OPTN

Public Comment Proposal

Updated Cohort for Calculation of the Lung Allocation Score (LAS)

OPTN Lung Transplantation Committee

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Updated Cohort for Calculation of the Lung Allocation Score (LAS)

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Sponsoring Committee:	*Lung Transplantation*
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Executive Summary

The Lung Allocation Score (LAS) is a balance of a candidate's expected 1-year waitlist survival and expected 1-year post-transplant survival. It is used in lung allocation to priority rank candidates. A higher expected waitlist mortality and lower expected post-transplant mortality corresponds to a higher LAS. The coefficients used to calculate LAS are based on analysis of transplant candidates and recipients performed by the Scientific Registry of Transplant Recipients (SRTR). The values that are currently used in the LAS calculation were calculated based on a cohort ending in 2008.[1] This proposal replaces those values with values based on an updated analysis using a cohort ending in 2018.

During the validation of the new results, the Lung Committee (Committee) determined that there were some variables that were included in the calculation that did not add to the ability of the model to predict survival, and in some cases, the resulting coefficient for those variables would result in an impact that is contrary to medical experience. Accordingly, several variables are proposed for removal from the calculation. The data on these values will still be collected in case they are found to be predictive in the future, but those values will not be used in the proposed updated LAS calculation.

[1] OPTN Briefing Paper, *Proposal to Revise the Lung Allocation Score (LAS) System*. 2012.

Background

The LAS equation was last updated in 2012, based on a cohort of candidates listed for transplant between September 1, 2006 and September 30, 2008 and a cohort of recipients transplanted between May 4, 2005 and September 30, 2008.[2] At that time, the OPTN removed percent predicted forced vital capacity (FVC) for certain candidates, and added the following variables to the LAS calculation:

- Cardiac index
- Central venous pressure (CVP)
- Creatinine
- Six-minute-walk-distance
- Increase in creatinine of at least 150%
- Oxygen needed at rest

As part of the same change, several other variables used in the LAS calculation were modified, and all of the coefficients were updated.

Since that time, the cohort underlying the LAS calculation has not been updated. At this point, the cohort is almost 12 years old.

The Committee is currently developing larger modifications to lung allocation as part of its continuous distribution project. A Request for Feedback regarding that project is posted for feedback concurrently with this public comment proposal. As part of that project, the Committee intends for LAS to become an element of a new composite allocation score. In order to ensure that the composite allocation score is based on the most recent data, the Committee is pursuing an update to the LAS cohort first. Accordingly, the Committee proposes these changes as a predicate proposal.

Purpose

This proposal addresses the need for an update to the cohort of candidates and recipients used to determine a candidate's LAS.

The Committee submits the following proposal under the authority of the OPTN Final Rule, which states "The OPTN Board of Directors shall be responsible for developing…policies for the equitable allocation for cadaveric organs."

Overview of Proposal

This proposal will update the variables, coefficients, and probabilities used in the LAS calculation. The changes reflect the use of an updated cohort of more recent lung transplant candidates and recipients, as well as refining the variables to those that are predictive within the models for waitlist mortality and post-transplant mortality.

Updated Cohort

The Committee submitted a request to the Scientific Registry of Transplant Recipients (SRTR) to refit the LAS waitlist and post-transplant models using a more contemporary cohort of candidates and recipients

[2] OPTN Briefing Paper, *Proposal to Revise the Lung allocation Score (LAS) System*. 2012.

on September 23, 2019, and first reviewed the results of that analysis (Refit 1) on a conference call in December 2019.[3] Over the ensuing discussions, the Committee requested refinements to the model.[4] The results of the final revised modeling request (Refit 2) are used in this proposal.

The Committee proposes updated coefficients and probabilities based on the updated cohorts of lung candidates and recipients from March 1, 2015 through March 31, 2018 to predict death within 1 year on the waitlist and death within 1 year post-transplant.[5] This will make the population basis for the LAS calculation more recent. The new values for the coefficients and probabilities reflect this updated cohort.

Removed Variables

As a result of review of the modeling results in Refit 1, the Committee chose to remove several variables. These variables are recommended for removal based on the fact that there is not sufficient confidence in the values at this time. Removing these variables results in minimal impact on candidates. Although these variables may be predictive when analyzed alone, when incorporated in the larger analysis they do not add to the predictive value of the model as a whole. This appears to be because their impact is already accounted for in other variables.

Figure 1: LAS rank comparison, all candidates[6]

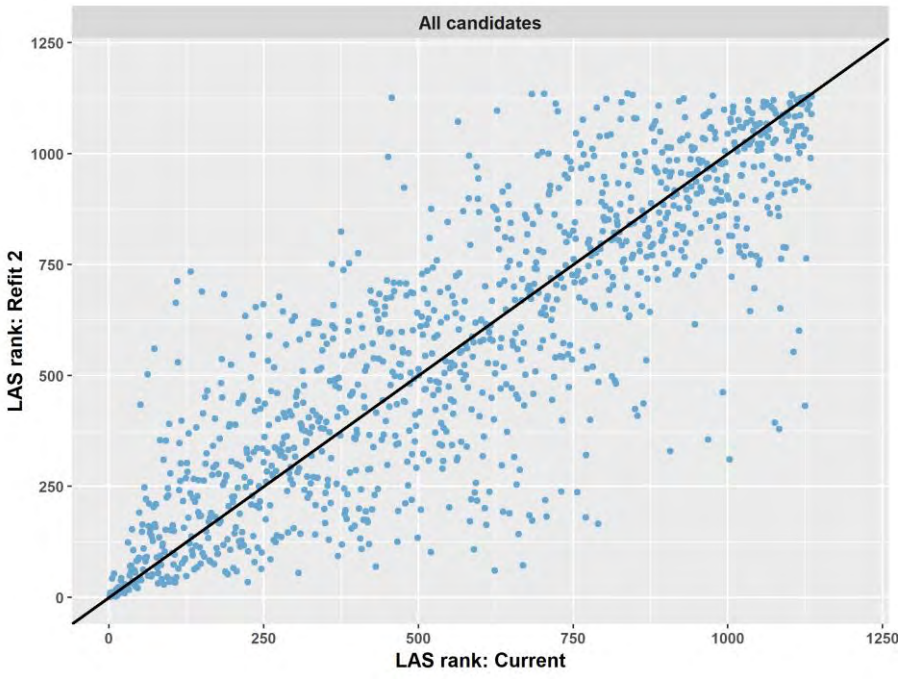


Figure 1 shows the impact of the proposed changes on individual candidates. If there was no change in position on a match run between the current system and the Refit, the blue dots would all be directly on the diagonal black line. The grouping close to that line suggests that the change will impact candidates'

[3] SRTR, *Analysis Report LU2019_02*, November 26, 2019.
[4] Ibid; SRTR *Analysis Report LU2020_03*, June 8, 2020.
[5] The Refit does not include candidates and recipients less 12 years old at the time.
[6] SRTR *Analysis Report LU2020_03*, June 8, 2020.

relative rankings, but that there are not expected to be many candidates who will experience major changes.

The Committee is not proposing changes to the data collected. Continuing to collect the underlying data on these variables will allow continued evaluation and potential inclusion in future updates.

Not predictive due to small numbers

Several of the variables only applied to a small number of candidates or recipients. There was not enough data to be confident that these variables were predictive of 1 year post-transplant or 1 year waitlist mortality due to small numbers of candidates in each group – fewer than 1% of the cohort for each[7].

The following values were poorly estimated due to small populations in the new cohort.

- Waitlist:
    - Obliterative Bronchiolitis (72 candidates)
    - Lymphangioleiomyomatosis (28 candidates)
    - Eisenmenger's (2 candidates)
    - Bilirubin increase >50%, group B (1 candidate)
- Post-transplant:
    - Lymphangioleiomyomatosis (27 recipients)
    - Creatinine increase > 150% (3 recipents)
    - Eisenmenger's syndrome (1 recipient)

Accordingly, the Committee proposes removing these variables.

Reversed sign

In the Refits, the coefficients associated with several of the variables reversed sign. A positive sign indicates a positive correlation with mortality (ie. a candidate with that value is more likely to die within 1 year on the waitlist or within 1 year post-transplant than someone with otherwise similar values). A negative sign indicates a negative correlation with mortality (ie. a candidate with that value is less likely to die within 1 year on the waitlist or 1 year post-transplant than someone with otherwise similar values).

A change in sign alone is not necessarily a reason to exclude a variable, but merely reflects one way that the coefficients can change with the updated cohort. The change in direction caused the Committee to reassess the variables in light of having to update the least beneficial values. In that reassessment, the Committee realized that none of the variables that switched sign were predictive in the current cohort, so they were removed.

[7] There were 7,928 total candidates in the waitlist model and 7,045 total recipients in the post-transplant model. SRTR *Analysis Report LU2020_03*, June 8, 2020.

Table 1: Parameter estimates and hazard ratios from 1-year waitlist survival models[8]

Variable	Current Estimate	Current P value	Refit Estimate	Refit P value
Pulmonary fibrosis, other	-0.21	0.6297	0.21	0.2093
Diabetes	0.47	0.0042	-0.04	0.7688
FVC < 80% spline, group D	-0.18	0.0064	0.00	0.9612
Cardiac index < 2 L/min/m2	0.54	0.0325	-0.08	0.6970
CVP > 7mm Hg spline, group B	0.02	0.6438	-0.02	0.6011

As seen in **Table 1** above, coefficients for five of the variables in the waitlist survival model changed sign. Each had a high p-value, well above above .05 in the Refit, suggesting that the variables were not predictive.

