SR TR

SCIENTIFIC REGISTRY 약 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 vou 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:



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	End date:		December 31,	2018				
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9-04	2017-01-01		0	2018-12-31	7	30 0.133535		0.13353521
10-15	2017-01-01		0	2018-07-22	5	68 0.130314		0.130314491
2-03	2017-01-01		1	2017-07-17	1	98 0.292709		0.29270915
2-28	2017-01-01		0	2018-07-23	5	69 0.175715		0.175715451
1-12	2017-01-01		0	2018-12-31	3	30 0.239021		0.239021147
2-06	2017-01-01		1	2018-09-20	6	28 0.549734		0.549733976
0-31	2017-01-01		1	2018-01-13	3	78 0.098396		0.098395612
0-22	2017-01-01		0	2018-12-10	5	09 0.402816		0.402815977
0-21	2017-01-01		0	2018-12-31	7	30 0.218119		0.218118944
0-28	2017-01-01		0	2018-12-17	5	16 0.851507		0.851507083
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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.

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

<u>Offer acceptance impacts the probability of waitlist mortality</u>: 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)

- Summarizes acceptance practices over a year.
- Includes figures to illustrate acceptance relative to other

programs

Offer Acceptance CUSUM (Secure Site)

 Provides a trajectory of acceptance practices over time and a separate summary of recent acceptance practices within certain subgroups OPO Offer Acceptance Report (Secure Site)

 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: <u>https://securesrtr.transplant.hrsa.gov</u> Welcome to the new SRTR Secure Website launched on February 20, 2019. If this is your first time logging in to the new site, and you had an active account on the old site, you MUST reactivate your account.

Log In

Enter your email address and password to continue. To keep SRTR secure, passwords expire after 60 days of inactivity.

EMAIL ADDRESS

Email Address
PASSWORD
Password
SHOW
Forgot your password?
LOG IN

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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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Security	Update	
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Announcements

Go to: REPORTS

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Current Release

CURRENT RELEASE

COMMENTS

Reports

ARCHIVES

CUSUM CHARTS

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 PERIOD Heart Spring 2019

DOWNLOAD ALL FILES





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PROGRAM Heart ~

Spring 2019

PERIOD

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CUSUM charts Reports Learn more about CUSUM charts CURRENT RELEASE COMMENTS PROGRAM PERIOD ARCHIVES Kidney August 2019 \sim \sim CUSUM CHARTS TYPE COHORT AGE Click on the TYPE Graft Survival Adult \sim \sim dropdown for a list of the different **DONOR TYPE CUSUMs** Deceased Donors \sim DOWNLOAD DATA (CSV)



Reports

CURRENT RELEASE

CUSUM charts

Learn more about CUSUM charts

COMMENTS	PROGRAM		PERIOD	
ARCHIVES	Kidney	~	August 2019	~
CUSUM CHARTS	Nancy		August 2019	
	ТҮРЕ		COHORT AGE	
	Graft Survival	~	Adult	~
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Choose Offer	Patient Survival			
Acceptance	Offer Acceptance			
	DOWNLOAD DATA (CSV)			



Reports

CURRENT RELEASE

COMMENTS

ARCHIVES

CUSUM CHARTS

CUSUM charts

Learn more about CUSUM charts

PROGRAM		PERIOD		
Kidney	~	August 2019	~	

TYPE

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

Offer Acceptance	~
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Expected – Observed CUSUM

Zoom 1m 3m 6m YTD 1y All

From Nov 29, 2018 To Apr 1, 2019

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





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.



One-Sided CUSUM

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





Expected – Observed CUSUM

Zoom 1m 3m 6m YTD 1y All

From Nov 28, 2018 To Mar 31, 2019

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?





One-Sided CUSUM

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





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.

