

Briefing to the OPTN Board of Directors on


Standardize Six-Minute Walk for Lung Allocation

OPTN Lung Transplantation Committee

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Standardize Six-Minute Walk for Lung Allocation

<i>Affected Policies:</i>	<p>10.1.A.1 Waitlist Survival Points for Candidates at least 12 Years Old</p> <p>10.1.B.1 Post-Transplant Outcomes Points for Candidates at least 12 Years Old</p> <p>10.3.B Lung Clinical Values That Must Be Updated Every Six Months</p> <p>21.2.A Values Used in the Calculation of Lung Waiting List Survival</p> <p>21.2.B.1 Coefficients Used in Calculating Lung Post-Transplant Outcomes</p>
<i>Data Collection Affected:</i>	OPTN Waiting List
<i>Sponsoring Committee:</i>	Lung Transplantation
<i>Public Comment Period:</i>	January 23, 2024-March 19, 2024
<i>Board of Directors Meeting:</i>	June 17-18, 2024

Executive Summary

Six-minute walk distance is a variable in the lung composite allocation score (CAS). The distance (measured in feet) that a lung candidate can walk in six minutes factors into both the medical urgency and post-transplant outcome portions of the lung CAS for candidates aged 12 years and older. Lung candidates who cannot walk far during the six-minute walk test generally have more medical urgency for transplant, and these candidates receive a higher medical urgency score and a lower post-transplant outcomes score. Lung candidates who walk farther during the six-minute walk test do not receive as many points for their medical urgency score but receive more points for their post-transplant outcomes score.

Existing clinical standards provide guidance for performing the six-minute walk test but do not provide details on conducting the walk with severely impaired patients, which is particularly relevant for the lung transplant candidate population. Additionally, OPTN Policy regarding the six-minute walk distance is not well aligned with the clinical standards as it leaves broad discretion to transplant programs on increasing supplemental oxygen during the six-minute walk test. Due to these gaps, lung transplant program representatives report that performance of the six-minute walk test is not consistent across transplant programs. Provision of supplemental oxygen during the test is one of the main sources of variability.

Given the importance of the six-minute walk test in the lung CAS, this proposal would require lung transplant programs to perform an oxygen titration test ahead of the initial six-minute walk test for lung candidates at least 12 years old to standardize how supplemental oxygen needs are determined for conducting the six-minute walk test. This proposal also includes guidance to supplement the existing clinical standards with recommendations specifically for lung transplant programs, and data definition changes to align with the policy changes and guidance.

The OPTN Lung Transplantation Committee (the Committee) approved these changes based on community feedback received during the public comment period:

- Specify in guidance that the oxygen titration test should be done as close in time as possible, but no more than 12 weeks ahead of the six-minute walk test

- Remove examples from guidance describing when it may be unfeasible/unsafe for a candidate to complete the six-minute walk test
- Add guidance for altitude considerations including a recommendation to perform both the oxygen titration test and six-minute walk test at the transplant hospital to ensure consistency
- Adjust the implementation date to September 3, 2024 and related transition plan dates to better align with the OPTN's current implementation processes
 - Remove this from proposed policy language and address this through an enactment clause, so that policy will not become outdated once these dates have passed

Purpose

The purpose of this proposal is to standardize how transplant programs perform the six-minute walk test when reporting the walk distance for use in the CAS. This proposal would:

- Add a new policy requirement to complete an oxygen titration test ahead of the initial six-minute walk test conducted for lung candidates at least 12 years old, and for the six-minute walk test conducted just before candidates turn 12 years old
- Provide guidance specifically for lung transplant programs to supplement existing clinical standards
- Update the six-minute walk distance data definition to align with the policy changes and guidance

Background

The six-minute walk test is a simple walking test used to assess a patient’s cardiopulmonary function.¹ The patient is asked to walk as far as they can over a six-minute interval, and the distance that the patient walks is measured.² Clinically, the test is used for several purposes, including assessing how patients with cardiac or pulmonary disease are responding to treatment; stratifying preoperative risk; and measuring exercise tolerance and prognosis.³

Six-minute walk distance (measured in feet) has been incorporated into lung allocation since the implementation of the lung allocation score (LAS) in 2005.⁴ The LAS calculation was derived from two models: a waiting list survival model and a post-transplant survival model. The models estimate the degree to which various clinical factors are predictive of survival and are used to determine the coefficients for each variable in the LAS. When LAS was first implemented by the OPTN in 2005, six-minute walk distance was a variable in the waiting list survival model but not in the post-transplant survival model. The six-minute walk distance variable was dichotomous and only impacted the score if the candidate’s walk distance was less than 150 feet. In 2015, the LAS was updated to incorporate six-minute walk distance as a continuous variable in the waiting list survival model, as recommended concurrently in clinical literature,⁵ and to add six-minute walk distance to the post-transplant survival model.⁶ In 2021, the LAS was updated based on analysis of a more current cohort of lung candidates.⁷ As part of that change, the coefficients for six-minute walk distance were updated in both the waiting list survival and post-transplant survival models. Finally, with the implementation of continuous distribution

¹ Harold A. Matos Casano and Fatima Anjum, “Six-Minute Walk Test,” StatPearls, accessed October 10, 2023, available <https://www.ncbi.nlm.nih.gov/books/NBK576420/>.

² “Guidelines for the Six-Minute Walk Test,” American Thoracic Society, March 2002, accessed October 9, 2023, available <https://www.atsjournals.org/doi/10.1164/airccm.166.1.at1102>.

³ Casano and Anjum, “Six-Minute Walk Test.”

⁴ T.M. Egan, S. Murray, R.T. Bustami, et al., “Development of the New Lung Allocation System in the United States,” *American Journal of Transplantation* 6 no. 5 (May 2006): 1212 – 1227, <https://doi.org/10.1111/j.1600-6143.2006.01276.x>.

⁵ A.W. Castleberry, B.R. Englum, L.D. Snyder, et al., “Utility of Six-Minute Walk Distance in Predicting Outcomes After Lung Transplant: A Nationwide Survival Analysis,” *The Journal of Heart and Lung Transplantation* 32 no. 4 (April 2013): S147, <https://doi.org/10.1016/j.healun.2013.01.332>.

⁶ “Proposal to Revise the Lung Allocation Score (LAS) System,” OPTN, Briefing Paper, 2012. This proposal was approved by the OPTN Board of Directors in 2012 and implemented in 2015. See “Changes to the lung allocation system,” OPTN, February 17, 2015, accessed October 9, 2023, available <https://optn.transplant.hrsa.gov/news/changes-to-the-lung-allocation-system/>.

⁷ “Updated Cohort for Calculation of the Lung Allocation Score (LAS),” OPTN, Policy Notice, accessed October 9, 2023, available <https://optn.transplant.hrsa.gov/media/4244/updated-cohort-for-calculation-of-the-las.pdf>.

of lungs on March 9, 2023, the lung composite allocation score (CAS) replaced the LAS.⁸ While the lung CAS includes additional factors in the score compared to the LAS, the medical urgency and post-transplant outcomes portions of the lung CAS are based on the modeling approach used for LAS. With the shift from LAS to the lung CAS, there were no changes to the coefficients for the variables in the waiting list survival model, including six-minute walk distance. However, the post-transplant outcomes component of the lung CAS is based on a model of five-year post-transplant survival rather than the one-year post-transplant survival model used for LAS. This altered how the six-minute walk distance factors into the post-transplant outcomes component of the allocation score. The differences between LAS and lung CAS are summarized in **Table 1**.

Table 1: Comparison of the LAS (2005 – 2023) and the Lung CAS (2023 – Present)

Attribute	LAS	CAS
Waiting list survival	1 year	1 year
Post-transplant survival	1 year	5 year
Candidate biology	Not included	Blood type, CPRA, height
Patient access	Not included	Pediatric, Prior Living Donor
Placement efficiency	Not included	Travel, Proximity Efficiency

Other differences	LAS	CAS
Total points for waiting list survival & post-transplant survival	100 out of 100	50 out of 100
Ratio of waiting list survival to post-transplant survival	2:1	1:1
Waiting list survival rating scale	Linear	Nonlinear

⁸ "Establish Continuous Distribution of Lungs," OPTN, Policy Notice, accessed November 13, 2023, https://optn.transplant.hrsa.gov/media/b13dlep2/policy-notice_lung_continuous-distribution.pdf.

The changes to how six-minute walk distance has factored into lung allocation since the 2005 implementation of LAS are summarized in **Table 2**.

Table 2: Incorporation of the Six-Minute Walk Distance in Lung Allocation

Lung Allocation	Waitlist Survival Model	Post-transplant Survival Model
2005 LAS	0.33075226458318394 if six-minute walk distance < 150 feet 0 if six-minute walk distance ≥ 150 feet	Not incorporated
2015 LAS update	-0.0844896372724000 * six-minute walk distance/100	0.0004594953809594 * (1200 – six-minute walk distance) 0 if six-minute walk distance is at least 1200 feet
2021 LAS update	-0.09937981549564 * six-minute walk distance/100	0.0001943695814883 * (1200 – six-minute walk distance) 0 if six-minute walk distance is at least 1200 feet
2023 Lung CAS	-0.09937981549564 * six-minute walk distance/100	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

In the current allocation score (the lung CAS), the six-minute walk distance has opposing effects in the medical urgency and post-transplant outcome scores. Candidates with a shorter six-minute walk distance have higher medical urgency scores and lower post-transplant outcome scores, whereas candidates with a longer six-minute walk distance receive fewer points for this variable in their medical urgency score and more points in their post-transplant outcome scores. This effect is shown in **Figure 1**, where the distribution of six-minute walk distance for the candidates with medical urgency scores in the top 25% skewed lower compared to the distribution of six-minute walk distance for candidates with medical urgency scores in the bottom 75%. It is also important to highlight there is more weight on post-transplant outcomes in the lung CAS than in the LAS as the ratio of waitlist outcome and post-transplant outcomes was 2:1 in the LAS calculation and 1:1 in the lung CAS.

