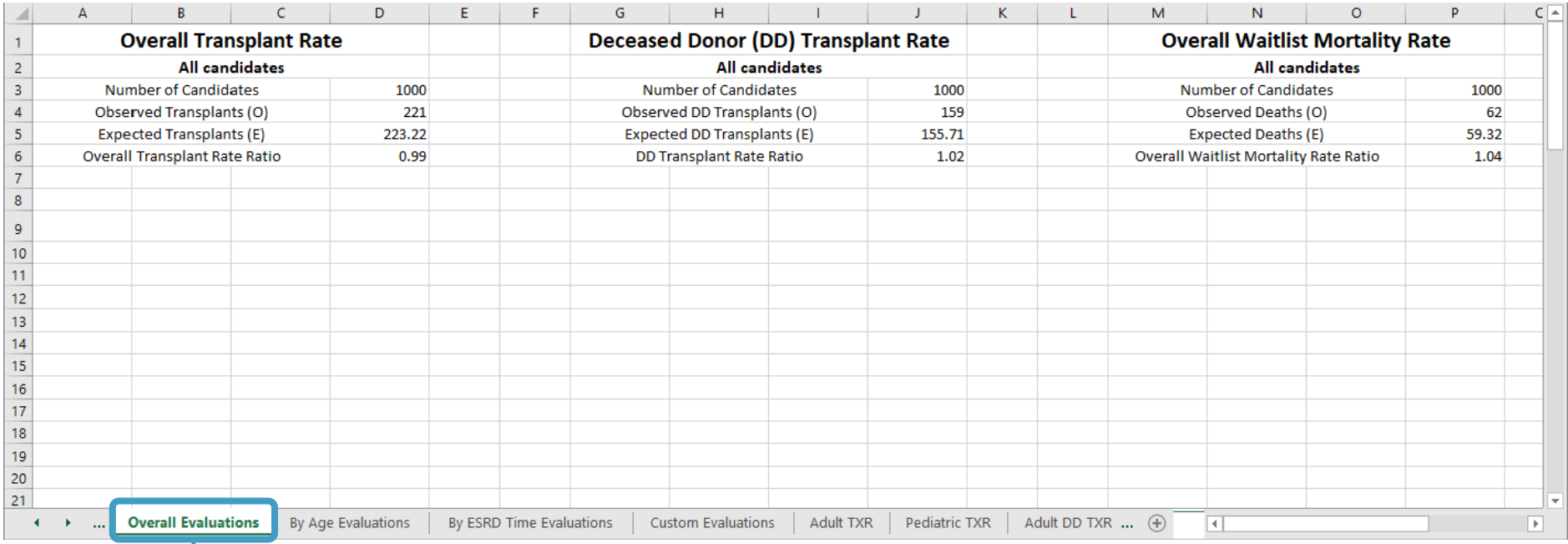
17		

Overall Evaluations | By Age Evaluations | By ESRD Time Evaluations | Custom Evaluations

The evaluation tabs summarize pretransplant metrics for all candidates and for certain subgroups

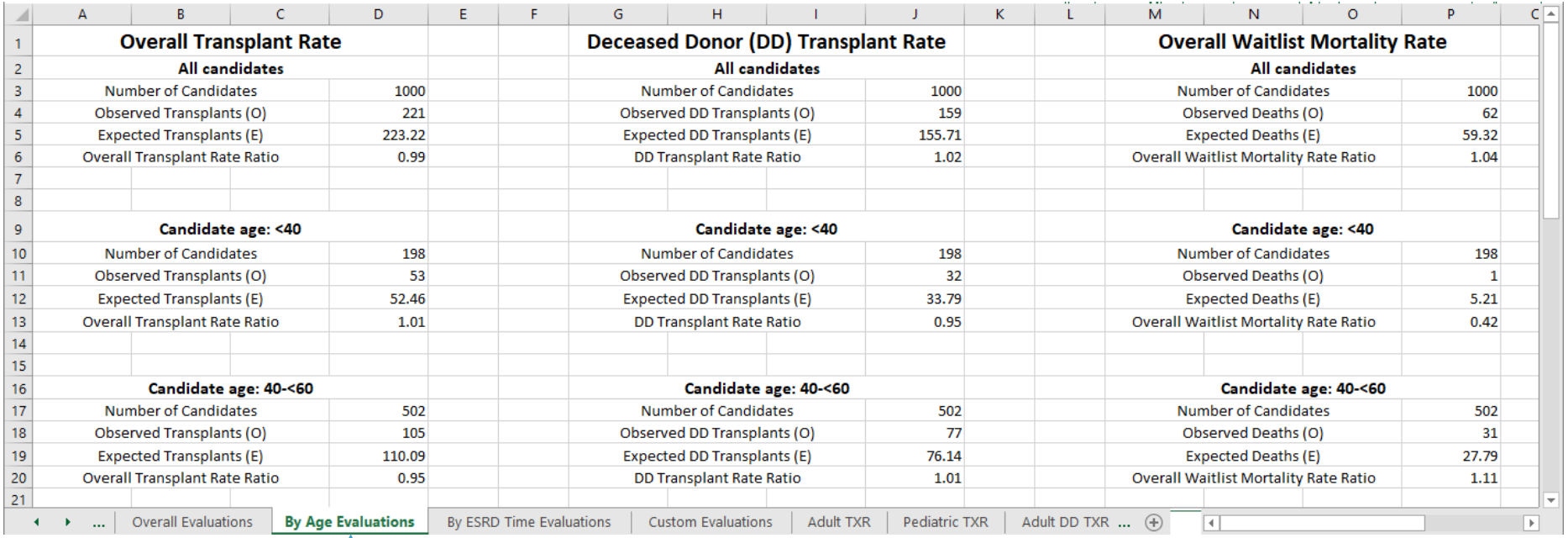


Overall Transplant Rate	
All candidates	
Number of Candidates	1000
Observed Transplants (O)	221
Expected Transplants (E)	223.22
Overall Transplant Rate Ratio	0.99

Deceased Donor (DD) Transplant Rate	
All candidates	
Number of Candidates	1000
Observed DD Transplants (O)	159
Expected DD Transplants (E)	155.71
DD Transplant Rate Ratio	1.02

Overall Waitlist Mortality Rate	
All candidates	
Number of Candidates	1000
Observed Deaths (O)	62
Expected Deaths (E)	59.32
Overall Waitlist Mortality Rate Ratio	1.04

The Overall Evaluations tab presents the transplant and waitlist mortality rates reported in the PSRs



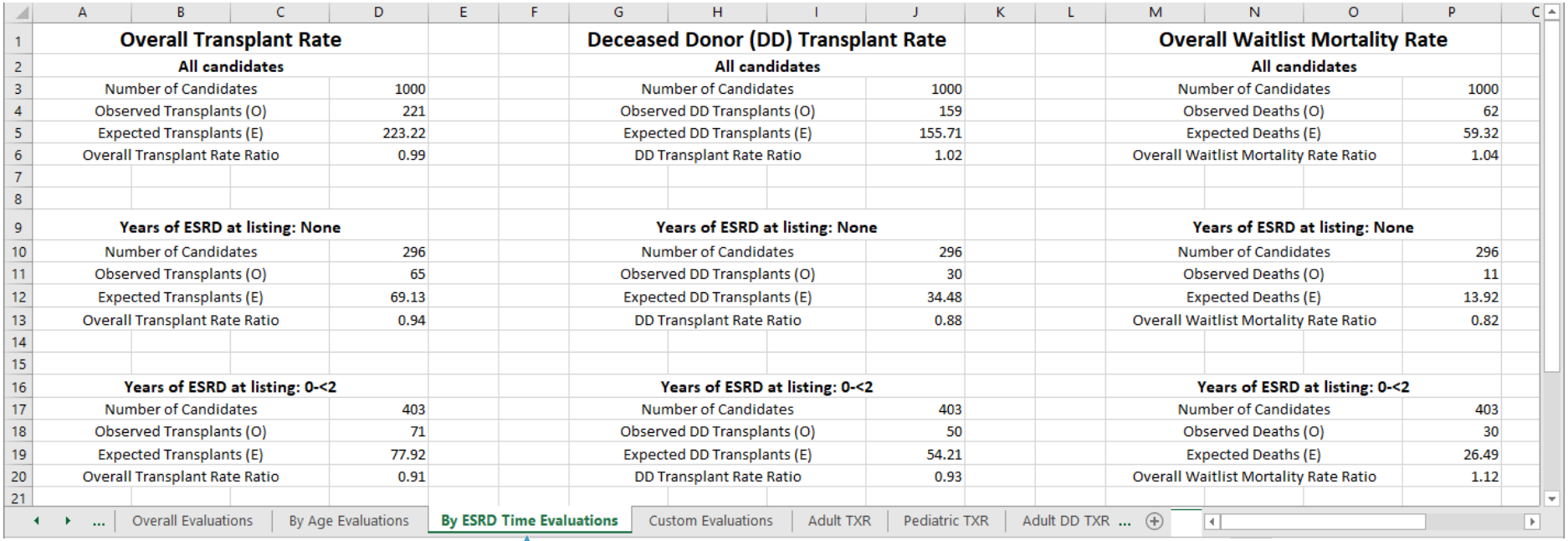
Overall Transplant Rate	
All candidates	
Number of Candidates	1000
Observed Transplants (O)	221
Expected Transplants (E)	223.22
Overall Transplant Rate Ratio	0.99
Candidate age: <40	
Number of Candidates	198
Observed Transplants (O)	53
Expected Transplants (E)	52.46
Overall Transplant Rate Ratio	1.01
Candidate age: 40-<60	
Number of Candidates	502
Observed Transplants (O)	105
Expected Transplants (E)	110.09
Overall Transplant Rate Ratio	0.95

