OPTN

Notice of OPTN Policy, Guidance, and Guideline Changes

Establish Continuous Distribution of Lungs

Sponsoring Committee:	**OPTN Lung Transplantation Committee**
Policies Affected:	*1.2: Definitions*
	3.6.A: Waiting Time for Inactive Candidates
	5.10.F: Allocation of Lung-Kidneys
	5.10.G: Allocation of Heart-Liver and Lung-Liver
	6.6.F: Allocation of Heart-Lungs
	6.6.F.i: Allocation of Heart-Lungs from Deceased Donors at Least 18 Years Old
	6.6.F.ii: Allocation of Heart-Lungs from Deceased Donors Less Than 18 Years Old
	10: Lung Allocation (and all subsections)
	21: Composite Allocation Score Reference (and all subsections)
Guidance Affected:	*Lung Review Board Guidance*
Guidelines Affected:	*Lung Review Board Operational Guidelines*
Public Comment:	**August 3, 2021 – September 30, 2021**
Board Approved:	**December 6, 2021**
	December 5, 2022
Clarification Approved:	**October 26, 2022**
Effective Date:	**Pending implementation and notice to OPTN members (Target implementation date is March 2, 2023)**

Note: The OPTN Executive Committee approved a clarification to these policy changes at its meeting on October 26, 2022. For more information regarding this clarification, please see the Mini-Brief: Clarifications to the Continuous Distribution of Lungs, available at https://optn.transplant.hrsa.gov/policies-bylaws/public-comment/establish-continuous-distribution-of-lungs, or contact member.questions@unos.org.

Purpose of Policy Changes

This change better aligns lung allocation policy regulatory requirements, community and ethical goals identified by the OPTN, and medical advancements, while considering each candidate holistically. It moves lung allocation into a continuous distribution framework, removes rigid boundaries in lung allocation, and introduces the composite allocation score for lung candidates.

Proposal History

To educate the community about continuous distribution, a presence on the OPTN website was established to explain concepts and plans for development. Progress specific to the development of lung continuous distribution included:

2019
- Concept paper on the continuous distribution of lungs[1]

2020
- Request for feedback and update on work that had been completed to date[2]
- Results of community feedback on priorities that was provided through a prioritization exercise[3]
- Results of an analysis to reveal the preferences inherent in the current lung allocation system[4]
- An interactive tool for visualizing what a match would look like under continuous distribution[5]

2021
- Results from the first round of SRTR modeling[6]
- Results from modeling impact of 5-year post-transplant outcomes[7]
- Results from the second round of SRTR modeling[8]
- Continuous Distribution public comment proposal[9]
- Establish Continuous Distribution of Lungs briefing paper[10]

2022
- Public comment proposal to update multi-organ allocation for continuous distribution of lungs[11]
- Public comment proposal to revise Lung Review Board guidelines, guidance, and policy[12]

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[1] Concept Paper, *Continuous Distribution of Lungs*, OPTN Thoracic Organ Transplantation Committee. Public Comment Period August 2, 2019-October 2, 2019. https://optn.transplant.hrsa.gov/media/3111/thoracic_publiccomment_201908.pdf.

[2] OPTN Request for Feedback, Update on the Continuous Distribution of Organs Project, OPTN Lung Transplantation Committee. Public Comment Period August 4, 2020-October 1, 2020.
https://optn.transplant.hrsa.gov/media/3932/continuous_distribution_lungs_concept_paper_pc.pdf.

[3] Continuous Distribution of Lungs, Summer 2020 Prioritization Exercise – Community Results, October 12, 2020.
https://optn.transplant.hrsa.gov/media/4157/2020-10_report_community_ahp_prioritization.pdf.

[4] Darren E. Stewart , Dallas W. Wood , James B. Alcorn , Erika D. Lease , Michael Hayes , Brett Hauber and Rebecca E. Goff, A revealed preference analysis to develop composite scores approximating lung allocation policy in the U.S., January 6, 2021.
https://optn.transplant.hrsa.gov/media/4317/2021-revealed-preference-analysis.pdf.

[5] https://public.tableau.com/profile/optn.committees#!/vizhome/ContinuousDistributionofLungs/Home.

[6] SRTR, Continuous Distribution Simulations for Lung Transplant, Data Request ID# LU2020_05, February 12, 2021.
https://optn.transplant.hrsa.gov/media/4450/lu2020_05_cont_distn_srtr_1.pdf.

[7] SRTR The impact of extending follow-up for the PTAUC model from 1 year to 5 years after transplant, February 17, 2021. (Accessed June 18, 2021) https://optn.transplant.hrsa.gov/media/4675/lu_posttx_5y_2_2021.pdf.

[8] SRTR, Continuous distribution simulations for lung transplant: Round 2, Data Request ID#: LU2021_01, May 28, 2021.
https://optn.transplant.hrsa.gov/media/4646/lu2021_01_cont_distn_report_final.pdf.

[9] Public Comment Proposal, Establish Continuous Distribution of Lungs, OPTN Lung Transplantation Committee. Public Comment Period August 3, 2021- September 30, 2021. https://optn.transplant.hrsa.gov/media/4772/continuous_distribution_of_lungs-public_comment.pdf.

[10] Briefing Paper, Establish Continuous Distribution of Lungs, OPTN Lung Transplantation Committee, December 2021.
https://optn.transplant.hrsa.gov/media/esjb4ztn/20211206-bp-lung-establish-cont-dist-lungs.pdf.

[11] Public Comment Proposal, Update Multi-Organ Allocation for Continuous Distribution of Lungs, OPTN Lung Transplantation Committee. Public Comment Period August 3, 2022 – September 28, 2022. https://optn.transplant.hrsa.gov/media/ss1h253a/update-multi-organ-allocation-for-continuous-distribution-of-lungs_lung_pc-summer-2022.pdf.

[12] Public Comment Proposal, Revise Lung Review Board Guidelines, Guidance, and Policy for Continuous Distribution, OPTN Lung Transplantation Committee. Public Comment Period August 3, 2022 – September 28, 2022.
https://optn.transplant.hrsa.gov/media/hzdktvbm/revise-lung-review-board-guidelines-guidance-and-policy-for-continuous-distribution_lung_pc-summer-2022.pdf.

- Policy clarification[13]
- Briefing paper to update multi-organ allocation for continuous distribution of lungs[14]
- Briefing paper to revise Lung Review Board guidelines, guidance, and policy[15]

Summary of Changes

This change removes the current classification system and replaces it with a lung composite allocation score (CAS) which is comprised of the following attributes:

- Medical Urgency, or how long a patient is expected to live without receiving a transplant
- Post-Transplant Outcomes, or a patient's life expectancy within the first five years following a transplant
- Biological Disadvantages, for patients who are medically harder to match which includes candidate blood type, sensitization, and height
- Patient Access, for patients under the age of 18 and patients who are prior living donors
- Placement efficiency, or the resources required to match, transport, and transplant an organ which includes both travel efficiency and proximity efficiency

Each attribute has a rating scale, which will determine how many points a candidate receives for each, and each attribute has a relative weight. The total weights add up to 100. These points combine into a total score for the candidate. With every organ offer, a candidate receives a new Composite Allocation Score (CAS), which is used to rank the candidates for that organ offer. The lung composite allocation score will be awarded in the proportions of:

Attribute	Percentage	
Waitlist Survival	25%	
Post-transplant Outcomes	25%	
Biological Disadvantages	15%	
Blood Type		5%
CPRA		5%
Height		5%
Patient Access	25%	
Pediatric		20%
Prior living donor		5%
Placement Efficiency	10%	
Travel Efficiency		5%
Proximity Efficiency		5%

Each candidate will be awarded a portion of the score for each attribute based on their individual characteristics relative to the rating scale for that attribute.

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[13] Mini-Brief, Clarifications to the Continuous Distribution of Lungs, OPTN Lung Transplantation Committee, October 2022, https://optn.transplant.hrsa.gov/policies-bylaws/public-comment/establish-continuous-distribution-of-lungs/.
[14] Briefing Paper, Update Multi-Organ Allocation for Continuous Distribution of Lungs, OPTN Lung Transplantation Committee, December 2022. https://optn.transplant.hrsa.gov/media/jtcizwok/bp_update-mot-for-cd-of-lung.pdf.
[15] Briefing Paper, Revise Lung Review Board Guidelines, Guidance, and Policy for Continuous Distribution, OPTN Lung Transplantation Committee, December 2022. https://optn.transplant.hrsa.gov/media/hbilgzlf/bp_revise-lung-review-board-guidelines-guidance-and-policy-for-cd_dec-2022.pdf.

Data collection related to supplemental oxygen, assisted ventilation, and prior living donation will be changed, and the update schedule for the most urgent candidates will change. There are also changes to multi-organ allocation and to lung score exceptions designed to align these with the CAS system.

These changes reflect two amendments adopted by the Board of Directors in December 2021 and a clarification adopted by the Executive Committee in October 2022 that:
- Replaced outdated references to the lung allocation score (LAS) with references to the CAS
- Limited the changes to the policy language, removing proposed changes to the Lung Review Board Operational Guidelines
- Address questions raised during implementation

Operational guidelines and clinical guidance for the Lung Review Board went through public comment in August – September 2022 and were approved by the Board of Directors in December 2022.[16]

Implementation

Transplant hospitals will need to educate staff and patients about the changes to the allocation system, and the impact it will have on scoring, offers, exceptions, and updates to certain testing. There will be limited changes to data collection related to supplemental oxygen, assisted ventilation, and prior living donation.

OPOs may need to train staff on the new match run and revised multi-organ allocation rules. This change is also likely to alter offer patterns, and OPOs may develop new relationships with transplant hospitals they did not work with frequently in the past.

This change includes candidate CPRA as a factor in the composite allocation score. Histocompatibility laboratories may need to work with the lung transplant hospitals they serve to update candidate testing policies, and may be asked to test lung candidates more frequently.

This change will require extensive system changes and member education. There will be limited changes to data collection related to supplemental oxygen, assisted ventilation, and prior living donation.

Prior to implementation, information will be provided to members to assist them in determining the impact of the new allocation system on their candidate, and members will be able to request exception scores so that candidates can use an exception score on the day the new system is implemented. The OPTN plans to distribute educational materials related to the new system, including specific educational offerings related to the changes to the lung review board such as clinical exception guidance. It will also publish a new online CAS calculator and patient's guide to understanding the new composite allocation score.

The first phase of continuous distribution of lungs was implemented on November 8, 2022. This included implementation of two new fields:
- Prior living donor
    - Requires documentation to be submitted to the Organ Center for lung candidates who previously donated an organ in order for those candidates to receive prior living donor points
- On high flow nasal cannula

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[16] OPTN, Revise Lung Review Board Guidelines, Guidance, and Policy for Continuous Distribution, OPTN Lung Transplantation Committee, Public Comment Period August 3, 2022 – September 28, 2022. https://optn.transplant.hrsa.gov/media/hzdktvbm/revise-lung-review-board-guidelines-guidance-and-policy-for-continuous-distribution_lung_pc-summer-2022.pdf.

- o Displays when the candidate requires supplemental oxygen at rest, at night or with exercise
- o This field will become required for all lung candidates receiving supplemental oxygen at rest, at night or with exercise when lung continuous distribution is implemented

Additional information regarding implementation is posted on the lung continuous distribution policy toolkit: https://optn.transplant.hrsa.gov/professionals/by-organ/heart-lung/lung-continuous-distribution-policy/.

Affected Policy Language

New language is underlined (example) and language that is deleted is struck through (~~example~~).

1.2   Definitions

Composite allocation score (CAS)
The scoring system used to prioritize candidates on the match run. It ranges from 0-100 and is an aggregate of separate goal level scores.

~~Lung allocation score (LAS)~~
~~The scoring system used to measure illness severity in the allocation of lungs to candidates 12 years and older.~~

3.6.A   Waiting Time for Inactive Candidates

Candidates accrue waiting time while inactive according to *Table 3-3* below. Inactive candidates do not receive organ offers.

Table 3-3: Waiting Time for Inactive Candidates

If the candidate is registered for the following organ…	Then the candidate accrues waiting time while inactive as follows…
Heart	No time
Intestine	Up to 30 cumulative days
Kidney	Unlimited time
Kidney-pancreas	Unlimited time
Liver	No time
~~Lung and is at least 12 years old~~	~~No time~~
Lung ~~and is less than 12 years old~~	Unlimited time
Pancreas	Unlimited time
Pancreas islet	Unlimited time
Any covered VCA	Unlimited time
~~All other organs~~	~~Up to 30 days~~

5.10.E   Other Multi-Organ Combinations

When an OPO is offering a heart or lung, and a liver or kidney is also available from the same deceased donor, PTRs who meet the criteria in *Table 5-4* must be offered the second organ.

Table 5-4 Second Organ for Heart or Lung PTRs

~~If the OPO is offering the following organ:~~	~~And a PTR is also registered for one of the following organs:~~	~~The OPO must offer the second organ if the PTR is registered at a transplant hospital at or within 500 NM of the donor hospital and meets the following criteria:~~
~~Heart~~	~~Liver or Kidney~~	~~Heart Adult Status 1, 2, 3 or any active pediatric status~~
~~Lung~~	~~Liver or Kidney~~	~~Lung allocation score of greater than or equal to 35 or candidates less than 12 years old~~

If the OPO is offering the following organ:	And a PTR is also registered for one of the following organs:	The OPO must offer the second organ if the PTR meets *all* of the following criteria:
Heart	Liver or Kidney	• Registered at a transplant hospital at or within 500 NM of the donor hospital • Heart Adult Status 1, 2, 3 or any active pediatric status
Lung	Liver or Kidney	Has a Lung Composite Allocation Score of 25 or greater

When the OPO is offering a heart or lung and two PTRs meet the criteria in *Table 5-4*, the OPO has the discretion to offer the second organ to either PTR.