Figure 1: Distribution of Six-Minute Walk Distance (feet) by Medical Urgency Category⁹



Historically, professional medical organizations have issued clinical guidelines and standards for conducting the six-minute walk test. For example, in 2002, the American Thoracic Society released guidelines for the six-minute walk test.¹⁰ The guidelines include indications and limitations, contraindications, safety issues, technical aspects, and quality assurance considerations, among other topics. Additionally, in 2014, the European Respiratory Society and American Thoracic Society released a technical standard for field walking tests in chronic respiratory disease which included the six-minute walk test.¹¹ This standard included further guidance for performing the six-minute walk test based on clinical literature published following release of the 2002 guidelines. While detailed, these standards do not delineate a specific approach for determining oxygen requirements ahead of the six-minute walk test or provide guidance on how to conduct the walk with severely impaired patients, which is particularly relevant for the lung transplant candidate population. Furthermore, as detailed below, OPTN policy regarding the six-minute walk distance is not well aligned with the clinical standards as it leaves broad discretion to transplant programs on increasing supplemental oxygen during the six-minute walk test. Due to these gaps, lung transplant program representatives report that performance of the six-minute walk test is not consistent across transplant programs and have expressed concerns that the variation may result in inequities in allocation priority.

The Committee established the Six-Minute Walk Workgroup (the Workgroup) to discuss approaches for standardizing performance of the six-minute walk test for lung transplant candidates and supplementing the existing clinical standards with guidance specifically for lung transplant programs. The Workgroup included pulmonologists and patient representatives from the Committee, as well as respiratory therapists. Their recommendations were presented to the Committee to inform the development of this proposal.

⁹ Samantha Weiss and Chelsea Weibel, "Medical Urgency Data Request: Distributions of Characteristics of Most Medically Urgent Lung Candidates," OPTN Descriptive Data Request for the National Lung Review Board, October 5, 2023. Analysis includes all lung-alone candidates on the OPTN waiting list as of July 31, 2023 and their data at that time. The top 25% of medically urgent candidates are those with at least 0.6350 medical urgency points, excluding exceptions.

¹⁰ "Guidelines for the Six-Minute Walk Test," American Thoracic Society.

¹¹ Anne E. Holland, Martijn A. Spruit, Thierry Troosters, et al., "An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease," *European Respiratory Journal* 44 (2014): 1428-1446, DOI: 10.1183/09031936.00150314.

Proposal for Board Consideration

The Committee proposes policy and data definition changes, as well as new guidance to promote standardization of the six-minute walk test for the purposes of lung allocation.

New Policy Requirement for Oxygen Titration Test

The Committee proposed adding a new requirement in policy for lung transplant programs to perform an oxygen titration test ahead of the initial six-minute walk test for lung candidates at least 12 years old, and for lung candidates approaching 12 years of age. The final amount of supplemental oxygen from the oxygen titration test would be the amount of supplemental oxygen provided to the candidate at the start of the six-minute walk test and would need to be documented in the candidate's medical record.

Following discussion of practices at their own hospitals and review of six-minute walk test and oxygen titration protocols submitted by several transplant programs, the Workgroup identified provision of supplemental oxygen as the main source of variability in how the six-minute walk test is administered to lung transplant candidates. Many transplant programs reported using the 2002 and 2014 standards to guide how they perform the test, though transplant programs also reported titrating up supplemental oxygen during the six-minute walk test if the candidate desaturated. The 2014 technical standard states, "Oxygen is not to be titrated during any of the tests where distance is a measured outcome. If oxygen titration is desired, this should be done during a separate test."¹² However, the current OPTN policy language suggests that oxygen titration during the six-minute walk test is acceptable since it states that "Increase in supplemental oxygen during this test is at the discretion of the center performing the test." The Workgroup noted that transplant programs aim to support their lung candidates in walking as far as they can during the test since that often results in a higher overall allocation score.

The Workgroup discussed extensively how to balance consistent administration of the six-minute walk test with the goal of providing appropriate access to transplant for lung candidates, as determined in part by their six-minute walk distance. The Workgroup determined that the optimal approach is for transplant programs to perform a separate oxygen titration test ahead of the six-minute walk test, as advised by the 2014 technical standard,¹³ to determine how much supplemental oxygen the candidate should receive during the six-minute walk test and to avoid titrating up supplemental oxygen during the six-minute walk test. The intent is for candidates to receive adequate supplemental oxygen to complete the six-minute walk test without providing excessive supplemental oxygen that would impact the candidate's performance.

The Workgroup considered whether an oxygen titration test should be recommended in guidance or required by policy. The Workgroup noted that completing an oxygen titration test and a six-minute walk test in the same day may be physically taxing for a candidate and logistically challenging for both the candidate and the transplant program, as the candidate may need time (up to a few hours) to rest and recover in between the two tests. The oxygen titration test may not be necessary prior to every six-minute walk test if the candidate's supplemental oxygen needs with exertion are well-established and stable. Workgroup members noted that administering the six-minute walk test to pediatric candidates can be challenging and respiratory therapists may need to make the test seem like a game to get the candidate to adhere to the instructions, so administering two separate tests may be particularly challenging for these candidates. Their supplemental oxygen needs may also be well-established due to frequent inpatient care. The Workgroup also noted that each transplant program's pulmonary function

¹² Holland et al., "Field walking tests," 1438.

¹³ Ibid.

testing laboratory may not always have the capacity to conduct an oxygen titration test every time that a candidate does a six-minute walk test. However, since guidance is not binding, members of the Workgroup and the Committee decided that a minimum requirement should be added to policy to promote standardization of the six-minute walk test across lung transplant programs. Accordingly, the Committee determined that requiring an oxygen titration test ahead of the candidate's initial six-minute walk test would be an appropriate compromise, with supplementary guidance recommending that additional oxygen titration tests be completed at least once in every 6-month period, or more frequently as needed as a candidate's condition changes.

Candidates less than 12 years old are assigned waitlist survival and post-transplant outcomes points based on their pediatric priority. Their scores are not impacted by changes to their six-minute walk distance up until they turn 12 years old, at which point their waitlist survival and post-transplant outcomes points are calculated based on the clinical values entered, including six-minute walk distance. Accordingly, the Committee determined that only candidates ages 12 and older should be required to complete the oxygen titration test ahead of the six-minute walk test. However, since six-minute walk distance impacts the allocation score as soon as a candidate turns 12 years old, the policy would also require transplant programs to perform an oxygen titration test as the candidate's 12th birthday approaches. Specifically, the policy would require transplant programs to conduct the oxygen titration test before reporting a six-minute walk distance within six months of a candidate's 12th birthday. This would ensure that as soon as the six-minute walk distance factors into a candidate's score upon turning 12, the value entered will be based on the same standardized approach for determining supplemental oxygen needs as for other candidates at least 12 years old.

The Committee also proposes removing some of the existing policy language regarding the six-minute walk distance. Lung allocation policy describes how the six-minute walk distance factors into the waitlist survival calculation and the post-transplant outcomes calculation of the lung CAS. These policies specify that the six-minute walk distance is "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." The Committee proposes removing this description of how the six-minute walk test should be performed from policy and instead providing more direction on how to conduct the test via guidance.

Finally, the Committee proposes clarifying how age factors into the waitlist survival calculation. *Table 21-3: Waiting List Survival Calculation: Covariates and their Coefficients* currently states that "age at the time of the match run" in fractional calendar year is included in the lung waiting list survival calculation for "all candidates." However, per *Policy 10.1.A.2 Waitlist Survival Points for Candidates Less than 12 Years Old*, candidates less than 12 years old are assigned waitlist survival points based on their pediatric priority and do not receive a calculated waiting list survival score. Accordingly, the Committee proposes replacing "all candidates" in the table with language to indicate that age is incorporated into the waiting list survival calculation when "candidates are at least 12 years old."

Data Definition Change

The current data definition on the Lung Candidate Record in OPTN Waiting List for the six-minute walk distance is as follows:

Enter the total exertional distance on a flat surface the candidate is able to walk in six minutes in feet. The distance walked is a measure of functional status. The normal range is between 0 and 3000, although a value outside of this range may be entered. Enter the Test Date when this information was obtained. These fields must be updated every 6 months from the time the

candidate was added to the waiting list. If they are incomplete or expired, the least beneficial value will be used to calculate the candidate's lung composite allocation score.

The Committee proposes adding a sentence to this data definition to direct users to additional guidance on completing the six-minute walk test and clarifying that values “greater than” rather than “outside of” the specified range may be entered. Additionally, the phrase “normal range” would be replaced with “expected range of values.” The Committee also proposes striking “the distance walked is a measure of functional status” as the test may be used for different purposes and this statement does not provide instruction on how to enter the data. The proposed changes are summarized in **Appendix A**.

Recommendations

The proposed guidance offers recommendations to lung transplant programs on how to perform the six-minute walk test for their lung candidates, with specific recommendations for provision of supplemental oxygen during the test and safety considerations for the lung transplant candidate population. While the guidance does not include considerations for altitude, the Committee requested community feedback on whether any adjustments were needed to account for altitude when reporting six-minute walk distance.