Deceased Donor (DD) Transplant Rate	
All candidates	
Number of Candidates	1000
Observed DD Transplants (O)	159
Expected DD Transplants (E)	155.71
DD Transplant Rate Ratio	1.02
Candidate age: <40	
Number of Candidates	198
Observed DD Transplants (O)	32
Expected DD Transplants (E)	33.79
DD Transplant Rate Ratio	0.95
Candidate age: 40-<60	
Number of Candidates	502
Observed DD Transplants (O)	77
Expected DD Transplants (E)	76.14
DD Transplant Rate Ratio	1.01

Overall Waitlist Mortality Rate	
All candidates	
Number of Candidates	1000
Observed Deaths (O)	62
Expected Deaths (E)	59.32
Overall Waitlist Mortality Rate Ratio	1.04
Candidate age: <40	
Number of Candidates	198
Observed Deaths (O)	1
Expected Deaths (E)	5.21
Overall Waitlist Mortality Rate Ratio	0.42
Candidate age: 40-<60	
Number of Candidates	502
Observed Deaths (O)	31
Expected Deaths (E)	27.79
Overall Waitlist Mortality Rate Ratio	1.11

Overall Evaluations | By Age Evaluations | By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR ...

The By Age Evaluations tab stratifies for age subgroups and is included for each organ.

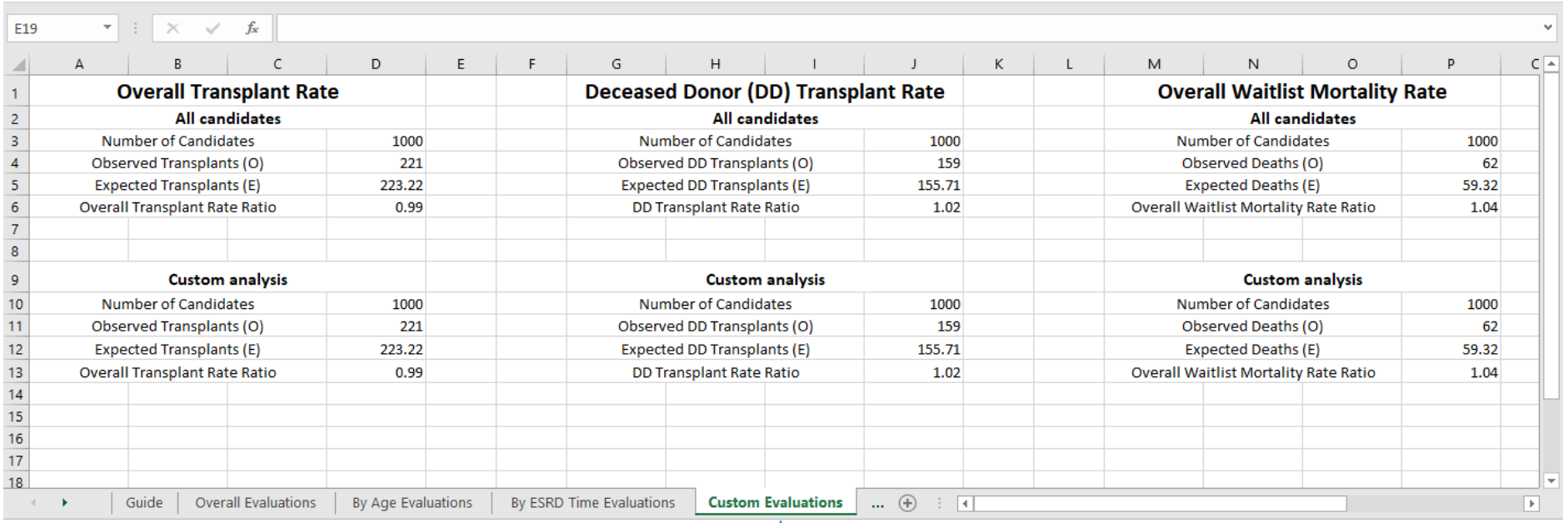


Overall Transplant Rate	
All candidates	
Number of Candidates	1000
Observed Transplants (O)	221
Expected Transplants (E)	223.22
Overall Transplant Rate Ratio	0.99
Years of ESRD at listing: None	
Number of Candidates	296
Observed Transplants (O)	65
Expected Transplants (E)	69.13
Overall Transplant Rate Ratio	0.94
Years of ESRD at listing: 0-<2	
Number of Candidates	403
Observed Transplants (O)	71
Expected Transplants (E)	77.92
Overall Transplant Rate Ratio	0.91

Deceased Donor (DD) Transplant Rate	
All candidates	
Number of Candidates	1000
Observed DD Transplants (O)	159
Expected DD Transplants (E)	155.71
DD Transplant Rate Ratio	1.02
Years of ESRD at listing: None	
Number of Candidates	296
Observed DD Transplants (O)	30
Expected DD Transplants (E)	34.48
DD Transplant Rate Ratio	0.88
Years of ESRD at listing: 0-<2	
Number of Candidates	403
Observed DD Transplants (O)	50
Expected DD Transplants (E)	54.21
DD Transplant Rate Ratio	0.93

Overall Waitlist Mortality Rate	
All candidates	
Number of Candidates	1000
Observed Deaths (O)	62
Expected Deaths (E)	59.32
Overall Waitlist Mortality Rate Ratio	1.04
Years of ESRD at listing: None	
Number of Candidates	296
Observed Deaths (O)	11
Expected Deaths (E)	13.92
Overall Waitlist Mortality Rate Ratio	0.82
Years of ESRD at listing: 0-<2	
Number of Candidates	403
Observed Deaths (O)	30
Expected Deaths (E)	26.49
Overall Waitlist Mortality Rate Ratio	1.12