It is permissible for the OPO to offer the second organ to other multi-organ PTRs that do not meet the criteria above.

~~6.6.F   Allocation of Heart-Lungs~~

~~If a host OPO is offering a heart and a lung from the same deceased donor, then the host OPO must offer the heart and the lung according to *Policy 6.6.F.i: Allocation of Heart-Lungs from Deceased Donors at Least 18 Years Old* or *Policy 6.6.F.ii: Allocation of Heart-Lungs from Deceased Donors Less Than 18 Years Old.*~~

~~The blood type matching requirements described in *Policy 6.6.A: Allocation of Hearts by Blood Type* apply to heart-lung candidates when the candidates appear on the heart match run. The blood type matching requirements in *Policy 10.4.B: Allocation of Lungs by Blood Type* apply to heart-lung candidates when the candidates appear on the lung match run.~~

6.6.F.i Allocation of Heart-Lungs from Deceased Donors at Least 18 Years Old

~~If a heart or heart-lung potential transplant recipient (PTR) requires a lung, the OPO must offer the lungs from the same deceased donor to the heart or heart-lung PTR according to *Policy 6.6.D: Allocation of Hearts from Donors at Least 18 Years Old.*~~
~~If a lung or heart-lung PTR in allocation classifications 1 through 12 according to *Policy 10.4.C: Allocation of Lungs From Deceased Donors at Least 18 Years Old* requires a heart, the OPO cannot allocate the heart from the same deceased donor to the lung or heart-lung PTR until after the heart has been offered to all heart and heart-lung PTRs in allocation classifications 1 through 4 according to *Policy 6.6.D: Allocation of Hearts from Donors at Least 18 Years Old.*~~

If a host OPO is offering a heart and lung from the same deceased donor, then the host OPO must offer the heart and lung in the following order:
1. To all heart and heart-lung PTRs in allocation classifications 1 through 4 according to *Policy 6.6.D: Allocation of Hearts from Donors at Least 18 Years Old*
2. To all lung and heart-lung PTRs according to *Policy 10.1 Lung Composite Allocation Score* until offers have been made to all heart-lung PTRs with a lung composite allocation score of 25 or higher
3. To heart and heart-lung PTRs in classifications 5 or later according to Policy 6.6.D: Allocation of Hearts from Donors at Least 18 Years Old.

The host OPO must follow the order on each match run, including heart-lung, heart, and lung candidates.

6.6.F.ii Allocation of Heart-Lungs from Deceased Donors Less Than 18 Years Old

~~If a heart or heart-lung potential transplant recipient (PTR) requires a lung, the OPO must offer the lungs from the same deceased donor to the heart or heart-lung PTR according to *Policy 6.6.E: Allocation of Hearts from Donors Less Than 18 Years Old*.~~

~~If a lung or heart-lung PTR in allocation classifications 1 through 10 according to *Policy 10.4.D: Allocation of Lungs From Deceased Donors Less Than 18 Years Old* requires a heart, the OPO cannot allocate the heart from the same deceased donor to the lung or heart-lung PTR until after the heart has been offered to all heart and heart-lung PTRs in allocation classifications 1 through 12 according to *Policy 6.6.E: Allocation of Hearts from Donors Less Than 18 Years Old.*~~

If a host OPO is offering a heart and lung from the same deceased donor, then the host OPO must offer:
1. To all heart and heart-lung PTRs in allocation classifications 1 through 12 according to *Policy 6.6.E: Allocation of Hearts from Donors Less Than 18 Years Old*
2. To all lung and heart-lung PTRs according to *Policy 10.1 Lung Composite Allocation Score* until offers have been made to all heart-lung PTRs with a lung composite allocation score of 25 or higher
3. To heart and heart-lung PTRs in classifications 13 or later according to *Policy 6.6.E: Allocation of Hearts from Donors Less Than 18 Years Old*

The host OPO must follow the order on each match run, including heart-lung, heart, and lung candidates.

Policy 10: Allocation of Lungs

Repealed.

Policy 10: Allocation of Lungs

10.1 Lung Composite Allocation Score

The lung composite allocation score is the combined total of the candidate's lung medical urgency score, lung post-transplant outcomes score, lung biological disadvantages score, lung patient access score and lung placement efficiency score. The lung composite allocation score is awarded on a scale from 0 to 100.

Candidates will be rank-ordered by lung composite allocation score. If two or more candidates have the same lung composite allocation score, the tied candidates will be ranked by order of their registration date (oldest to newest).

10.1.A Prioritizing Medically Urgent Candidates

The lung medical urgency score is equal to the candidate's lung waitlist survival points.

10.1.A.1. Waitlist Survival Points for Candidates at least 12 Years Old

For candidates at least 12 years old at the time of the match run lung waitlist survival points are awarded based on the candidate's waiting list survival probability, based on the following factors:
- Age at the time of the match run (fractional calendar years)
- Bilirubin (mg/dL) value with the most recent test date and time
- Body mass index (BMI) (kg/m2)
- Assisted ventilation
- Creatinine (serum) (mg/dL) with the most recent test date and time
- Diagnosis Group (A, B, C, or D), as defined in Policy *10.1.F Lung Disease Diagnosis Groups*
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
    - Bronchiectasis
    - Sarcoidosis with pulmonary artery (PA) mean pressure of 30 mm Hg or less
    - Sarcoidosis with PA mean pressure missing
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
    - COVID-19: pulmonary fibrosis
    - Pulmonary fibrosis, other specify cause
    - Sarcoidosis with PA mean pressure greater than 30 mm Hg
- Functional Status

- Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) at rest (L/min)
- PCO2 (mm Hg): current
- PCO2 increase of at least 15%
- PA systolic pressure (mm Hg) at rest, prior to any exercise
- 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.

Lung waitlist survival points are awarded on a scale of 0-25. *Policy 21.1.A: Waiting List Survival Formulas* details the calculation of lung waitlist survival points.

10.1.A.2 Waitlist Survival Points for Candidates Less than 12 Years Old

Lung candidates assigned pediatric priority 1 receive 1.9073 waitlist survival points based on the candidate's waitlist survival probability.

Lung candidates assigned pediatric priority 2 receive 0.4406 waitlist survival points based on the candidate's waitlist survival probability.

10.1.A.2.a Candidates Less than 12 Years Old - Priority 1

A lung candidate less than 12 years old may be assigned priority 1 if at least *one* of the following requirements is met:

1. Candidate has respiratory failure, evidenced by at least *one* of the following:
   - Requires continuous mechanical ventilation
   - Requires supplemental oxygen delivered by any means to achieve FiO_2 greater than 50% in order to maintain oxygen saturation levels greater than 90%
   - Has an arterial or capillary PCO_2 greater than 50 mm Hg
   - Has a venous PCO_2 greater than 56 mm Hg

2. Candidate has pulmonary hypertension, evidenced by at least *one* of the following:
   - Has pulmonary vein stenosis involving 3 or more vessels
   - Exhibits *any* of the following, in spite of medical therapy:
     - Cardiac index less than 2 L/min/M^2
     - Syncope
     - Hemoptysis
     - Suprasystemic PA pressure on cardiac catheterization or by echocardiogram estimate

10.1.A.2.b Candidates Less than 12 Years Old - Priority 2

If a lung candidate less than 12 years old does not meet any of the above criteria to qualify for priority 1, then the candidate is assigned priority 2.

10.1.B Improving Post-Transplant Outcomes

Each lung candidate is assigned a lung post-transplant outcomes score. The lung post-transplant outcomes score is equal to the candidate's lung post-transplant outcomes points.

10.1.B.1 Post-Transplant Outcomes Points for Candidates at Least 12 Years Old

For candidates at least 12 years old at the time of the match run, lung post-transplant outcomes points are awarded based on the candidate's post-transplant survival probability, based on the following factors:

- Age at the time of the match run(fractional calendar years)
- Creatinine (serum) (mg/dL) with the most recent data and time
- Cardiac index (L/min/m2) at rest, prior to any exercise
- Assisted ventilation
- Diagnosis Group (A, B, C, or D), as defined in *10.1.F: Lung Disease Diagnosis Groups*
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
  - Bronchiectasis
  - Lymphangioleiomyomatosis
  - Sarcoidosis with PA mean pressure of 30 mm Hg or less
  - Sarcoidosis with PA mean pressure missing
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
  - COVID-19: pulmonary fibrosis
  - Obliterative bronchiolitis (non-retransplant)
  - Constrictive bronchiolitis
  - Sarcoidosis with PA mean pressure greater than 30 mm Hg
  - Pulmonary fibrosis, other specify cause
- Functional Status
- 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

Lung post-transplant outcomes points are awarded on a scale of 0-25. *Policy 21.1.B: Post-Transplant Outcomes Formulas* details the calculation of lung post-transplant outcomes points.

10.1.B.2 Post-Transplant Outcomes Points for Candidates Less than 12 years Old

Lung candidates who are less than 12 years old are assigned 18.6336 post-transplant outcomes points based on the candidate's post-transplant survival probability.

10.1.C Reducing Biological Disadvantages

Each lung candidate is assigned a lung biological disadvantages score. The lung biological disadvantages score is equal to the total of the candidate's lung blood type points, lung CPRA points, and lung height points.

10.1.C.1 Blood Type

Each lung candidate is assigned lung blood type points determined based on the proportion of donors the candidate could accept based on blood type compatibility, according to *Table 10-1: Points by Blood Type.* Candidates who are eligible to accept blood group incompatible donors according to *Policy 10.4.A Eligibility for Intended Blood Group Incompatible Offers for Deceased Donor Lungs* receive the same blood type points as other candidates in their blood group.

Table 10-1: Points by Blood Type

A candidate with a blood type of	Will receive this many lung blood type points
AB	0
A	.0455
B	.2439
O	.4550

10.1.C.2 CPRA

Each lung candidate is assigned lung CPRA points based on the proportion of donors the candidate could accept based on antigen acceptability. Lung CPRA points are awarded on a scale of 0-5. *Policy 21.1.C.1: Lung CPRA Points* details the calculation of lung CPRA points.

10.1.C.3 Height

Each lung candidate is assigned lung height points based on the proportion of donors the candidate could accept based on height compatibility. Lung height points are awarded on a scale of 0-5. *Policy 21.1.C.2: Lung Height Points* details the calculation of lung height points.

10.1.D Promoting Patient Access

The lung patient access score is equal to the total of the candidate's lung pediatric points and lung living donor points.

10.1.D.1 Pediatric Candidates

A candidate who was less than 18 years old at the time of registration on the lung waiting list will receive 20 lung pediatric points.

10.1.D.2 Prior Living Donors

A candidate who is a prior living organ donor will receive 5 lung living donor points.

A lung candidate will be classified as a prior living donor if the candidate donated for transplantation, within the United States or its territories, at least one organ and the candidate's physician reports all of the following information to the OPTN:

> a. The name of the recipient or intended recipient of the donated organ or organ segment
>
> b. The recipient's or intended recipient's transplant hospital
>
> c. The date the donated organ was procured

10.1.E Promoting the Efficient Management of the Organ Placement System

The lung placement efficiency score is the total of the candidate's lung travel efficiency and lung proximity efficiency points.

10.1.E.1 Travel Efficiency

A candidate's lung travel efficiency points are determined based on the straight-line distance between the donor hospital and the transplant hospital where the candidate is listed. Lung travel efficiency points are awarded on a scale of 0-5. Policy *21.1.D.1: Lung Travel Efficiency Points* details the calculation of lung travel efficiency points.

10.1.E.2 Proximity Efficiency

A candidate's lung proximity efficiency points are determined based on the straight-line distance between the donor hospital and the transplant hospitals where the candidate is listed. Lung proximity efficiency points are awarded on a scale of 0-5. *Policy 21.1.D.2: Lung Proximity Efficiency Points* details the calculation of lung travel efficiency points.

10.1.F   Lung Disease Diagnosis Groups

Each candidate is assigned a diagnosis group, based on their lung disease diagnosis, which is used in the calculation of their medical urgency score and their post-transplant survival score.