Introduction

The guidance advises lung transplant programs to follow the 2002¹⁴ and 2014¹⁵ standards to the extent possible as these standards provide direction on many details of the test that can have a substantial impact on a patient’s performance. For example, the 2014 standard notes that the six-minute walk distance is “highly sensitive to changes in methodology,” including shape and length of the track used for the walk, whether a wheeled walking aid is used, whether the patient or the respiratory technician carries any supplemental oxygen used, and the instructions and encouragement provided to the patient. The patient representatives on the Workgroup emphasized that completing the six-minute walk test can be stressful and challenging for lung candidates so it is important to prevent obstacles and distractions. For example, the test should be conducted in a quiet, 100 foot (30 meter) hallway, if possible, as “a shorter corridor requires patients to take more time to reverse directions more often, reducing the [six-minute walk distance].”¹⁶ Completing the test in a busy corridor may require the candidate to navigate obstacles like people or equipment. The standards also state that the technician performing the test should not talk to anyone during the test except to say standard phrases of encouragement to the candidate. The patient representatives on the Workgroup reiterated that talking or being asked questions during the test can interfere with the patient’s performance.

Provision of Supplemental Oxygen

In addition to the policy requirement for an oxygen titration test ahead of a candidate’s initial six-minute walk test (for candidates at least 12 years old or within six months of turning 12), the Committee proposes guidance regarding provision of supplemental oxygen during the six-minute walk test. Per *OPTN Policy 10.3.B Lung Clinical Values That Must Be Updated Every Six Months*, the six-minute walk distance must be updated at least once in every six-month period following registration for each

¹⁴ “Guidelines for the Six-Minute Walk Test,” American Thoracic Society.

¹⁵ Anne E. Holland, Martijn A. Spruit, Thierry Troosters, et al., “An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease,” *European Respiratory Journal* 44 (2014): 1428-1446, DOI: 10.1183/09031936.00150314.

¹⁶ “Guidelines for the Six-Minute Walk Test,” American Thoracic Society, 113.

candidate on the lung waiting list. To align with this timing, the guidance recommends that transplant programs perform the oxygen titration test at least once in every six-month period. The guidance notes that both the oxygen titration test and the six-minute walk test may be completed and updated more frequently if deemed appropriate by the transplant program due to a candidate’s changing clinical status. For pediatric lung transplant programs, the guidance reiterates that candidates approaching 12 years of age should have an oxygen titration test conducted ahead of the six-minute walk test for the six-minute walk distance reported within 6 months before the candidate turns 12 years old.

The Workgroup discussed whether to prohibit transplant programs from titrating up supplemental oxygen during the six-minute walk test in policy. While oxygen titration during the six-minute walk test should be avoided, the Workgroup determined that in instances where candidates desaturate during the six-minute walk test and need additional supplemental oxygen to complete the test, it is more appropriate for the transplant program to provide additional supplemental oxygen than to halt the six-minute walk test and ask the candidate to perform the oxygen titration test and/or the six-minute walk test again. While it is important for six-minute walk distances to be reported consistently for lung allocation, completion of the test is not intended to be a barrier for granting a candidate the appropriate priority in lung allocation. If a candidate’s six-minute walk distance is missing or expired on the Lung Candidate Record in OPTN Waiting List, least beneficial values are substituted in the waiting list survival and post-transplant outcomes scores as indicated in *OPTN Policy 21.2.A Values Used in the Calculation of Lung Waiting List Survival* and *Policy 21.2.B.1 Coefficients Used in Calculating Lung Post-Transplant Outcomes* and summarized in **Table 3**. The substituted values result in a lower lung CAS than if a six-minute walk distance is reported.

Table 3. Substituted Values for Six-Minute Walk Distance if Missing or Expired¹⁷

Calculation	If six-minute walk distance is:	Then the calculation uses this substituted value:
Waiting list survival	Missing or expired	4,000 feet
Post-transplant outcomes	Missing or expired	200 feet

As part of post-public comment updates, the Committee added a recommendation to guidance advising transplant hospitals that the oxygen titration test should be done as close as possible, but no more than 12 weeks ahead of the six-minute walk test. Following the public comment period, there was extensive discussion about whether to specify a timeframe within which the oxygen titration test should be performed ahead of the six-minute walk test. Community feedback and Committee discussions indicated that there is wide variation in when transplant hospitals determine candidates’ oxygenation needs ahead of the six-minute walk test. This variation is related to multiple factors, including the physical burden on the candidate and logistical and financial burden on the candidate and transplant hospital. Members agreed, the closer in time that the oxygen titration test is performed ahead of the six-minute walk test, the more precisely candidate oxygenation needs are met during the six-minute walk test. However, the Committee recognized the need for flexibility to mitigate burdens, therefore, opted for a recommendation via guidance.

Safety Considerations

The Workgroup identified certain safety considerations for lung transplant candidates that are not addressed by the current technical standards for the six-minute walk. First, the current policy language

¹⁷ OPTN Policy 21.2.B.1 *Coefficients Used in Calculating Lung Post-Transplant Outcomes* also reports that if six-minute walk distance is greater than 1,600, then the post-transplant outcomes score calculation uses the substituted value of 1,600 feet.

indicates that candidates should be provided supplemental oxygen to maintain oxygen saturation (SpO₂) of 88% or greater at rest. However, the 2014 technical standard states that the six-minute walk test “has an excellent safety profile” when the test is stopped if the patient’s oxygen saturation falls below 80%.¹⁸ The Workgroup discussed whether to change the oxygen saturation level in policy to 80% to align with the technical standard, but many of the Workgroup members were uncomfortable with the lower threshold as they did not think it would be clinically appropriate to allow some lung transplant candidates to desaturate to that level. The patient representatives on the Workgroup also reiterated how challenging these tests can be for candidates and expressed concern about transplant programs allowing them to desaturate to 80%. The Workgroup also noted that some lung transplant candidates may not be able to maintain an oxygen saturation level of 88% at rest with supplemental oxygen but may still be able to safely complete the six-minute walk test. Accordingly, the Workgroup recommended removing the desaturation threshold from policy and leaving some discretion to transplant programs to determine what is most appropriate for their candidates.

The Workgroup agreed that the six-minute walk test should be administered to lung transplant candidates if possible and “0 feet” should only be entered for the six-minute walk distance if completing the test is not safe or feasible, for example, because the candidate is on continuous mechanical ventilation and/or extracorporeal membrane oxygenation. The Workgroup also agreed that for candidates who are unable to complete the six-minute walk test due to reasons unrelated to their lung disease – for example, lower limb amputation or joint necrosis – transplant programs may consider submitting an exception request. A recommendation for developing an exception request for this situation is detailed in the guidance.

Community feedback suggested adding guidance for candidates on high flow oxygen that are inpatient on intermediate or intensive care units, undergoing urgent waitlist evaluation. The Committee agreed that it may not be safe or feasible for such candidates to attempt the six-minute walk test as they often cannot be transported to a pulmonary function test laboratory and ICUs are not set up appropriately. The Committee discussed that the scenario described is captured by the recommendation to enter “0 feet” if completing the test is not safe or feasible. The Committee decided to remove examples associated with this language in guidance to avoid confusion about when “0 feet” should be entered. Transplant program discretion should be used to determine a candidate’s ability to safely perform the six-minute walk test.

Altitude

The Workgroup discussed that some candidates live in locations at altitudes that are significantly different than the altitude of the transplant hospital where they are registered. The Workgroup noted that these candidates may have different supplemental oxygen needs at home versus at the transplant hospital. One study on individuals without lung disease found that those who lived at high altitudes had shorter six-minute walk distances at sea level compared to individuals who lived at sea level,¹⁹ though these individuals did not use supplemental oxygen. The Committee requested feedback on whether the oxygen titration test will adequately determine a candidate’s supplemental oxygen needs if they are performing the tests at a different altitude than their residence, or if any special consideration needs to be given for candidates performing the tests at a different altitude than their residence. There was somewhat mixed community feedback, which included the following:

¹⁸ Holland et al., “Field walking tests,” 1433.

¹⁹ Deirdre Caffrey, J. Jaime Miranda, Robert H. Gilman, et al., “A cross-sectional study of differences in 6-min walk distance in health adults residing at high altitude versus sea level,” *Extreme Physiology & Medicine* 3, no. 3 (2014), <https://extremephysiolmed.biomedcentral.com/articles/10.1186/2046-7648-3-3>.

- Altitude should be considered so that certain candidates are not disadvantaged.
- Performing the titration test at a similar elevation to where the candidate resides is preferred, but not always practical due to limited provider availability in some areas.
- A suggestion for tests to be done at the transplant program where the candidate is registered to ensure data quality.

The Committee discussed that there are likely few programs and candidates affected by altitude. It was noted that it would be difficult to ensure the oxygen titration protocol was performed consistently if done at a location other than the transplant program. Therefore, the Committee recommended that the oxygen titration test and the six-minute walk test be performed at the transplant program to ensure consistency and fairness in allocation.

Overall Sentiment from Public Comment

Generally, public comment sentiment was supportive of this proposal, as indicated by the total sentiment score of 3.8, with some pockets of concern. There was overall support for requiring an oxygen titration test ahead of the initial six-minute walk test with some concerns related to the logistical and financial burden on transplant programs and candidates. Additionally, there were some comments that recommended aligning OPTN requirements and recommendations with six-minute walk guidance from the American Thoracic Society; as mentioned, this proposal is meant to address gaps in this guidance to ensure equitable allocation priority for lung transplant candidates.

Regarding Figures 2 and 3 below, sentiment is collected from participants who submit an individual public comment and from regional meeting participants. Participants are asked to provide their feedback on “What is your opinion of this proposal?”. There are five Likert scale response choices with 1 representing strongly oppose up to 5 representing strongly support.

Figure 2 shows sentiment received from all respondents (regional meeting, online, and email) by their stated member type. Again, there was overall support for the concept, demonstrated by a sentiment score of 3.8.