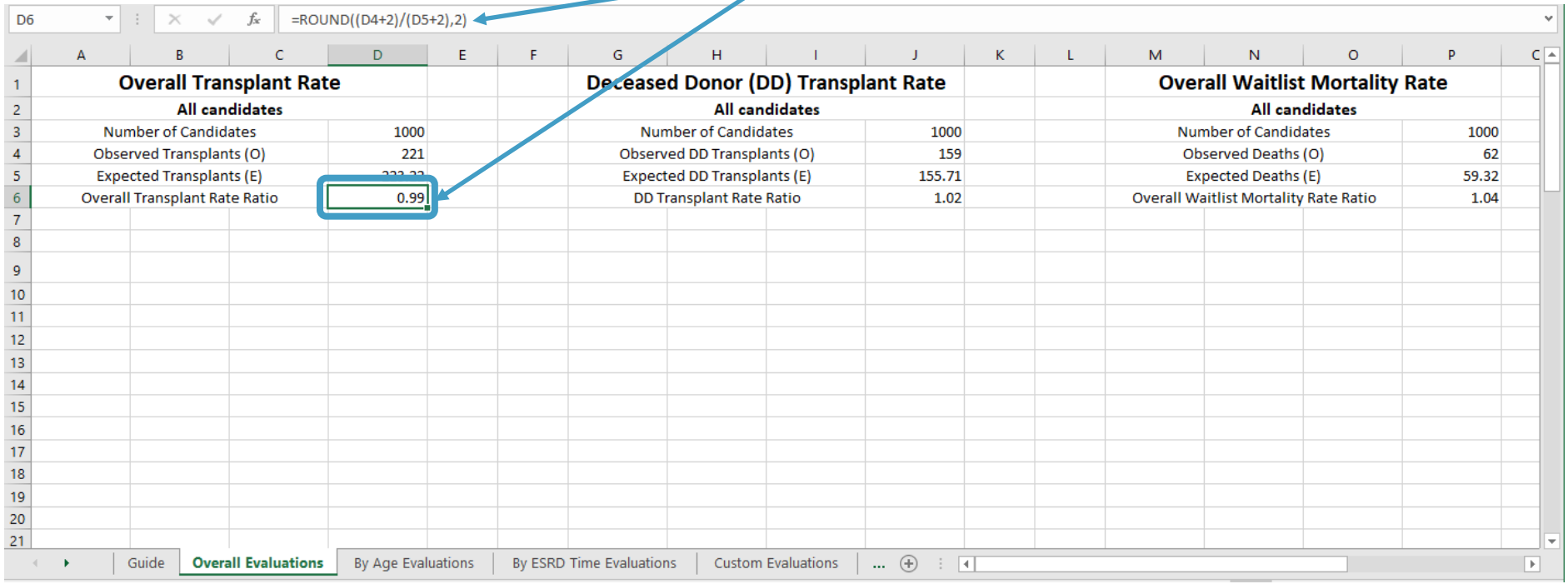
The By ESRD Time Evaluations tab stratifies by subgroups of years since first initiation of dialysis. The category depends on the organ and corresponds to the primary measure of allocation priority (it does not exist for heart).



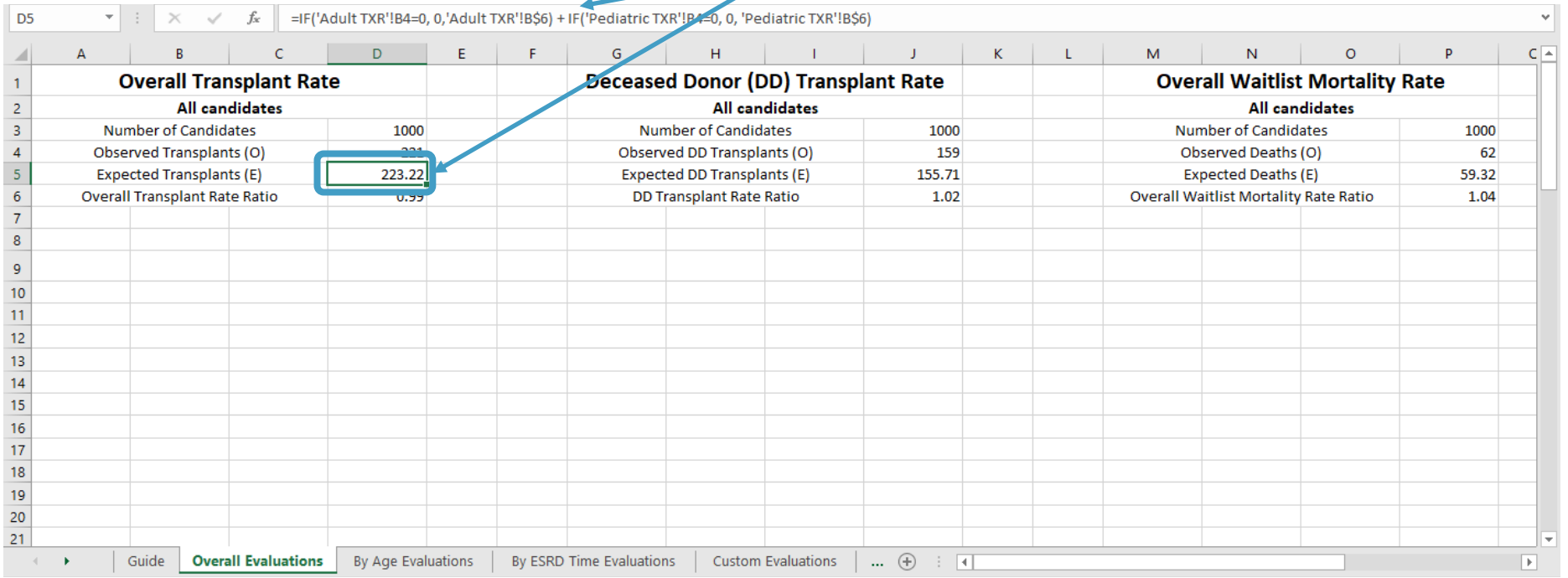
Overall Transplant Rate		Deceased Donor (DD) Transplant Rate		Overall Waitlist Mortality Rate	
All candidates		**All candidates**		**All candidates**	
Number of Candidates	1000	Number of Candidates	1000	Number of Candidates	1000
Observed Transplants (O)	221	Observed DD Transplants (O)	159	Observed Deaths (O)	62
Expected Transplants (E)	223.22	Expected DD Transplants (E)	155.71	Expected Deaths (E)	59.32
Overall Transplant Rate Ratio	0.99	DD Transplant Rate Ratio	1.02	Overall Waitlist Mortality Rate Ratio	1.04
Custom analysis		**Custom analysis**		**Custom analysis**	
Number of Candidates	1000	Number of Candidates	1000	Number of Candidates	1000
Observed Transplants (O)	221	Observed DD Transplants (O)	159	Observed Deaths (O)	62
Expected Transplants (E)	223.22	Expected DD Transplants (E)	155.71	Expected Deaths (E)	59.32
Overall Transplant Rate Ratio	0.99	DD Transplant Rate Ratio	1.02	Overall Waitlist Mortality Rate Ratio	1.04

The Custom Evaluations tab allows the user to perform subgroup analyses. The overall evaluation are the default settings.

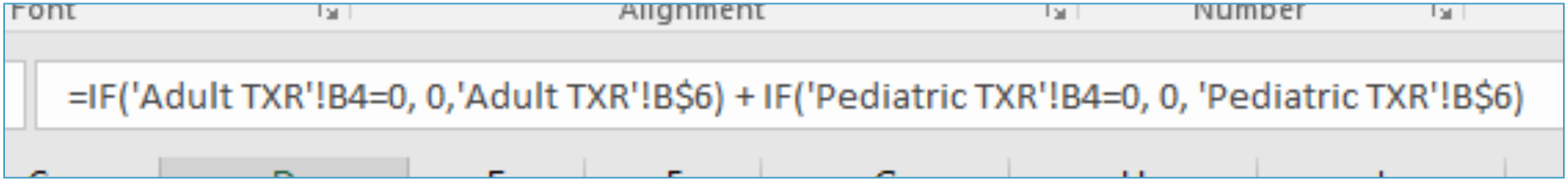
The transplant rate ratio cell displays the calculations…