In the waitlist model, the Committee proposes removing all of the variables that reversed sign except for pulmonary fibrosis. For pulmonary fibrosis alone, the Committee believed that the change could be consistent with their medical experience and there was sufficient basis to retain the variable.

Table 2: Parameter estimates and hazard ratios from 1-year post-transplant survival models[9]

Variable	Current Estimate	Current P value	Refit Estimate	Refit P value
Pulmonary fibrosis, other	-0.072	0.6549	0.003	0.9845
Sarcoidosis, PA >30	-0.044	0.8575	0.436	0.0736
Sarcoidosis, PA <=30	-0.139	0.7019	0.980	<.0001
Functional status, no assistance	-0.190	0.1435	0.011	0.9490

Sarcoidosis with pulmonary arterial (PA) mean pressure greater than 30 mmHg, sarcoidosis with PA mean pressure less than or equal to 30 mmHG, pulmonary fibrosis, and functional status all reversed sign from negative to positive in the post-transplant model. The Committee chose to remove pulmonary fibrosis and functional status because they are no longer predictive, with higher p-values in the Refit. The Committee chose to retain the sarcoidosis variables because they were both still predictive or potentially predictive of post-transplant mortality, shown by lower p-values, and were not inconsistent with medical expertise.

NOTA and Final Rule Analysis

The Final Rule requires that when developing policies for the equitable allocation of cadaveric organs, such policies must be developed "in accordance with §121.8," which requires that allocation policies "(1) Shall be based on sound medical judgment; (2) Shall seek to achieve the best use of donated organs; (3) Shall preserve the ability of a transplant program to decline an offer of an organ or not to use the organ for the potential recipient in accordance with §121.7(b)(4)(d) and (e); (4) Shall be specific for each organ type or combination of organ types to be transplanted into a transplant candidate; (5) Shall be designed to avoid wasting organs, to avoid futile transplants, to promote patient access to transplantation, and to promote the efficient management of organ placement;…(8) Shall not be based on the candidate's place of residence or place of listing, except to the extent required by paragraphs (a)(1)-(5) of this section." This proposal:

[8] SRTR *Analysis Report LU2020_03*, June 8, 2020.
[9] SRTR *Analysis Report LU2020_03*, June 8, 2020.

- **Is based on sound medical judgment**[10] because it is an evidenced-based change relying on the following evidence:
    - Data showing the predicted impact of each variable on 1-year post-transplant survival and 1-year waitlist survival.
    - Medical judgment regarding whether the variables that switched signs are logically aligned with clinical observations
    - Data showing little impact on predictive ability of the model when removing the variables proposed to be removed.
- **Seeks to achieve the best use of donated organs**[11] **by** ensuring organs are allocated and transplanted according to medical urgency. This proposal allows for improved prediction of waitlist and post-transplant mortality to ensure that the most medically urgent will receive the offer sooner.
- **Is designed to avoid futile transplants**[12]**:** This proposal should not result in transplanting patients that are unlikely to have good post-transplant outcomes. The proposal seeks to improve the calculation of the candidates' likelihood of post-transplant survival used for lung allocation.
- **Is designed to…promote patient access to transplantation**[13] **by** giving similarly situated candidates equitable opportunities to receive an organ offer. It improves the mortality predictions so that candidates with the same medical urgency are more likely to have similar LAS scores.
- **Is not based on the candidate's place of residence or place of listing, except to the extent required to achieve** best use of organs, avoid futile transplants, and promote patient access to transplantation.[14] This proposal is not based on the candidate's place of residence or place of listing.

This proposal also preserves the ability of a transplant program to decline and offer or not use the organ for a potential recipient,[15] and it is specific to an organ type, in this case lung.[16]

Although the proposal outlined in this briefing paper addresses certain aspects of the Final Rule listed above, the Committee does not expect impacts on the following aspects of the Final Rule:

- Is designed to avoid wasting organs[17]
- Promotes the efficient management of organ placement[18]

Implementation Considerations

Member and OPTN Operations

The Committee would like feedback regarding whether there is a benefit to waiting to implement these changes concurrently with Continuous Distribution.

[10] 42 CFR §121.8(a)(1)
[11] 42 CFR §121.8(a)(2)
[12] Ibid.
[13] Ibid.
[14] 42 CFR §121.8(a)(8)
[15] 42 CFR §121.8(a)(3)
[16] 42 CFR §121.8(a)(4)
[17] 42 CFR §121.8(a)(5)
[18] Ibid.

Operations affecting Transplant Hospitals

This proposal is not anticipated to affect the data collection associated with lung candidate listings, and is not anticipated to affect the operations of Transplant Hospitals.

Operations affecting Histocompatibility Laboratories

This proposal is not anticipated to affect the operations of Histocompatibility Laboratories.

Operations affecting Organ Procurement Organizations (OPOs)

This proposal is not anticipated to affect the operations of OPOs.

Operations affecting the OPTN

This proposal will require programming of changes to UNet℠.

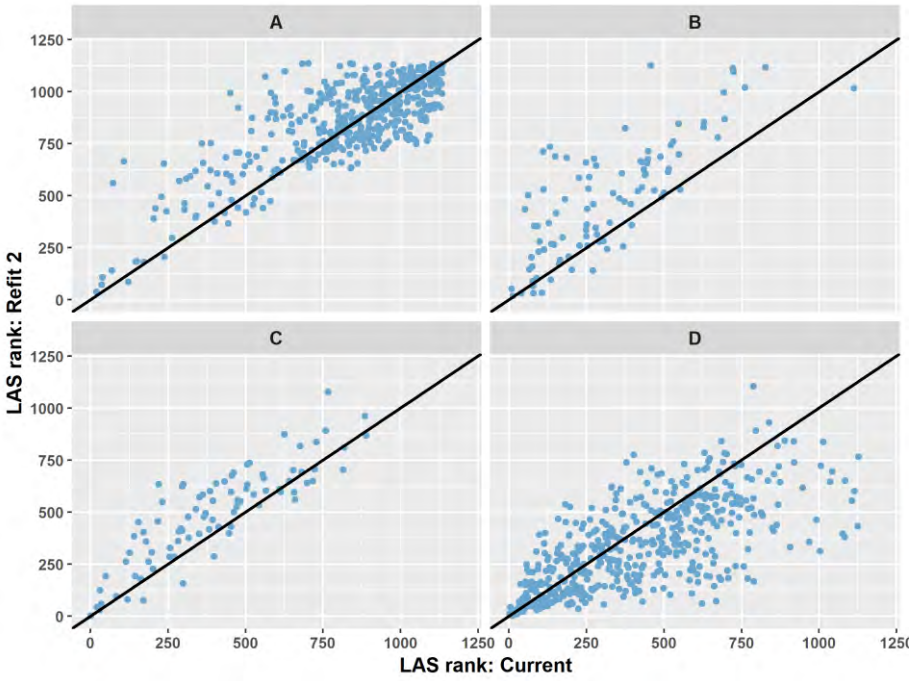
Potential Impact on Select Patient Populations

Since the Committee is proposing removal of certain diagnoses, the Committee carefully evaulated the impact on the different diagnosis groups. The diagnoses are grouped into diagnosis groups A-D. Diagnosis group A is generally the most urgent, with those in diagnosis D less urgent. Most candidates are in diagnosis group D, and the next largest group is diagnosis group A. [19]

As seen in **Figure 2** below, most of the decreases in LAS rank occurred in diagnosis group A, with some increased access for group D candidates at lower-numbered ranks. The majority of increased access in group A was related to candidates beginning at lower ranks. The Committee was reassured by this information that the changes in rank were related to appropriately providing more access to candidates who are more medically urgent. In the event that the changes result in a specific candidate being unfairly disadvantaged, that candidate's transplant program retains the option to apply for an LAS score exception as outlined in *Policy 10.2.B Lung Candidates with Exceptional Cases*.

[19] OPTN Final Report, *Monitoring of the Lung Allocation Change, 2 Year Report Removal of DSA as a Unit of Allocation*, February 12, 2020, https://optn.transplant.hrsa.gov/media/3661/item_25_thoracic_committee_20200212.pdf.

Figure 2: LAS rank comparison by diagnosis group[20]



Projected Fiscal Impact

Minimal or no fiscal impact to members.

Projected Impact on the OPTN

Preliminary estimates indicate that this would be a large project for the OPTN to implement, as 1,000 – 1,600 hours may be needed for IT programming and other implementation efforts.

Post-implementation Monitoring

Member Compliance

The Final Rule requires that allocation policies "include appropriate procedures to promote and review compliance including, to the extent appropriate, prospective and retrospective reviews of each transplant program's application of the policies to patients listed or proposed to be listed at the program."[21] The proposed language will not require new routine monitoring of OPTN members. Site surveyors will continue to review a sample of medical records, and any material incorporated into the medical record by reference, to verify that data reported through UNet is consistent with source documentation for all variables that can affect the LAS. Site surveyors will no longer review three data elements that are proposed to be removed from the LAS algorithm: central venous pressure (CVP), diabetes status, and forced vital capacity (FVC).

[20] SRTR *Analysis Report LU2020_03*, June 8, 2020.
[21] 42 CFR §121.8(a)(7).

Policy Evaluation

The Final Rule requires that allocation policies "be reviewed periodically and revised as appropriate."[22] Monitoring reports will be delivered after implementation of this proposal at 6 months, 1 year and 2 years (or along the same time frame as implementation of Continuous Distribution of Lungs, whichever comes first) to the Lung Committee. Reports will focus on changes in the waiting list population and transplant recipient population and will encompass the following:

- Examine changes to the waiting list including the size, number of additions and/or removals, LAS, diagnosis groups, and population characteristics
- Examine changes in deceased donor lung transplants including recipient characteristics, LAS, and diagnosis groups
- Examine changes in waiting list and post transplant outcomes including waiting list mortality rate, transplant rate and post-transplant patient survival by diagnosis group and LAS group.