Figure 2: Public Comment Sentiment by Member Type, Standardize Six Minute Walk for Lung Allocation, 2024

Sentiment by Member Type

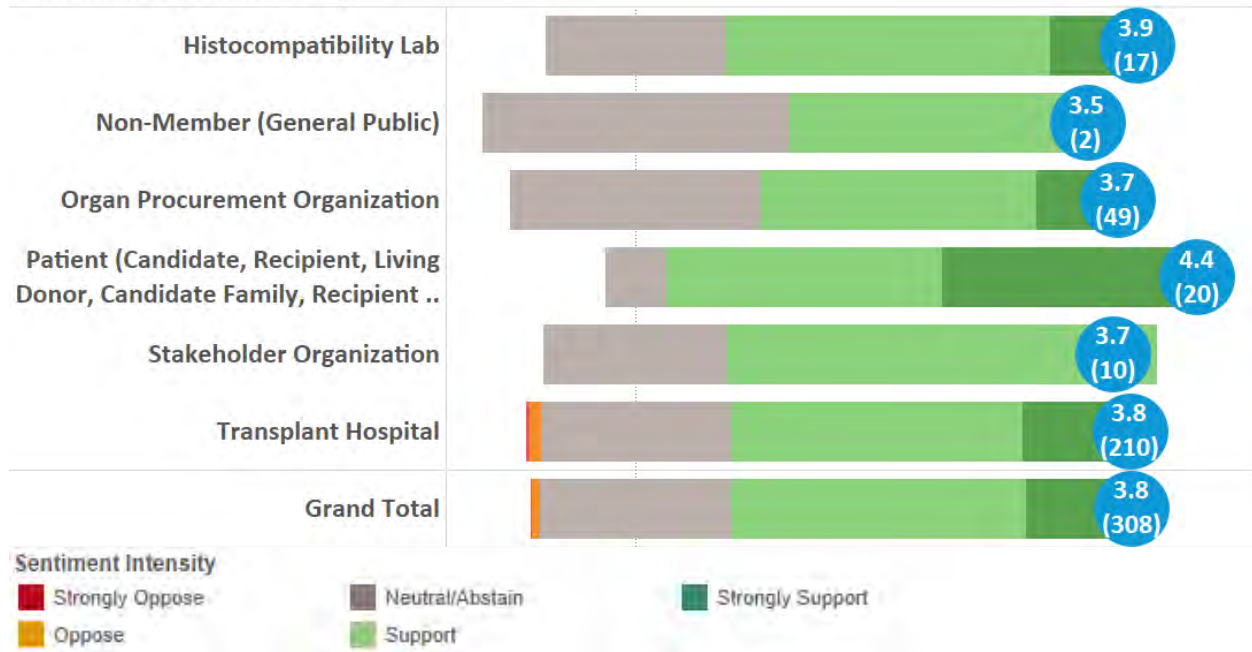
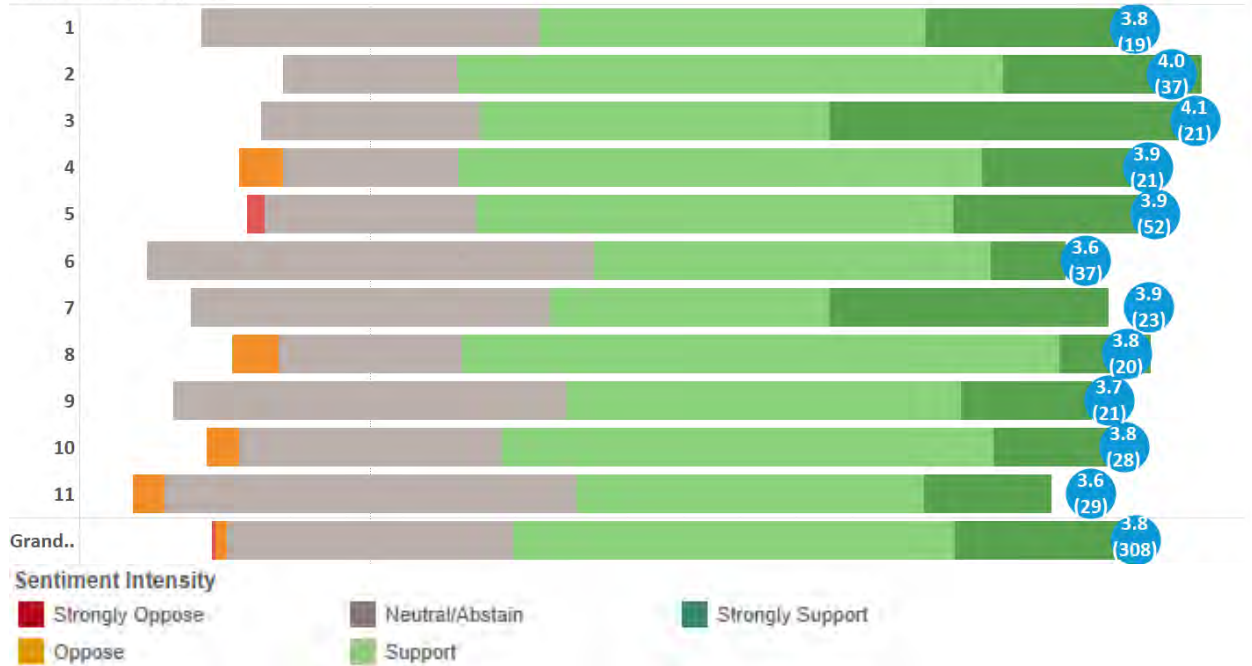


Figure 3 shows sentiment from all respondents by region. Again, overall sentiment was supportive, as indicated by a total sentiment score of 3.8. The number of members that chose to remain neutral/abstain may be due to the proposal being lung-specific.

Figure 3: Public Comment Sentiment by Region, Standardize Six Minute Walk for Lung Allocation, 2024

Sentiment by Region



The Committee approved these changes based on community feedback received during the public comment period:

- Specify in guidance that the oxygen titration test should be done as close in time as possible, but no more than 12 weeks ahead of the six-minute walk test
- Remove examples from policy describing when it may be unfeasible/unsafe for a candidate to complete the six-minute walk test
- Add guidance for altitude considerations including a recommendation to perform both the oxygen titration test and six-minute walk test at the transplant hospital to ensure consistency
- Adjust the implementation date to September 3, 2024 and related transition plan dates to better align with the OPTN's current implementation processes
 - Remove this from proposed policy language and add as a policy resolution, so that policy will not become outdated once these dates have passed

Compliance Analysis

NOTA and OPTN Final Rule

The Committee submits this proposal for consideration under the authority of the National Organ Transplant Act of 1984 (NOTA) and the OPTN Final Rule. NOTA requires the OPTN to "establish... medical criteria for allocating organs and provide to members of the public an opportunity to comment with respect to such criteria."²⁰ The OPTN Final Rule states that "allocation policies shall be designed to achieve equitable allocation of organs among patients" through "[s]etting priority rankings expressed, to the extent possible, through objective and measurable medical criteria."²¹ This proposal is not an allocation policy and would not change the medical criteria for allocating lungs; however, it would clarify how one medical criterion, the six-minute walk distance, should be measured and reported to the OPTN for the purposes of lung allocation. The Final Rule also states that one of the performance goals for allocation policies is to "reduc[e] inter-transplant program variance" in performance indicators.²² This proposal would assist in reducing inter-transplant program variance in how lung candidates of similar disease states are prioritized for transplant by promoting standardization in how the six-minute walk test is conducted for lung allocation purposes.

Transition Plan

The Final Rule requires the OPTN to "consider whether to adopt transition procedures that would treat people on the waiting list and awaiting transplantation prior to the adoption or effective date of the revised policies no less favorably than they would have been treated under the previous policies" whenever organ allocation policies are revised.²³ While this proposal would not change lung allocation, and thus this Final Rule requirement does not need to be satisfied prior to its implementation, this proposal may impact how transplant programs measure a clinical value that ultimately affects candidates' lung composite allocation scores. For this reason, the Committee considered the proposal in light of this Final Rule provision. The Committee determined that no transition plan is needed prior to the effective date of the revised policies. However, the Committee proposes that lung transplant programs would need to complete an oxygen titration test prior to a six-minute walk test within six months from the implementation date for candidates registered on the lung waiting list prior to the

²⁰ 42 USC §274(b)(2)(B).

²¹ 42 CFR §121.8(b)(2).

²² 42 CFR §121.8(b)(4).

²³ 42 CFR § 121.8(d).

implementation of the proposed policies. This approach would ensure that lung candidates on the waiting list prior to implementation are treated similarly to candidates registered on the lung waiting list following implementation.

Initially, the Committee proposed an implementation date of September 5, 2024, which means that oxygen titration tests would need to be completed along with the six-minute walk test by March 5, 2025, for lung candidates registered prior to September 5, 2024. Overall, community feedback indicated that this would provide lung transplant programs sufficient time to prepare for this implementation if the proposal is approved by the OPTN Board of Directors in June 2024. To better align with current OPTN implementation processes, the Committee now proposes an implementation date of September 3, 2024, and subsequent deadline of March 3, 2025. After the public comment period, this portion of the proposal was removed from the policy language and will be addressed by an enactment clause, so that policy will not become outdated once these dates have passed.

OPTN Strategic Plan

This proposal aligns with the strategic plan goal to improve equity in access to transplants. This proposal aims to create more consistency between programs in how the six-minute walk is conducted, thereby increasing the quality of OPTN data used in the lung composite allocation score calculation.

Implementation Considerations

This proposal will impact the operations of transplant hospitals and the OPTN and is expected to have a low overall fiscal impact on transplant hospitals. There is no anticipated operational or fiscal impact to organ procurement organizations or histocompatibility laboratories.

Transplant Hospitals

Operational considerations

Transplant hospitals with lung transplant programs must ensure that oxygen titration tests are completed ahead of the six-minute walk test for lung candidates as specified in this proposal. Lung transplant programs may also need to update their internal policies regarding oxygen titration and six-minute walk to align with the policy changes and guidance, and coordinate with their pulmonary function testing laboratories to schedule additional tests for lung candidates.