	DISTANCE	DECEASED DONOR TRANSPLANTS IN A YEAR	LIVING DONOR TRANSPLANTS IN A YEAR	SURVIVAL ON THE WAITLIST	GETTING A DECEASED DONOR	1-YEAR LIVER SURVIVAL
i For liver transplant candidates, only candidates who received a trans	this measure has th splant.	he largest impact on s	survival after listing	among these three r	neasures. 1 year liver s	survival includes
Mayo Clinic Hospital						
Mayo Clinic Hospital Phoenix, AZ	N/A	128	1			



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?

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By ESRD Time Evaluations

Custom ... (+)

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Overall Evaluations

Risk-Adjustment Model Coefficients

Baseline Hazards for the Risk-Adjustment Models

By Age Evaluations

15 Model Coefficients

Guide

16 Baseline Hazard

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Ready

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



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11	Obse	rved Transplan	ts (O)	53			Observ	ed DD Transplant	ts (O)	32			O	bserved Deaths	5 (O)	1	
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The By Age Evaluations tab stratifies for age subgroups and is included for each organ.



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1	C	Overall Tran	splant Ra	ate		Dece	ased Donor	(DD) Transp	olant Rate		Ove	rall Waitlist	Mortality	Rate	
2		All cano	lidates				All d	andidates				All cano	didates		
3	Nun	nber of Candida	tes	1000			Number of Can	didates	1000		Nu	mber of Candida	ates	1000	
4	Obse	rved Transplant	s (O)	221		Ob	served DD Tran	splants (O)	159		O	bserved Deaths (0)	62	
5	Expe	cted Transplant	s (E)	223.22		Ex	pected DD Tran	splants (E)	155.71		E	xpected Deaths (E)	59.32	
6	Overall	l Transplant Rat	e Ratio	0.99		I	DD Transplant Ra	ate Ratio	1.02		Overall W	aitlist Mortality/	Rate Ratio	1.04	
7															
8															
9	Y	ears of ESRD a	t listing: N	one			Years of ESF	RD at listing: No	one		1	Years of ESRD a	t listing: Non	e	
10	Nun	nber of Candida	tes	296			Number of Can	didates	296		Nu	mber of Candida	ates	296	
11	Obse	rved Transplant	s (O)	65		Ob	served DD Tran	splants (O)	30		O	bserved Deaths (0)	11	
12	Expe	cted Transplant	s (E)	69.13		Ex	pected DD Tran	splants (E)	34.48		E	xpected Deaths (E)	13.92	
13	Overall	l Transplant Rate	e Ratio	0.94		I	DD Transplant Ra	ate Ratio	0.88		Overall W	/aitlist Mortality	Rate Ratio	0.82	
14															
15															
16	Y	ears of ESRD a	at listing: 0	-<2			Years of ES	RD at listing: 0-	<2			Years of ESRD a	at listing: 0-<	2	
17	Nun	nber of Candida	tes	403			Number of Can	didates	403		Nu	mber of Candida	ates	403	_
18	Obse	rved Transplant	s (O)	71		Ob	served DD Tran	splants (O)	50		O	bserved Deaths (0)	30	_
19	Expe	cted Transplant	s (E)	77.92		Ex	pected DD Tran	splants (E)	54.21		E	xpected Deaths (E)	26.49	_
20	Overall	l Transplant Rat	e Ratio	0.91		I	DD Transplant Rate Ratio		0.93		Overall W	aitlist Mortality	Rate Ratio	1.12	_
21												_			
	· · …	Overall Evaluation	ons By A	ge Evaluations	By ESRD	Time Evaluations	Custom Evaluat	tions Adult T	XR Pediatric T	XR Adult DD	rxr 🕂	•			Þ

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).