Group A
A candidate is in Group A if the candidate has *any* of the following diagnoses:

- Allergic bronchopulmonary aspergillosis
- Alpha-1 antitrypsin deficiency
- Bronchiectasis
- Bronchopulmonary dysplasia
- Chronic obstructive pulmonary disease/emphysema

- Ehlers-Danlos syndrome
- Granulomatous lung disease
- Inhalation burns/trauma
- Kartagener's syndrome
- Lymphangioleiomyomatosis
- Obstructive lung disease
- Primary ciliary dyskinesia;
- Sarcoidosis with either:
    - Pulmonary artery (PA) mean pressure of 30 mm Hg or less
    - PA mean pressure missing
- Tuberous sclerosis
- Wegener's granuloma – bronchiectasis

Group B
A candidate is in Group B if the candidate has *any* of the following diagnoses:

- Congenital malformation
- CREST – pulmonary hypertension
- Eisenmenger's syndrome: atrial septal defect (ASD)
- Eisenmenger's syndrome: multi-congenital anomalies
- Eisenmenger's syndrome: other specify
- Eisenmenger's syndrome: patent ductus arteriosus (PDA)
- Eisenmenger's syndrome: ventricular septal defect (VSD)
- Portopulmonary hypertension
- Pulmonary hypertension/pulmonary arterial hypertension
- Pulmonary capillary hemangiomatosis
- Pulmonary telangiectasia – pulmonary hypertension
- Pulmonary thromboembolic disease
- Pulmonary vascular disease
- Pulmonary veno-occlusive disease
- Pulmonic stenosis
- Right hypoplastic lung
- Scleroderma – pulmonary hypertension
- Secondary pulmonary hypertension
- Thromboembolic pulmonary hypertension

Group C
A candidate is in Group C if the candidate has *any* of the following diagnoses:

- Common variable immune deficiency
- Cystic fibrosis
- Fibrocavitary lung disease
- Hypogammaglobulinemia
- Schwachman-Diamond syndrome

Group D

A candidate is in Group D if the candidate has *any* of the following diagnoses:

- ABCA3 transporter mutation
- Alveolar proteinosis
- Amyloidosis
- Acute respiratory distress syndrome or pneumonia
- Bronchioloalveolar carcinoma (BAC)
- Carcinoid tumorlets
- Chronic pneumonitis of infancy
- Constrictive bronchiolitis
- COVID-19: acute respiratory distress syndrome
- COVID-19: pulmonary fibrosis
- CREST – Restrictive
- Eosinophilic granuloma
- Fibrosing Mediastinitis
- Graft versus host disease (GVHD)
- Hermansky Pudlak syndrome
- Hypersensitivity pneumonitis
- Idiopathic interstitial pneumonia, with at least one of the following disease entities:
  - Acute interstitial pneumonia
  - Cryptogenic organizing pneumonia/Bronchiolitis obliterans with organizing pneumonia (BOOP)
  - Desquamative interstitial pneumonia
  - Idiopathic pulmonary fibrosis (IPF)
  - Nonspecific interstitial pneumonia
  - Lymphocytic interstitial pneumonia (LIP)
  - Respiratory bronchiolitis-associated interstitial lung disease
- Idiopathic pulmonary hemosiderosis
- Lung retransplant or graft failure: acute rejection
- Lung retransplant or graft failure: non-specific
- Lung retransplant or graft failure: obliterative bronchiolitis-obstructive
- Lung retransplant or graft failure: obliterative bronchiolitis-restrictive
- Lung retransplant or graft failure: obstructive
- Lung retransplant or graft failure: other specify
- Lung retransplant or graft failure: primary graft failure
- Lung retransplant or graft failure: restrictive
- Lupus
- Mixed connective tissue disease
- Obliterative bronchiolitis: non-retransplant
- Occupational lung disease: other specify
- Paraneoplastic pemphigus associated Castleman's disease
- Polymyositis
- Pulmonary fibrosis: other specify cause
- Pulmonary hyalinizing granuloma

- Pulmonary lymphangiectasia (PL)
- Pulmonary telangiectasia – restrictive
- Rheumatoid disease
- Sarcoidosis with PA mean pressure greater than 30 mm Hg
- Scleroderma – restrictive
- Silicosis
- Sjogren's syndrome
- Surfactant protein B deficiency
- Surfactant protein C deficiency
- Teratoma
- Wegener's granuloma – restrictive

10.2 Lung Composite Score Exceptions

If a candidate's current lung composite allocation score does not appropriately prioritize the candidate for transplant, the candidate's transplant program may submit an exception request to the Lung Review Board. A candidate's lung composite allocation score cannot exceed 100, inclusive of score exceptions.

10.2.A Lung Review Board Composition

For lung exceptions, there is a Lung Review Board.

The Lung Review Board reviews lung medical urgency score, lung post-transplant outcomes score, lung biological disadvantages score, and lung patient access score exceptions.

The Lung Transplantation Committee will develop and approve operational guidelines that detail the administrative details of the Lung Review Board operations. The Lung Transplantation Committee may develop clinical guidance documents for specific clinical scenarios. These guidelines may include appropriate documentation for the Lung Review Board to consider, appropriate clinical values, and suggested (but not automatically accepted) exception requests.

10.2.B Exception Requests

An exception request must include all of the following:
1. Indication of the applicable goal in the composite allocation score
2. A request for a specific score
3. A justification of how the medical criteria supports the higher score for the candidate
4. An explanation of how the candidate's current condition is comparable to that of other candidates with the requested score

Approved exception scores are valid until the candidate is transplanted, is removed from the lung waiting list, or withdraws the exception.

10.2.C Review of Exceptions

The Lung Review Board must review exception requests within five days of the date the request is submitted to the Lung Review Board.

10.2.D Appeals to Lung Review Board

If the Lung Review Board denies an exception request, the candidate's transplant program may appeal to the Lung Review Board within seven days of receiving the denial. The Lung Review Board must review appeals within five days of the date the appeal is submitted to the Lung Review Board.

10.2.E Appeals to Lung Transplantation Committee

If the Lung Review Board denies an exception request on appeal, the candidate's transplant program may appeal to the Lung Transplantation Committee within seven days of receiving the denial. The Lung Transplantation Committee must review the appeal no later than fourteen days following the request to the Committee.

10.3 Clinical Values and Update Schedule

Transplant programs must report to the OPTN clinical data corresponding with the factors outlined in *Policy 10.1.A.1: Waitlist Survival Points for Candidates at least 12 Years Old* and *10.1.B.1: Post-Transplant Outcomes Points for Candidates at Least 12 Years Old.* 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, with the exception of the following values:

- Cardiac index (L/min/m2) at rest, prior to any exercise
- PA mean pressure
- Pulmonary artery (PA) systolic pressure (mm Hg) at rest, prior to any exercise

The transplant program must maintain source documentation for all clinical values reported in the candidate's medical chart.

10.3.A Lung Clinical Values That Must Be Updated Every 28 Days

When a transplant program reports that a candidate on the lung waiting list is on continuous mechanical ventilation or ECMO, or requires supplemental oxygen provided via a high flow nasal cannula, the program must report the following values, assessed within the 28 days preceding the report:
- Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) (L/min)
- Assisted ventilation status

The transplant program must continue to assess and report the amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) and assisted ventilation status every 28 days following the most recent assessment while the candidate remains on continuous mechanical ventilation or ECMO, or continues to require supplemental oxygen provided via a high flow nasal cannula.

10.3.B Lung Clinical Values That Must Be Updated Every Six Months

Transplant hospitals must update *all* of the following clinical values at least once in every six month period following registration for each candidate on the lung waiting list:

- Bilirubin (mg/dL) value with the most recent test date and time
- Weight to determine body mass index (BMI) (kg/m2)
- Creatinine (serum) (mg/dL) value with the most recent test date and time
- Functional Status
- Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) (L/min)
- PCO_2 (mm Hg)
- 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.
- Assisted ventilation status

The transplant program must maintain source documentation for all clinical values reported in the candidate's medical chart.

Candidates who are less than 12 years old and are assigned priority 1 based on evidence of respiratory failure in accordance with *Policy 10.1.A.2.a Candidates Less than 12 Years Old - Priority 1* will be assigned to priority 2 if the clinical values that qualify the candidates for priority 1 are more than six months old on the six-month anniversary of the candidate's listing date.

10.3.C Lung Clinical Values That Must Be Updated When Performed

Transplant hospitals must report updated values for the following clinical values if they were obtained within any six month period following registration for each candidate at an active or inactive status.

- Cardiac index (L/min/m2) at rest, prior to any exercise
- PA mean pressure, if candidate's diagnosis is Sarcoidosis
- Pulmonary artery (PA) systolic pressure (mm Hg) at rest, prior to any exercise

The transplant program must maintain source documentation for all clinical values reported in the candidate's medical chart.

10.4 Eligibility Criteria

10.4.A   Eligibility for Intended Blood Group Incompatible Offers for Deceased Donor Lungs

Incompatible blood types are defined in *Table 10-2: Incompatible Blood Groups for Deceased Donor Lungs*.

**Table 10-2: Incompatible Offers Blood Groups for
Deceased Donor Lungs**

Deceased Donor's Blood Type	Candidate's Blood Type
A	O and B
B	O and A
AB	O, A, and B

Candidates with incompatible blood types will be screened from lung match runs unless the candidate meets the criteria for eligibility in *Table 10-3: Eligibility for Intended Blood Group Incompatible Offers for Deceased Donor Lungs* below.

**Table 10-3: Eligibility for Intended Blood Group Incompatible Offers for
Deceased Donor Lungs**

If the candidate is:	And meets *all* of the following:
Less than one year old at the time of the match run	1. Has a waiting list survival score of at least 1.9073 2. Has reported isohemagglutinin titer information for A or B blood type antigens to the OPTN within the last 30 days
At least one year old at the time of the match run	1. Is registered prior to turning two years old 2. Has a waiting list survival score of at least 1.9073 3. Has reported to the OPTN isohemagglutinin titers less than or equal to 1:16 for A or B blood type antigens from a blood sample collected within the last 30 days. The candidate must not have received treatments that may have reduced isohemagglutinin titers to 1:16 or less within 30 days of when this blood sample was collected

10.4.B   Isohemagglutinin Titer Reporting Requirements for a Candidate Willing to Receive an Intended Blood Group Incompatible Lung

If a laboratory provides more than one isohemagglutinin titer value for a tested blood sample, the transplant program must report the highest titer value to the OPTN.

Accurate isohemagglutinin titers must be reported for candidates eligible for an intended blood type incompatible lung, according to Table 10-4 below, at all of the following times:

1. Upon initially reporting that a candidate is willing to accept an intended blood type incompatible lung.
2. Every 30 days after initially reporting that a candidate is willing to accept an intended blood type incompatible lung.

Table 10-4: Isohemagglutinin Titer Reporting Requirements for a Candidate Willing to Receive an Intended Blood Type Incompatible Lung

If the candidate's blood type is:	Then the transplant program must report the following isohemagglutinin titers to the OPTN:
A	Anti-B
B	Anti-A
O	Anti-A and Anti-B

Accurate isohemagglutinin titers must be reported for recipients of an intended blood type incompatible lung, according to *Table 10-5*, as follows:

1. At transplant, from a blood sample taken within 24 hours prior to transplant.
2. If graft loss occurs within one year after transplant from the most recent sample, if available.
3. If recipient death occurs within one year after transplant from the most recent blood sample, if available.

Table 10-5: Isohemagglutinin Titer Reporting Requirements for a Recipient of an Intended Blood Type Incompatible Lung

If the deceased donor's blood type is:	And the recipient's blood type is:	Then the transplant program must report the following isohemagglutinin titers to the OPTN:
A	B or O	Anti-A
B	A or O	Anti-B
AB	A	Anti-B
AB	B	Anti-A
AB	O	Anti-A and Anti-B

Policy 21: Composite Allocation Score Reference

21.1 Formulas

21.1.A Waiting List Survival Formulas

21.1.A.1 Lung Waitlist Area Under the Curve (WLAUC)

The area under the lung waiting list survival probably curve within one year (WLAUC) is calculated using the formula

$$WL_i = \sum_{k=1}^{365} S_{WL,i}(k-1)$$

The calculation for $S_{WL,i}$ is in *Policy 21.1.A.2 Expected Lung Waiting List Survival Probability Within One Year*.

21.1.A.2 Expected Lung Waiting List Survival Probability Within One Year

The formula used to calculate expected lung waiting list survival probability within one year is

$$S_{WL,i}(t) = S_{WL,0}(t)e^{\beta_1 X_{1i} + \beta_2 X_{2i} + \dots + \beta_p X_{pi}}$$

Table 21-1: Expected Lung Waiting List Survival Probability Within One Year Variables lists what each variable in the formula represents.

Table 21-1 Expected Lung Waiting List Survival Probability Within One Year Variables

The variable	Represents
$S_{WL,i}(t)$	the expected waiting list survival probability at time t for candidate i
$S_{WL,0}(t)$	the baseline waiting list survival probability at time t
$\beta_1, \beta_2, \dots \beta_p$	the parameter estimates from the waiting list model (Table 21-5)
X_{ji}	the value of characteristic j for candidate i
i	1, 2, …, N is the candidate identifier

21.1.A.3 Converting Lung WLAUC to Lung Waiting List Survival Points

Waiting list Survival Points are equal to

$$((25^{(1-WLAUC/365)} - 1)/24)*25$$

21.1.B Post-Transplant Outcomes Formulas

21.1.B.1 Expected Lung Five years Post-Transplant Area Under the Curve (PTAUC)

The area under the post-transplant survival probably curve during the first five years post-transplant (PTAUC) is calculated using the formula

$$PT_i = \sum_{k=1}^{1826} S_{TX,i}(k)$$

21.1.B.2 Expected Lung Post-Transplant Survival Probability Within Five Years

The formula used to calculate expected lung post-transplant survival probability within five years is

$$S_{TX,i}(t) = S_{TX,0}(t)e^{\alpha_1 Y_1 + \alpha_2 Y_2 + \dots + \alpha_q Y_q}$$

Table 21-2: Expected Lung Post-Transplant Survival Probability Within Five Years Variables lists what each variable in the formula represents.

Table 21-2 Expected Lung Post-Transplant Survival Probability Within Five Years Variables

The variable	Represents
$S_{TX,i}(t)$	expected post-transplant survival probability at time t for candidate i
$S_{TX,0}(t)$	the baseline post-transplant survival probability at time t
$\alpha_1, \alpha_2, \dots \alpha_q$	the parameter estimates from the post-transplant model (Table 21-8)
Y_{ji}	the value of characteristic j for candidate i
i	1, 2, …, N is the candidate identifier

21.1.B.3 Converting Lung PTAUC to Lung Post-Transplant Outcomes Points

Post-Transplant Outcomes Points are equal to

(PTAUC/1826)*25

21.1.C Biological Disadvantages Formulas

21.1.C.1 Lung CPRA Points

The Lung CPRA points are equal to

$((100^{CPRA}-1)/99)*5$

The variable CPRA represents the probability of incompatibility based on the candidate's CPRA.

21.1.C.2 Lung Height Points

The Lung Height points are equal to

$$((100^{HTIN}-1)/99)*5$$

The variable HTIN represents the probability of incompatibility based on the candidate's height found in *Policy 21.2.C.1: Probability of Incompatible Lung Donors Based on Height*.

21.1.D Efficient Management Formulas

21.1.D.1 Lung Travel Efficiency Points

The Lung travel efficiency points are equal to

$$(1 - [6.3*NM + 247.63 * (NM - 43.44) * I\{NM > 43.44\} - 104.44 * (NM - 67.17) * I\{NM > 67.17\} - 128.34 * (NM - 86.9) * I\{NM > 86.9\}] / 116989.1)*5$$

The variable NM represents straight-line distance between donor hospital and candidate hospital in nautical miles.