The OPTN and SRTR contractors will work with the committee to define any additional analyses requested for monitoring.

The Final Rule also requires the OPTN to "consider whether to adopt transition procedures" whenever organ allocation policies are revised.[23] Although these changes will result in changes to individual candidates' LAS scores, the changes appear to correspond to the candidates' disease severity. As shown in **Figure 3** above, the candidates most likely to be treated "less favorably than they would have been treated under the previous policies" if these proposed policies are approved by the Board of Directors are those who are less medically urgent.[24] Additionally, In the event that the changes result in a specific candidate being unfairly disadvantaged, that candidate's transplant program retains the option to apply for an LAS score exception as outlined in *Policy 10.2.B Lung Candidates with Exceptional Cases.* Therefore, the Committee does not believe there is a need for a transition procedure, but requests feedback on whether there are any populations for which transition procedures might need to be adopted, and what transition procedures might be appropriate if so.

Conclusion

This proposal would update data used in the LAS calculation using a more recent cohort to achieve more equity in the allocation of lungs by improving the way waiting list and post-transplant mortality are calculated when they are used to determine medical urgency for lung allocation. As part of that update, the Committee proposes removing obliterative bronchiolitis, LAM, Eisenmenger syndrome, bilirubin increase of 50% or more for group B candidates, diabetes, cardiac index, CVP, and FVC from the equation used to determine expected waitlist survival in the LAS score. It also proposes removing LAM, Eisenmenger syndrome, pulmonary fibrosis, functional status and serum creatinine increase of 150% or more from the LAS expected post-transplant survival calculation.

[22] 42 CFR §121.8(a)(6).
[23] C.F.R. § 121.8(d).
[24] SRTR *Analysis Report LU2020_03*, June 8, 2020.

The Committee specifically seeks feedback on the following questions:

1. Are the appropriate variables being removed from the calculation?
2. Should the Committee add any transition procedures to protect any specific population?
3. Should implementation of this proposal be before or concurrent with the implementation of Continuous Distribution changes?

Policy Language

Proposed new language is underlined (example) and language that is proposed for removal is struck through (~~example~~). Heading numbers, table and figure captions, and cross-references affected by the numbering of these policies will be updated as necessary.

10.1.E LAS Values and Clinical Data Update Schedule for Candidates at Least 12 Years Old

When registering a candidate who is at least 12 years old for a lung transplant, or when registering a candidate with an approved adolescent classification exception according to *Policy 10.2.B: Lung Candidates with Exceptional Cases*, transplant programs must report to the OPTN Contractor clinical data corresponding with to the covariates shown in *Table 10-3: Waiting List Mortality Calculation: Covariates and Their Coefficients* and *Table 10-4: Post-Transplant Survival Calculation, Covariates, and Their Coefficients*.

The data reported at the time of the candidate's registration on the lung transplant waiting list must be six months old or less from the date of the candidate's registration date. The transplant program must maintain source documentation for all laboratory values reported in the candidate's medical chart.

Except as noted in *Policy 10.1.G: Reporting Additional Data for Candidates with an LAS of 50 or Higher*, transplant programs must report to the OPTN Contractor LAS covariate clinical data for every covariate in *Table 10-3* and *Table 10-4* for each candidate at least once in every six month period after the date of the candidate's initial registration or the LRB's approval of an adolescent classification exception. The first six-month period begins six months from the date of the candidate's initial registration, or, in the case of adolescent classification exceptions, six months from the date of LRB approval, with a new six-month period occurring every six months thereafter.

A covariate's value expires if the covariate's test date is six-months older than the most recent six-month anniversary date. The LAS system considers actual values and approved estimated values for pulmonary pressures to be valid until the transplant program updates them with new actual values or new approved estimated values as described in Policy *10.2.B.iii: Estimated Values Approved by the LRB*.

Transplant programs may report a medically reasonable estimated value if a test needed to obtain an actual value for a covariate variable cannot be performed due to the candidate's medical condition. Before entering estimated values, programs must receive approval from the LRB, which will determine whether the estimated values are appropriate according to *Policy 10.2.B.iii: Estimated Values Approved by the LRB.* Approved estimated values remain valid until an updated actual value is reported for the covariate, or until the transplant program reports a new, approved estimated value.

LAS covariate data obtained by heart catheterization does not need to be reported to the OPTN Contractor every six months. For LAS covariate data that requires a heart catheterization, the transplant program may determine the frequency of updating the data. However, if a transplant

program performs a heart catheterization test on the candidate during the six month interval, then it must report the data to the OPTN Contractor.

If values for certain covariates are missing, expired, or below the threshold as defined by *Table 10-1*, then the LAS calculation will substitute normal or least beneficial values to calculate the candidate's LAS. A normal value is one that a healthy individual is likely to exhibit. A least beneficial value is one that will calculate the lowest LAS for a candidate. *Table 10-1* lists the normal and least beneficial values that will be substituted.

Table 10-1: Values Substituted for Missing or Expired Actual Values in Calculating the LAS

If this covariate's value:	Is:	Then the LAS calculation will use this substituted value:
Bilirubin	Missing, expired, or less than 0.7 mg/dL	0.7 mg/dL
Body mass index (BMI)	Missing or expired	100 kg/m^2
Cardiac index	Missing	3.0 $L/min/m^2$
~~Central venous pressure (CVP)~~	~~Missing or less than 5 mm Hg~~	~~5 mm Hg~~
Continuous mechanical ventilation	Missing or expired	No mechanical ventilation in the waiting list model Continuous mechanical ventilation while hospitalized in the post-transplant survival measure
Creatinine: serum	Missing or expired	0.1 mg/dL in the waiting list model 40 mg/dL in the post-transplant survival measure for candidates at least 18 years old 0 mg/dL in the post-transplant survival measure for candidates less than 18 years old
~~Diabetes~~	~~Missing or expired~~	~~No diabetes~~
~~Forced vital capacity (FVC)~~	~~Missing or expired~~	~~150% for Diagnosis Group D~~
Functional status	Missing or expired	No assistance needed in the waiting list model Some or total assistance needed in the post-transplant survival measure

If this covariate's value:	Is:	Then the LAS calculation will use this substituted value:
Oxygen needed at rest	Missing or expired	No supplemental oxygen needed in the waiting list model 26.33 L/min in the post-transplant survival measure
PCO_2	Missing, expired, or less than 40 mm Hg	40 mm Hg
Pulmonary artery (PA) systolic pressure	Missing or less than 20 mm Hg	20 mm Hg
Six-minute-walk distance	Missing or expired	4,000 feet in the waiting list urgency measure 0 feet in the post-transplant survival measure

10.1.F The LAS Calculation

The LAS calculation uses *all* of the following measures:

- Waiting List Urgency Measure, which is the expected number of days a candidate will live without a transplant during an additional year on the waiting list.
- Post-transplant Survival Measure, which is the expected number of days a candidate will live during the first year post-transplant.
- Transplant Benefit Measure, which is the difference between the Post-transplant Survival Measure and the Waiting List Urgency Measure.
- Raw Allocation Score, which is the difference between Transplant Benefit Measure and Waiting List Urgency Measure.

To determine a candidate's LAS, the Raw Allocation Score is normalized to a continuous scale of zero to 100.

The equation for the LAS calculation is:

$$LAS = \frac{100 * [PTAUC - 2 * WLAUC + 730]}{1095} + 68$$

Table 10-2: LAS Calculation Values

Where…	Includes…
$PTAUC = \sum_{k=0}^{364} S_{TX}(k)$	PTAUC = the area under the post-transplant survival probability curve during the first post-transplant year. β_I = the coefficient for characteristic i from the waiting list measure, according to *Table 10-3: Waiting List Mortality Calculation: Covariates and their Coefficients.*
$S_{TX}(t) = S_{TX,0}(t)^{e^{\alpha_1 Y_1 + \alpha_2 Y_2 + \ldots + \alpha_q Y_q}}$	$S_{TX}(t)$ = the expected post-transplant survival probability at time t for an individual candidate. Y_i = the value of the j^{th} characteristic for an individual candidate $\propto_j$ = the coefficient for characteristic j from the post-transplant survival measure, according to *Table 10-4: Post-Transplant Survival Calculation, Covariates, and Their Coefficients*.
$WLAUC = \sum_{k=0}^{364} S_{WL}(k)$	WLAUC = the area under the waiting list survival probability curve during the next year.
$S_{WL}(t) = S_{WL,0}(t)^{e^{\beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_p X_p}}$	$S_{WL,0}(t)$ = the baseline waiting list survival probability at time t, according to *Table 10-11: Baseline Waiting List Survival (SWL(t)) Probability*. $S_{TX,0}(t)$ = the baseline post-transplant survival probability at time t, according to *Table 10-12: Baseline Post-Transplant Survival ($S_{TX}(t)$) Probability*. $S_{WL}(t)$ = the expected waiting list survival probability at time t for an individual candidate X_i = the value of the i^{th} characteristic for an individual candidate.

Table 10-3 provides the covariates and their coefficients for the waiting list mortality calculation. See *Policy 10.1.F.i: Lung Disease Diagnosis Groups* for specific information on each diagnosis group.