The transplant rate ratio cells show the calculations…



The evaluations are taken from the ‘Adult TXR’ and ‘Pediatric TXR’ tabs

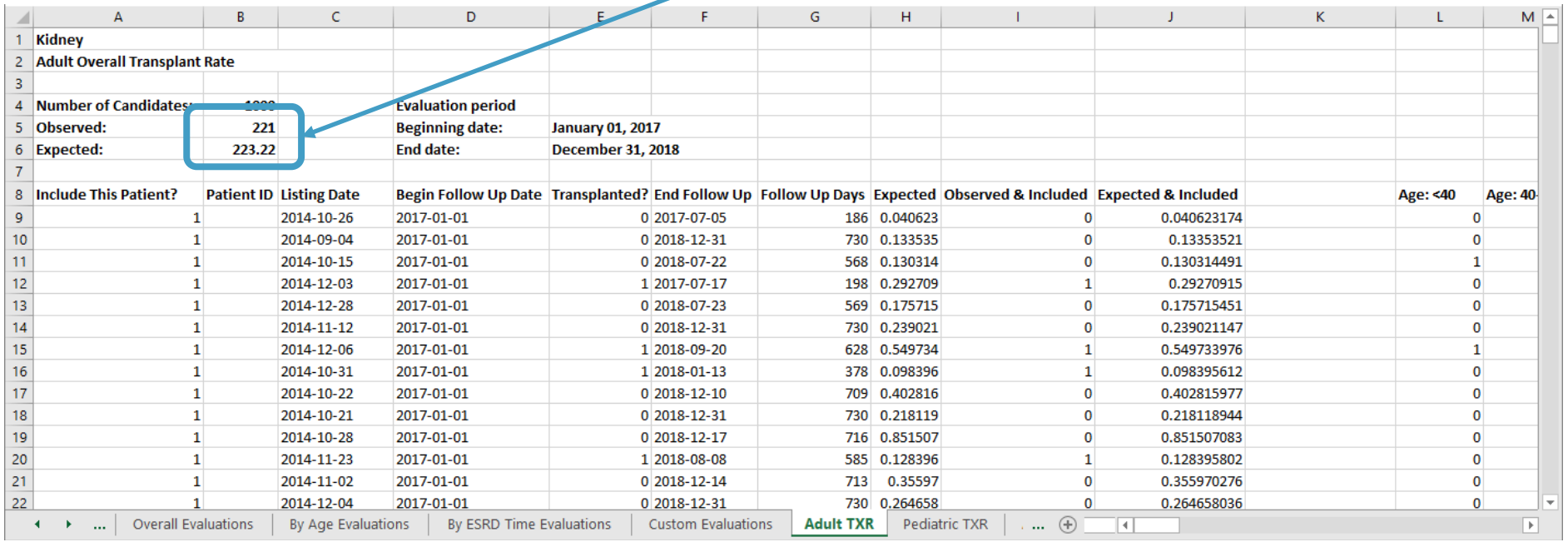


The ‘Adult TXR’ and ‘Pediatric TXR’ tabs contain the patient-level data

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	**Kidney**												
2	**Adult Overall Transplant Rate**												
3													
4	**Number of Candidates:**	**1000**		**Evaluation period**									
5	**Observed:**	**221**		**Beginning date:**	**January 01, 2017**								
6	**Expected:**	**223.22**		**End date:**	**December 31, 2018**								
7													
8	**Include This Patient?**	**Patient ID**	**Listing Date**	**Begin Follow Up Date**	**Transplanted?**	**End Follow Up**	**Follow Up Days**	**Expected**	**Observed & Included**	**Expected & Included**		**Age: <40**	**Age: 40-**
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	
19	1		2014-10-28	2017-01-01	0	2018-12-17	716	0.851507	0	0.851507083		0	
20	1		2014-11-23	2017-01-01	1	2018-08-08	585	0.128396	1	0.128395802		0	
21	1		2014-11-02	2017-01-01	0	2018-12-14	713	0.35597	0	0.355970276		0	
22	1		2014-12-04	2017-01-01	0	2018-12-31	730	0.264658	0	0.264658036		0	

... | Overall Evaluations | By Age Evaluations | By ESRD Time Evaluations | Custom Evaluations | **Adult TXR** | Pediatric TXR | ...

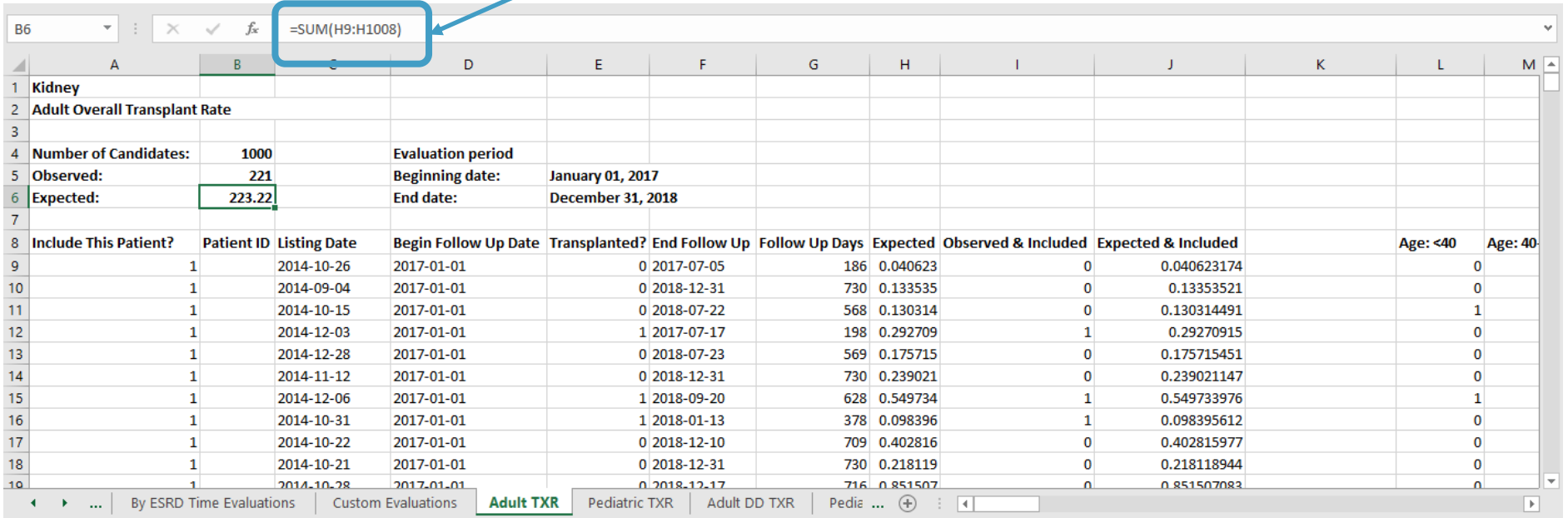
The overall evaluations use these values if the program has more than 0 adult (or pediatric) candidates.



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	[illegible]		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	
19	1		2014-10-28	2017-01-01	0	2018-12-17	716	0.851507	0	0.851507083		0	
20	1		2014-11-23	2017-01-01	1	2018-08-08	585	0.128396	1	0.128395802		0	
21	1		2014-11-02	2017-01-01	0	2018-12-14	713	0.35597	0	0.355970276		0	
22	1		2014-12-04	2017-01-01	0	2018-12-31	730	0.264658	0	0.264658036		0	

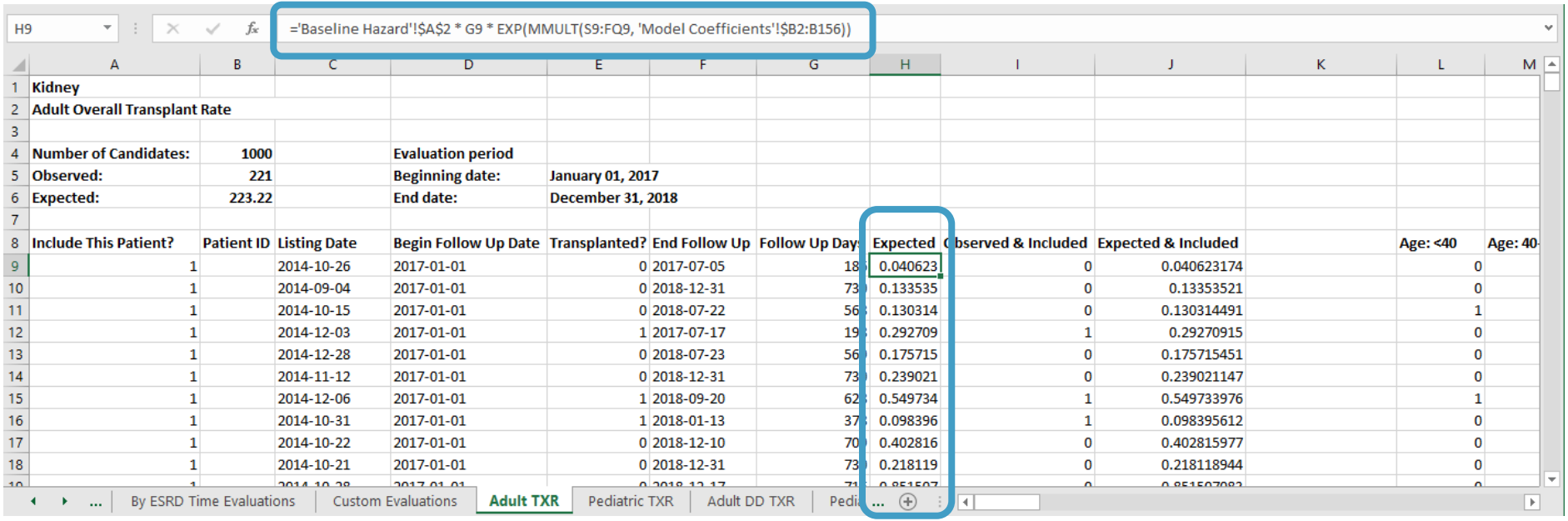
Overall Evaluations | By Age Evaluations | By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR

Where does the expected come from?