	A	В	C	D	E F	G	н		J	ĸ	L	M	N	0	Р
1	0	verall Tra	nsplant Rat	te		Decea	sed Donor	(DD) Trans	plant Rate			Over	rall Waitlist	t Mortality	Rate
2		All car	ndidates				All ca	andidates					All can	didates	
3	Num	ber of Candio	dates	1000		1	Number of Cand	idates	1000			Nur	mber of Candid	ates	1000
4	Obser	ved Transpla	nts (O)	221		Obs	erved DD Trans	plants (O)	159			Ob	served Deaths	(0)	62
5	Expe	cted Transplai	nts (E)	223.22		Exp	ected DD Trans	plants (E)	155.71			Ex	pected Deaths	(E)	59.32
6	Overall	Transplant Ra	ite Ratio	0.99		D	D Transplant Rat	te Ratio	1.02			Overall Wa	aitlist Mortality	Rate Ratio	1.04
7															
8															
9		Custom analysis					Custo	m analysis					Custom	analysis	
10	Num	nber of Candio	dates	1000		1	Number of Cand	idates	1000			Nur	mber of Candid	ates	1000
1	Obser	ved Transpla	nts (O)	221		Obs	erved DD Trans	plants (O)	159			Ob	served Deaths	(0)	62
12	Expe	cted Transpla	nts (E)	223.22		Exp	ected DD Trans	plants (E)	155.71			Ex	pected Deaths	(E)	59.32
13	Overall	Transplant Ra	ite Ratio	0.99		D	D Transplant Rat	te Ratio	1.02			Overall Wa	aitlist Mortality	Rate Ratio	1.04
4															
5															
6															
7															
18															

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...

D6	•	E X N	<i>f</i> ≈ =RC	0UND((D4+2)/(D5	i+2),2) 🗲												v
	А	В	С	D	E	F	G	н	I	J	к	L	М	N	0	Р	C
1	0	verall Tra	ansplant Ra	ate			Decease	d Donor (I	DD) Transp	olant Rate			Over	rall Waitlis	t Mortality	Rate	
2		All ca	andidates					All car	ndidates					All ca	ndidates		
3	Num	ber of Cand	idates	1000			Nun	nber of Candio	dates	1000			Nur	mber of Candi	dates	1000	
4	Obser	ved Transpla	ants (O)	221			Observ	ed DD Transpl	lants (O)	159			Ob	served Death	s (O)	62	
5	Expec	ted Transpl	ants (E)				Expect	ed DD Transpl	lants (E)	155.71			Ex	pected Death	s (E)	59.32	
6	Overall	Transplant F	Rate Ratio	0.99			DD T	ransplant Rate	Ratio	1.02			Overall W	aitlist Mortali	y Rate Ratio	1.04	
7																	
8																	
9																	
10																	
11																	_
12																	
13																	
14																	
15																	
16																	
1/																	
18																	
20																	
20																	
-	• G	uide Ove	erall Evaluation	s By Age Eva	uations	By ESRD	Time Evaluation	ns Custom	Evaluations	🕂 🗄	•			1			•



The transplant rate ratio cells show the calculations...

D5	•	: ×	√ <i>f</i> _x =IF('	Adult TXR'!B4=0), 0,'Adult	TXR'!B\$6) +	IF('Pediatric TXR	'!P4=0, 0, 'Pe	diatric TXR'!B\$	6)							~
	А	В	С	D	E	F	G	н	I.	J	к	L	м	N	0	Р	C 🔺
1	C	Overall T	ransplant Ra	te			Deceased	Donor (I	DD) Transp	lant Rate			Over	all Waitlis	t Mortality	Rate	
2		All o	candidates					All car	didates					All car	ndidates		
З	Nui	mber of Can	didates	1000			Numb	er of Candio	lates	1000			Nun	nber of Candic	lates	1000	
4	Obse	erved Transp	olants (O)	221			Observe	d DD Transpl	ants (O)	159			Ob	served Deaths	; (0)	62	
5	Expe	ected Transp	olants (E)	223.22			Expecte	d DD Transpl	ants (E)	155.71			Exp	pected Deaths	; (E)	59.32	
6	Overal	l Transplant	Rate Ratio	0.55			DD Tra	nsplant Rate	Ratio	1.02			Overall Wa	itlist Mortalit	y Rate Ratio	1.04	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	
21	1							1									
4	•	Guide O	verall Evaluations	By Age Eva	luations	By ESRD	Time Evaluations	Custom	Evaluations	(+) 🗄 🖣	t						Þ