21.1.D.2 Lung Proximity Efficiency Points

The Lung proximity efficiency points are equal to

$$(I\{NM \leq 45\} + I\{NM \in (45,90)\}*(1 - 0.15 / 45 * (NM - 45)) + I\{NM \geq 90\}*0.875 / [1 + exp(0.0025 * (NM - 1500))])*5$$

The variable NM represents straight-line distance between donor hospital and candidate hospital in nautical miles.

21.2 Reference Values

21.2.A Values Used in the Calculation of Lung Waiting List Survival

Table 21-3 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.

Table 21-3: Waiting List Survival Calculation: Covariates and their Coefficients

For this covariate:	When	The following coefficient is used in the lung waiting list survival calculation:
Age at the time of the match run (fractional calendar year)	All candidates	0.0281444188123287*age

For this covariate:	When	The following coefficient is used in the lung waiting list survival calculation:
Bilirubin (mg/dL) value with the most recent test date and time	Bilirubin is more than 1.0 mg/dL	$0.15572123729572*(bilirubin - 1)$
	1.0 mg/dL or less	0
Body mass index (BMI) (kg/m^2)	BMI less than 20 kg/m^2	$0.10744133677215*(20 - BMI)$
	BMI is at least 20 kg/m^2	0
Assisted ventilation	ECMO or continuous mechanical-hospitalized	1.57618530736936
	Not ECMO or continuous mechanical-hospitalized	0
Creatinine (serum) (mg/dL) with the most recent test date and time	Candidate is at least 18 years old	$0.0996197163645* creatinine$
	Candidate is less than 18 years old	0
Diagnosis Group	A	0
Diagnosis Group	B	1.26319338239175
Diagnosis Group	C	1.78024171092307
Diagnosis Group	D	1.51440083414275
Detailed diagnosis within group A	Bronchiectasis	0.40107198445555
	Sarcoidosis with PA mean pressure of 30 mm Hg or less	1.39885489102977
	Sarcoidosis with PA mean pressure missing	1.39885489102977
Detailed Diagnosis within group D	COVID-19: pulmonary fibrosis	0.2088684500011

For this covariate:	When	The following coefficient is used in the lung waiting list survival calculation:
	Pulmonary fibrosis, other	0.2088684500011
	Sarcoidosis with PA mean pressure greater than 30 mm Hg	-0.64590852776042
Functional Status	No assistance needed with activities of daily living	-0.59790409246653
	Some or total assistance needed with activities of daily living	0
Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) (L/min)	At rest, Diagnosis Group B	$0.0340531822566417*O_2$
	At rest, Diagnosis Groups A, C, and D	$0.08232292818591*O_2$
	Not needed at rest	0
PCO_2 (mm Hg): current	PCO_2 is at least 40 mm Hg	$0.12639905519026*PCO_2/10$
PCO_2 threshold change	PCO_2 increase is at least 15%	0.15556911866376
	PCO_2 increase is less than 15%	0
Pulmonary artery (PA) systolic pressure (mm Hg) at rest, prior to any exercise	Diagnosis Group A and the PA systolic pressure is greater than 40 mm Hg	$0.55767046368853*(PA\ systolic - 40)/10$

For this covariate:	When	The following coefficient is used in the lung waiting list survival calculation:
	Diagnosis Group A and the PA systolic pressure is 40 mm Hg or less	0
	Diagnosis Groups B, C, and D	0.1230478043299*PA systolic/10
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.	-0.09937981549564*Six-minute-walk distance/100

If values for certain covariates are missing, expired, or below the threshold as defined by *Table 21-4*, then the composite allocation score calculation will substitute normal or least beneficial values to calculate the candidate's waiting list survival score. *Table 21-4* lists the normal and least beneficial values that will be substituted.

Table 21-4: Values Substituted for Missing or Expired Actual Values in Calculating Waiting List Survival Score

If this covariate's value:	Is:	Then the waiting list survival calculation will use this substituted value:
Bilirubin	Missing, expired, or less than 0.7 mg/dL	0.7 mg/dL
Height or weight to determine body mass index (BMI)	Missing	100 kg/m^2
Weight to determine BMI	Expired	100 kg/m^2
Assisted ventilation	Missing or expired	No mechanical ventilation
Creatinine (serum) (mg/dL)	Missing or expired	0.1 mg/dL
Functional status	Missing or expired	No assistance needed

If this covariate's value:	Is:	Then the waiting list survival calculation will use this substituted value:
Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or greater) (L/min)	Missing or expired	No supplemental oxygen needed at rest
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

21.2.A.1   PCO2 Threshold Change in the Waiting List Survival Calculation

The CAS calculation uses two measures of PCO_2:

1. Current PCO_2
2. PCO_2 Threshold Change

Current PCO_2
Current PCO_2 is the PCO_2 value reported to the OPTN with the most recent test date and time. A program may report a PCO_2 value from an arterial, venous, or capillary blood gas test. All blood gas values will be converted to an arterial value as follows:

- A capillary value will equal an arterial value.
- A venous value minus 6 mmHg equals an arterial value.

PCO_2 Threshold Change
There are two PCO_2 threshold change calculations:

- The PCO_2 Threshold Change Calculation
- The Threshold Change Maintenance Calculation

The PCO_2 Threshold Change Calculation
An increase in PCO_2 that is at least 15% will impact a candidate's CAS. If a value is less than 40 mmHg, the system will substitute the normal clinical value of 40 mmHg before calculating change. The PCO_2 threshold change calculation uses the highest and lowest values of PCO_2 as follows:

- The test date and time of the lowest value reported to the OPTN used in the PCO_2 threshold change calculation must be earlier than the test date and time of the highest value used in the PCO_2 threshold change calculation.
- Test dates of these highest and lowest values cannot be more than six months apart.

- The PCO_2 threshold change calculation can use an expired lowest value, but cannot use an expired highest value.

If a current PCO_2 value expires according *to Policy 10.3 Clinical Update Schedule,* the candidate's CAS will lose the impact from the PCO_2 threshold change calculation. The equation for the PCO_2 threshold change calculation is:

$$\frac{\text{Highest } PCO_2 - \text{Lowest } PCO_2}{\text{Lowest } PCO_2}$$

The Threshold Change Maintenance Calculation

When a 15% or greater PCO_2 threshold change calculation impacts a candidate's CAS, the CAS threshold change maintenance calculation assesses whether to maintain that impact. To maintain the impact of the PCO_2 increase, the candidate's current PCO_2 value must be at least 15% higher than the lowest value used in the PCO_2 threshold change calculation. The equation for this threshold change maintenance calculation is:

$$\frac{\text{Current } PCO_2 - \text{Lowest } PCO_2}{\text{Lowest } PCO_2}$$

The threshold change maintenance calculation occurs either when the current PCO_2 value expires, according to *Policy 10.3 Clinical Update Schedule,* or a new current PCO_2 value is entered. For this calculation, the lowest and highest values that were used in the PCO_2 threshold change calculation can be expired. The current PCO_2 value can be the highest one that was used in the PCO_2 threshold change calculation. If a current PCO_2 value expires, the candidate's CAS will no longer be affected by the PCO_2 threshold change.

If a transplant hospital reports a new current PCO_2 value for a candidate who has lost the impact from the PCO_2 threshold change calculation, the CAS will perform the threshold change maintenance calculation. If the new current PCO_2 value is at least 15% higher than the lowest value used in the PCO_2 threshold change calculation, the candidate's CAS will again be affected by the PCO_2 threshold change calculation.

Normal PCO_2 Value

The normal clinical PCO_2 value is 40mmHg. If a current PCO_2 value is below 40 mmHg, or if the current PCO_2 value is missing or expired, the CAS calculation will use the normal clinical PCO_2 value.

21.2.A.2   Probabilities Used in Calculating Lung Waiting List Survival

Table 21-5: Baseline Waiting List Survival (SWL(t)) Probability Where t=Time in Days

T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$
0	1.000000	1	0.999998	2	0.999983	3	0.999956

T	S_{TX}(t)	T	S_{TX}(t)	T	S_{TX}(t)	T	S_{TX}(t)
4	0.999928	46	0.999002	88	0.998244	130	0.997610
5	0.999902	47	0.998978	89	0.998244	131	0.997599
6	0.999878	48	0.998967	90	0.998226	132	0.997584
7	0.999856	49	0.998949	91	0.998179	133	0.997577
8	0.999814	50	0.998922	92	0.998179	134	0.997570
9	0.999786	51	0.998886	93	0.998171	135	0.997570
10	0.999770	52	0.998852	94	0.998144	136	0.997561
11	0.999740	53	0.998843	95	0.998131	137	0.997552
12	0.999705	54	0.998843	96	0.998115	138	0.997540
13	0.999682	55	0.998821	97	0.998115	139	0.997540
14	0.999650	56	0.998815	98	0.998076	140	0.997540
15	0.999635	57	0.998772	99	0.998046	141	0.997540
16	0.999629	58	0.998734	100	0.998046	142	0.997540
17	0.999615	59	0.998725	101	0.998036	143	0.997534
18	0.999597	60	0.998703	102	0.998036	144	0.997534
19	0.999565	61	0.998703	103	0.998026	145	0.997534
20	0.999527	62	0.998665	104	0.997991	146	0.997530
21	0.999508	63	0.998665	105	0.997980	147	0.997515
22	0.999493	64	0.998660	106	0.997980	148	0.997504
23	0.999460	65	0.998630	107	0.997976	149	0.997499
24	0.999430	66	0.998617	108	0.997965	150	0.997492
25	0.999406	67	0.998575	109	0.997944	151	0.997477
26	0.999382	68	0.998570	110	0.997877	152	0.997477
27	0.999361	69	0.998567	111	0.997872	153	0.997455
28	0.999335	70	0.998556	112	0.997828	154	0.997410
29	0.999302	71	0.998510	113	0.997824	155	0.997335
30	0.999294	72	0.998494	114	0.997824	156	0.997335
31	0.999272	73	0.998490	115	0.997824	157	0.997327
32	0.999262	74	0.998431	116	0.997824	158	0.997321
33	0.999243	75	0.998413	117	0.997824	159	0.997315
34	0.999201	76	0.998403	118	0.997824	160	0.997294
35	0.999178	77	0.998391	119	0.997783	161	0.997294
36	0.999155	78	0.998391	120	0.997777	162	0.997294
37	0.999130	79	0.998379	121	0.997767	163	0.997273
38	0.999128	80	0.998370	122	0.997761	164	0.997273
39	0.999103	81	0.998363	123	0.997734	165	0.997273
40	0.999080	82	0.998347	124	0.997656	166	0.997269
41	0.999060	83	0.998314	125	0.997656	167	0.997223
42	0.999048	84	0.998306	126	0.997650	168	0.997223
43	0.999048	85	0.998295	127	0.997637	169	0.997218
44	0.999036	86	0.998257	128	0.997610	170	0.997209
45	0.999036	87	0.998244	129	0.997610	171	0.997209

T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$
172	0.997209	214	0.996621	256	0.995938	298	0.995439
173	0.997209	215	0.996621	257	0.995938	299	0.995439
174	0.997209	216	0.996614	258	0.995927	300	0.995414
175	0.997183	217	0.996602	259	0.995927	301	0.995414
176	0.997169	218	0.996579	260	0.995923	302	0.995385
177	0.997169	219	0.996579	261	0.995923	303	0.995358
178	0.997169	220	0.996574	262	0.995923	304	0.995345
179	0.997169	221	0.996524	263	0.995923	305	0.995345
180	0.997160	222	0.996511	264	0.995923	306	0.995345
181	0.997160	223	0.996439	265	0.995923	307	0.995309
182	0.997132	224	0.996439	266	0.995895	308	0.995296
183	0.997113	225	0.996423	267	0.995794	309	0.995296
184	0.997113	226	0.996423	268	0.995794	310	0.995274
185	0.997109	227	0.996412	269	0.995778	311	0.995274
186	0.997099	228	0.996388	270	0.995778	312	0.995251
187	0.997099	229	0.996388	271	0.995778	313	0.995251
188	0.997099	230	0.996368	272	0.995778	314	0.995251
189	0.997099	231	0.996368	273	0.995778	315	0.995228
190	0.997099	232	0.996368	274	0.995770	316	0.995228
191	0.997099	233	0.996368	275	0.995764	317	0.995228
192	0.997099	234	0.996368	276	0.995741	318	0.995167
193	0.997099	235	0.996368	277	0.995726	319	0.995131
194	0.997091	236	0.996368	278	0.995726	320	0.995131
195	0.997067	237	0.996368	279	0.995726	321	0.995131
196	0.996968	238	0.996368	280	0.995726	322	0.995131
197	0.996968	239	0.996368	281	0.995691	323	0.995131
198	0.996968	240	0.996368	282	0.995691	324	0.995080
199	0.996959	241	0.996258	283	0.995691	325	0.995080
200	0.996959	242	0.996258	284	0.995691	326	0.995080
201	0.996945	243	0.996195	285	0.995680	327	0.995080
202	0.996861	244	0.996195	286	0.995680	328	0.995080
203	0.996838	245	0.996195	287	0.995680	329	0.995080
204	0.996838	246	0.996096	288	0.995661	330	0.995080
205	0.996825	247	0.996044	289	0.995661	331	0.995080
206	0.996819	248	0.996025	290	0.995639	332	0.995067
207	0.996819	249	0.995988	291	0.995639	333	0.994986
208	0.996819	250	0.995974	292	0.995548	334	0.994951
209	0.996819	251	0.995974	293	0.995548	335	0.994951
210	0.996810	252	0.995955	294	0.995505	336	0.994951
211	0.996796	253	0.995955	295	0.995498	337	0.994937
212	0.996717	254	0.995938	296	0.995479	338	0.994937
213	0.996636	255	0.995938	297	0.995464	339	0.994937

T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$	T	$S_{TX}(t)$
340	0.994937	347	0.994738	354	0.994585	361	0.994477
341	0.994937	348	0.994695	355	0.994585	362	0.994477
342	0.994937	349	0.994685	356	0.994572	363	0.994477
343	0.994937	350	0.994685	357	0.994527	364	0.994390
344	0.994842	351	0.994685	358	0.994527		
345	0.994842	352	0.994685	359	0.994527		
346	0.994842	353	0.994685	360	0.994477		

21.2.B   Values Used in the Calculation of Post-Transplant Outcomes

21.2.B.1   Coefficients Used in Calculating Lung Post-Transplant Outcomes

Table 21-6: Post-Transplant Outcomes Calculation: Covariates and Their Coefficients lists the covariates and corresponding coefficients in the waiting list and post-transplant survival measures. See *Policy 10.1.F: Lung Disease Diagnosis Groups* for specific information on each diagnosis group.