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Table 10-3: Waiting List Mortality Calculation: Covariates and their Coefficients

For this covariate:	The following coefficient is used in the LAS calculation:
1. Age (year)	~~0.0083990318885565~~ 0.0281444188123287*age
2. Bilirubin (mg/dL) value with the most recent test date and time	~~0.0431682188302477~~ 0.15572123729572*(bilirubin – 1) if bilirubin is more than 1.0 mg/dL 0 when bilirubin is 1.0 mg/dL or less
~~3. Bilirubin increase of at least 50%~~	~~1.4144058906830200 for Diagnosis Group B~~ ~~0 for Diagnosis Groups A, C, and D~~
4. Body mass index (BMI) (kg/m^2)	~~0.1261444133358100~~ 0.10744133677215*(20 – BMI) for BMI less than 20 kg/m^2 0 if BMI is at least 20 kg/m^2
~~5. Cardiac index prior to any exercise~~	~~0.5435368888028200 if the cardiac index is less than 2 L/min/m^2~~ ~~0 if the cardiac index is at least 2 L/min/m^2~~
~~6. Central venous pressure (CVP) (mm Hg) at rest, prior to any exercise~~	~~0.0173841981251578*(CVP – 7) for CVP greater than 7 mm Hg (Diagnosis Group B only)~~ ~~0 if less than or equal to 7 mm Hg for Diagnosis Group B~~ ~~0 for candidates in Diagnosis Groups A, C, and D~~
7. Ventilation status if candidate is hospitalized	~~1.6771121096052300~~ 1.57618530736936 if continuous mechanical ventilation needed 0 if no continuous mechanical ventilation needed
8. Creatinine (serum) (mg/dL) with the most recent test date and time	~~0.5034346761960600~~ 0.0996197163645* creatinine if candidate is at least 18 years old 0 if candidate is less than 18 years old
~~9. Diabetes~~	~~0.4680254026735700 if diabetic~~ ~~0 if not diabetic~~
10. Diagnosis Group A	0
11. Diagnosis Group B	~~1.5774243292137200~~ 1.26319338239175
12. Diagnosis Group C	~~1.2313926484343600~~ 1.78024171092307
13. Diagnosis Group D	~~0.6259577164157700~~ 1.51440083414275

For this covariate:	The following coefficient is used in the LAS calculation:
14. Detailed diagnosis: Bronchiectasis (Diagnosis Group A only)	~~0.6680518055684700~~ 0.40107198445555
~~15. Detailed diagnosis: Eisenmenger's syndrome (Diagnosis Group B only)~~	~~-0.6278657824830000~~
~~16. Detailed diagnosis: Lymphangioleiomyomatosis (Diagnosis Group A only)~~	~~-0.3162937838984600~~
~~17. Detailed Diagnosis: Obliterative bronchiolitis (not retransplant) (Diagnosis Group D only)~~	~~0.4453284411081100~~
18. Detailed Diagnosis: Pulmonary fibrosis, not idiopathic (Diagnosis Group D only)	~~-0.2091170018125500~~ 0.2088684500011
19. Detailed Diagnosis: Sarcoidosis with PA mean pressure greater than 30 mm Hg (Diagnosis Group D only)	~~-0.4577749354638600~~ -0.64590852776042
20. Detailed Diagnosis: Sarcoidosis with PA mean pressure of 30 mm Hg or less (Diagnosis Group A only)	~~0.9330846239906700~~ 1.39885489102977
~~21. Forced vital capacity (FVC)~~	~~0.1829476350587400*(80 – FVC)/10 if FVC is less than 80% for Diagnosis Group D~~ ~~0 if FVC is greater than or equal to 80% for Diagnosis Group D~~ ~~0 for candidates in Diagnosis Groups A, B, and C~~
22. Functional Status	~~-0.4471034284458400~~ -0.59790409246653 if no assistance needed with activities of daily living 0 if some or total assistance needed with activities of daily living
23. Oxygen needed to maintain adequate oxygen saturation (88% or greater) at rest (L/min)	~~0.0213187586203456~~ 0.0340531822566417*O_2 for Diagnosis Group B ~~0.1188479817592500~~ 0.08232292818591*O_2 for Diagnosis Groups A, C, and D
24. PCO_2 (mm Hg): current	~~0.1104609835819100~~ 0.12639905519026*PCO_2/10 if PCO_2 is at least 40 mm Hg

For this covariate:	The following coefficient is used in the LAS calculation:
25. PCO_2 increase of at least 15%	~~0.2331149280428300~~ 0.15556911866376 if PCO_2 increase is at least 15% 0 if PCO_2 increase is less than 15%
26. Pulmonary artery (PA) systolic pressure (10 mm Hg) at rest, prior to any exercise	~~0.4155116686114300~~ 0.55767046368853*(PA systolic – 40)/10 for Diagnosis Group A if the PA systolic pressure is greater than 40 mm Hg 0 for Diagnosis Group A if the PA systolic pressure is 40 mm Hg or less ~~0.0462410402627318~~ 0.1230478043299*PA systolic/10 for Diagnosis Groups B, C, and D
27. Six-minute-walk distance (feet) obtained while the candidate is receiving supplemental oxygen required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental oxygen during this test is at the discretion of the center performing the test.	~~-0.0844896372724000~~ -0.09937981549564*Six-minute-walk distance/100

Table 10-4 lists the covariates and corresponding coefficients in the waiting list and post-transplant survival measures. See *Policy 10.1.F.i: Lung Disease Diagnosis Groups* for specific information on each diagnosis group.

Table 10-4: Post-Transplant Survival Calculation: Covariates and Their Coefficients

For this covariate:	The following is used in the LAS calculation:
1. Age (years)	~~0.0246579831271869~~ 0.0208895939056676*(age–45) if candidate is greater than 45 years old 0 if candidate is 45 years old or younger
2. Creatinine (serum) at transplant (mg/dL) with the most recent data and time	~~0.0895569900508900~~ 0.25451764981323*creatinine if candidate is at least 18 years old 0 if candidate is less than 18 years old

For this covariate:	The following is used in the LAS calculation:
~~3. Creatinine increase of at least 150%~~	~~0.7708616024698100 if increase in creatinine is at least 150%, and the higher value determining this increase is at least 1 mg/dL~~ ~~0 if increase in creatinine of 150% if the higher value determining this increase is less than 1 mg/dL~~ ~~0 if increase in creatinine less than 150%~~
4. Cardiac index (L/min/m^2) at rest, prior to any exercise	~~0.3499381679822400~~ 0.1448727551614 if less than 2 L/min/m^2 0 if at least 2 L/min/m^2
5. Ventilation status if candidate is hospitalized	~~0.6094478988424900~~ 0.33161555489537 if continuous mechanical ventilation needed 0 if no continuous mechanical ventilation needed
6. Diagnosis Group A	0
7. Diagnosis Group B	~~0.6115547319209300~~ 0.51341349576197
8. Diagnosis Group C	~~0.3627014422464200~~ 0.23187885123342
9. Diagnosis Group D	~~0.4641392063023200~~ 0.12527366545917
10. Detailed diagnosis: Bronchiectasis (Diagnosis Group A only)	~~0.1889100379099400~~ 0.12048575705296
~~11. Detailed diagnosis: Eisenmenger's syndrome (Diagnosis Group B only)~~	~~0.9146727886744700~~
~~12. Detailed diagnosis: Lymphangioleiomyomatosis (Diagnosis Group A only)~~	~~-1.5194416206749400~~
13. Detailed diagnosis: Obliterative bronchiolitis (not-retransplant, Diagnosis Group D only)	~~-1.2050508750702600~~ -0.33402539276216
~~14. Detailed diagnosis: Pulmonary fibrosis, not idiopathic (Diagnosis Group D only)~~	~~-0.0723596761367600~~
15. Detailed diagnosis: Sarcoidosis with PA mean pressure greater than 30 mm Hg (Diagnosis Group D only)	~~-0.0437880049066331~~ 0.43537371336129
16. Detailed diagnosis: Sarcoidosis with PA mean pressure of 30 mm Hg or less (Diagnosis Group A only)	~~-0.1389363636019300~~ 0.98051166673574

For this covariate:	The following is used in the LAS calculation:
17. Oxygen needed to maintain adequate oxygen saturation (88% or greater) at rest (L/min)	~~0.0747978926517300~~ 0.0100383613234584*O_2 for Diagnosis Group A ~~0.0164276945879309~~ 0.0093694370076423*O_2 for Diagnosis Groups B, C, and D
~~18. Functional Status~~	~~-0.1900086366785100 if no assistance needed with activities of daily living~~ ~~0 if some or total assistance needed with activities of daily living~~
19. Six-minute-walk-distance (feet) obtained while candidate is receiving supplemental oxygen required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental oxygen during this test is at the discretion of the center performing the test.	~~0.0004594953809594~~ 0.0001943695814883*(1200-Six-minute-walk distance) 0 if six-minute-distance-walked is at least 1,200 feet

See *Policy 10.5: Probability Data Used in the LAS Calculation* for *Tables 10-11* and *10-12* that provide data used in the LAS calculation.