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	В	С	D	E	F	G	н	l I	J	К	L	M	
1	Kidney													
2	Adult Overall Transplant	Rate												
3														
4	Number of Candidates:	1000		Evaluation period										
5	Observed:	221		Beginning date:	January 01, 201	7								
6	Expected:	223.22		End date:	December 31, 2	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	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	0	
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		0	D	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	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	J
	Overall Eva	aluations	By Age Evaluat	tions By ESRD Time E	valuations	Custom Evaluatio	ns Adult TXR	Pediat	tric TXR 🛛 , 🕂	4			Þ	



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

	A	В	С	D	E	F	G	н	I	J	K	L	M
1	Kidney												
2	Adult Overall Transplar	nt Rate											
3													
4	Number of Candidates	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 201	7							
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 E 	valuations	By Age Evaluat	ions By ESRD Time E	Evaluations	Custom Evaluatio	ns Adult TXR	Pedia	tric TXR 🛛 , 🕂	4			Þ



Where does the expected come from?

в	6 • : ×	√ f _x	=SUM(H9:H10	08)										¥
		D			5	5	C.				V.			
-	A	В		U	E	F	G	н		J	ĸ	L	IVI	ŀ
1	Kidney													
2	Adult Overall Transplant	Rate												
3														
4	Number of Candidates:	1000	l	Evaluation period										
5	Observed:	221		Beginning date:	January 01, 201	17								
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	1
14	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147			0	1
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	1
18	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944			0	1
10	1		201/1-10-28	2017-01-01	0	2018-12-17	716	0 851507		0.851507083			0	F
	By ESRD Ti	ime Evaluati	ons Custom	Evaluations Adult T	XR Pediatric	TXR Adult D	D TXR Pedia	🕂	4				Þ]



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

H		√ f _x	='Baseline Haz	ard'!\$A\$2 * G9 * EXP(MM	//ULT(S9:FQ9, 'I	Model Coefficier	nts'!\$B2:B156))							~
	А	в	С	D	E	F	G	н	1	J	к	L	N	1 🔺
1	Kidney													L
2	Adult Overall Transplant	Rate												
3														
4	Number of Candidates:	1000		Evaluation period										
5	Observed:	221		Beginning date:	January 01, 20	17								
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 Day	Expected	bserved & Included	Expected & Included		Age: <40	Age: 4	0-
9	1		2014-10-26	2017-01-01	0	2017-07-05	18	0.040623	0	0.040623174		(J	
10	1		2014-09-04	2017-01-01	0	2018-12-31	73	0.133535	0	0.13353521		(J	
11	1		2014-10-15	2017-01-01	0	2018-07-22	56	0.130314	0	0.130314491		1	L	
12	1		2014-12-03	2017-01-01	1	2017-07-17	19	0.292709	1	0.29270915		(J	
13	1		2014-12-28	2017-01-01	0	2018-07-23	56	0.175715	0	0.175715451		(J	
14	1		2014-11-12	2017-01-01	0	2018-12-31	73	0.239021	0	0.239021147		(J	
15	1		2014-12-06	2017-01-01	1	2018-09-20	62	0.549734	1	0.549733976		1	L	
16	1		2014-10-31	2017-01-01	1	2018-01-13	37	0.098396	1	0.098395612		(J	
17	1		2014-10-22	2017-01-01	0	2018-12-10	70	0.402816	0	0.402815977		(J	
18	1		2014-10-21	2017-01-01	0	2018-12-31	73	0.218119	0	0.218118944		(J	
10	1		2014 10 28	2017 01 01	· · · · · ·	2010 12 17	71	0.051507	^	0.051507000			<u>م</u> ــــــــــــــــــــــــــــــــــــ	
	 By ESRD Ti 	ime Evaluati	ons Custom	Evaluations Adult T)	CR Pediatric	TXR Adult D	D TXR Pedi	(+) :					Ľ	<u>}</u>



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.