Table 21-6: Post-Transplant Outcomes Calculation: Covariates and Their Coefficients

For this covariate	When	The following coefficient is used in the lung post-transplant outcomes score calculation
Age at the time of the match run (fractional calendar year)	age is less than 20	0.0676308559079852 x (20 - age) + 0.78241832
	age is at least 20 and less than 30,	-0.0782418319259552 x (age - 20) + 0.78241832
	age is at least 30 and less than 40	0
	age is at least 40 and less than 50	0.0025908121347866 x (age - 40)
	age is at least 50 and less than 60	0.0167463361760962 x (age - 50) + 0.02590812
	age is at least 60 and less than 70	0.0227144625797883 x (age - 60) + 0.19337148
	age is at least 70	0.0612288624399672 x (age - 70) + 0.42051611
Creatinine (serum) (mg/dL) with the most recent test date and time	creatinine is less than 0.4 and candidate is at least 18 years old	-7.4016726145812200 x (0.4 - creatinine) + 0.41872820
	creatinine is at least 0.4 and less than 0.6 and candidate is at least 18 years old	-1.2584103289549000 x (creatinine - 0.4) + 0.41872820

30

For this covariate	When	The following coefficient is used in the lung post-transplant outcomes score calculation
	creatinine is at least 0.6 and less than 0.8 and candidate is at least 18 years old	$0.3712348866558860 \times$ (creatinine - 0.6) + 0.16704614
	creatinine is at least 0.8 and less than 1.4 and candidate is at least 18 years old	$0.6844301806854400 \times$ (creatinine - 0.8) + 0.24129311
	creatinine is at least 1.4 and candidate is at least 18 years old	$0.6881894154264970 \times$ (creatinine - 1.4) + 0.65195122
	Candidate is less than 18 years old	0
Cardiac index (L/min/m^2) at rest, prior to any exercise	Less than 2 L/min/m^2	$-0.4837491139906200 \times (2$ − cardiac index) + 0.04030226
	At least 2 and less than 2.5 L/min/m^2	$-0.0806045255202868 \times$ (cardiac index - 2) + 0.04030226
	At least 2.5 and less than 3.5 L/min/m^2	$0.0136169358319050 \times$ (cardiac index - 2.5)
	At least 3.5 and less than 4.5 L/min/m^2	$0.0808432592591954 \times$ (cardiac index - 3.5) + 0.01361694
	At least 4.5 and less than 5 L/min/m^2	$0.0696938839239190 \times$ (cardiac index - 4.5) + 0.09446020
	At least 5 L/min/m^2	$-0.0023264599609358 \times$ (cardiac index - 5) + 0.12930714
Assisted ventilation	ECMO or continuous mechanical-hospitalized	0.267537018672253
	not ECMO or continuous mechanical-hospitalized	0
Diagnosis Group	A	-0.098901796
	B	0
	C	-0.167126401
	D	0
Detailed diagnosis within Group A	Bronchiectasis	-0.026706663
	Lymphangioleiomyomatosis	-0.271420386
	Sarcoidosis with PA mean pressure of 30 mm Hg or less	0.501743373724746

For this covariate	When	The following coefficient is used in the lung post-transplant outcomes score calculation
	Sarcoidosis with PA mean pressure missing	0.501743373724746
Detailed diagnosis within Group D	COVID-19: pulmonary fibrosis	0.046504644
	Obliterative bronchiolitis (non-retransplant)	-0.132634978
	Constrictive bronchiolitis	-0.132634978
	Sarcoidosis with PA mean pressure greater than 30 mm Hg	0.0561853179859775
	Pulmonary fibrosis, other	0.046504644
Functional Status	No assistance needed with activities of daily living	-0.005304128
	Some assistance needed with activities of daily living	0
	Total assistance needed with activities of daily living	0.074378407
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.	Less than 200 feet	-0.0002535116049789 x (200 - Six-minute-walk distance) + 0.11168755
	At least 200 feet and less than 600 feet	-0.0002841805913329 x (Six-minute-walk distance - 200) + 0.11168755
	At least 600 feet and less than 800 feet	-0.0000049617083362 x (Six-minute-walk distance - 600) - 0.00198468
	At least 800 feet and less than 1,200 feet	-0.0001950464256370 x (Six-minute-walk distance - 800) - 0.00297703
	At least 1,200 feet and less than 1,600 feet	-0.0007428583659073 x (Six-minute-walk distance - 1200) - 0.08099560
	At least 1,600 feet	0.0035374143842919 x (Six-minute-walk distance - 1600) - 0.37813894

9

10   If values for certain covariates are missing, expired, or below the threshold as defined by *Table*
11   *10-4*, then the composite allocation score calculation will substitute normal or least beneficial
12   values to calculate the candidate's post-transplant outcomes score. *Table 21-7: Values*
13   *Substituted for Missing or Expired Actual Values in Calculating Post-Transplant Outcomes*
14   *Score* lists the normal and least beneficial values that will be substituted.

15

16   **Table 21-7: Values Substituted for Missing or Expired Actual Values in Calculating Post-Transplant Outcomes**
17   **Score**

If this covariate's value:	Is:	Then the post-transplant outcomes score calculation will use this substituted value:
Cardiac index	Missing, or greater than 5	5.0 L/min/m^2
Assisted ventilation	Missing or expired	Continuous mechanical ventilation while hospitalized
Creatinine (serum) (mg/dL)	Missing, expired or greater than 1.6	1.6 mg/dL
Functional status	Missing or expired	Total assistance needed
Six-minute-walk distance	Missing or expired	200 feet
	Greater than 1,600	1,600 feet

18

19   ### 21.2.B.2   Probabilities Used in Calculating Lung Post-Transplant Survival

20   **Table 21-8: Baseline Post-Transplant Survival ($S_{TX}(t)$) Probability Where t=Time in Days**

21

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
0	1	16	0.989747	32	0.984048	48	0.979687
1	0.999154	17	0.989294	33	0.983592	49	0.979484
2	0.998058	18	0.988942	34	0.98344	50	0.979484
3	0.997111	19	0.98864	35	0.983238	51	0.979179
4	0.996312	20	0.988287	36	0.982731	52	0.978772
5	0.995562	21	0.988086	37	0.982478	53	0.978772
6	0.995162	22	0.987633	38	0.982225	54	0.978467
7	0.994562	23	0.98738	39	0.981616	55	0.978162
8	0.994011	24	0.986977	40	0.981363	56	0.977857
9	0.99336	25	0.986574	41	0.981007	57	0.977653
10	0.992859	26	0.986473	42	0.980957	58	0.977347
11	0.992107	27	0.986069	43	0.980652	59	0.977195
12	0.991806	28	0.985917	44	0.980297	60	0.977042
13	0.991154	29	0.985463	45	0.980144	61	0.976634
14	0.990802	30	0.984907	46	0.980043	62	0.976431
15	0.99025	31	0.984705	47	0.97989	63	0.976125

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
64	0.976074	105	0.970398	146	0.96479	187	0.958994
65	0.975921	106	0.970346	147	0.964481	188	0.958943
66	0.975717	107	0.970193	148	0.964377	189	0.958839
67	0.975666	108	0.969987	149	0.964223	190	0.958579
68	0.975513	109	0.969885	150	0.964068	191	0.958475
69	0.975411	110	0.969731	151	0.963913	192	0.958164
70	0.975156	111	0.969474	152	0.963913	193	0.958008
71	0.974748	112	0.969423	153	0.963655	194	0.957852
72	0.974645	113	0.969269	154	0.963345	195	0.9578
73	0.974441	114	0.969115	155	0.963241	196	0.9578
74	0.974339	115	0.968755	156	0.963138	197	0.957644
75	0.974339	116	0.968652	157	0.963035	198	0.957384
76	0.974339	117	0.968395	158	0.96288	199	0.957176
77	0.974288	118	0.968292	159	0.962724	200	0.957072
78	0.974186	119	0.967984	160	0.962621	201	0.956864
79	0.974083	120	0.967932	161	0.962518	202	0.956604
80	0.973981	121	0.967675	162	0.962414	203	0.956396
81	0.973879	122	0.967572	163	0.962311	204	0.95624
82	0.973828	123	0.967469	164	0.962207	205	0.955928
83	0.973726	124	0.967315	165	0.962052	206	0.955824
84	0.973675	125	0.967161	166	0.961845	207	0.955772
85	0.973572	126	0.967161	167	0.961741	208	0.955511
86	0.97347	127	0.966955	168	0.961638	209	0.955303
87	0.973214	128	0.966903	169	0.961586	210	0.955147
88	0.972908	129	0.966852	170	0.961483	211	0.954886
89	0.972703	130	0.966749	171	0.961275	212	0.95473
90	0.972549	131	0.966697	172	0.961224	213	0.954678
91	0.972549	132	0.966646	173	0.961017	214	0.954469
92	0.972396	133	0.966543	174	0.960913	215	0.954313
93	0.972396	134	0.966543	175	0.960706	216	0.954156
94	0.972242	135	0.96644	176	0.96055	217	0.954052
95	0.971884	136	0.966388	177	0.960447	218	0.954
96	0.971884	137	0.966131	178	0.960239	219	0.953843
97	0.971782	138	0.965925	179	0.960187	220	0.953739
98	0.971474	139	0.965925	180	0.960032	221	0.953634
99	0.971423	140	0.965615	181	0.959928	222	0.953478
100	0.971064	141	0.965461	182	0.959876	223	0.953269
101	0.970808	142	0.965358	183	0.959565	224	0.95306
102	0.970757	143	0.965254	184	0.959513	225	0.952956
103	0.970552	144	0.965151	185	0.959358	226	0.952799
104	0.970398	145	0.964842	186	0.95915	227	0.952642

t	S$_{TX}$(t)	t	S$_{TX}$(t)	t	S$_{TX}$(t)	t	S$_{TX}$(t)
228	0.952329	269	0.946461	310	0.940876	351	0.935259
229	0.952277	270	0.946198	311	0.940771	352	0.935047
230	0.952016	271	0.945935	312	0.940559	353	0.934887
231	0.951963	272	0.945935	313	0.9404	354	0.934728
232	0.951702	273	0.94583	314	0.940295	355	0.934728
233	0.95165	274	0.945778	315	0.940189	356	0.934675
234	0.95144	275	0.945567	316	0.94003	357	0.934462
235	0.951074	276	0.945462	317	0.939925	358	0.934196
236	0.950813	277	0.94541	318	0.939766	359	0.934037
237	0.950603	278	0.945199	319	0.939713	360	0.933877
238	0.950446	279	0.945147	320	0.93966	361	0.933664
239	0.950342	280	0.944989	321	0.939607	362	0.933664
240	0.950342	281	0.944936	322	0.939501	363	0.933664
241	0.950289	282	0.944831	323	0.939342	364	0.933664
242	0.950185	283	0.94462	324	0.939342	365	0.933664
243	0.950028	284	0.94462	325	0.939078	366	0.933505
244	0.949923	285	0.944515	326	0.938972	367	0.933239
245	0.949713	286	0.944357	327	0.938919	368	0.932866
246	0.949713	287	0.944094	328	0.938707	369	0.932653
247	0.949556	288	0.943936	329	0.938495	370	0.932546
248	0.949556	289	0.943831	330	0.938389	371	0.93228
249	0.949399	290	0.943673	331	0.938177	372	0.931854
250	0.949137	291	0.943356	332	0.938124	373	0.931801
251	0.949085	292	0.943198	333	0.937913	374	0.931747
252	0.949032	293	0.942987	334	0.937701	375	0.931641
253	0.94898	294	0.942882	335	0.937435	376	0.931481
254	0.94877	295	0.942777	336	0.93717	377	0.931374
255	0.948613	296	0.942777	337	0.936905	378	0.931267
256	0.948193	297	0.942513	338	0.93664	379	0.930947
257	0.947931	298	0.94246	339	0.936534	380	0.930947
258	0.947826	299	0.942302	340	0.936428	381	0.930787
259	0.947774	300	0.942196	341	0.936162	382	0.930627
260	0.947616	301	0.941985	342	0.936056	383	0.930147
261	0.947459	302	0.941985	343	0.936003	384	0.929987
262	0.947406	303	0.941827	344	0.93595	385	0.929666
263	0.947301	304	0.941774	345	0.935897	386	0.929506
264	0.947196	305	0.94151	346	0.935737	387	0.929453
265	0.946986	306	0.941405	347	0.935631	388	0.929292
266	0.946881	307	0.941352	348	0.935578	389	0.929079
267	0.946724	308	0.941193	349	0.935472	390	0.928865
268	0.946566	309	0.940982	350	0.935259	391	0.928811