~~10.1.F.iii Bilirubin in the LAS~~

~~The LAS calculation uses two measures of total bilirubin:~~

- ~~Current bilirubin (for all candidates)~~
- ~~Bilirubin Threshold Change (for diagnosis Group B only)~~

~~Current Bilirubin~~

~~Current bilirubin is the total bilirubin value with the most recent test date and time reported to the OPTN Contractor. A current bilirubin value greater than 1.0 mg/dL will impact candidate's LAS.~~

~~Bilirubin Threshold Change (Diagnosis Group B Only)~~

~~There are two Bilirubin.threshold change calculations:~~

- ~~Bilirubin Threshold Change Calculation~~
- ~~Threshold Change Maintenance Calculation~~

~~***Bilirubin Threshold Change Calculation***~~

~~For candidates in diagnosis Group B, an increase-in-bilirubin that is at least 50% impacts the candidate's LAS. The bilirubin threshold change calculation uses the highest and lowest values of bilirubin as follows:~~

- ~~The test date and time of the lowest bilirubin value reported to the OPTN Contractor used in the bilirubin threshold change calculation must be earlier than the test date and time of the highest bilirubin value used in the bilirubin threshold change calculation.~~
- ~~The highest value must be at least 1.0 mg/dL.~~
- ~~Test dates of these highest.and lowest values cannot be more than six months apart.~~
- ~~The bilirubin threshold calculation can use an expired lowest value, but cannot use an expired highest value.~~
- ~~If a value is less than 0.7 mg/dL, the bilirubin threshold change calculation will use the normal clinical value of 0.7 mg/dL.~~

~~The equation for this bilirubin threshold change calculation is:~~

$$\frac{\text{Highest Bilirubin-Lowest Bilirubin}}{\text{Lowest Bilirubin}}$$

~~***Threshold Change Maintenance Calculation***~~

~~When a 50% or greater increase in bilirubin impacts a candidate's LAS, the LAS threshold change maintenance calculation assesses whether to maintain that impact. To maintain the impact of the bilirubin increase, the candidate's current bilirubin value must be at least 1.0 mg/dL and at least 50% higher than the lowest value used in the bilirubin threshold change calculation. The equation for the threshold change maintenance calculation is:~~

$$\frac{\text{Current Bilirubin-Lowest Bilirubin}}{\text{Lowest Bilirubin}}$$

~~The threshold change maintenance calculation occurs either when the current bilirubin value expires, according to *Policy 10.1.E: LAS Values and Clinical Data Update Schedule for Candidates at Least 12 Years Old*, or a new current bilirubin value is entered. For this calculation, the lowest and highest values that were used in the bilirubin threshold change calculation can be expired. The current bilirubin value can be the highest one that was used in the bilirubin threshold change calculation. If a current bilirubin.value expires, the candidate's LAS will no longer be affected by the bilirubin threshold change.~~

~~If a transplant hospital reports a new current bilirubin value for a candidate who has lost the impact from the bilirubin threshold change calculation, the LAS will perform the threshold change maintenance calculation. If the new current bilirubin value is at least 50% higher than the lowest value used in the bilirubin threshold change~~

calculation, the candidate's LAS will again be affected by the bilirubin threshold change calculation.

Normal Bilirubin Value

The normal clinical current bilirubin value is 0.7 mg/dL. If a current bilirubin value is below 0.7 mg/dL, or if the current bilirubin.value is missing or expired, the LAS calculation will use the normal clinical current bilirubin value.

10.1.F.iv Creatinine in the LAS

The LAS calculation uses two measures of creatinine:

1. Current creatinine (only for candidates who are at least 18 years old)
2. Creatinine Threshold Change (for all candidates)

Current Creatinine

Current creatinine is the serum creatinine value with the most recent test date and time reported to the OPTN Contractor for candidates who are at least 18 years old.

Creatinine Threshold Change Calculations

There are two creatinine.threshold change calculations:

1. Creatinine Threshold Change Calculation
2. Threshold Change Maintenance Calculation

The Creatinine Threshold Change Calculation

An increase in creatinine that is at least 150% will impact a candidate's LAS. The creatinine threshold change calculation uses the highest and lowest values of creatinine as follows:

- The test date and time of the lowest creatinine value reported to the OPTN Contractor used in the creatinine threshold change calculation must be earlier than the test date and time of the highest creatinine value used in the creatinine threshold change calculation.
- The highest value must be at least 1.0 mg/dL.
- Test dates of these highest.and lowest values cannot be more than six months apart.
- The creatinine threshold change calculation can use an expired lowest value, but cannot use an expired highest value.

The equation for this creatinine threshold change calculation is:

$$\frac{\text{Highest Creatinine-Lowest Creatinine}}{\text{Lowest Creatinine}}$$

~~***The Threshold Change Maintenance Calculation***~~

~~When a creatinine threshold change calculation impacts a candidate's LAS, the threshold change maintenance calculation assesses whether to maintain that impact. To maintain the impact of the increase in creatinine, the candidate's current creatinine value must be at least 1.0 mg/dL and at least 150% higher than the lowest value used in the creatinine threshold change calculation. The equation for the threshold change maintenance calculation is:~~

$$\frac{\text{Current Creatinine-Lowest Creatinine}}{\text{Lowest Creatinine}}$$

~~If the current creatinine value expires or a new creatinine value is entered, then the threshold change maintenance calculation will occur.~~

10.5 Probability Data Used in the LAS Calculation

Table 10-11: Baseline Waiting List Survival (SWL(t)) Probability Where t=Time in Days

t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$
0	1.0000000000	49	0.9966437334	98	0.9931596573	147	0.9905400510	196	0.9872991723
1	0.9999907157	50	0.9965433845	99	0.9930980163	148	0.9905400510	197	0.9872626749
2	0.9999254055	51	0.9965175429	100	0.9930607383	149	0.9905400510	198	0.9871552755
3	0.9998674170	52	0.9963972737	101	0.9930052489	150	0.9905400510	199	0.9871220338
4	0.9997455435	53	0.9963972737	102	0.9930052489	151	0.9905400510	200	0.9865302072
5	0.9995975343	54	0.9963631304	103	0.9929378277	152	0.9903840245	201	0.9865302072
6	0.9994989961	55	0.9963053385	104	0.9929378277	153	0.9903328361	202	0.9864801346
7	0.9993713802	56	0.9961914895	105	0.9928829296	154	0.9903328361	203	0.9859628001
8	0.9993046242	57	0.9961189511	106	0.9928829296	155	0.9903328361	204	0.9859256159
9	0.9992177050	58	0.9959421227	107	0.9928506946	156	0.9902446847	205	0.9859256159
10	0.9990851999	59	0.9959421227	108	0.9927619069	157	0.9902446847	206	0.9858198690
11	0.9989901794	60	0.9959092500	109	0.9927244496	158	0.9902446847	207	0.9858198690
12	0.9988873318	61	0.9959092500	110	0.9926433860	159	0.9901449203	208	0.9857415923
13	0.9988160788	62	0.9958731922	111	0.9926433860	160	0.9896887318	209	0.9857415923
14	0.9987295863	63	0.9958457969	112	0.9925624932	161	0.9896887318	210	0.9857415923
15	0.9986602768	64	0.9958457969	113	0.9920885646	162	0.9896520090	211	0.9857075131
16	0.9985875403	65	0.9956136053	114	0.9920640055	163	0.9895745634	212	0.9857075131
17	0.9984554393	66	0.9955529860	115	0.9920400127	164	0.9895745634	213	0.9855411680
18	0.9983616851	67	0.9955529860	116	0.9919966080	165	0.9889025189	214	0.9855411680
19	0.9982588046	68	0.9955529860	117	0.9919660469	166	0.9888730124	215	0.9855411680
20	0.9982200289	69	0.9955000986	118	0.9919399263	167	0.9888730124	216	0.9854501485
21	0.9980677506	70	0.9954789372	119	0.9919399263	168	0.9887838841	217	0.9854501485
22	0.9980357372	71	0.9953493820	120	0.9919399263	169	0.9887222824	218	0.9854501485
23	0.9979724590	72	0.9952934145	121	0.9915144847	170	0.9886945957	219	0.9853304718
24	0.9978684291	73	0.9951363273	122	0.9915144847	171	0.9886945957	220	0.9852652088
25	0.9977699910	74	0.9949654223	123	0.9915144847	172	0.9886945957	221	0.9852652088
26	0.9977420222	75	0.9948209678	124	0.9915144847	173	0.9886549235	222	0.9852652088
27	0.9976665328	76	0.9947736691	125	0.9914883902	174	0.9886549235	223	0.9852652088
28	0.9976255053	77	0.9947021905	126	0.9914618560	175	0.9886549235	224	0.9852652088
29	0.9975404117	78	0.9947021905	127	0.9913925084	176	0.9886246774	225	0.9846212073
30	0.9974725579	79	0.9946337898	128	0.9913069760	177	0.9885475245	226	0.9845486667
31	0.9973914097	80	0.9945649862	129	0.9913069760	178	0.9885475245	227	0.9845486667
32	0.9973268946	81	0.9945465023	130	0.9912697831	179	0.9885475245	228	0.9845486667
33	0.9972974521	82	0.9944645092	131	0.9912361687	180	0.9880619575	229	0.9845486667
34	0.9972743143	83	0.9944645092	132	0.9912361687	181	0.9880619575	230	0.9844886959
35	0.9972419197	84	0.9942969766	133	0.9910529687	182	0.9880619575	231	0.9844886959
36	0.9972419197	85	0.9942969766	134	0.9910121623	183	0.9880212199	232	0.9843962284
37	0.9971814314	86	0.9942969766	135	0.9910121623	184	0.9879335450	233	0.9843236173
38	0.9971367830	87	0.9942969766	136	0.9909776544	185	0.9878851712	234	0.9842799561
39	0.9971209292	88	0.9941805902	137	0.9909776544	186	0.9878851712	235	0.9840794709
40	0.9971209292	89	0.9940771789	138	0.9909776544	187	0.9878851712	236	0.9840794709
41	0.9970189115	90	0.9940345018	139	0.9909355857	188	0.9878851712	237	0.9840145629
42	0.9969461979	91	0.9940082090	140	0.9909011142	189	0.9878560942	238	0.9840145629
43	0.9969159237	92	0.9938663826	141	0.9909011142	190	0.9878560942	239	0.9840145629
44	0.9968488001	93	0.9938313146	142	0.9908111395	191	0.9878560942	240	0.9840145629
45	0.9968488001	94	0.9938070978	143	0.9907387924	192	0.9878560942	241	0.9838347625
46	0.9968199961	95	0.9937145919	144	0.9905945464	193	0.9878560942	242	0.9838347625
47	0.9967799694	96	0.9933077154	145	0.9905945464	194	0.9876077782	243	0.9837917116
48	0.9967313053	97	0.9932199214	146	0.9905400510	195	0.9873585581	244	0.9837534417