G	• • : ×	$\sqrt{-f_x}$	=F9 - D9 + 1	٦									
	A	В	с	D	E	F	G	н	I	ſ	к	L	M
1	Kidney												
2	Adult Overall Transplant	Rate											
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 201	7							
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 U	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
10	1		2014 10 29	2017 01 01		2010 12 17	716	0.051507	0	0.051507000			
	By ESRD Ti	ime Evaluati	ons Custom E	valuations Adult T	(R Pediatric	TXR Adult	D TXR Pedia	. 🕂	4				Þ



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.

1	A	В	С	D	E	F	G	н	l I	J	К	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 3	31, 2018								
7														
8	Include This Patient?	Patient J	Listing Date	Begin Follow Up Date	Transplant	d? End Follow Up	ollow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40	۶.
9	1		2014-10-26	2017-01-01		0 2017-07-05	186	0.040623	0	0.040623174		C)	
10) 1		2014-09-04	2017-01-01		0 2018-12-31	730	0.133535	0	0.13353521		C)	
11	1 1		2014-10-15	2017-01-01		0 2018-07-22	568	0.130314	0	0.130314491		1	L	
12	2 1		2014-12-03	2017-01-01		1 2017-07-17	198	0.292709	1	0.29270915		C)	
13	3 1		2014-12-28	2017-01-01		0 2018-07-23	569	0.175715	0	0.175715451		C)	
14	4 1		2014-11-12	2017-01-01		0 2018-12-31	730	0.239021	0	0.239021147		C)	
15	5 1		2014-12-06	2017-01-01		1 2018-09-20	628	0.549734	1	0.549733976		1	L	
16	5 1		2014-10-31	2017-01-01		1 2018-01-13	378	0.098396	1	0.098395612		C)	
17	7 1		2014-10-22	2017-01-01		0 2018-12-10	709	0.402816	0	0.402815977		C)	
18	3 1		2014-10-21	2017-01-01		0 2018-12-31	730	0.218119	0	0.218118944		C)	
19) 1		2014-10-28	2017-01-01		0 2018-12-17	716	0.851507	0	0.851507083		C)	
20) 1		2014-11-23	2017-01-01		1 2018-08-08	585	0.128396	1	0.128395802		C)	
21	1 1		2014-11-02	2017-01-01		0 2018-12-14	713	0.35597	0	0.355970276		C)	
22	2 1		2014-12-04	2017-01-01		0 2018-12-31	730	0.264658	0	0.264658036)	-
	 • … Overall Eva 	aluations	by Age Eralaut	iono Dy cono Time E	valuations	Custom Eranaario	ns Adult TXF	Pedia	tric TXR 🛛 🕂	•			Þ]



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.

A)	$\sqrt{-f_X}$	1											~
	А	В	С	D	E	F	G	н	I	J	К	L	M	
1	Kidney													L
2	Adult Overall Transplant	Rate												
3														
4	Number of Candidates:	1000		Evaluation period										
5	Observed:	221		Beginning date:	January 01, 20	17								
6	Expected:	223.22		End date:	December 31,	2018								1
7														
8	Include This Patient?	Fatient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40	F.
ç	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		(J	
1)	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		(C	
1	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	L	
12	1		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	1	0.29270915		(C	
13	1		2014-12-28	2017-01-01	0	2018-07-23	569	0.175715	0	0.175715451		(C	
11	1		2014-11-12	2017-01-01	0	2018-12-31	730	0.239021	0	0.239021147		(J	
15	1		2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	1	0.549733976		1	L	
15	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612		(J	
17	1		2014-10-22	2017-01-01	0	2018-12-10	709	0.402816	0	0.402815977		(C	
13	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		(J	
-	1		2014 10 28	2017 01 01		2010 12 17	716	0.051507	0	0.051507000			۰ .	J
		me Evaluati	ons Custom	Evaluations Adult T)	(R Pediatric	TXR Adult D	D TXR Pedia	🕂	•				Þ]