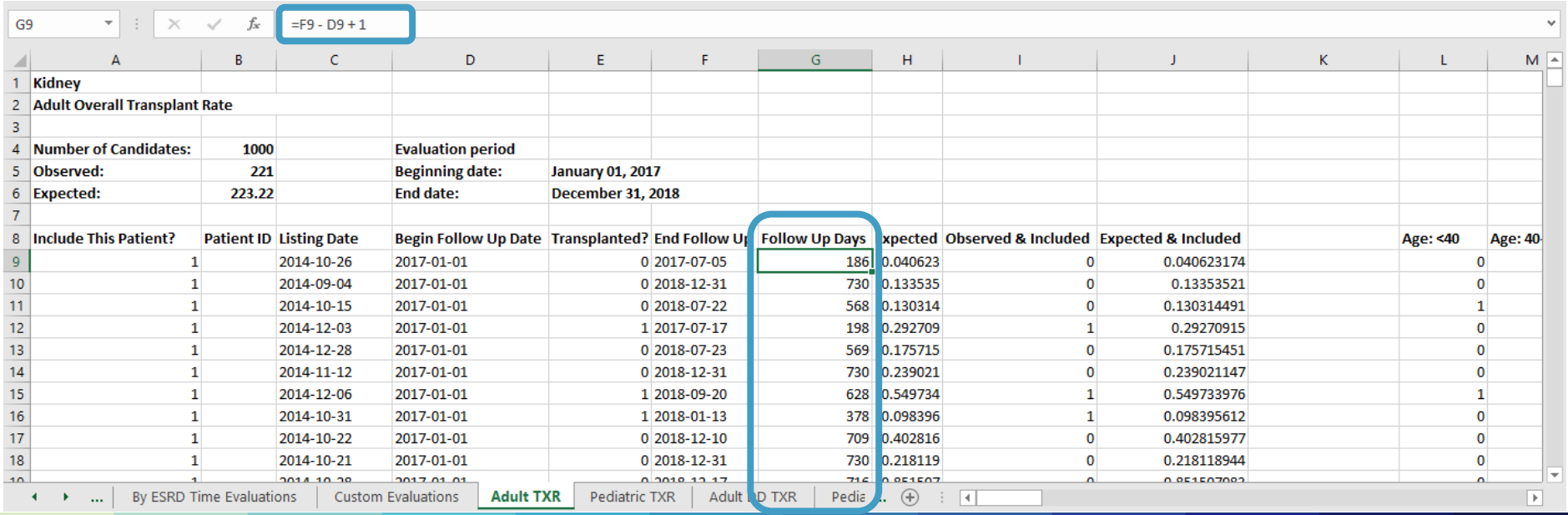
	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	
19	1		2014-10-28	2017-01-01	0	2018-12-17	716	0.851507	0	0.851507083		0	

The expected column is the contribution of each patient given their characteristics at listing and “Follow Up Days”



	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	18	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	73	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	56	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	19	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	56	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	73	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	62	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	37	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	70	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	73	0.218119	0	0.218118944		0	

Follow Up Days is determined as the time from listing or start of the evaluation window, whichever is later, and the end of follow up.



G9 | =F9 - D9 + 1

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	xpected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	

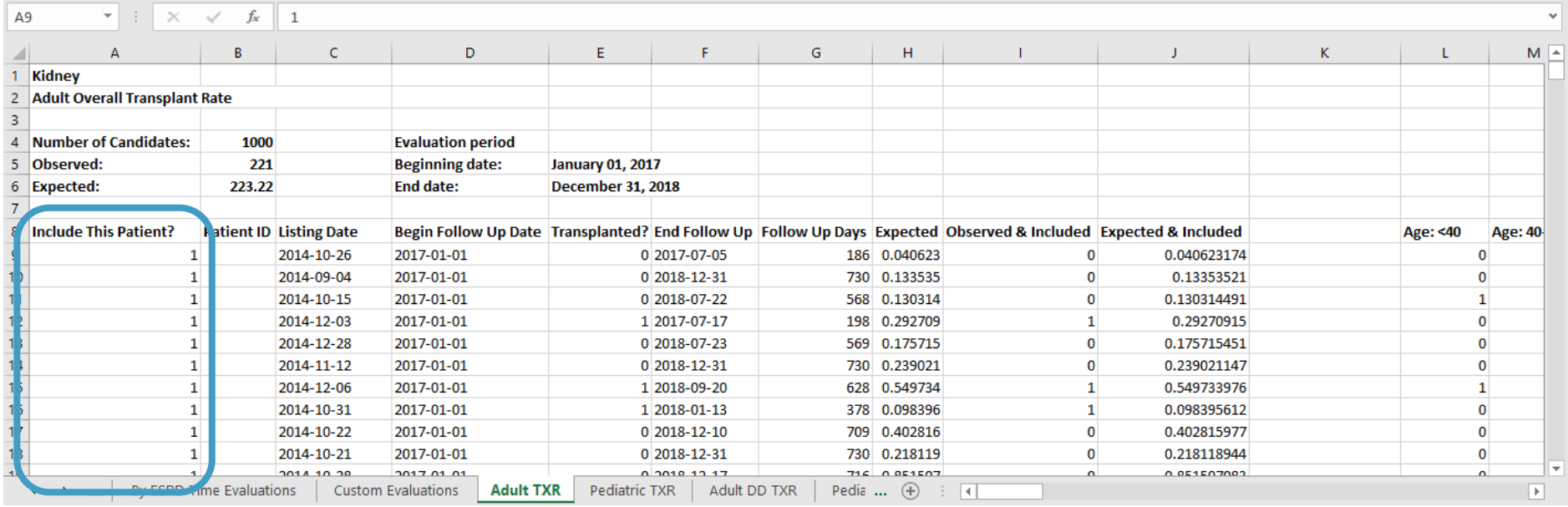
By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | Adult LD TXR | Pedia...

Follow Up Days is determined as the time from listing or start of the evaluation window, whichever is later, and the end of follow up.

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	
19	1		2014-10-28	2017-01-01	0	2018-12-17	716	0.851507	0	0.851507083		0	
20	1		2014-11-23	2017-01-01	1	2018-08-08	585	0.128396	1	0.128395802		0	
21	1		2014-11-02	2017-01-01	0	2018-12-14	713	0.35597	0	0.355970276		0	
22	1		2014-12-04	2017-01-01	0	2018-12-31	730	0.264658	0	0.264658036		0	

... Overall Evaluations | By Age Evaluations | By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | ...

This column can be used to facilitate subgroup analyses by including/excluding patients from the analysis. The Custom Evaluations tab summarizes the current subgroup analyses.