Fiscal Impact

Transplant hospitals may incur added staffing costs in the event a full-time respiratory therapist must be made available for these assessments. Transplant hospitals may need to cover costs of assessments if not covered by payors.

OPTN

Operational considerations

This proposal refers to the submission of official OPTN data that are presently collected by the OPTN. T Data collected pursuant to the OPTN's regulatory requirements in §121.11 of the OPTN Final Rule will be collected through OMB approved data collection forms. After OPTN Board approval, the updated OMB instructions for the existing data collection will be submitted to OMB.

The OPTN would publish the updated policies and guidance; update help documentation in OPTN Waiting List for six-minute walk distance; and communicate the changes to members.

Resource Estimates

It is estimated that 210 hours would be needed to implement this proposal. Implementation would involve providing education, guidance, and communication efforts to transplant hospitals with lung transplant programs about the proposed policy changes. It is estimated that 50 hours would be required for ongoing support. Ongoing support includes post-implementation monitoring for the additional data fields and answering member questions and, as necessary.

Potential Impact on Select Patient Populations

Lung transplant candidates may be asked by their transplant programs to complete additional oxygen titration tests or to make other modifications to how they perform the six-minute walk test. Since the intent of this proposal is to standardize how six-minute walk distance is reported for all lung candidates for use in lung allocation, the Committee does not anticipate that any subset of lung transplant candidates would be impacted differently from other lung transplant candidates.

Post-implementation Monitoring

Member Compliance

At transplant hospitals, site surveyors will review a sample of medical records, and any material incorporated into the medical record by reference, to include an oxygen titration test, to verify that lung composite allocation score clinical values are consistent with source documentation.

Policy Evaluation

The Committee identified the key metric for this project to be “qualitative feedback from the community” as it does not incorporate any changes to OPTN data collection nor allocation. This project arose because of conversations within the community regarding inconsistencies in how the six-minute walk test was being performed across transplant programs. As a result, the Committee determined that these community conversations would be the best way to assess whether the policy had the intended effect to standardize six-minute walk testing practices.

Conclusion

Since a candidate’s six-minute walk distance is a significant factor in lung allocation, the Committee proposes requiring an oxygen titration test in policy ahead of the initial six-minute walk test for candidates at least 12 years old and for candidates approaching 12 years of age. This proposed policy change is intended to promote a standardized approach for providing supplemental oxygen during the six-minute walk test, in part by requiring that the final amount of supplemental oxygen from the oxygen titration test must be the amount provided to the candidate at the start of the six-minute walk test. The Committee also proposes guidance and data definition changes to complement the proposed policy change, with the overall goal of promoting equity in lung allocation. Ultimately, this proposal will better align OPTN policy with the clinical standards regarding the six-minute walk.

After considering community feedback, the Committee approved post-public comment changes to the proposed guidance for the oxygen titration test. The Committee added guidance recommending the

oxygen titration test be performed as close in time as possible, but no more than 12 weeks ahead of the six-minute walk test and that both the oxygen titration test and the six-minute walk test be performed at the transplant hospital to account for altitude differences. To be less prescriptive, the Committee decided to remove examples of when it may be unfeasible or unsafe for the candidate to perform the six-minute walk test. Finally, the Committee updated the implementation date from September 5, 2024 to September 3, 2024 to align with current OPTN implementation processes; this portion of the transition plan was moved from proposed policy language to an enactment clause, so that once implementation dates pass, policy language will not become outdated.

Policy Language

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

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

2 For candidates at least 12 years old at the time of the match run lung waitlist survival points are
3 awarded based on the candidate's waiting list survival probability, based on the following factors:

- 4 • Age at the time of the match run (fractional calendar years)
- 5 • Bilirubin (mg/dL) value with the most recent test date and time
- 6 • Body mass index (BMI) (kg/m²)
- 7 • Assisted ventilation
- 8 • Creatinine (serum) (mg/dL) with the most recent test date and time
- 9 • Diagnosis Group (A, B, C, or D), as defined in Policy 10.1.F Lung Disease Diagnosis Groups
- 10 • Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
 - 11 ○ Bronchiectasis
 - 12 ○ Sarcoidosis with pulmonary artery (PA) mean pressure of 30 mm Hg or less
 - 13 ○ Sarcoidosis with PA mean pressure missing
- 14 • Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
 - 15 ○ COVID-19: pulmonary fibrosis
 - 16 ○ Pulmonary fibrosis, other specify cause
 - 17 ○ Sarcoidosis with PA mean pressure greater than 30 mm Hg
- 18 • Functional Status
- 19 • Oxygen needed to maintain adequate oxygen saturation (88% or greater) at rest (L/min)
- 20 • PCO₂ (mm Hg): current
- 21 • PCO₂ increase of at least 15%
- 22 • PA systolic pressure (mm Hg) at rest, prior to any exercise
- 23 • Six-minute walk distance (feet) ~~obtained while the candidate is receiving supplemental oxygen~~
24 ~~required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental~~
25 ~~oxygen during this test is at the discretion of the center performing the test.~~

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

28 10.1.B.1 Post-Transplant Outcomes Points for Candidates at Least 12 Years Old

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

- 32 • Age at the time of the match run (fractional calendar years)
- 33 • Creatinine (serum) (mg/dL) with the most recent data and time
- 34 • Cardiac index (L/min/m²) at rest, prior to any exercise
- 35 • Assisted ventilation
- 36 • Diagnosis Group (A, B, C, or D), as defined in 10.1.F: Lung Disease Diagnosis Groups
- 37 • Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
 - 38 ○ Bronchiectasis

- 39 ○ Lymphangioleiomyomatosis
- 40 ○ Sarcoidosis with PA mean pressure of 30 mm Hg or less
- 41 ○ Sarcoidosis with PA mean pressure missing
- 42 ● Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
- 43 ○ COVID-19: pulmonary fibrosis
- 44 ○ Obliterative bronchiolitis (non-retransplant)
- 45 ○ Constrictive bronchiolitis
- 46 ○ Sarcoidosis with PA mean pressure greater than 30 mm Hg
- 47 ○ Pulmonary fibrosis, other specify cause
- 48 ● Functional Status
- 49 ● Six-minute walk distance (feet) ~~obtained while the candidate is receiving supplemental oxygen~~
- 50 ~~required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental~~
- 51 ~~oxygen during this test is at the discretion of the center performing the test.~~

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

54 [...]

55 10.3 Clinical Values and Update Schedule

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

59 For any six-minute walk distances reported during the six months preceding a candidate turning 12
 60 years old, and for any initial six-minute walk distances reported for candidates at least 12 years old,
 61 transplant programs must perform an oxygen titration test prior to conducting the six-minute walk test
 62 for a candidate on the lung waiting list. The final amount of supplemental oxygen from the oxygen
 63 titration test must be the amount provided to the candidate at the start of the six-minute walk test and
 64 documented in the candidate’s medical record.

65 For six-minute walk distances reported prior to the six months preceding the candidate turning 12 years
 66 old, and for any subsequent updates to the six-minute walk distance according to *Policy 10.3.B Lung*
 67 *Clinical Values That Must Be Updated Every Six Months*, transplant programs may conduct an oxygen
 68 titration test prior to the six-minute walk test and may modify the amount of supplemental oxygen
 69 provided to the candidate at the start of the six-minute walk test.

70 The data reported at the time of the candidate’s registration on the lung transplant waiting list must be
 71 six months old or less from the date of the candidate’s registration date, with the exception of the
 72 following values:

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

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

78 [...]

79 **10.3.B Lung Clinical Values That Must Be Updated Every Six Months**

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

- 82 • Bilirubin (mg/dL) value with the most recent test date and time
- 83 • Weight to determine body mass index (BMI) (kg/m²)
- 84 • Creatinine (serum) (mg/dL) value with the most recent test date and time
- 85 • Functional Status
- 86 • Amount of supplemental oxygen required to maintain adequate oxygen saturation (88% or
87 greater) (L/min)
- 88 • PCO₂ (mm Hg)
- 89 • Six-minute walk distance (feet) ~~obtained while the candidate is receiving supplemental oxygen~~
90 ~~required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental~~
91 ~~oxygen during this test is at the discretion of the center performing the test.~~
- 92 • Assisted ventilation status

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

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

99 **21.2.A Values Used in the Calculation of Lung Waiting List Survival**

100 *Table 21-3* provides the covariates and their coefficients for the waiting list mortality calculation.
101 See *Policy 10.1.F.i: Lung Disease Diagnosis Groups* for specific information on each diagnosis group.

102

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 <u>Candidates</u> are at least 12 <u>years old</u>	$0.0281444188123287 * \text{age}$
[...]		
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. <u>Candidates</u> are at least 12 <u>years old</u>	$-0.09937981549564 * \text{Six-minute walk distance} / 100$

103 [...]

104 **21.2.B.1 Coefficients Used in Calculating Lung Post-Transplant Outcomes**

105 *Table 21-6: Post-Transplant Outcomes Calculation: Covariates and Their Coefficients* lists the covariates
 106 and corresponding coefficients in the waiting list and post-transplant survival measures. See *Policy*
 107 *10.1.F: Lung Disease Diagnosis Groups* for specific information on each diagnosis group.

108

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
[...]		
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	$-0.0002535116049789 \times (200 - \text{Six-minute walk distance}) + 0.11168755$
	At least 200 feet and less than 600 feet	$-0.0002841805913329 \times (\text{Six-minute walk distance} - 200) + 0.11168755$
	At least 600 feet and less than 800 feet	$-0.0000049617083362 \times (\text{Six-minute walk distance} - 600) - 0.00198468$
	At least 800 feet and less than 1,200 feet	$-0.0001950464256370 \times (\text{Six-minute walk distance} - 800) - 0.00297703$
	At least 1,200 feet and less than 1,600 feet	$-0.0007428583659073 \times (\text{Six-minute walk distance} - 1200) - 0.08099560$
	At least 1,600 feet	$0.0035374143842919 \times (\text{Six-minute walk distance} - 1600) - 0.37813894$

109 [...]