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

A	9 • : ×	$\sqrt{-f_x}$	1										
	A	В	С	D	E	F	G	н	I	J	К	L	M
1	Kidney												L
2	Adult Overall Transplant	Rate											
3													
4	Number of Candidates:	1000		Evaluation period									
5	Observed:	221		Beginning date:	January 01, 20	17							
6	Expected:	223.22		End date:	December 31,	2018							
7													
٤	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
5	1		2014-10-26	2017-01-01	0	2017-07-05	186	0.040623	0	0.040623174		0)
1)	1		2014-09-04	2017-01-01	0	2018-12-31	730	0.133535	0	0.13353521		0)
1	1		2014-10-15	2017-01-01	0	2018-07-22	568	0.130314	0	0.130314491		1	L
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	L
15	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)
13	1		2014-10-21	2017-01-01	0	2018-12-31	730	0.218119	0	0.218118944		0)
-	1		2014 10 28	2017 01 01	•	2010 12 17	716	0.051507	•	0.051507000		0	
		ne Evaluati	ons Custom	Evaluations Adult T)	(R Pediatric	TXR Adult D	D TXR Pedia	(+)	4				►



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

AT	8	• :	× v	<i>f</i> _∞ Ca	ndidate di	abetes stat	us/type at o	onset: Typ	e 2													~
	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	AR	AS	AT	AU	AV	4 -
1																						
2																						
3																						
4																						
5																						
6 7																						
/	Condidate	Candidat	c Candidat	Condidate	Condidat	Condidate	Condidate	Candidate	Condidate	Condidate	Condidate	Condidate	Candidate	Candidate	Candidate	Condidate	Condidate	Candid	te Condidate	andidati	Condidat	Can
0	Canuluate	Canuluat					Canuluate		Canuluate	Canuluate	11 00091	2 00091	1 00091	Canuluate	Canuluate	Canuluate	Canuluate	Canulua		(anuluau		2 Can
10	0				1		0	0	0	0	12 06689	4 066893	2 066893	0	0	0	0		0 1			<u></u>
11	0) O) 1	0	0	0	0	0	11 62001	3 620005	1 620005	0	0	0	0		0 1			<u></u>
12	0) O) 1	0	0	0	0	2,982537	3.017463	0.020003	1.020005	0	0	0	1		0 0			,
13	0)))) 1) 0	0	0	0	1.783117	4.216883	0	0	0	0	0	1		0 0	0) (5
14	0		0 0) 0) 1	0	0	0	0	0	9.124846	1.124846	0	0	0	0	0		0 1	C) (
15	0	() () 0) 1	L 0	0	0	0	3.271404	2.728596	0	0	0	0	0	1		0 0	C) C)
16	0	(0 0) 0) 1	L 0	0	0	0	0	16.04362	8.043616	6.043616	2.043616	0	0	0		0 1	C) C)
17	0	:	1 0	0 0) () 0	0	0	0	0	13.31229	5.312292	3.312292	0	0	0	1		0 0	C	i C)
18	0	(0 0) 0) 1	L 0	0	0	0	0	7.687891	0	0	0	0	0	1		0 0	C	1 0)
10	< →	. By ES	RD Time Ev	valuations	Custon	n Evaluation	s Adult	TXR	ediatric TX	R Adu	t DD TXR	Pedia .	(+) :	•			1		0 0		•	•



And write a formula into the entire "Include This Patient?" column...