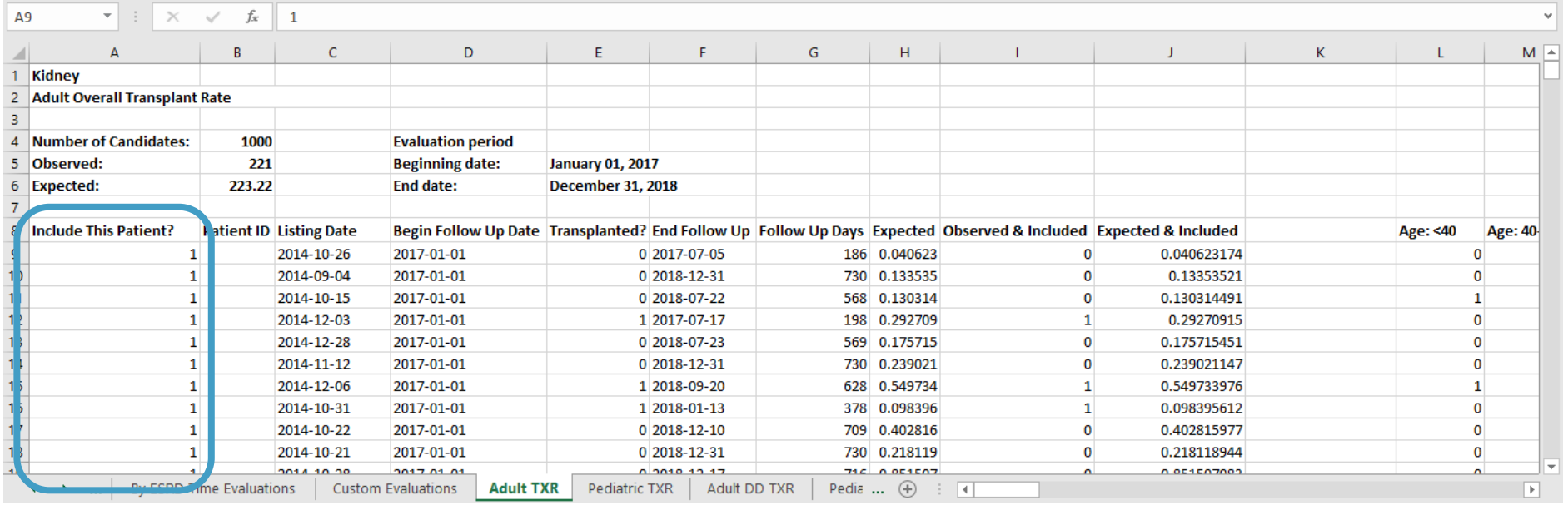


A9 | 1

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	atient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	

Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR | Pedia ...

The subgroup analyses may require identifying the appropriate patients from their ID. Alternatively, you can use the patient-level data in the workbook.

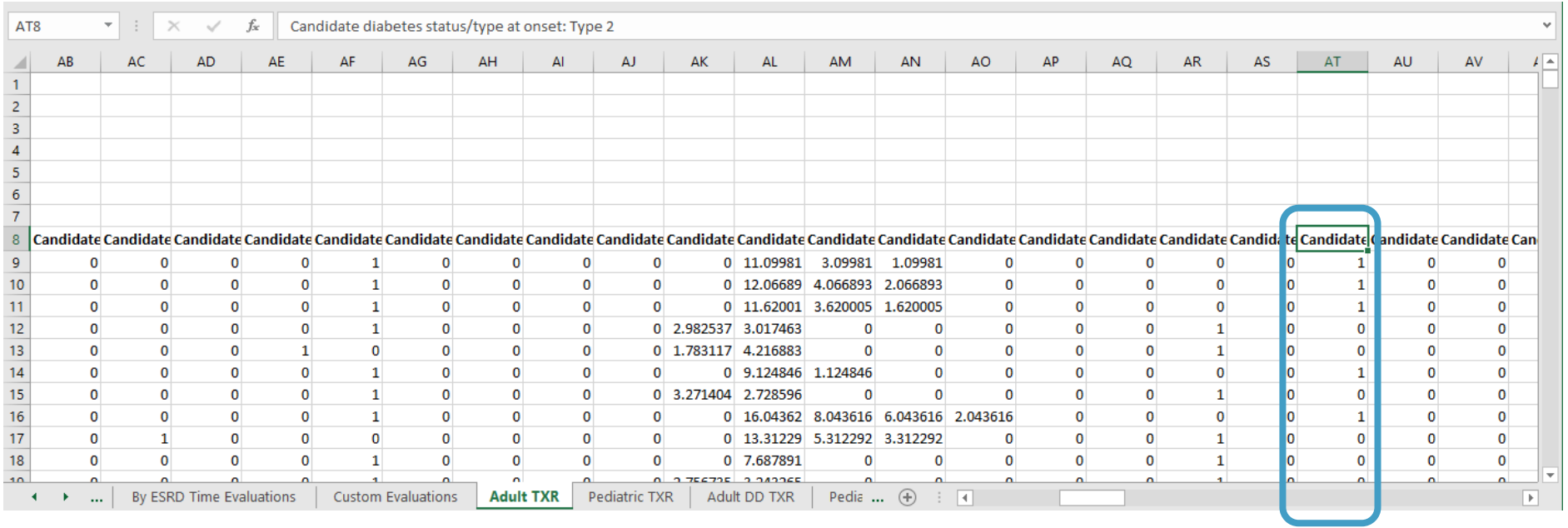


A9 | 1

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	atient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
9	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		0	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0	

Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR | Pedia ...

For example, if you want to know the transplant rate for type 2 diabetics, you need to find the appropriate column…

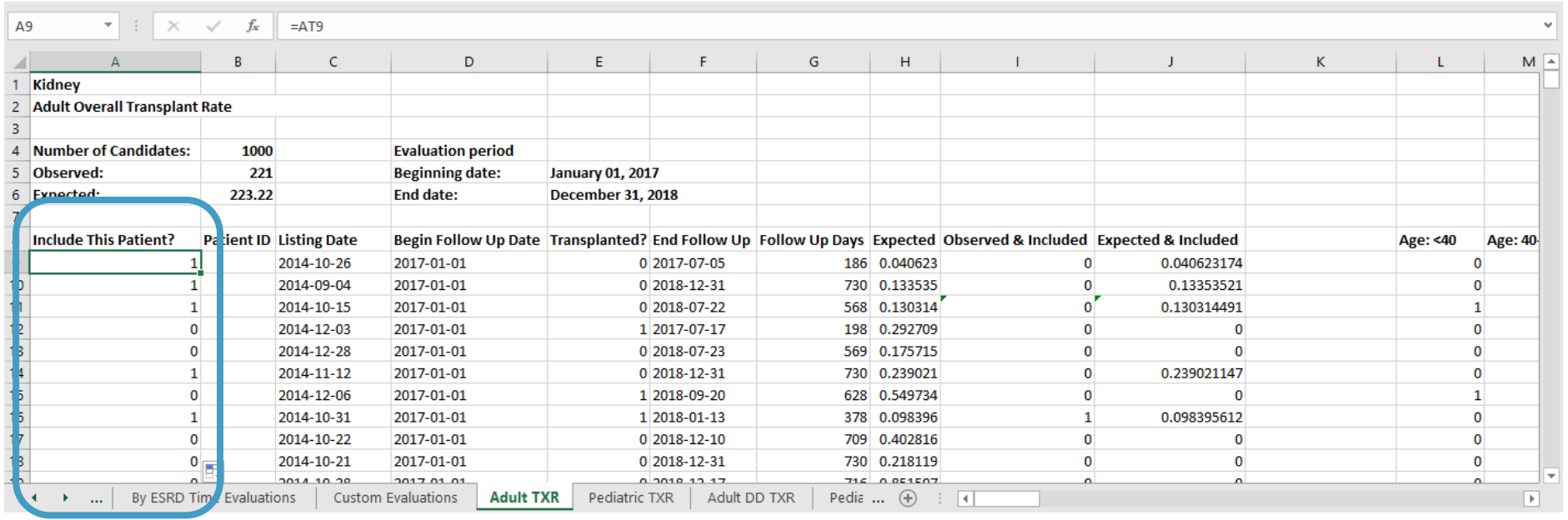


AT8 | Candidate diabetes status/type at onset: Type 2

	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV
8	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate
9	0	0	0	0	1	0	0	0	0	0	11.09981	3.09981	1.09981	0	0	0	0	0	1	0	0
10	0	0	0	0	1	0	0	0	0	0	12.06689	4.066893	2.066893	0	0	0	0	0	1	0	0
11	0	0	0	0	1	0	0	0	0	0	11.62001	3.620005	1.620005	0	0	0	0	0	1	0	0
12	0	0	0	0	1	0	0	0	0	2.982537	3.017463	0	0	0	0	0	1	0	0	0	0
13	0	0	0	1	0	0	0	0	0	1.783117	4.216883	0	0	0	0	0	1	0	0	0	0
14	0	0	0	0	1	0	0	0	0	0	9.124846	1.124846	0	0	0	0	0	0	1	0	0
15	0	0	0	0	1	0	0	0	0	3.271404	2.728596	0	0	0	0	0	1	0	0	0	0
16	0	0	0	0	1	0	0	0	0	0	16.04362	8.043616	6.043616	2.043616	0	0	0	0	1	0	0
17	0	1	0	0	0	0	0	0	0	0	13.31229	5.312292	3.312292	0	0	0	1	0	0	0	0
18	0	0	0	0	1	0	0	0	0	0	7.687891	0	0	0	0	0	1	0	0	0	0