110 **ENACTMENT CLAUSE:**

111 **For lung candidates registered prior to September 3, 2024, who are at least 11 years 6 months old on**
 112 **September 3, 2024, transplant programs must perform an oxygen titration test prior to conducting the**
 113 **six-minute walk test for reporting a six-minute walk distance by March 3, 2025.**

Guidance Language

Proposed new language is underlined (example).

114 Guidance for Conducting the Six-Minute Walk Test for 115 Lung Allocation

116 Per OPTN Policy 10.3.B Lung Clinical Values That Must Be Updated Every Six Months, transplant hospitals
117 must update the six-minute walk distance in feet for each lung candidate at least once in every six-
118 month period following registration on the waiting list. This guidance offers recommendations for
119 performing the six-minute walk test to promote standardization across transplant programs in how the
120 six-minute walk distance is reported for the purposes of lung allocation. Transplant programs are
121 advised to follow the 2002 American Thoracic Society Guidelines for the Six-Minute Walk Test¹ and the
122 2014 European Respiratory Society/American Thoracic Society technical standard on field walking tests
123 in chronic respiratory disease² to the extent possible. If the walk distance is measured in meters, use
124 **Appendix A** to convert the walk distance from meters to feet.

125 Provision of Supplemental Oxygen

126 The 2014 technical standard states, “Oxygen is not to be titrated during any of the tests where distance
127 is a measured outcome. If oxygen titration is desired, this should be done during a separate test.”³ Per
128 OPTN Policy 10.3 Clinical Values and Update Schedule, transplant hospitals must conduct an oxygen
129 titration test to determine the amount of supplemental oxygen that should be provided to the
130 candidate during the candidate’s initial six-minute walk test. This requirement applies to candidates at
131 least 12 years old and for six-minute walk distances reported during the six months preceding a
132 candidate turning 12 years old. Accordingly, transplant programs are advised to perform the oxygen
133 titration test as close in time ahead of the six-minute walk test as is feasible but no more than 12 weeks
134 prior to the six-minute walk test. Pediatric lung transplant programs are advised to ensure that
135 candidates approaching 12 years old complete an oxygen titration test ahead of the six-minute walk test
136 for the six-minute walk distance reported within six months before the candidate turns 12 years of age.
137 The intent of performing the oxygen titration test ahead of the six-minute walk test is to provide a
138 standardized approach for determining supplemental oxygen needs for completing the test and to avoid
139 titration during the test so as not to interfere with the candidate’s performance. Accordingly, transplant
140 programs are advised to perform the oxygen titration test as close in time ahead of the six-minute walk
141 test as is feasible but no more than 12 weeks prior to the six-minute walk test. A sample oxygen titration
142 protocol is enclosed in **Appendix B**. If a candidate desaturates during the six-minute walk test, the
143 transplant program may provide additional supplemental oxygen to enable the candidate to complete
144 the test.

145 Per OPTN Policy 10.3.B Lung Clinical Values That Must Be Updated Every Six Months, the six-minute walk
146 distance must be updated at least once in every six-month period following registration for each

¹ “Guidelines for the Six-Minute Walk Test,” American Thoracic Society, March 2002, accessed October 9, 2023, available <https://www.atsjournals.org/doi/10.1164/airccm.166.1.at1102>.

² Anne E. Holland, Martijn A. Spruit, Thierry Troosters, et al., “An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease,” *European Respiratory Journal* 44 (2014): 1428-1446, DOI: 10.1183/09031936.00150314.

³ Holland et al., “Field walking tests,” 1438.

147 candidate on the lung waiting list. To align with this timing, transplant programs are advised to perform
148 the oxygen titration test at least once in every six-month period. Both the oxygen titration test and the
149 six-minute walk test may be completed and updated more frequently if deemed appropriate by the
150 transplant program due to a candidate's changing clinical status. However, transplant programs may
151 determine that a candidate's supplemental oxygen needs are well established and that a separate
152 oxygen titration test is not necessary prior to performing a six-minute walk test other than the
153 candidate's initial six-minute walk test. For example, particularly for pediatric candidates, adherence to
154 multiple test protocols in the same day may present a challenge and the candidates' oxygen needs with
155 exertion may be well established.

156 Safety Considerations

157 For most candidates, it is recommended that transplant programs provide supplemental oxygen to
158 maintain a candidate's oxygen saturation of greater than 88% during the performance of the test. The
159 2014 technical standard states that the six-minute walk test "has an excellent safety profile" when the
160 test is stopped if the patient's oxygen saturation falls below 80%.⁴ Depending on the candidate's
161 diagnosis and disease severity, lung transplant programs should not feel obligated to allow their
162 candidates to desaturate below 80% before halting the test. For candidates who are unable to maintain
163 an oxygen saturation of 88% or greater at rest but can safely complete the six-minute walk test, the
164 transplant program may use a lower oxygen saturation threshold to guide supplemental oxygen needs.

165 If a candidate is unable to safely perform the six-minute walk test, then the test should not be
166 performed, and the lung transplant program should report a walk distance of 0 feet for the candidate.
167 However, lung transplant programs are advised to avoid entering a walk distance of 0 feet and to
168 administer the six-minute walk test if it is deemed safe for a candidate to attempt the test, even if the
169 candidate is not expected to walk far or is not expected to walk the full six minutes.

170 When a lung candidate is unable to complete the six-minute walk due to reasons unrelated to their lung
171 disease severity (e.g., lower limb amputation, joint necrosis, etc.), the lung transplant program should
172 report a walk distance of 0 feet for the candidate. The transplant program may submit an exception
173 request for the post-transplant outcomes component of the candidate's lung composite allocation
174 score. In this case, transplant programs should estimate the candidate's six-minute walk distance based
175 on the documented walk distance of candidates with similar levels of fitness and enter that value into
176 the CAS calculator⁵ along with the candidate's other characteristics to determine the estimated post-
177 transplant outcomes subscore for that candidate were they able to complete the six-minute walk test.
178 The transplant program should then divide this value by the total possible number of points for post-
179 transplant outcomes and multiply by 100 to determine the percentage that should be entered into the
180 exception request form. The exception request will be reviewed and adjudicated as outlined in OPTN
181 *Policy 10.2 Lung Composite Score Exceptions* and the Lung Review Board Operational Guidelines.⁶

182 Altitude Considerations

183 Some candidates may live at an altitude that is different enough from their transplant program that the
184 candidates require different levels of supplemental oxygen when at the transplant center relative to

⁴ Holland et al., "Field walking tests," 1433.

⁵ "Lung CAS Calculator," OPTN, accessed October 9, 2023, available <https://optn.transplant.hrsa.gov/data/allocation-calculators/lung-cas-calculator/>.

⁶ "Lung Review Board Operational Guidelines," OPTN, accessed October 9, 2023, available <https://optn.transplant.hrsa.gov/about/review-boards/>.

185 what they use at home.⁷ Transplant programs located in areas where residential altitude varies widely
186 are advised to perform the oxygen titration test and the six-minute walk test at their transplant hospital
187 when possible so that all candidates registered at the program are performing these tests at the same
188 altitude. This approach will help to ensure that the six-minute walk distances reported for each
189 candidate registered at the program are being measured consistently.

⁷ Deirdre Caffrey, J. Jaime Miranda, Robert H. Gilman, et al., "A cross-sectional study of differences in 6-min walk distance in health adults residing at high altitude versus sea level," Extreme Physiology & Medicine 3, no. 3 (2014), <https://extremephysiolmed.biomedcentral.com/articles/10.1186/2046-7648-3-3>.

Appendix A: Convert Walk Distance from Meters to Feet

190 Six-minute walk distance is entered in OPTN Waiting List as a whole number measured in feet. The
 191 following table is provided for converting six-minute walk distances measured in meters to a whole
 192 number in feet, where one meter is equal to 3.28084 feet. The value was rounded up to the next whole
 193 number if the converted value in feet ended in a decimal value of at least 0.5.

Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
<u>0</u>	<u>0</u>	<u>35</u>	<u>115</u>	<u>70</u>	<u>230</u>	<u>105</u>	<u>344</u>
<u>1</u>	<u>3</u>	<u>36</u>	<u>118</u>	<u>71</u>	<u>233</u>	<u>106</u>	<u>348</u>
<u>2</u>	<u>7</u>	<u>37</u>	<u>121</u>	<u>72</u>	<u>236</u>	<u>107</u>	<u>351</u>
<u>3</u>	<u>10</u>	<u>38</u>	<u>125</u>	<u>73</u>	<u>240</u>	<u>108</u>	<u>354</u>
<u>4</u>	<u>13</u>	<u>39</u>	<u>128</u>	<u>74</u>	<u>243</u>	<u>109</u>	<u>358</u>
<u>5</u>	<u>16</u>	<u>40</u>	<u>131</u>	<u>75</u>	<u>246</u>	<u>110</u>	<u>361</u>
<u>6</u>	<u>20</u>	<u>41</u>	<u>135</u>	<u>76</u>	<u>249</u>	<u>111</u>	<u>364</u>
<u>7</u>	<u>23</u>	<u>42</u>	<u>138</u>	<u>77</u>	<u>253</u>	<u>112</u>	<u>367</u>
<u>8</u>	<u>26</u>	<u>43</u>	<u>141</u>	<u>78</u>	<u>256</u>	<u>113</u>	<u>371</u>
<u>9</u>	<u>30</u>	<u>44</u>	<u>144</u>	<u>79</u>	<u>259</u>	<u>114</u>	<u>374</u>
<u>10</u>	<u>33</u>	<u>45</u>	<u>148</u>	<u>80</u>	<u>262</u>	<u>115</u>	<u>377</u>
<u>11</u>	<u>36</u>	<u>46</u>	<u>151</u>	<u>81</u>	<u>266</u>	<u>116</u>	<u>381</u>
<u>12</u>	<u>39</u>	<u>47</u>	<u>154</u>	<u>82</u>	<u>269</u>	<u>117</u>	<u>384</u>
<u>13</u>	<u>43</u>	<u>48</u>	<u>157</u>	<u>83</u>	<u>272</u>	<u>118</u>	<u>387</u>
<u>14</u>	<u>46</u>	<u>49</u>	<u>161</u>	<u>84</u>	<u>276</u>	<u>119</u>	<u>390</u>
<u>15</u>	<u>49</u>	<u>50</u>	<u>164</u>	<u>85</u>	<u>279</u>	<u>120</u>	<u>394</u>
<u>16</u>	<u>52</u>	<u>51</u>	<u>167</u>	<u>86</u>	<u>282</u>	<u>121</u>	<u>397</u>
<u>17</u>	<u>56</u>	<u>52</u>	<u>171</u>	<u>87</u>	<u>285</u>	<u>122</u>	<u>400</u>
<u>18</u>	<u>59</u>	<u>53</u>	<u>174</u>	<u>88</u>	<u>289</u>	<u>123</u>	<u>404</u>
<u>19</u>	<u>62</u>	<u>54</u>	<u>177</u>	<u>89</u>	<u>292</u>	<u>124</u>	<u>407</u>
<u>20</u>	<u>66</u>	<u>55</u>	<u>180</u>	<u>90</u>	<u>295</u>	<u>125</u>	<u>410</u>
<u>21</u>	<u>69</u>	<u>56</u>	<u>184</u>	<u>91</u>	<u>299</u>	<u>126</u>	<u>413</u>
<u>22</u>	<u>72</u>	<u>57</u>	<u>187</u>	<u>92</u>	<u>302</u>	<u>127</u>	<u>417</u>
<u>23</u>	<u>75</u>	<u>58</u>	<u>190</u>	<u>93</u>	<u>305</u>	<u>128</u>	<u>420</u>
<u>24</u>	<u>79</u>	<u>59</u>	<u>194</u>	<u>94</u>	<u>308</u>	<u>129</u>	<u>423</u>
<u>25</u>	<u>82</u>	<u>60</u>	<u>197</u>	<u>95</u>	<u>312</u>	<u>130</u>	<u>427</u>
<u>26</u>	<u>85</u>	<u>61</u>	<u>200</u>	<u>96</u>	<u>315</u>	<u>131</u>	<u>430</u>
<u>27</u>	<u>89</u>	<u>62</u>	<u>203</u>	<u>97</u>	<u>318</u>	<u>132</u>	<u>433</u>
<u>28</u>	<u>92</u>	<u>63</u>	<u>207</u>	<u>98</u>	<u>322</u>	<u>133</u>	<u>436</u>
<u>29</u>	<u>95</u>	<u>64</u>	<u>210</u>	<u>99</u>	<u>325</u>	<u>134</u>	<u>440</u>
<u>30</u>	<u>98</u>	<u>65</u>	<u>213</u>	<u>100</u>	<u>328</u>	<u>135</u>	<u>443</u>
<u>31</u>	<u>102</u>	<u>66</u>	<u>217</u>	<u>101</u>	<u>331</u>	<u>136</u>	<u>446</u>
<u>32</u>	<u>105</u>	<u>67</u>	<u>220</u>	<u>102</u>	<u>335</u>	<u>137</u>	<u>449</u>
<u>33</u>	<u>108</u>	<u>68</u>	<u>223</u>	<u>103</u>	<u>338</u>	<u>138</u>	<u>453</u>
<u>34</u>	<u>112</u>	<u>69</u>	<u>226</u>	<u>104</u>	<u>341</u>	<u>139</u>	<u>456</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>140</u>	<u>459</u>	<u>182</u>	<u>597</u>	<u>224</u>	<u>735</u>	<u>266</u>	<u>873</u>
<u>141</u>	<u>463</u>	<u>183</u>	<u>600</u>	<u>225</u>	<u>738</u>	<u>267</u>	<u>876</u>
<u>142</u>	<u>466</u>	<u>184</u>	<u>604</u>	<u>226</u>	<u>741</u>	<u>268</u>	<u>879</u>
<u>143</u>	<u>469</u>	<u>185</u>	<u>607</u>	<u>227</u>	<u>745</u>	<u>269</u>	<u>883</u>
<u>144</u>	<u>472</u>	<u>186</u>	<u>610</u>	<u>228</u>	<u>748</u>	<u>270</u>	<u>886</u>
<u>145</u>	<u>476</u>	<u>187</u>	<u>614</u>	<u>229</u>	<u>751</u>	<u>271</u>	<u>889</u>
<u>146</u>	<u>479</u>	<u>188</u>	<u>617</u>	<u>230</u>	<u>755</u>	<u>272</u>	<u>892</u>
<u>147</u>	<u>482</u>	<u>189</u>	<u>620</u>	<u>231</u>	<u>758</u>	<u>273</u>	<u>896</u>
<u>148</u>	<u>486</u>	<u>190</u>	<u>623</u>	<u>232</u>	<u>761</u>	<u>274</u>	<u>899</u>
<u>149</u>	<u>489</u>	<u>191</u>	<u>627</u>	<u>233</u>	<u>764</u>	<u>275</u>	<u>902</u>
<u>150</u>	<u>492</u>	<u>192</u>	<u>630</u>	<u>234</u>	<u>768</u>	<u>276</u>	<u>906</u>
<u>151</u>	<u>495</u>	<u>193</u>	<u>633</u>	<u>235</u>	<u>771</u>	<u>277</u>	<u>909</u>
<u>152</u>	<u>499</u>	<u>194</u>	<u>636</u>	<u>236</u>	<u>774</u>	<u>278</u>	<u>912</u>
<u>153</u>	<u>502</u>	<u>195</u>	<u>640</u>	<u>237</u>	<u>778</u>	<u>279</u>	<u>915</u>
<u>154</u>	<u>505</u>	<u>196</u>	<u>643</u>	<u>238</u>	<u>781</u>	<u>280</u>	<u>919</u>
<u>155</u>	<u>509</u>	<u>197</u>	<u>646</u>	<u>239</u>	<u>784</u>	<u>281</u>	<u>922</u>
<u>156</u>	<u>512</u>	<u>198</u>	<u>650</u>	<u>240</u>	<u>787</u>	<u>282</u>	<u>925</u>
<u>157</u>	<u>515</u>	<u>199</u>	<u>653</u>	<u>241</u>	<u>791</u>	<u>283</u>	<u>928</u>
<u>158</u>	<u>518</u>	<u>200</u>	<u>656</u>	<u>242</u>	<u>794</u>	<u>284</u>	<u>932</u>
<u>159</u>	<u>522</u>	<u>201</u>	<u>659</u>	<u>243</u>	<u>797</u>	<u>285</u>	<u>935</u>
<u>160</u>	<u>525</u>	<u>202</u>	<u>663</u>	<u>244</u>	<u>801</u>	<u>286</u>	<u>938</u>
<u>161</u>	<u>528</u>	<u>203</u>	<u>666</u>	<u>245</u>	<u>804</u>	<u>287</u>	<u>942</u>
<u>162</u>	<u>531</u>	<u>204</u>	<u>669</u>	<u>246</u>	<u>807</u>	<u>288</u>	<u>945</u>
<u>163</u>	<u>535</u>	<u>205</u>	<u>673</u>	<u>247</u>	<u>810</u>	<u>289</u>	<u>948</u>
<u>164</u>	<u>538</u>	<u>206</u>	<u>676</u>	<u>248</u>	<u>814</u>	<u>290</u>	<u>951</u>
<u>165</u>	<u>541</u>	<u>207</u>	<u>679</u>	<u>249</u>	<u>817</u>	<u>291</u>	<u>955</u>
<u>166</u>	<u>545</u>	<u>208</u>	<u>682</u>	<u>250</u>	<u>820</u>	<u>292</u>	<u>958</u>
<u>167</u>	<u>548</u>	<u>209</u>	<u>686</u>	<u>251</u>	<u>823</u>	<u>293</u>	<u>961</u>
<u>168</u>	<u>551</u>	<u>210</u>	<u>689</u>	<u>252</u>	<u>827</u>	<u>294</u>	<u>965</u>
<u>169</u>	<u>554</u>	<u>211</u>	<u>692</u>	<u>253</u>	<u>830</u>	<u>295</u>	<u>968</u>
<u>170</u>	<u>558</u>	<u>212</u>	<u>696</u>	<u>254</u>	<u>833</u>	<u>296</u>	<u>971</u>
<u>171</u>	<u>561</u>	<u>213</u>	<u>699</u>	<u>255</u>	<u>837</u>	<u>297</u>	<u>974</u>