A	• • • ×	$\sqrt{-f_x}$	=AT9											۷
	А	В	С	D	E	F	G	н	I	J	К	L	м	
1	Kidney													L
2	Adult Overall Transplant F	Rate												
3														
4	Number of Candidates:	1000		Evaluation period										
5	Observed:	221		Beginning date:	January 01, 20	17								
6	Expected	223.22		End date:	December 31,	2018								
7														
	Include This Patient?	Pa tient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40	1
	1		2014-10-26	2017-01-01	C	2017-07-05	186	0.040623	0	0.040623174			0	
10	1		2014-09-04	2017-01-01	C	2018-12-31	730	0.133535	0	0.13353521			0	
11	1		2014-10-15	2017-01-01	C	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	C	2018-07-23	569	0.175715	0	0			0	
14	1		2014-11-12	2017-01-01	C	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	
15	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	C	2018-12-10	709	0.402816	0	0			0	
13	0		2014-10-21	2017-01-01	C	2018-12-31	730	0.218119	0	0			0	
1	0		2014 10 29	2017 01 01	· · · · · · · · · · · · · · · · · · ·	2010 12 17	716	0.051507					^	Ľ
	 By ESRD Tin 	n Evaluati	ons Custom	Evaluations Adult T	(R Pediatric	TXR Adult D	D TXR Pedia	🕂	•				Þ	



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

G16	• :	$\times \checkmark f_x$														
	Α	B C	D	Е	F	G	н	I.	J	К	L	М	N	0	Р	C
1	Ove	erall Transplant	Rate			Decease	d Donor (I	D) Transp	lant Rate			Ove	rall Waitli	st Mortality	/ Rate	
2		All candidates					All can	didates					All ca	ndidates		
3	Numbe	er of Candidates	1000			Nun	nber of Candid	ates	1000			Nu	mber of Candi	idates	1000	
4	Observe	ed Transplants (O)	221			Observ	ed DD Transpl	ants (O)	159			0	bserved Death	is (O)	62	
5	Expecte	ed Transplants (E)	223.22			Expect	ed DD Transpl	ants (E)	155.71			E	xpected Death	is (E)	59.32	
6	Overall Tra	ansplant Rate Ratio	0.99			DD TI	ansplant Rate	Ratio	1.02			Overall W	/aitlist Mortali	ty Rate Ratio	1.04	
8 9		Custom analysis					Custom	analysis					Custor	n analysis		
10	Numbe	er of Candidates	378			Nun	nber of Candid	ates	1000			Nu	mber of Candi	idates	1000	
11	Observe	ed Transplants (O)	59			Observ	ed DD Transpl	ants (O)	159			0	bserved Death	is (O)	62	
12	Expecte	ed Transplants (E)	65.10			Expect	ed DD Transpl	ants (E)	155.71			E	xpected Death	is (E)	59.32	
13 14	Overall Tra	ansplant Rate Ratio	0.91	J		DD Tr	ansplant Rate	Ratio	1.02			Overall W	/aitlist Mortali	ty Rate Ratio	1.04	
16 17																
18	▶ By	ESRD Time Evaluations	Custom Evalua	tions	Adult TXR	Pediatric TX	R Adult DE	TXR Pedi	a 🕂 🗄 🖣							•