By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR | Pedia …

And write a formula into the entire “Include This Patient?” column…

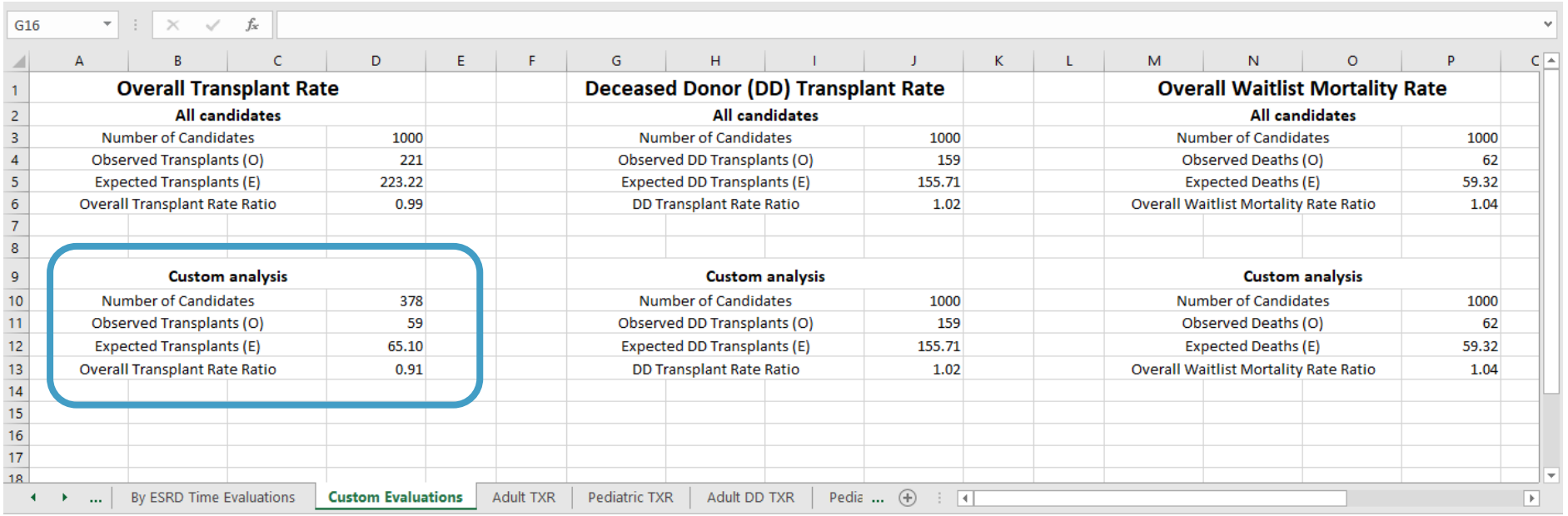


A9 =AT9

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0	
10	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0	
11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	0		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	0	0		0	
13	0		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	0		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	0	0		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	0		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0		0	
18	0		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0		0	

... By ESRD Time Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR | Pedia ...

The Custom Evaluations tab now shows the overall transplant rate ratio for type 2 diabetics…



Overall Transplant Rate	
All candidates	
Number of Candidates	1000
Observed Transplants (O)	221
Expected Transplants (E)	223.22
Overall Transplant Rate Ratio	0.99
Custom analysis	
Number of Candidates	378
Observed Transplants (O)	59
Expected Transplants (E)	65.10
Overall Transplant Rate Ratio	0.91

Deceased Donor (DD) Transplant Rate	
All candidates	
Number of Candidates	1000
Observed DD Transplants (O)	159
Expected DD Transplants (E)	155.71
DD Transplant Rate Ratio	1.02
Custom analysis	
Number of Candidates	1000
Observed DD Transplants (O)	159
Expected DD Transplants (E)	155.71
DD Transplant Rate Ratio	1.02

Overall Waitlist Mortality Rate	
All candidates	
Number of Candidates	1000
Observed Deaths (O)	62
Expected Deaths (E)	59.32
Overall Waitlist Mortality Rate Ratio	1.04
Custom analysis	
Number of Candidates	1000
Observed Deaths (O)	62
Expected Deaths (E)	59.32
Overall Waitlist Mortality Rate Ratio	1.04

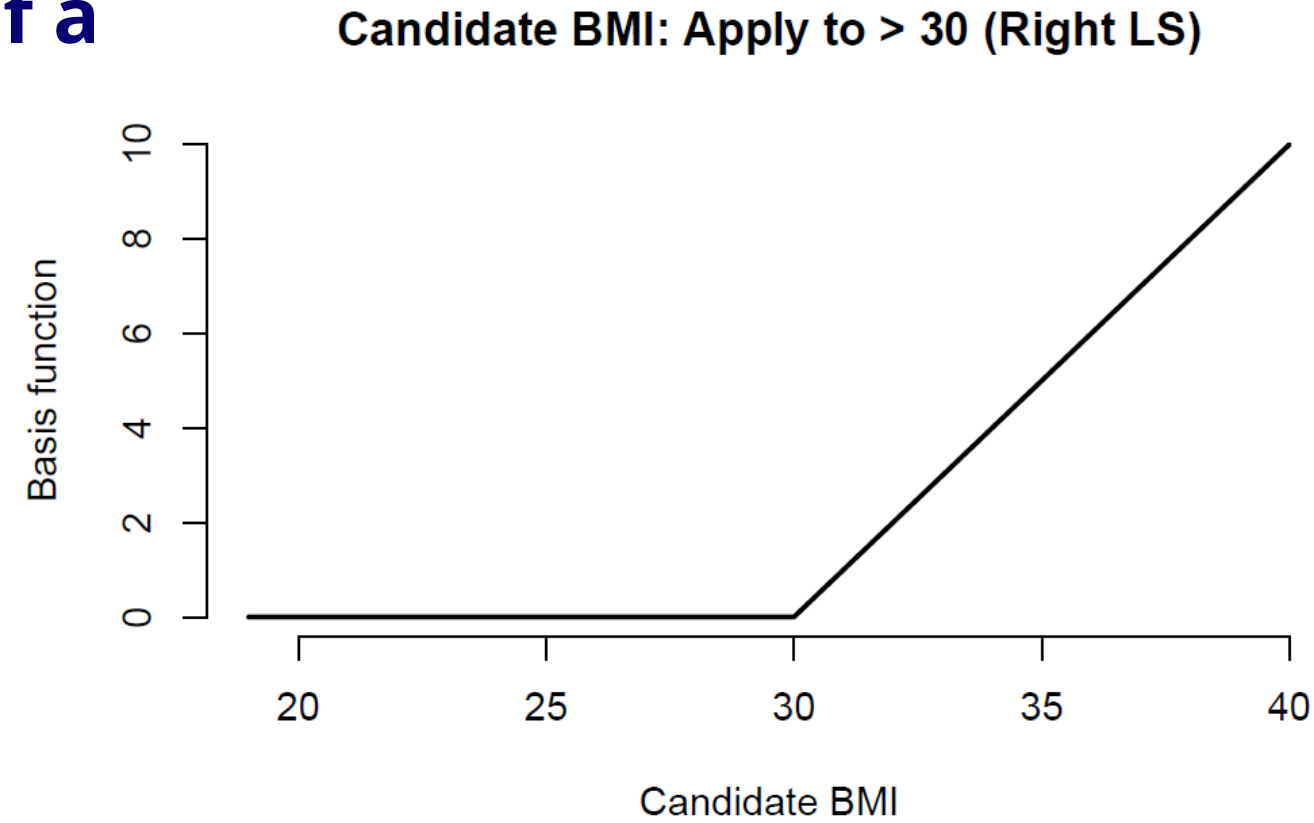
More complicated subgroup analyses

- More complicated subgroup analyses are possible. For example, what if you want to know the overall transplant rate for candidates with a BMI > 30 at listing?