OPTN

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
392	0.928704	433	0.922915	474	0.916659	515	0.911613
393	0.928277	434	0.922646	475	0.916442	516	0.911232
394	0.92817	435	0.922485	476	0.916442	517	0.911069
395	0.927956	436	0.922377	477	0.916388	518	0.910797
396	0.927849	437	0.922108	478	0.91628	519	0.910688
397	0.927421	438	0.922001	479	0.916172	520	0.910525
398	0.927368	439	0.921839	480	0.916117	521	0.910525
399	0.927207	440	0.92157	481	0.916009	522	0.910471
400	0.926993	441	0.921409	482	0.915955	523	0.910362
401	0.926886	442	0.921355	483	0.915793	524	0.910253
402	0.926725	443	0.921301	484	0.915522	525	0.910144
403	0.926725	444	0.921247	485	0.915413	526	0.909926
404	0.926618	445	0.921193	486	0.915413	527	0.909872
405	0.926457	446	0.921139	487	0.915142	528	0.909817
406	0.926189	447	0.920816	488	0.915088	529	0.909817
407	0.926136	448	0.920708	489	0.91498	530	0.909599
408	0.925975	449	0.920493	490	0.91498	531	0.90949
409	0.925921	450	0.920277	491	0.91498	532	0.909436
410	0.925868	451	0.920223	492	0.91498	533	0.909381
411	0.925707	452	0.920062	493	0.914926	534	0.909381
412	0.925439	453	0.9199	494	0.914709	535	0.909272
413	0.925439	454	0.919846	495	0.914655	536	0.909163
414	0.925332	455	0.919576	496	0.914492	537	0.908945
415	0.925332	456	0.919361	497	0.914221	538	0.908836
416	0.925117	457	0.919199	498	0.914112	539	0.908618
417	0.925063	458	0.919091	499	0.914058	540	0.908618
418	0.924956	459	0.918983	500	0.913949	541	0.908455
419	0.924634	460	0.918821	501	0.913841	542	0.908291
420	0.924634	461	0.918821	502	0.913732	543	0.908073
421	0.924581	462	0.918659	503	0.913461	544	0.908018
422	0.92442	463	0.918389	504	0.913352	545	0.9078
423	0.924312	464	0.918173	505	0.913243	546	0.907745
424	0.924205	465	0.918119	506	0.913026	547	0.907636
425	0.923829	466	0.917795	507	0.912972	548	0.907527
426	0.92356	467	0.917632	508	0.912809	549	0.907472
427	0.923507	468	0.917416	509	0.912592	550	0.907254
428	0.923292	469	0.917308	510	0.912429	551	0.907144
429	0.923184	470	0.917254	511	0.912265	552	0.906926
430	0.923184	471	0.917092	512	0.912157	553	0.906871
431	0.92313	472	0.916875	513	0.911939	554	0.906817
432	0.922969	473	0.916821	514	0.911776	555	0.906598

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
556	0.90627	597	0.901496	638	0.896878	679	0.891874
557	0.906161	598	0.90133	639	0.89682	680	0.891756
558	0.906161	599	0.90133	640	0.89682	681	0.891519
559	0.906051	600	0.901274	641	0.896591	682	0.89146
560	0.905723	601	0.901274	642	0.896534	683	0.89146
561	0.905559	602	0.901051	643	0.896477	684	0.891341
562	0.90534	603	0.900829	644	0.896247	685	0.891162
563	0.905231	604	0.900773	645	0.896075	686	0.890805
564	0.905121	605	0.900662	646	0.895845	687	0.890567
565	0.905121	606	0.90055	647	0.895729	688	0.890507
566	0.905121	607	0.900438	648	0.895556	689	0.890448
567	0.904902	608	0.900326	649	0.895441	690	0.890448
568	0.904738	609	0.90027	650	0.895268	691	0.890328
569	0.904574	610	0.900103	651	0.89521	692	0.890268
570	0.90441	611	0.900103	652	0.895152	693	0.890149
571	0.904355	612	0.899934	653	0.895152	694	0.890089
572	0.904245	613	0.89971	654	0.894978	695	0.890089
573	0.904136	614	0.899654	655	0.894746	696	0.889669
574	0.903971	615	0.899485	656	0.894688	697	0.889548
575	0.903862	616	0.899317	657	0.894688	698	0.889368
576	0.903643	617	0.899204	658	0.894572	699	0.889187
577	0.903533	618	0.899148	659	0.894514	700	0.889067
578	0.903259	619	0.899035	660	0.894455	701	0.888946
579	0.903149	620	0.898979	661	0.894222	702	0.888946
580	0.903094	621	0.898866	662	0.893988	703	0.888825
581	0.902875	622	0.898866	663	0.893872	704	0.888705
582	0.902875	623	0.89864	664	0.893638	705	0.888584
583	0.902765	624	0.898527	665	0.893579	706	0.888341
584	0.902655	625	0.898414	666	0.893404	707	0.88816
585	0.90249	626	0.898414	667	0.893345	708	0.888038
586	0.902269	627	0.898187	668	0.893287	709	0.887856
587	0.902159	628	0.898017	669	0.893228	710	0.887735
588	0.902104	629	0.897903	670	0.893052	711	0.887613
589	0.902049	630	0.89779	671	0.892935	712	0.887309
590	0.901938	631	0.897562	672	0.892641	713	0.887188
591	0.901883	632	0.897505	673	0.892641	714	0.887188
592	0.901773	633	0.897448	674	0.892523	715	0.887005
593	0.901662	634	0.897277	675	0.892405	716	0.886883
594	0.901607	635	0.897163	676	0.892346	717	0.886883
595	0.901551	636	0.896992	677	0.89211	718	0.886883
596	0.901496	637	0.896935	678	0.892051	719	0.886821

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
720	0.886821	761	0.881142	802	0.876246	843	0.869619
721	0.886821	762	0.881015	803	0.876115	844	0.869482
722	0.886637	763	0.880888	804	0.876049	845	0.869414
723	0.886515	764	0.880825	805	0.875918	846	0.869209
724	0.886453	765	0.880761	806	0.875786	847	0.869141
725	0.886207	766	0.880634	807	0.875654	848	0.868936
726	0.886146	767	0.880315	808	0.875522	849	0.868799
727	0.886084	768	0.880187	809	0.87539	850	0.868593
728	0.886084	769	0.880187	810	0.875192	851	0.868456
729	0.886022	770	0.88006	811	0.874795	852	0.868319
730	0.885961	771	0.879932	812	0.87453	853	0.86825
731	0.885899	772	0.879676	813	0.874398	854	0.868112
732	0.885775	773	0.87942	814	0.874332	855	0.868112
733	0.885528	774	0.879356	815	0.874265	856	0.867768
734	0.885528	775	0.879292	816	0.874265	857	0.867768
735	0.885404	776	0.8791	817	0.874133	858	0.867768
736	0.885404	777	0.878971	818	0.873933	859	0.867561
737	0.885032	778	0.878779	819	0.873866	860	0.867422
738	0.884845	779	0.878586	820	0.8736	861	0.867353
739	0.884721	780	0.878457	821	0.8734	862	0.867215
740	0.884597	781	0.878264	822	0.8734	863	0.867215
741	0.884597	782	0.878199	823	0.873199	864	0.867215
742	0.884285	783	0.878199	824	0.873066	865	0.867006
743	0.884035	784	0.87807	825	0.872865	866	0.866937
744	0.88366	785	0.87794	826	0.872664	867	0.866867
745	0.883472	786	0.877811	827	0.872462	868	0.866797
746	0.88316	787	0.877811	828	0.872395	869	0.866728
747	0.883097	788	0.877681	829	0.872261	870	0.866588
748	0.882721	789	0.877616	830	0.872193	871	0.866518
749	0.882532	790	0.877551	831	0.872059	872	0.866518
750	0.88247	791	0.877551	832	0.871856	873	0.866379
751	0.882407	792	0.877291	833	0.871519	874	0.866169
752	0.882344	793	0.877226	834	0.871384	875	0.865889
753	0.882092	794	0.877161	835	0.871249	876	0.865748
754	0.882029	795	0.877031	836	0.871046	877	0.865608
755	0.881902	796	0.876835	837	0.870775	878	0.865467
756	0.881839	797	0.876639	838	0.870707	879	0.865397
757	0.881713	798	0.876443	839	0.870435	880	0.865397
758	0.88165	799	0.876443	840	0.870367	881	0.865186
759	0.881586	800	0.876312	841	0.870231	882	0.865044
760	0.881333	801	0.876312	842	0.869755	883	0.865044

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
884	0.864974	925	0.860345	966	0.855543	1007	0.851257
885	0.864903	926	0.860197	967	0.855313	1008	0.851098
886	0.864832	927	0.860124	968	0.855313	1009	0.851018
887	0.86469	928	0.859976	969	0.85516	1010	0.851018
888	0.864619	929	0.859828	970	0.855083	1011	0.851018
889	0.864619	930	0.859828	971	0.85493	1012	0.850858
890	0.864477	931	0.85968	972	0.854699	1013	0.850778
891	0.864335	932	0.859606	973	0.854622	1014	0.850778
892	0.864335	933	0.859458	974	0.854622	1015	0.850778
893	0.864192	934	0.859384	975	0.854545	1016	0.850618
894	0.864121	935	0.859384	976	0.854468	1017	0.850538
895	0.864049	936	0.859235	977	0.854237	1018	0.850217
896	0.863978	937	0.859012	978	0.854159	1019	0.849895
897	0.863978	938	0.859012	979	0.854159	1020	0.849895
898	0.863978	939	0.858863	980	0.854082	1021	0.849895
899	0.863978	940	0.858863	981	0.854005	1022	0.849815
900	0.863691	941	0.858714	982	0.853927	1023	0.849492
901	0.863691	942	0.85849	983	0.853694	1024	0.849492
902	0.863691	943	0.85849	984	0.853616	1025	0.849492
903	0.863619	944	0.858266	985	0.853539	1026	0.849492
904	0.863474	945	0.858191	986	0.853539	1027	0.84933
905	0.863402	946	0.857966	987	0.853383	1028	0.84933
906	0.86333	947	0.857891	988	0.853305	1029	0.84933
907	0.863186	948	0.857665	989	0.853149	1030	0.849249
908	0.862896	949	0.85759	990	0.853071	1031	0.849086
909	0.862607	950	0.85759	991	0.852914	1032	0.848842
910	0.862317	951	0.85744	992	0.852836	1033	0.848679
911	0.8621	952	0.85744	993	0.852836	1034	0.848598
912	0.862027	953	0.857364	994	0.852758	1035	0.848353
913	0.862027	954	0.857063	995	0.852679	1036	0.848109
914	0.861881	955	0.856987	996	0.852601	1037	0.848109
915	0.861809	956	0.85676	997	0.852601	1038	0.847782
916	0.86159	957	0.856685	998	0.852286	1039	0.847619
917	0.861517	958	0.856305	999	0.852049	1040	0.847619
918	0.861444	959	0.856229	1000	0.852049	1041	0.847455
919	0.861078	960	0.856229	1001	0.852049	1042	0.847373
920	0.861078	961	0.856153	1002	0.851812	1043	0.84729
921	0.860785	962	0.856077	1003	0.851495	1044	0.847126
922	0.860712	963	0.855772	1004	0.851336	1045	0.846961
923	0.860712	964	0.855619	1005	0.851336	1046	0.846879
924	0.860492	965	0.855619	1006	0.851257	1047	0.846714

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
1048	0.846549	1089	0.841907	1130	0.836987	1171	0.830997
1049	0.846301	1090	0.841907	1131	0.836896	1172	0.830997
1050	0.84597	1091	0.841821	1132	0.836806	1173	0.830997
1051	0.845804	1092	0.841734	1133	0.836806	1174	0.830997
1052	0.845638	1093	0.841561	1134	0.836535	1175	0.830808
1053	0.845389	1094	0.841389	1135	0.836263	1176	0.830524
1054	0.845389	1095	0.841129	1136	0.835901	1177	0.830524
1055	0.845389	1096	0.841042	1137	0.835719	1178	0.830429
1056	0.845222	1097	0.840956	1138	0.835719	1179	0.830144
1057	0.845138	1098	0.840869	1139	0.835628	1180	0.830049
1058	0.845138	1099	0.840695	1140	0.835537	1181	0.830049
1059	0.845138	1100	0.840695	1141	0.835446	1182	0.829858
1060	0.844971	1101	0.840608	1142	0.835082	1183	0.829763
1061	0.844971	1102	0.840434	1143	0.835082	1184	0.829763
1062	0.844887	1103	0.840259	1144	0.834899	1185	0.829667
1063	0.844887	1104	0.839735	1145	0.834899	1186	0.829571
1064	0.844719	1105	0.839648	1146	0.834532	1187	0.829379
1065	0.844635	1106	0.839473	1147	0.834532	1188	0.829187
1066	0.844635	1107	0.839385	1148	0.834256	1189	0.82861
1067	0.84455	1108	0.839122	1149	0.834256	1190	0.82861
1068	0.844466	1109	0.839034	1150	0.834072	1191	0.828417
1069	0.844466	1110	0.838946	1151	0.834072	1192	0.828224
1070	0.844128	1111	0.838946	1152	0.834072	1193	0.827837
1071	0.844044	1112	0.838858	1153	0.833795	1194	0.827643
1072	0.844044	1113	0.838858	1154	0.83361	1195	0.827546
1073	0.843959	1114	0.838682	1155	0.833518	1196	0.827546
1074	0.843959	1115	0.838505	1156	0.833147	1197	0.827449
1075	0.843789	1116	0.838417	1157	0.833147	1198	0.827449
1076	0.84362	1117	0.838328	1158	0.833055	1199	0.827254
1077	0.84362	1118	0.838151	1159	0.832869	1200	0.827059
1078	0.843535	1119	0.838151	1160	0.832683	1201	0.826961
1079	0.843364	1120	0.837973	1161	0.832683	1202	0.826863
1080	0.843194	1121	0.837795	1162	0.83231	1203	0.826765
1081	0.843023	1122	0.837795	1163	0.832217	1204	0.826569
1082	0.843023	1123	0.837706	1164	0.832124	1205	0.826373
1083	0.843023	1124	0.837706	1165	0.832124	1206	0.826373
1084	0.842851	1125	0.837706	1166	0.831843	1207	0.826373
1085	0.842508	1126	0.837527	1167	0.831655	1208	0.826373
1086	0.842337	1127	0.837437	1168	0.831561	1209	0.826373
1087	0.842251	1128	0.837437	1169	0.831186	1210	0.826275
1088	0.841993	1129	0.837257	1170	0.831092	1211	0.826078