(Continued on next page)

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t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$
245	0.9837534417	269	0.9829597020	293	0.9818267812	317	0.9802178676	341	0.9785965606
246	0.9837534417	270	0.9829597020	294	0.9818267812	318	0.9801289145	342	0.9785965606
247	0.9836972199	271	0.9827972342	295	0.9815730256	319	0.9801289145	343	0.9783012252
248	0.9836363251	272	0.9827972342	296	0.9813194319	320	0.9800157994	344	0.9782502701
249	0.9836363251	273	0.9827972342	297	0.9807747475	321	0.9800157994	345	0.9782502701
250	0.9836363251	274	0.9827972342	298	0.9807747475	322	0.9800157994	346	0.9782502701
251	0.9836363251	275	0.9827004206	299	0.9805186284	323	0.9797725024	347	0.9781167565
252	0.9832432776	276	0.9826027019	300	0.9803970706	324	0.9797725024	348	0.9780370471
253	0.9832432776	277	0.9826027019	301	0.9803970706	325	0.9796706377	349	0.9780370471
254	0.9832432776	278	0.9825107450	302	0.9803970706	326	0.9796706377	350	0.9780370471
255	0.9830967678	279	0.9824570403	303	0.9803970706	327	0.9791639481	351	0.9780370471
256	0.9830967678	280	0.9824570403	304	0.9803970706	328	0.9791639481	352	0.9779370209
257	0.9830967678	281	0.9824570403	305	0.9803970706	329	0.9791639481	353	0.9779370209
258	0.9830967678	282	0.9824128485	306	0.9803970706	330	0.9791639481	354	0.9779370209
259	0.9830967678	283	0.9823232942	307	0.9803390799	331	0.9791001516	355	0.9778553245
260	0.9830967678	284	0.9823232942	308	0.9803390799	332	0.9791001516	356	0.9778553245
261	0.9830967678	285	0.9823232942	309	0.9803390799	333	0.9789346942	357	0.9778553245
262	0.9830516708	286	0.9823232942	310	0.9803390799	334	0.9789346942	358	0.9777099092
263	0.9830516708	287	0.9823232942	311	0.9803390799	335	0.9788174060	359	0.9777099092
264	0.9830516708	288	0.9823232942	312	0.9803390799	336	0.9788174060	360	0.9768812539
265	0.9830516708	289	0.9823232942	313	0.9803390799	337	0.9788174060	361	0.9768812539
266	0.9830516708	290	0.9823232942	314	0.9803390799	338	0.9788174060	362	0.9768812539
267	0.9830516708	291	0.9819156574	315	0.9802178676	339	0.9788174060	363	0.9767085255
268	0.9829597020	292	0.9818779459	316	0.9802178676	340	0.9788174060	364	0.9767085255

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t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$
0	1.0000000000	49	0.9989492645	98	0.9980759414	147	0.9975146609	196	0.9969683767
1	0.9999975489	50	0.9989218966	99	0.9980462038	148	0.9975044749	197	0.9969683767
2	0.9999827070	51	0.9988856853	100	0.9980462038	149	0.9974993058	198	0.9969683767
3	0.9999561442	52	0.9988518113	101	0.9980357746	150	0.9974923101	199	0.9969587577
4	0.9999275553	53	0.9988426443	102	0.9980357746	151	0.9974768114	200	0.9969587577
5	0.9999018223	54	0.9988426443	103	0.9980261747	152	0.9974768114	201	0.9969454938
6	0.9998777824	55	0.9988209613	104	0.9979909233	153	0.9974554527	202	0.9968612819
7	0.9998561463	56	0.9988149888	105	0.9979796304	154	0.9974097005	203	0.9968383024
8	0.9998143795	57	0.9987715012	106	0.9979796304	155	0.9973345023	204	0.9968383024
9	0.9997863737	58	0.9987338578	107	0.9979760272	156	0.9973345023	205	0.9968247526
10	0.9997696882	59	0.9987247079	108	0.9979646981	157	0.9973270637	206	0.9968185781
11	0.9997397377	60	0.9987034482	109	0.9979440109	158	0.9973208018	207	0.9968185781
12	0.9997045384	61	0.9987034482	110	0.9978768653	159	0.9973148013	208	0.9968185781
13	0.9996823002	62	0.9986649209	111	0.9978718005	160	0.9972940898	209	0.9968185781
14	0.9996498264	63	0.9986649209	112	0.9978279771	161	0.9972940898	210	0.9968097445
15	0.9996353431	64	0.9986596474	113	0.9978239640	162	0.9972940898	211	0.9967964069
16	0.9996288212	65	0.9986301115	114	0.9978239640	163	0.9972727684	212	0.9967166260
17	0.9996154867	66	0.9986166941	115	0.9978239640	164	0.9972727684	213	0.9966358744
18	0.9995970948	67	0.9985746371	116	0.9978239640	165	0.9972727684	214	0.9966212192
19	0.9995652300	68	0.9985695968	117	0.9978239640	166	0.9972688422	215	0.9966212192
20	0.9995271489	69	0.9985667636	118	0.9978239640	167	0.9972234233	216	0.9966144147
21	0.9995080982	70	0.9985563118	119	0.9977825323	168	0.9972234233	217	0.9966016656
22	0.9994934457	71	0.9985101367	120	0.9977771080	169	0.9972179105	218	0.9965791846
23	0.9994602264	72	0.9984938912	121	0.9977674724	170	0.9972086398	219	0.9965791846
24	0.9994302540	73	0.9984903590	122	0.9977606316	171	0.9972086398	220	0.9965744007
25	0.9994060375	74	0.9984305838	123	0.9977340449	172	0.9972086398	221	0.9965236975
26	0.9993816059	75	0.9984129085	124	0.9976558111	173	0.9972086398	222	0.9965110962
27	0.9993613122	76	0.9984027696	125	0.9976558111	174	0.9972086398	223	0.9964387358
28	0.9993350553	77	0.9983908074	126	0.9976504510	175	0.9971827158	224	0.9964387358
29	0.9993022038	78	0.9983908074	127	0.9976370243	176	0.9971692174	225	0.9964227617
30	0.9992938892	79	0.9983787271	128	0.9976101536	177	0.9971692174	226	0.9964227617
31	0.9992721423	80	0.9983696472	129	0.9976101536	178	0.9971692174	227	0.9964120372
32	0.9992622566	81	0.9983630336	130	0.9976101536	179	0.9971692174	228	0.9963875823
33	0.9992427448	82	0.9983467929	131	0.9975990034	180	0.9971603270	229	0.9963875823
34	0.9992005080	83	0.9983136954	132	0.9975835550	181	0.9971603270	230	0.9963684607
35	0.9991776739	84	0.9983064970	133	0.9975766810	182	0.9971320838	231	0.9963684607
36	0.9991551715	85	0.9982951177	134	0.9975701094	183	0.9971131145	232	0.9963684607
37	0.9991302006	86	0.9982565537	135	0.9975701094	184	0.9971131145	233	0.9963684607
38	0.9991278479	87	0.9982441865	136	0.9975607830	185	0.9971091508	234	0.9963684607
39	0.9991028378	88	0.9982441865	137	0.9975520103	186	0.9970985061	235	0.9963684607
40	0.9990801777	89	0.9982441865	138	0.9975404803	187	0.9970985061	236	0.9963684607
41	0.9990600363	90	0.9982257230	139	0.9975404803	188	0.9970985061	237	0.9963684607
42	0.9990482109	91	0.9981791418	140	0.9975404803	189	0.9970985061	238	0.9963684607
43	0.9990482109	92	0.9981791418	141	0.9975404803	190	0.9970985061	239	0.9963684607
44	0.9990358743	93	0.9981714154	142	0.9975404803	191	0.9970985061	240	0.9963684607
45	0.9990358743	94	0.9981444359	143	0.9975344179	192	0.9970985061	241	0.9962582929
46	0.9990016655	95	0.9981313503	144	0.9975344179	193	0.9970985061	242	0.9962582929
47	0.9989778087	96	0.9981154417	145	0.9975344179	194	0.9970911735	243	0.9961947546
48	0.9989665684	97	0.9981154417	146	0.9975298313	195	0.9970671621	244	0.9961947546

(Continued on next page)