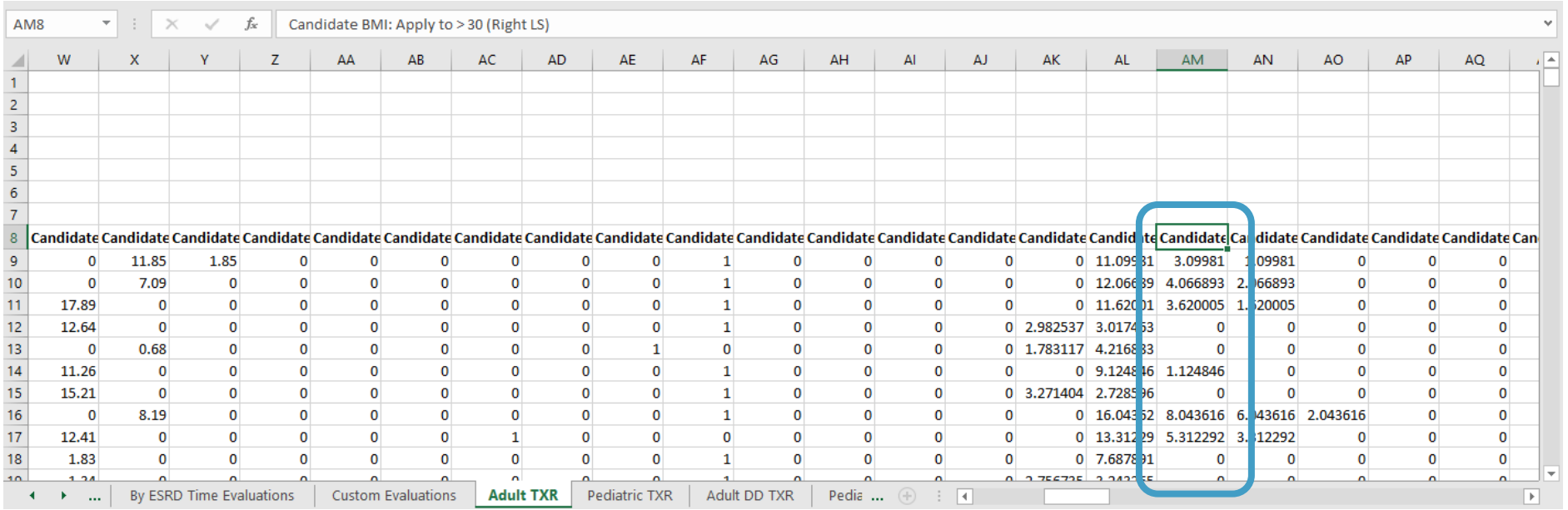
- Continuous variables are not directly included in the workbook but linear splines of continuous variables are included.

- What is a linear spline? Well, the “right-hand” linear spline at 30 for BMI has the following name “Candidate BMI: Apply to > 30 (Right LS)”. This column is BMI – 30 when a candidate’s BMI is greater than 30. Otherwise, the column is zero.

Illustration of a linear spline

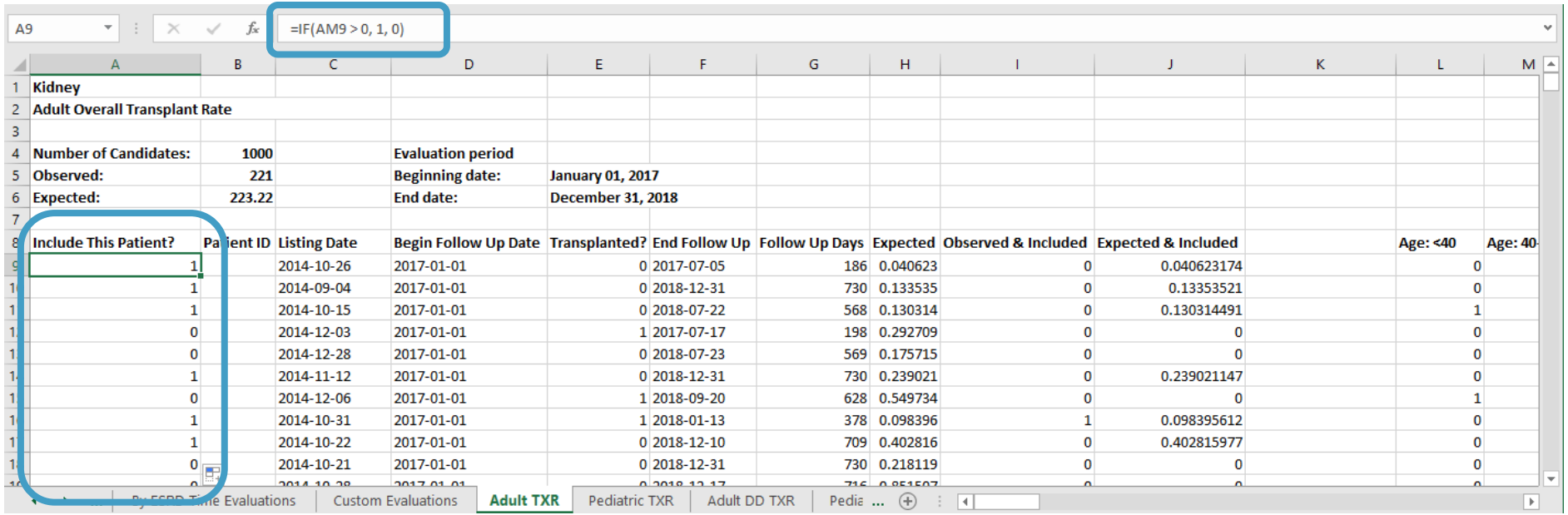


Determining the transplant rate for BMI > 30 at listing… Find an appropriate column…



	W	X	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
8	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate	Candidate
9	0	11.85	1.85	0	0	0	0	0	0	1	0	0	0	0	0	11.09981	3.09981	1.09981	0	0	0
10	0	7.09	0	0	0	0	0	0	0	1	0	0	0	0	0	12.06689	4.066893	2.066893	0	0	0
11	17.89	0	0	0	0	0	0	0	0	1	0	0	0	0	0	11.62001	3.620005	1.620005	0	0	0
12	12.64	0	0	0	0	0	0	0	0	1	0	0	0	0	2.982537	3.017463	0	0	0	0	0
13	0	0.68	0	0	0	0	0	0	1	0	0	0	0	0	1.783117	4.216883	0	0	0	0	0
14	11.26	0	0	0	0	0	0	0	0	1	0	0	0	0	0	9.124846	1.124846	0	0	0	0
15	15.21	0	0	0	0	0	0	0	0	1	0	0	0	0	3.271404	2.728596	0	0	0	0	0
16	0	8.19	0	0	0	0	0	0	0	1	0	0	0	0	0	16.04362	8.043616	6.043616	2.043616	0	0
17	12.41	0	0	0	0	0	1	0	0	0	0	0	0	0	0	13.31229	5.312292	3.312292	0	0	0
18	1.83	0	0	0	0	0	0	0	0	1	0	0	0	0	0	7.687891	0	0	0	0	0

Write an appropriate formula into the “Include This Patient?” column…



A9 | =IF(AM9 > 0, 1, 0)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplant Rate												
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 2017								
6	Expected:	223.22		End date:	December 31, 2018								
7													
8	Include This Patient?	Patient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40-
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11	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	
12	0		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	0	0		0	
13	0		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0		0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	
15	0		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	0	0		1	
16	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		0	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		0	
18	0		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0		0	

Sheet tabs: … Evaluations | Custom Evaluations | Adult TXR | Pediatric TXR | Adult DD TXR | Pedia …

More complicated subgroup analyses

- Determining the appropriate column and formula for these type of subgroup analyses is more difficult. Users need to carefully select the appropriate *type* and *location* of the linear spline.

- “Left-hand” linear splines have a similar but different definition. For example “Candidate BMI: Apply to < 24 (Left LS)” is 24 – BMI when a candidate’s BMI is less than 24. Otherwise, it is zero. This spline *cannot* distinguish among candidates with a BMI above 24 and, therefore, cannot be used for the BMI > 30 subgroup analysis.

- A right-hand linear spline at a BMI of 32, “Candidate BMI: Apply to > 32 (Right LS)”, cannot distinguish among candidates with a BMI lower than 32 and, therefore, cannot be used for the subgroup analysis.

Pretransplant expected workbooks

- Before moving to questions… What is next for pretransplant metrics?
- SRTR plans to integrate a metric for patient mortality after listing, which integrates pretransplant and posttransplant survival, into the PSRs during the July 2020 release.
- We plan to preview the models and reports during the January 2020 report. We also plan on releasing an “expected workbook” for patient mortality after listing during the July 2020 release.

Pretransplant expected workbooks

Any questions?

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