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



Candidate BMI



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

AN	/18	• : :	× ✓	<i>f</i> _x Car	ndidate BN	/II: Apply to	> 30 (Right LS	5)														~
	w	x	Y	Z	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ	1
1																						
2																						
3																						
4																						
5																						
6																						
7																(
8	Candidate	Candidate	Candidate	Candidate	Candidat	e Candidate (Candidate Car	ndidate	Candidate C	andidate	Candidate	Candidate	Candidate	Candidat	e Candidate	Candid t	e Candidate	Ca didate	Candidate	Candidate	Candidate	2 Can
9	0	11.85	1.85	0	C	0 0	0	0	0	1	0	0	0	(0 0	11.099 31	3.09981	1 .09981	0	0	0	1
10	0	7.09	0	0	C	0 0	0	0	0	1	0	0	0	0	0 0	12.066 39	4.066893	2. 66893	0	0	0	1
11	17.89	0	0	0	C	0 0	0	0	0	1	0	0	0	0	0 0	11.620 01	3.620005	1. 20005	0	0	0	1
12	12.64	0	0	0	C	0 0	0	0	0	1	0	0	0	(2.982537	3.0174 53	3 0	0	0	0	0	1
13	0	0.68	0	0	C	0 0	0	0	1	0	0	0	0	0	1.783117	4.2168 33	3 0	0	0	0	0	1
14	11.26	0	0	0	C	0 0	0	0	0	1	0	0	0	(0 0	9.1248 46	5 1.124846	0	0	0	0	1
15	15.21	0	0	0	C	0 0	0	0	0	1	0	0	0	0	3.271404	2.7285)6	i 0	0	0	0	0	1
16	0	8.19	0	0	C	0 0	0	0	0	1	0	0	0	(0 0	16.043 52	8.043616	6. 43616	2.043616	0	0	1
17	12.41	0	0	0	C	0 0	1	0	0	0	0	0	0	(0 0	13.312 29	5.312292	3. 12292	0	0	0	1
18	1.83	0	0	0	C	0 0	0	0	0	1	0	0	0	(0 0	7.6878)1	L 0	0	0	0	0	1
10	1 24			n	Custon				o diatria TVD	1		Dedia	· ·		1 756735	2 2422 28			0	0		
	• • …	BYESI	KD Time EV	aluations	Custon	Evaluations	Adult 17	AK PE	ediaune TXR	Adu	IL DD TXR	Pedia .	. 🕀 :	4								



Write an appropriate formula into the "Include This Patient?" column...

A	• • : ×	√ f _x	=IF(AM9 > 0, 1,	.0)										~
	A	в	С	D	E	F	G	н	I	J	К	L	N	1
1	Kidney													٦C
2	Adult Overall Transplant	Rate												
3														
4	Number of Candidates:	1000		Evaluation period										
5	Observed:	221		Beginning date:	January 01, 20	17								
6	Expected:	223.22		End date:	December 31,	2018								
7														
8	Include This Patient?	Pa ient ID	Listing Date	Begin Follow Up Date	Transplanted?	End Follow Up	Follow Up Days	Expected	Observed & Included	Expected & Included		Age: <40	Age: 40	0
9	1		2014-10-26	2017-01-01	C	2017-07-05	186	0.040623	0	0.040623174			0	
1	1		2014-09-04	2017-01-01	C	2018-12-31	730	0.133535	0	0.13353521			0	
1	1		2014-10-15	2017-01-01	C	2018-07-22	568	0.130314	0	0.130314491			1	_
1	0		2014-12-03	2017-01-01	1	2017-07-17	198	0.292709	0	0		-	0	_
1	0		2014-12-28	2017-01-01	C	2018-07-23	569	0.175715	0	0			0	_
1	1		2014-11-12	2017-01-01	C	2018-12-31	730	0.239021	. 0	0.239021147			0	_
1	0	_	2014-12-06	2017-01-01	1	2018-09-20	628	0.549734	0	0			1	_
1	1		2014-10-31	2017-01-01	1	2018-01-13	378	0.098396	1	0.098395612			0	_
1	1	_	2014-10-22	2017-01-01	C	2018-12-10	709	0.402816	0	0.402815977			0	_
1	0		2014-10-21	2017-01-01	C	2018-12-31	730	0.218119	0	0			0	_
-10		ne Evaluati	ons Custom	Evaluations Adult T	(R Pediatric	TXR Adult D	D TXR Pedia	(+)		^		1	n	



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?



SR T_เ

Contact us: SRTR@SRTR.org

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