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
1212	0.825782	1253	0.82084	1294	0.81567	1335	0.812243
1213	0.825585	1254	0.820634	1295	0.815562	1336	0.81213
1214	0.825487	1255	0.82053	1296	0.815562	1337	0.811903
1215	0.825487	1256	0.82022	1297	0.815562	1338	0.811903
1216	0.825487	1257	0.82022	1298	0.815453	1339	0.811561
1217	0.825487	1258	0.82022	1299	0.815236	1340	0.811446
1218	0.825387	1259	0.820116	1300	0.815236	1341	0.811332
1219	0.825288	1260	0.819804	1301	0.815236	1342	0.811217
1220	0.824991	1261	0.819804	1302	0.815236	1343	0.810988
1221	0.824891	1262	0.8197	1303	0.815236	1344	0.810873
1222	0.824891	1263	0.819595	1304	0.815236	1345	0.810528
1223	0.824891	1264	0.819387	1305	0.814798	1346	0.810298
1224	0.824692	1265	0.819387	1306	0.814798	1347	0.810183
1225	0.824392	1266	0.819177	1307	0.814579	1348	0.810068
1226	0.824392	1267	0.818968	1308	0.814359	1349	0.809953
1227	0.824292	1268	0.818863	1309	0.814359	1350	0.809722
1228	0.823992	1269	0.818653	1310	0.814029	1351	0.809722
1229	0.823791	1270	0.818548	1311	0.814029	1352	0.809722
1230	0.823791	1271	0.818442	1312	0.813809	1353	0.809374
1231	0.823791	1272	0.818126	1313	0.813809	1354	0.809258
1232	0.823791	1273	0.818126	1314	0.813809	1355	0.809142
1233	0.82369	1274	0.818021	1315	0.813809	1356	0.809025
1234	0.823489	1275	0.817809	1316	0.813698	1357	0.808909
1235	0.823187	1276	0.817598	1317	0.813587	1358	0.808793
1236	0.822884	1277	0.817492	1318	0.813365	1359	0.808676
1237	0.822884	1278	0.817386	1319	0.813365	1360	0.808676
1238	0.822884	1279	0.817173	1320	0.813142	1361	0.808676
1239	0.822884	1280	0.817067	1321	0.813142	1362	0.808442
1240	0.822681	1281	0.817067	1322	0.813142	1363	0.80809
1241	0.822579	1282	0.817067	1323	0.813142	1364	0.80809
1242	0.822274	1283	0.817067	1324	0.812918	1365	0.807972
1243	0.822172	1284	0.816854	1325	0.812918	1366	0.807855
1244	0.82207	1285	0.81664	1326	0.812806	1367	0.807855
1245	0.82207	1286	0.81664	1327	0.812806	1368	0.807737
1246	0.821968	1287	0.81664	1328	0.812581	1369	0.807737
1247	0.821968	1288	0.816426	1329	0.812468	1370	0.807737
1248	0.821456	1289	0.816426	1330	0.812468	1371	0.807618
1249	0.821149	1290	0.816211	1331	0.812356	1372	0.807618
1250	0.821149	1291	0.816103	1332	0.812356	1373	0.807618
1251	0.821149	1292	0.816103	1333	0.812356	1374	0.8075
1252	0.821149	1293	0.815887	1334	0.812243	1375	0.807143

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
1376	0.807024	1417	0.802145	1458	0.796634	1499	0.791084
1377	0.806905	1418	0.801895	1459	0.796502	1500	0.791084
1378	0.806905	1419	0.801895	1460	0.796502	1501	0.790945
1379	0.806905	1420	0.801895	1461	0.796238	1502	0.790805
1380	0.806905	1421	0.801644	1462	0.796238	1503	0.790665
1381	0.806786	1422	0.801519	1463	0.796105	1504	0.790665
1382	0.806786	1423	0.801141	1464	0.795708	1505	0.790524
1383	0.806546	1424	0.801141	1465	0.795708	1506	0.790524
1384	0.806427	1425	0.801141	1466	0.795441	1507	0.790524
1385	0.806187	1426	0.801015	1467	0.795174	1508	0.790524
1386	0.806067	1427	0.800636	1468	0.795174	1509	0.790524
1387	0.805826	1428	0.800256	1469	0.795174	1510	0.790383
1388	0.805586	1429	0.800003	1470	0.79504	1511	0.790241
1389	0.805586	1430	0.800003	1471	0.794638	1512	0.790241
1390	0.805344	1431	0.800003	1472	0.794503	1513	0.790098
1391	0.805223	1432	0.800003	1473	0.794503	1514	0.790098
1392	0.805223	1433	0.800003	1474	0.794368	1515	0.790098
1393	0.805102	1434	0.799875	1475	0.794368	1516	0.789813
1394	0.805102	1435	0.79962	1476	0.794233	1517	0.789813
1395	0.805102	1436	0.799493	1477	0.793827	1518	0.789813
1396	0.804981	1437	0.799365	1478	0.793691	1519	0.789813
1397	0.804737	1438	0.799365	1479	0.793419	1520	0.789669
1398	0.804615	1439	0.799365	1480	0.793419	1521	0.789525
1399	0.804494	1440	0.799365	1481	0.793147	1522	0.789237
1400	0.804494	1441	0.799365	1482	0.79301	1523	0.789237
1401	0.804371	1442	0.799108	1483	0.792737	1524	0.789237
1402	0.804249	1443	0.799108	1484	0.792737	1525	0.789092
1403	0.804249	1444	0.799108	1485	0.792737	1526	0.788947
1404	0.804126	1445	0.798849	1486	0.792737	1527	0.788947
1405	0.803635	1446	0.79872	1487	0.792464	1528	0.788947
1406	0.803635	1447	0.79872	1488	0.792464	1529	0.788654
1407	0.803635	1448	0.798332	1489	0.792464	1530	0.788654
1408	0.803512	1449	0.798332	1490	0.792189	1531	0.788361
1409	0.803265	1450	0.798072	1491	0.792052	1532	0.788215
1410	0.803265	1451	0.797942	1492	0.791776	1533	0.787921
1411	0.803141	1452	0.797682	1493	0.791776	1534	0.787921
1412	0.803141	1453	0.797682	1494	0.791362	1535	0.787627
1413	0.803017	1454	0.79729	1495	0.791223	1536	0.787479
1414	0.802893	1455	0.79729	1496	0.791223	1537	0.787479
1415	0.802395	1456	0.796897	1497	0.791084	1538	0.787479
1416	0.802395	1457	0.796765	1498	0.791084	1539	0.787479

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
1540	0.787035	1581	0.783366	1622	0.781726	1663	0.777765
1541	0.787035	1582	0.783366	1623	0.781726	1664	0.777765
1542	0.787035	1583	0.783207	1624	0.781558	1665	0.777584
1543	0.787035	1584	0.783207	1625	0.781221	1666	0.777584
1544	0.787035	1585	0.783047	1626	0.781052	1667	0.777584
1545	0.786736	1586	0.783047	1627	0.781052	1668	0.777584
1546	0.786287	1587	0.783047	1628	0.780544	1669	0.777584
1547	0.786137	1588	0.783047	1629	0.780205	1670	0.777402
1548	0.786137	1589	0.782887	1630	0.780035	1671	0.777402
1549	0.785986	1590	0.782887	1631	0.780035	1672	0.777402
1550	0.785835	1591	0.782887	1632	0.780035	1673	0.777219
1551	0.785684	1592	0.782887	1633	0.780035	1674	0.777219
1552	0.785533	1593	0.782887	1634	0.780035	1675	0.776668
1553	0.785533	1594	0.782887	1635	0.780035	1676	0.776668
1554	0.785381	1595	0.782887	1636	0.780035	1677	0.776301
1555	0.785381	1596	0.782887	1637	0.779691	1678	0.776116
1556	0.785076	1597	0.782887	1638	0.779691	1679	0.776116
1557	0.785076	1598	0.782887	1639	0.779691	1680	0.775931
1558	0.784923	1599	0.782887	1640	0.779345	1681	0.775931
1559	0.784769	1600	0.782887	1641	0.779172	1682	0.77556
1560	0.784769	1601	0.782887	1642	0.778825	1683	0.77556
1561	0.784769	1602	0.782887	1643	0.778825	1684	0.77556
1562	0.784462	1603	0.782723	1644	0.778652	1685	0.775373
1563	0.784308	1604	0.782723	1645	0.778652	1686	0.774998
1564	0.784308	1605	0.782723	1646	0.778652	1687	0.774998
1565	0.784153	1606	0.782559	1647	0.778652	1688	0.774809
1566	0.784153	1607	0.782559	1648	0.778652	1689	0.774809
1567	0.784153	1608	0.782559	1649	0.778652	1690	0.77462
1568	0.784153	1609	0.782559	1650	0.778652	1691	0.77462
1569	0.784153	1610	0.782559	1651	0.778475	1692	0.77462
1570	0.784153	1611	0.782228	1652	0.778475	1693	0.77462
1571	0.784153	1612	0.782228	1653	0.778298	1694	0.77443
1572	0.783997	1613	0.782228	1654	0.777943	1695	0.774048
1573	0.783997	1614	0.782228	1655	0.777943	1696	0.774048
1574	0.783997	1615	0.781895	1656	0.777943	1697	0.773856
1575	0.783997	1616	0.781895	1657	0.777943	1698	0.773664
1576	0.783839	1617	0.781895	1658	0.777765	1699	0.773471
1577	0.783682	1618	0.781895	1659	0.777765	1700	0.773471
1578	0.783524	1619	0.781895	1660	0.777765	1701	0.773471
1579	0.783524	1620	0.781895	1661	0.777765	1702	0.773471
1580	0.783366	1621	0.781895	1662	0.777765	1703	0.773277

t	$S_{TX}(t)$	t	$S_{TX}(t)$	t	$S_{TX}(t)$
1704	0.773277	1745	0.76785	1786	0.760337
1705	0.773083	1746	0.767434	1787	0.760337
1706	0.773083	1747	0.766599	1788	0.759442
1707	0.772692	1748	0.766599	1789	0.759217
1708	0.772497	1749	0.766389	1790	0.759217
1709	0.772497	1750	0.765758	1791	0.759217
1710	0.772497	1751	0.765758	1792	0.759217
1711	0.772497	1752	0.765547	1793	0.759217
1712	0.772497	1753	0.765125	1794	0.759217
1713	0.772497	1754	0.764913	1795	0.758991
1714	0.7723	1755	0.764913	1796	0.758991
1715	0.7723	1756	0.764701	1797	0.758991
1716	0.7723	1757	0.764701	1798	0.758991
1717	0.772101	1758	0.764701	1799	0.758762
1718	0.771505	1759	0.764701	1800	0.758533
1719	0.771505	1760	0.764487	1801	0.758533
1720	0.770906	1761	0.764487	1802	0.758303
1721	0.770906	1762	0.764487	1803	0.758303
1722	0.770505	1763	0.764487	1804	0.758303
1723	0.770304	1764	0.764057	1805	0.758303
1724	0.770103	1765	0.763412	1806	0.758303
1725	0.769699	1766	0.763196	1807	0.758303
1726	0.769699	1767	0.763196	1808	0.75807
1727	0.769699	1768	0.763196	1809	0.757837
1728	0.769699	1769	0.763196	1810	0.757837
1729	0.769699	1770	0.763196	1811	0.757837
1730	0.769496	1771	0.763196	1812	0.757602
1731	0.769293	1772	0.76276	1813	0.757602
1732	0.769293	1773	0.762542	1814	0.757602
1733	0.769293	1774	0.762542	1815	0.757602
1734	0.769293	1775	0.762323	1816	0.757602
1735	0.769088	1776	0.761884	1817	0.757602
1736	0.768883	1777	0.761664	1818	0.757365
1737	0.768883	1778	0.761224	1819	0.757365
1738	0.768678	1779	0.761003	1820	0.757365
1739	0.768472	1780	0.760782	1821	0.756888
1740	0.768472	1781	0.760782	1822	0.756888
1741	0.768472	1782	0.760782	1823	0.756888
1742	0.768265	1783	0.760337	1824	0.756409
1743	0.768265	1784	0.760337	1825	0.756169
1744	0.76785	1785	0.760337	1826	0.756168

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21.2.C Values Used in the Calculation of Biological Disadvantages

21.2.C.1 Probability of Incompatible Lung Donors Based on Height

Table 21-9 lists the proportion of incompatible donors based on the candidate's height and diagnosis group.