Table 10-11: Baseline Waiting List Survival (SWL(t)) Probability Where t=Time in Days (Continued)

t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$	t	$S_{WL}(t)$
245	0.9961947546	**269**	0.9957784566	**293**	0.9955475237	**317**	0.9952281619	**341**	0.9949369873
246	0.9960956354	**270**	0.9957784566	**294**	0.9955054645	**318**	0.9951666810	**342**	0.9949369873
247	0.9960437794	**271**	0.9957784566	**295**	0.9954978576	**319**	0.9951314001	**343**	0.9949369873
248	0.9960247257	**272**	0.9957784566	**296**	0.9954793243	**320**	0.9951314001	**344**	0.9948416999
249	0.9959880763	**273**	0.9957784566	**297**	0.9954639104	**321**	0.9951314001	**345**	0.9948416999
250	0.9959742895	**274**	0.9957702527	**298**	0.9954392804	**322**	0.9951314001	**346**	0.9948416999
251	0.9959742895	**275**	0.9957639142	**299**	0.9954392804	**323**	0.9951314001	**347**	0.9947378061
252	0.9959552359	**276**	0.9957410244	**300**	0.9954137179	**324**	0.9950798577	**348**	0.9946948263
253	0.9959552359	**277**	0.9957255372	**301**	0.9954137179	**325**	0.9950798577	**349**	0.9946845005
254	0.9959380587	**278**	0.9957255372	**302**	0.9953849510	**326**	0.9950798577	**350**	0.9946845005
255	0.9959380587	**279**	0.9957255372	**303**	0.9953581531	**327**	0.9950798577	**351**	0.9946845005
256	0.9959380587	**280**	0.9957255372	**304**	0.9953445180	**328**	0.9950798577	**352**	0.9946845005
257	0.9959380587	**281**	0.9956914479	**305**	0.9953445180	**329**	0.9950798577	**353**	0.9946845005
258	0.9959272229	**282**	0.9956914479	**306**	0.9953445180	**330**	0.9950798577	**354**	0.9945854823
259	0.9959272229	**283**	0.9956914479	**307**	0.9953093054	**331**	0.9950798577	**355**	0.9945854823
260	0.9959225083	**284**	0.9956914479	**308**	0.9952957037	**332**	0.9950670017	**356**	0.9945720480
261	0.9959225083	**285**	0.9956797646	**309**	0.9952957037	**333**	0.9949858453	**357**	0.9945265776
262	0.9959225083	**286**	0.9956797646	**310**	0.9952741113	**334**	0.9949512121	**358**	0.9945265776
263	0.9959225083	**287**	0.9956797646	**311**	0.9952741113	**335**	0.9949512121	**359**	0.9945265776
264	0.9959225083	**288**	0.9956605860	**312**	0.9952514686	**336**	0.9949512121	**360**	0.9944766010
265	0.9959225083	**289**	0.9956605860	**313**	0.9952514686	**337**	0.9949369873	**361**	0.9944766010
266	0.9958954164	**290**	0.9956391439	**314**	0.9952514686	**338**	0.9949369873	**362**	0.9944766010
267	0.9957938685	**291**	0.9956391439	**315**	0.9952281619	**339**	0.9949369873	**363**	0.9944766010
268	0.9957938685	**292**	0.9955475237	**316**	0.9952281619	**340**	0.9949369873	**364**	0.9943896539

Table 10-12: Baseline Post-Transplant Survival ($S_{TX}(t)$) Probability Where t=Time in Days

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
0	1.0000000000	48	0.9818819454	97	0.9724145650	146	0.9651646731	195	0.9585852831
0	0.9989463518	49	0.9813940581	98	0.9724145650	147	0.9650179741	196	0.9585852831
1	0.9975582572	50	0.9811149797	99	0.9721278916	148	0.9650179741	197	0.9585106153
2	0.9968950221	51	0.9808357071	100	0.9719843820	149	0.9647244778	198	0.9583612369
3	0.9963635815	52	0.9804163818	101	0.9717688365	150	0.9646510762	199	0.9580621750
4	0.9954983869	53	0.9802065044	102	0.9716969486	151	0.9645042403	200	0.9580621750
5	0.9951651492	54	0.9801365116	103	0.9715531365	152	0.9643573707	201	0.9579873451
6	0.9945645668	55	0.9799264755	104	0.9713373330	153	0.9640634927	202	0.9579873451
7	0.9941636334	56	0.9796462096	105	0.9712653813	154	0.9638429283	203	0.9579125074
8	0.9939630137	57	0.9794358024	106	0.9711934225	155	0.9636958085	204	0.9577628083
9	0.9933601591	58	0.9790847785	107	0.9711214419	156	0.9634750547	205	0.9576130592
10	0.9931589002	59	0.9788739877	108	0.9710494372	157	0.9633278327	206	0.9575381540
11	0.9924871748	60	0.9787334069	109	0.9709774209	158	0.9631069028	207	0.9573882873
12	0.9923526429	61	0.9784520623	110	0.9707613132	159	0.9627384081	208	0.9573133332
13	0.9919487360	62	0.9783816832	111	0.9706892585	160	0.9625171483	209	0.9572383663
14	0.9916792045	63	0.9781704820	112	0.9706171946	161	0.9624433701	210	0.9571633895
15	0.9912068471	64	0.9781000588	113	0.9705451162	162	0.9622957853	211	0.9571633895
16	0.9905308509	65	0.9779591798	114	0.9704730247	163	0.9620743353	212	0.9569383725
17	0.9902600814	66	0.9778182436	115	0.9703288079	164	0.9619266457	213	0.9568633391
18	0.9899212765	67	0.9778182436	116	0.9699680182	165	0.9617049921	214	0.9567883006
19	0.9895819543	68	0.9775361418	117	0.9698236079	166	0.9616310727	215	0.9567132550
20	0.9895140131	69	0.9772537901	118	0.9696791597	167	0.9615571395	216	0.9566381918
21	0.9889017936	70	0.9770418835	119	0.9696069224	168	0.9614831983	217	0.9564880147
22	0.9882201168	71	0.9769712231	120	0.9693901236	169	0.9614831983	218	0.9562625865
23	0.9878104319	72	0.9769005466	121	0.9691008601	170	0.9614092449	219	0.9562625865
24	0.9874685977	73	0.9767590709	122	0.9689561390	171	0.9611132339	220	0.9561873965
25	0.9872633504	74	0.9765466782	123	0.9686665562	172	0.9611132339	221	0.9561121949
26	0.9870579950	75	0.9764758630	124	0.9685941382	173	0.9610391867	222	0.9560369867
27	0.9865784176	76	0.9761925132	125	0.9683767411	174	0.9609651281	223	0.9558865533
28	0.9863040866	77	0.9759089522	126	0.9681590825	175	0.9608910582	224	0.9557360679
29	0.9860295071	78	0.9757670435	127	0.9680864781	176	0.9607428635	225	0.9557360679
30	0.9859608276	79	0.9756250284	128	0.9678684348	177	0.9605945954	226	0.9557360679
31	0.9857547158	80	0.9754829371	129	0.9677956729	178	0.9604462255	227	0.9556608016
32	0.9854796626	81	0.9754829371	130	0.9675043666	179	0.9604462255	228	0.9556608016
33	0.9851355094	82	0.9754829371	131	0.9673585766	180	0.9603719931	229	0.9555102388
34	0.9849288641	83	0.9749850268	132	0.9671398110	181	0.9602977341	230	0.9555102388
35	0.9845152420	84	0.9749850268	133	0.9671398110	182	0.9601491697	231	0.9552089409
36	0.9844462708	85	0.9747001806	134	0.9669939177	183	0.9600748710	232	0.9552089409
37	0.9841701925	86	0.9747001806	135	0.9667019115	184	0.9598519074	233	0.9551335669
38	0.9838247337	87	0.9744152006	136	0.9664827327	185	0.9597775675	234	0.9549827718
39	0.9834789109	88	0.9739873157	137	0.9664827327	186	0.9597032090	235	0.9548319320
40	0.9832019349	89	0.9738445742	138	0.9664096522	187	0.9596288106	236	0.9546810412
41	0.9830633211	90	0.9736303735	139	0.9662634193	188	0.9595543795	237	0.9545300840
42	0.9828552725	91	0.9734160812	140	0.9661902639	189	0.9594799325	238	0.9544545732
43	0.9827164882	92	0.9734160812	141	0.9661902639	190	0.9592564778	239	0.9542279182
44	0.9825775890	93	0.9732016972	142	0.9659707159	191	0.9591074222	240	0.9542279182
45	0.9822995280	94	0.9730587142	143	0.9657510525	192	0.9590328768	241	0.9540767061
46	0.9821604041	95	0.9729156920	144	0.9656778054	193	0.9590328768	242	0.9540767061
47	0.9819515885	96	0.9726294362	145	0.9653113457	194	0.9587345577	243	0.9539254009

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Table 10-12: Baseline Post-Transplant Survival ($S_{TX}(t)$) Probability Where t=Time in Days (Continued)

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
244	0.9538497172	269	0.9511902217	293	0.9485888127	317	0.9463585089	341	0.9437285938
245	0.9538497172	270	0.9509612738	294	0.9483586281	318	0.9463585089	342	0.9436509982
246	0.9537740199	271	0.9506558210	295	0.9482818803	319	0.9462042511	343	0.9435733917
247	0.9537740199	272	0.9505794198	296	0.9481283428	320	0.9462042511	344	0.9434181618
248	0.9536983112	273	0.9504265693	297	0.9480515582	321	0.9461270863	345	0.9433405390
249	0.9536225901	274	0.9502736813	298	0.9479747621	322	0.9460499065	346	0.9431075841
250	0.9533952367	275	0.9501207590	299	0.9478210865	323	0.9460499065	347	0.9430298440
251	0.9533193886	276	0.9501207590	300	0.9476673351	324	0.9458955253	348	0.9430298440
252	0.9530158831	277	0.9498147874	301	0.9476673351	325	0.9458183199	349	0.9429520371
253	0.9530158831	278	0.9496617253	302	0.9473596856	326	0.9455866228	350	0.9427185272
254	0.9527122194	279	0.9496617253	303	0.9473596856	327	0.9454321012	351	0.9427185272
255	0.9527122194	280	0.9495851653	304	0.9473596856	328	0.9454321012	352	0.9427185272
256	0.9527122194	281	0.9495851653	305	0.9473596856	329	0.9453548209	353	0.9426406582
257	0.9524843651	282	0.9494319939	306	0.9472827362	330	0.9452775175	354	0.9424848995
258	0.9524083896	283	0.9493553886	307	0.9472827362	331	0.9451228653	355	0.9424848995
259	0.9523323977	284	0.9492787721	308	0.9472057776	332	0.9451228653	356	0.9421732641
260	0.9522563886	285	0.9492787721	309	0.9471288083	333	0.9449681796	357	0.9420173651
261	0.9521803676	286	0.9492021461	310	0.9469748345	334	0.9448908227	358	0.9417833903
262	0.9521043365	287	0.9492021461	311	0.9468208245	335	0.9447360580	359	0.9417053586
263	0.9518761834	288	0.9491255112	312	0.9468208245	336	0.9445812189	360	0.9416273052
264	0.9518000820	289	0.9490488687	313	0.9468208245	337	0.9445037758	361	0.9415492338
265	0.9516477499	290	0.9488955575	314	0.9467438071	338	0.9441938892	362	0.9415492338
266	0.9516477499	291	0.9488188902	315	0.9465897325	339	0.9440388525	363	0.9413148953
267	0.9515715365	292	0.9488188902	316	0.9464356005	340	0.9439613054	364	0.9413148953
268	0.9514952979								

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
0	1.0000000000	49	0.9859396692	98	0.9804349392	147	0.9760079584	196	0.9711061937
1	0.9989168684	50	0.9858164949	99	0.9801864682	148	0.9759453602	197	0.9708538746
2	0.9984346294	51	0.9855701194	100	0.9800000394	149	0.9758201487	198	0.9706645555
3	0.9977712423	52	0.9855701194	101	0.9799378767	150	0.9757575320	199	0.9705383076
4	0.9973484709	53	0.9853236329	102	0.9798135405	151	0.9757575320	200	0.9703489195
5	0.9970462337	54	0.9850154170	103	0.9796891562	152	0.9754444350	201	0.9702226203
6	0.9965625190	55	0.9847070827	104	0.9796891562	153	0.9753817621	202	0.9700962568
7	0.9961993881	56	0.9846453556	105	0.9796891562	154	0.9752564117	203	0.9699066925
8	0.9958966278	57	0.9844601577	106	0.9796269487	155	0.9751937214	204	0.9698434819
9	0.9954724846	58	0.9842749162	107	0.9794403086	156	0.9751310267	205	0.9698434819
10	0.9951086930	59	0.9841513879	108	0.9793780730	157	0.9750683237	206	0.9697802663
11	0.9948053130	60	0.9838425267	109	0.9793158337	158	0.9748802003	207	0.9694642073
12	0.9942589911	61	0.9837807200	110	0.9792535831	159	0.9748174678	208	0.9693376951
13	0.9941374518	62	0.9835952969	111	0.9792535831	160	0.9747547321	209	0.9692111628
14	0.9938943616	63	0.9835334714	112	0.9791290692	161	0.9746919892	210	0.9691478845
15	0.9936511061	64	0.9834716335	113	0.9790668010	162	0.9746292392	211	0.9691478845
16	0.9932859829	65	0.9832242857	114	0.9788176541	163	0.9745037272	212	0.9691478845
17	0.9931032767	66	0.9831624223	115	0.9787553419	164	0.9744409567	213	0.9690213151
18	0.9927987155	67	0.9831624223	116	0.9786930245	165	0.9743154118	214	0.9688947255
19	0.9925549731	68	0.9830386904	117	0.9786307023	166	0.9741898451	215	0.9687681067
20	0.9924330443	69	0.9827292921	118	0.9785060459	167	0.9741270468	216	0.9687681067
21	0.9921891249	70	0.9824197258	119	0.9785060459	168	0.9741270468	217	0.9687681067
22	0.9920061484	71	0.9823577717	120	0.9783190327	169	0.9740014458	218	0.9686414652
23	0.9916401290	72	0.9822338558	121	0.9782566683	170	0.9738758131	219	0.9685147964
24	0.9914570116	73	0.9821718893	122	0.9781942967	171	0.9738758131	220	0.9684514491
25	0.9913959504	74	0.9821718893	123	0.9781319182	172	0.9736245232	221	0.9683880937
26	0.9910906393	75	0.9821718893	124	0.9779447835	173	0.9735616621	222	0.9682613699
27	0.9909073743	76	0.9821099189	125	0.9779447835	174	0.9734359312	223	0.9681979935
28	0.9904797245	77	0.9820479459	126	0.9778200018	175	0.9733101762	224	0.9681346105
29	0.9899294478	78	0.9819859697	127	0.9777575984	176	0.9732472868	225	0.9681346105
30	0.9898070359	79	0.9819239837	128	0.9777575984	177	0.9729957417	226	0.9681346105
31	0.9891950158	80	0.9818000096	129	0.9777575984	178	0.9729957417	227	0.9678810937
32	0.9887660579	81	0.9818000096	130	0.9777575984	179	0.9729328284	228	0.9678810937
33	0.9886434002	82	0.9817380113	131	0.9776951904	180	0.9728069960	229	0.9676274650
34	0.9884593786	83	0.9816760095	132	0.9775703575	181	0.9728069960	230	0.9675640123
35	0.9880912671	84	0.9816760095	133	0.9775703575	182	0.9724923862	231	0.9675005516
36	0.9879070815	85	0.9816140030	134	0.9775703575	183	0.9724923862	232	0.9675005516
37	0.9877842742	86	0.9814899878	135	0.9775079236	184	0.9723664833	233	0.9675005516
38	0.9873544476	87	0.9813659495	136	0.9772581879	185	0.9723035158	234	0.9672466908
39	0.9871700789	88	0.9812418882	137	0.9771332758	186	0.9721146241	235	0.9669292385
40	0.9869242045	89	0.9811178010	138	0.9771332758	187	0.9720516381	236	0.9667386173
41	0.9869242045	90	0.9811178010	139	0.9769458756	188	0.9719256562	237	0.9666114980
42	0.9868627089	91	0.9809936908	140	0.9767584228	189	0.9716736755	238	0.9664843455
43	0.9866167108	92	0.9809936908	141	0.9766959165	190	0.9715476030	239	0.9664843455
44	0.9865551891	93	0.9809936908	142	0.9766959165	191	0.9712954163	240	0.9664207511
45	0.9864321394	94	0.9808074944	143	0.9765708928	192	0.9712323468	241	0.9663571531
46	0.9863705962	95	0.9808074944	144	0.9763207692	193	0.9711692727	242	0.9661663551
47	0.9861243805	96	0.9806833301	145	0.9763207692	194	0.9711061937	243	0.9660391221
48	0.9859396692	97	0.9804970537	146	0.9760705488	195	0.9711061937	244	0.9659118728

(Continued on next page)

Table 10-12: Baseline Post-Transplant Survival ($S_{TX}(t)$) Probability Where t=Time in Days (Continued)

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
245	0.9659118728	**269**	0.9632965280	**293**	0.9611192441	**317**	0.9586128181	**341**	0.9555806338
246	0.9657209456	**270**	0.9631686533	**294**	0.9609908927	**318**	0.9585484383	**342**	0.9555806338
247	0.9657209456	**271**	0.9631686533	**295**	0.9609908927	**319**	0.9585484383	**343**	0.9555159535
248	0.9655936296	**272**	0.9631686533	**296**	0.9607341600	**320**	0.9584840545	**344**	0.9554512674
249	0.9655299608	**273**	0.9631686533	**297**	0.9606699547	**321**	0.9584196607	**345**	0.9553865754
250	0.9655299608	**274**	0.9629768044	**298**	0.9605415356	**322**	0.9582908711	**346**	0.9553865754
251	0.9654662741	**275**	0.9629128396	**299**	0.9604130979	**323**	0.9582908711	**347**	0.9553218775
252	0.9654662741	**276**	0.9628488713	**300**	0.9604130979	**324**	0.9580976632	**348**	0.9552571738
253	0.9652115383	**277**	0.9627209262	**301**	0.9604130979	**325**	0.9579688088	**349**	0.9550630638
254	0.9650840942	**278**	0.9627209262	**302**	0.9602846512	**326**	0.9579688088	**350**	0.9550630638
255	0.9648928664	**279**	0.9625929760	**303**	0.9602204141	**327**	0.9579043700	**351**	0.9548041910
256	0.9647015529	**280**	0.9625929760	**304**	0.9600277027	**328**	0.9577754767	**352**	0.9546099416
257	0.9646377632	**281**	0.9625289763	**305**	0.9599634408	**329**	0.9577754767	**353**	0.9544803563
258	0.9645739650	**282**	0.9623369773	**306**	0.9599634408	**330**	0.9577110163	**354**	0.9544803563
259	0.9645101605	**283**	0.9623369773	**307**	0.9598349128	**331**	0.9576465538	**355**	0.9544155483
260	0.9643187339	**284**	0.9623369773	**308**	0.9596420886	**332**	0.9574531426	**356**	0.9542211322
261	0.9642548867	**285**	0.9621448872	**309**	0.9595777902	**333**	0.9572596959	**357**	0.9539618458
262	0.9641910389	**286**	0.9618886886	**310**	0.9594491836	**334**	0.9569371935	**358**	0.9538321500
263	0.9640633401	**287**	0.9617605348	**311**	0.9593205637	**335**	0.9566145449	**359**	0.9537024130
264	0.9638717349	**288**	0.9617605348	**312**	0.9591919322	**336**	0.9564208317	**360**	0.9535077925
265	0.9638078451	**289**	0.9616964401	**313**	0.9590632846	**337**	0.9561624675	**361**	0.9535077925
266	0.9636800525	**290**	0.9614400217	**314**	0.9589346060	**338**	0.9560332045	**362**	0.9535077925
267	0.9635522259	**291**	0.9614400217	**315**	0.9588059096	**339**	0.9559039159	**363**	0.9535077925
268	0.9634883010	**292**	0.9612475822	**316**	0.9587415497	**340**	0.9556453115	**364**	0.9535077925

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