Table 21-9 Proportion of Incompatible Donors Based on Lung Height

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
63 or less	0.9949	0.9949	0.9949
64	0.9916	0.9949	0.9949
65	0.9916	0.9949	0.9949
66	0.9899	0.9949	0.9949
67	0.9882	0.9949	0.9949
68	0.9882	0.9949	0.9949
69	0.9882	0.9916	0.9949
70	0.9882	0.9916	0.9949
71	0.9866	0.9882	0.9916
72	0.9866	0.9882	0.9916
73	0.9849	0.9882	0.9899
74	0.9849	0.9882	0.9882
75	0.9849	0.9882	0.9882
76	0.9866	0.9866	0.9882
77	0.9849	0.9866	0.9882
78	0.9849	0.9849	0.9866
79	0.9849	0.9849	0.9866
80	0.9849	0.9866	0.9849
81	0.9849	0.9866	0.9849
82	0.9866	0.9849	0.9849
83	0.9866	0.9849	0.9849
84	0.9882	0.9849	0.9833
85	0.9882	0.9849	0.9849
86	0.9882	0.9866	0.9849
87	0.9849	0.9866	0.9849
88	0.9849	0.9882	0.9849

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
89	0.9849	0.9882	0.9849
90	0.9849	0.9882	0.9849
91	0.9849	0.9882	0.9866
92	0.9833	0.9849	0.9866
93	0.9833	0.9849	0.9882
94	0.9816	0.9849	0.9849
95	0.9816	0.9849	0.9849
96	0.9816	0.9849	0.9849
97	0.9816	0.9833	0.9849
98	0.9816	0.9833	0.9849
99	0.9799	0.9816	0.9833
100	0.9833	0.9816	0.9833
101	0.9833	0.9816	0.9816
102	0.9866	0.9816	0.9816
103	0.9866	0.9816	0.9816
104	0.9866	0.9833	0.9816
105	0.9866	0.9833	0.9816
106	0.9866	0.9849	0.9799
107	0.9866	0.9866	0.9799
108	0.9882	0.9866	0.9799
109	0.9882	0.9866	0.9833
110	0.9849	0.9866	0.9833
111	0.9849	0.9882	0.9849
112	0.9833	0.9866	0.9866
113	0.9833	0.9882	0.9866
114	0.9833	0.9882	0.9849
115	0.9799	0.9849	0.9849
116	0.9766	0.9849	0.9866
117	0.9701	0.9833	0.9833
118	0.9619	0.9833	0.9849
119	0.9603	0.9833	0.9833
120	0.9442	0.9799	0.9816

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
121	0.9394	0.9766	0.9816
122	0.9268	0.9652	0.9799
123	0.9206	0.9603	0.9766
124	0.9175	0.9603	0.9701
125	0.8825	0.9442	0.9619
126	0.8810	0.9394	0.9603
127	0.8247	0.9206	0.9442
128	0.7933	0.9206	0.9394
129	0.7879	0.9175	0.9268
130	0.7130	0.8825	0.9175
131	0.7118	0.8810	0.9144
132	0.6235	0.7986	0.8825
133	0.5776	0.7933	0.8810
134	0.5698	0.7892	0.8247
135	0.4756	0.7130	0.7919
136	0.4359	0.7105	0.7866
137	0.4220	0.6235	0.7118
138	0.3223	0.5776	0.7105
139	0.3129	0.5708	0.6235
140	0.2375	0.4435	0.5776
141	0.2106	0.4345	0.5698
142	0.2047	0.4220	0.4748
143	0.1359	0.3223	0.4352
144	0.1316	0.3129	0.4220
145	0.0998	0.2173	0.3223
146	0.0897	0.2091	0.3129
147	0.0865	0.2051	0.2375
148	0.0590	0.1359	0.2106
149	0.0576	0.1316	0.2047
150	0.0447	0.0910	0.1357
151	0.0388	0.0897	0.1314
152	0.0376	0.0869	0.0998

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
153	0.0226	0.0590	0.0893
154	0.0222	0.0576	0.0862
155	0.0161	0.0401	0.0587
156	0.0142	0.0390	0.0574
157	0.0134	0.0379	0.0447
158	0.0072	0.0227	0.0387
159	0.0070	0.0221	0.0373
160	0.0055	0.0143	0.0221
161	0.0051	0.0142	0.0217
162	0.0049	0.0137	0.0157
163	0.0045	0.0072	0.0137
164	0.0046	0.0070	0.0129
165	0.0046	0.0061	0.0067
166	0.0052	0.0051	0.0066
167	0.0052	0.0059	0.0053
168	0.0080	0.0046	0.0045
169	0.0082	0.0047	0.0043
170	0.0084	0.0061	0.0031
171	0.0133	0.0052	0.0031
172	0.0137	0.0073	0.0039
173	0.0163	0.0082	0.0036
174	0.0215	0.0084	0.0037
175	0.0224	0.0136	0.0049
176	0.0362	0.0136	0.0048
177	0.0378	0.0144	0.0068
178	0.0438	0.0215	0.0079
179	0.0617	0.0224	0.0081
180	0.0640	0.0361	0.0132
181	0.0939	0.0375	0.0135
182	0.0955	0.0388	0.0142
183	0.1090	0.0617	0.0215
184	0.1427	0.0639	0.0224

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
185	0.1458	0.0939	0.0359
186	0.2008	0.0953	0.0373
187	0.2084	0.0987	0.0386
188	0.2128	0.1427	0.0617
189	0.3189	0.1458	0.0639
190	0.3256	0.1823	0.0939
191	0.4397	0.2062	0.0953
192	0.4473	0.2124	0.0987
193	0.4589	0.3189	0.1427
194	0.6440	0.3250	0.1458
195	0.6539	0.4036	0.1823
196	0.7591	0.4435	0.2062
197	0.7668	0.4589	0.2124
198	0.7773	0.6440	0.3189
199	0.8795	0.6539	0.3250
200	0.8840	0.7154	0.4036
201	0.9021	0.7643	0.4435
202	0.9458	0.7773	0.4589
203	0.9458	0.8795	0.6440
204	0.9684	0.8825	0.6539
205	0.9750	0.8900	0.7154
206	0.9783	0.9458	0.7643
207	0.9882	0.9458	0.7773
208	0.9882	0.9684	0.8795
209	0.9949	0.9733	0.8825
210	0.9949	0.9750	0.8900
211	0.9949	0.9882	0.9458
212	0.9949	0.9882	0.9458
213	0.9966	0.9949	0.9684
214	1.0000	0.9949	0.9733
215	1.0000	0.9949	0.9750
216	1.0000	0.9949	0.9882

Candidate height (cm)	Proportion for Candidates in Diagnosis Groups A and C	Proportion for Candidates in Diagnosis Group B	Proportion for Candidates in Diagnosis Group D
217	1.0000	0.9966	0.9882
218	1.0000	1.0000	0.9949
219	1.0000	1.0000	0.9949
220	1.0000	1.0000	0.9949
221	1.0000	1.0000	0.9949
222	1.0000	1.0000	0.9966
223 or more	1.0000	1.0000	1.0000

Affected Guidance

Lung Review Board Guidance

Summary and Goals

Policy 10.2 allows a transplant program to submit exception requests for Medical Urgency, Post-Transplant Outcomes, Biological Disadvantages, and/or Patient Access Scores. The Lung Review Board (Review Board) provides prompt peer review of candidate score exceptions on the lung transplant waiting list. These guidelines are intended to promote consistent review of these scores.

When submitting an exception request, transplant programs must provide a clinical justification for the exception. Please refer to *Policy 10.2 Lung Composite Score Exceptions* for additional information about the exception review process.

This resource is not OPTN Policy, so it does not carry the monitoring or enforcement implications of policy. It is not an official guideline for clinical practice, nor is it intended to be clinically prescriptive or to define a standard of care. This resource is intended to provide guidance to transplant programs and the Review Board.

Recommendations

Exception Requests

In addition to the requirements listed in *OPTN Policy 10.2.B Exception Requests*, requesting transplant programs are encouraged to include citations to supporting literature where available. Transplant programs are encouraged to consult the CAS calculator, and the national score distribution information when considering what score to request, and may wish to include information in the request about how these were used in the choice of a requested score.

Pulmonary Hypertension

Lung transplant candidates diagnosed with pulmonary hypertension (PH) and who meet the following criteria may qualify for an increase in their Waitlist Survival and/or Post-Transplant Outcomes Scores:

1. Patient is deteriorating on optimal therapy, and
2. Patient has a right atrial pressure greater than 15 mm Hg *or* a cardiac index less than 1.8 L/min/m².

To request an increase in a PH candidate's scores, transplant programs must submit an exception request to the Review Board; this request should include sufficient clinical detail to support that the patient meets the above criteria.

If the transplant program believes that its patient has similar waiting list mortality and potential transplant benefit as a PH patient meeting the criteria listed above, then it should provide a detailed narrative on that assertion, referencing literature supporting the request for a higher score.

Transplant programs may wish to submit to the Review Board exception requests for the candidate's Waitlist Survival Score and Post-Transplant Outcomes Score to be at the national 90th percentile for each goal. This information is provided by the OPTN on a rolling basis.

Pediatric Priority 1

To request a pediatric priority 1 exception for a candidate currently assigned to priority 2, transplant programs should request an exception for 7.6292% of the waitlist survival score to get the 1.9073 waitlist points assigned to pediatric priority 1 candidates. It is not necessary to request an exception for post-transplant outcomes since pediatric priority 1 and 2 candidates are assigned the same number of post-transplant outcomes points.

Affected Guidelines

Lung Review Board Operational Guidelines[17]

Repealed.

Lung Review Board Operational Guidelines

Overview

The purpose of the Lung Review Board (Review Board) is to provide fair, equitable, and prompt peer review of exception requests. The Review Board will review these exception requests and determine if the request is comparable to other candidates with the same score.

Representation

Policy 10.2 Lung Composite Score Exceptions sets the structure and composition of the Review Board.

The membership of the Review Board is comprised of representatives from active lung transplant programs. Review Board members serve a term of 2 years. Service terms will be staggered among the Review Board members with a portion of active lung transplant programs permitted to appoint representatives each term. The Review Board membership is rotated to ensure each transplant program has equal opportunity to participate. Each participating lung transplant program may appoint a primary and an alternate representative. At least 4 of the active lung transplant programs must have performed at least one transplant for a candidate under the age of 12 within the last five years. The Review Board members from lung transplant programs that have performed at least one transplant for a candidate under the age of 12 within the last five years will be given priority for assignment to pediatric cases if they are available.

The immediate past Chair of the Lung Transplantation Committee will serve as the Review Board Chair for a 2-year term. In the event of a Review Board Chair vacancy, the Lung Transplantation Committee Chair will appoint a Review Board Chair.

Qualifications to serve on the Review Board include:
- The Review Board representative must be employed at an active lung transplant program.
    - If a transplant hospital inactivates or withdraws its lung program, the Review Board representative from that hospital may not participate in the Review Board.
    - If a transplant hospital inactivates or withdraws its pediatric lung component, the Review Board representative from that hospital may not participate in the Review Board.
    - The term of the transplant program or component's representative on the Review Board ends upon program or component's inactivation or withdrawal from the OPTN. Should a transplant program reactivate, it may again have the opportunity to be represented on the Review Board during future rotations.
    - It is the responsibility of each transplant program to provide the OPTN Contractor with the contact information for the both the primary Review Board representative and the alternate from their program. Should a representative leave his transplant program,

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[17] "Lung Review Board Information," OPTN, January 2015, accessed June 23, 2022, https://optn.transplant.hrsa.gov/media/2701/review_board_guidelines_lung.pdf.

then the program's alternate representative will become the primary Review Board member. The departing member will be removed from the Review Board.

- Complete a conflict of interest and confidentiality statement and orientation training prior to each term of service.
- The primary representative must have at least five years of post-training transplant experience.
- The alternate representative must have at least three years of post-training transplant experience.
- Transplant programs must ensure that Review Board volunteers from their programs meet these requirements.

Chair Responsibilities

The Review Board Chair:
A. Serves as a liaison between the Review Board and the Lung Transplantation Committee.
B. May remove members of the Review Board who the Chair identifies as non-responsive to Review Board cases.

Representatives Responsibilities

Review Board representatives must:
A. Vote on all exception requests and appeals according to the timelines set by policy.
B. When voting to deny an exception, provide constructive comments that are relevant to the candidate's clinical information and based on policy or guidance documents. These comments will be provided to the candidate's lung program.
C. Notify the OPTN of any planned absences. Requests will not be assigned to representatives who indicate they are out of the office.

The alternate representative will only be assigned cases if the primary representative indicates they are out of the office.

Voting Procedure

The OPTN Contractor will send the exception request or appeal to nine of the Review Board members. If there are fewer than nine reviewers available, the OPTN Contractor will send the case to all available reviewers.

If the assigned Review Board member has not voted within three days of when the OPTN Contractor sends the application or appeal to the Review Board, then the request will be reassigned to another representative.

The Review Board will review all exception requests prospectively. The candidate will not receive the exception score unless or until it is approved.

Voting will close at the earliest of when:
- A majority of all assigned voters have voted to approve an exception request
- A majority of all assigned voters have voted to deny an exception request
- The timeline lapses for the Review Board members to vote on the exception request.

The Review Board will have five days to vote and exception requests will be decided as follows:

Of the votes submitted, if…	The request is…
The majority vote to approve	Approved
The majority vote to deny	Denied
There is a tie	Approved
No votes are submitted	Approved

A majority is more than half of the votes submitted.

Appeal Process

A candidate's lung program may appeal the Review Board's decision to deny an exception request within seven days of receiving the appeal denial notification. All representative comments of denied requests are provided to the lung program. The program must submit additional written information justifying or amending the requested exception and may include responses to the comments of dissenting Review Board representatives. This additional information will be provided to the Review Board representatives for further consideration. To the extent possible, the appeal will be considered by the same reviewers who considered the initial exception application. Exception requests appealed to the Review Board are adjudicated as described in Voting Procedure, above.

Following a denial on an appeal to the Review Board, the candidate's lung program can appeal to the Committee. The lung program must appeal within 7 days of notification. The program can provide additional written information justifying or amending the requested exception to be sent to the Committee. The Committee will approve or deny each appeal no later than fourteen days following the request to the Committee. Exception requests appealed to the Committee are adjudicated as follows:

Of the votes submitted, if…	The request is…
The majority vote to approve	Approved
The majority vote to deny	Denied
There is a tie	Approved

Any member of the Committee who reviewed the case as a Review Board representative must abstain from voting on the appeal to the Committee.