<u>172</u>	<u>564</u>	<u>214</u>	<u>702</u>	<u>256</u>	<u>840</u>	<u>298</u>	<u>978</u>
<u>173</u>	<u>568</u>	<u>215</u>	<u>705</u>	<u>257</u>	<u>843</u>	<u>299</u>	<u>981</u>
<u>174</u>	<u>571</u>	<u>216</u>	<u>709</u>	<u>258</u>	<u>846</u>	<u>300</u>	<u>984</u>
<u>175</u>	<u>574</u>	<u>217</u>	<u>712</u>	<u>259</u>	<u>850</u>	<u>301</u>	<u>988</u>
<u>176</u>	<u>577</u>	<u>218</u>	<u>715</u>	<u>260</u>	<u>853</u>	<u>302</u>	<u>991</u>
<u>177</u>	<u>581</u>	<u>219</u>	<u>719</u>	<u>261</u>	<u>856</u>	<u>303</u>	<u>994</u>
<u>178</u>	<u>584</u>	<u>220</u>	<u>722</u>	<u>262</u>	<u>860</u>	<u>304</u>	<u>997</u>
<u>179</u>	<u>587</u>	<u>221</u>	<u>725</u>	<u>263</u>	<u>863</u>	<u>305</u>	<u>1001</u>
<u>180</u>	<u>591</u>	<u>222</u>	<u>728</u>	<u>264</u>	<u>866</u>	<u>306</u>	<u>1004</u>
<u>181</u>	<u>594</u>	<u>223</u>	<u>732</u>	<u>265</u>	<u>869</u>	<u>307</u>	<u>1007</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>308</u>	<u>1010</u>	<u>350</u>	<u>1148</u>	<u>392</u>	<u>1286</u>	<u>434</u>	<u>1424</u>
<u>309</u>	<u>1014</u>	<u>351</u>	<u>1152</u>	<u>393</u>	<u>1289</u>	<u>435</u>	<u>1427</u>
<u>310</u>	<u>1017</u>	<u>352</u>	<u>1155</u>	<u>394</u>	<u>1293</u>	<u>436</u>	<u>1430</u>
<u>311</u>	<u>1020</u>	<u>353</u>	<u>1158</u>	<u>395</u>	<u>1296</u>	<u>437</u>	<u>1434</u>
<u>312</u>	<u>1024</u>	<u>354</u>	<u>1161</u>	<u>396</u>	<u>1299</u>	<u>438</u>	<u>1437</u>
<u>313</u>	<u>1027</u>	<u>355</u>	<u>1165</u>	<u>397</u>	<u>1302</u>	<u>439</u>	<u>1440</u>
<u>314</u>	<u>1030</u>	<u>356</u>	<u>1168</u>	<u>398</u>	<u>1306</u>	<u>440</u>	<u>1444</u>
<u>315</u>	<u>1033</u>	<u>357</u>	<u>1171</u>	<u>399</u>	<u>1309</u>	<u>441</u>	<u>1447</u>
<u>316</u>	<u>1037</u>	<u>358</u>	<u>1175</u>	<u>400</u>	<u>1312</u>	<u>442</u>	<u>1450</u>
<u>317</u>	<u>1040</u>	<u>359</u>	<u>1178</u>	<u>401</u>	<u>1316</u>	<u>443</u>	<u>1453</u>
<u>318</u>	<u>1043</u>	<u>360</u>	<u>1181</u>	<u>402</u>	<u>1319</u>	<u>444</u>	<u>1457</u>
<u>319</u>	<u>1047</u>	<u>361</u>	<u>1184</u>	<u>403</u>	<u>1322</u>	<u>445</u>	<u>1460</u>
<u>320</u>	<u>1050</u>	<u>362</u>	<u>1188</u>	<u>404</u>	<u>1325</u>	<u>446</u>	<u>1463</u>
<u>321</u>	<u>1053</u>	<u>363</u>	<u>1191</u>	<u>405</u>	<u>1329</u>	<u>447</u>	<u>1467</u>
<u>322</u>	<u>1056</u>	<u>364</u>	<u>1194</u>	<u>406</u>	<u>1332</u>	<u>448</u>	<u>1470</u>
<u>323</u>	<u>1060</u>	<u>365</u>	<u>1198</u>	<u>407</u>	<u>1335</u>	<u>449</u>	<u>1473</u>
<u>324</u>	<u>1063</u>	<u>366</u>	<u>1201</u>	<u>408</u>	<u>1339</u>	<u>450</u>	<u>1476</u>
<u>325</u>	<u>1066</u>	<u>367</u>	<u>1204</u>	<u>409</u>	<u>1342</u>	<u>451</u>	<u>1480</u>
<u>326</u>	<u>1070</u>	<u>368</u>	<u>1207</u>	<u>410</u>	<u>1345</u>	<u>452</u>	<u>1483</u>
<u>327</u>	<u>1073</u>	<u>369</u>	<u>1211</u>	<u>411</u>	<u>1348</u>	<u>453</u>	<u>1486</u>
<u>328</u>	<u>1076</u>	<u>370</u>	<u>1214</u>	<u>412</u>	<u>1352</u>	<u>454</u>	<u>1490</u>
<u>329</u>	<u>1079</u>	<u>371</u>	<u>1217</u>	<u>413</u>	<u>1355</u>	<u>455</u>	<u>1493</u>
<u>330</u>	<u>1083</u>	<u>372</u>	<u>1220</u>	<u>414</u>	<u>1358</u>	<u>456</u>	<u>1496</u>
<u>331</u>	<u>1086</u>	<u>373</u>	<u>1224</u>	<u>415</u>	<u>1362</u>	<u>457</u>	<u>1499</u>
<u>332</u>	<u>1089</u>	<u>374</u>	<u>1227</u>	<u>416</u>	<u>1365</u>	<u>458</u>	<u>1503</u>
<u>333</u>	<u>1093</u>	<u>375</u>	<u>1230</u>	<u>417</u>	<u>1368</u>	<u>459</u>	<u>1506</u>
<u>334</u>	<u>1096</u>	<u>376</u>	<u>1234</u>	<u>418</u>	<u>1371</u>	<u>460</u>	<u>1509</u>
<u>335</u>	<u>1099</u>	<u>377</u>	<u>1237</u>	<u>419</u>	<u>1375</u>	<u>461</u>	<u>1512</u>
<u>336</u>	<u>1102</u>	<u>378</u>	<u>1240</u>	<u>420</u>	<u>1378</u>	<u>462</u>	<u>1516</u>
<u>337</u>	<u>1106</u>	<u>379</u>	<u>1243</u>	<u>421</u>	<u>1381</u>	<u>463</u>	<u>1519</u>
<u>338</u>	<u>1109</u>	<u>380</u>	<u>1247</u>	<u>422</u>	<u>1385</u>	<u>464</u>	<u>1522</u>
<u>339</u>	<u>1112</u>	<u>381</u>	<u>1250</u>	<u>423</u>	<u>1388</u>	<u>465</u>	<u>1526</u>
<u>340</u>	<u>1115</u>	<u>382</u>	<u>1253</u>	<u>424</u>	<u>1391</u>	<u>466</u>	<u>1529</u>
<u>341</u>	<u>1119</u>	<u>383</u>	<u>1257</u>	<u>425</u>	<u>1394</u>	<u>467</u>	<u>1532</u>
<u>342</u>	<u>1122</u>	<u>384</u>	<u>1260</u>	<u>426</u>	<u>1398</u>	<u>468</u>	<u>1535</u>
<u>343</u>	<u>1125</u>	<u>385</u>	<u>1263</u>	<u>427</u>	<u>1401</u>	<u>469</u>	<u>1539</u>
<u>344</u>	<u>1129</u>	<u>386</u>	<u>1266</u>	<u>428</u>	<u>1404</u>	<u>470</u>	<u>1542</u>
<u>345</u>	<u>1132</u>	<u>387</u>	<u>1270</u>	<u>429</u>	<u>1407</u>	<u>471</u>	<u>1545</u>
<u>346</u>	<u>1135</u>	<u>388</u>	<u>1273</u>	<u>430</u>	<u>1411</u>	<u>472</u>	<u>1549</u>
<u>347</u>	<u>1138</u>	<u>389</u>	<u>1276</u>	<u>431</u>	<u>1414</u>	<u>473</u>	<u>1552</u>
<u>348</u>	<u>1142</u>	<u>390</u>	<u>1280</u>	<u>432</u>	<u>1417</u>	<u>474</u>	<u>1555</u>
<u>349</u>	<u>1145</u>	<u>391</u>	<u>1283</u>	<u>433</u>	<u>1421</u>	<u>475</u>	<u>1558</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>476</u>	<u>1562</u>	<u>518</u>	<u>1699</u>	<u>560</u>	<u>1837</u>	<u>602</u>	<u>1975</u>
<u>477</u>	<u>1565</u>	<u>519</u>	<u>1703</u>	<u>561</u>	<u>1841</u>	<u>603</u>	<u>1978</u>
<u>478</u>	<u>1568</u>	<u>520</u>	<u>1706</u>	<u>562</u>	<u>1844</u>	<u>604</u>	<u>1982</u>
<u>479</u>	<u>1572</u>	<u>521</u>	<u>1709</u>	<u>563</u>	<u>1847</u>	<u>605</u>	<u>1985</u>
<u>480</u>	<u>1575</u>	<u>522</u>	<u>1713</u>	<u>564</u>	<u>1850</u>	<u>606</u>	<u>1988</u>
<u>481</u>	<u>1578</u>	<u>523</u>	<u>1716</u>	<u>565</u>	<u>1854</u>	<u>607</u>	<u>1991</u>
<u>482</u>	<u>1581</u>	<u>524</u>	<u>1719</u>	<u>566</u>	<u>1857</u>	<u>608</u>	<u>1995</u>
<u>483</u>	<u>1585</u>	<u>525</u>	<u>1722</u>	<u>567</u>	<u>1860</u>	<u>609</u>	<u>1998</u>
<u>484</u>	<u>1588</u>	<u>526</u>	<u>1726</u>	<u>568</u>	<u>1864</u>	<u>610</u>	<u>2001</u>
<u>485</u>	<u>1591</u>	<u>527</u>	<u>1729</u>	<u>569</u>	<u>1867</u>	<u>611</u>	<u>2005</u>
<u>486</u>	<u>1594</u>	<u>528</u>	<u>1732</u>	<u>570</u>	<u>1870</u>	<u>612</u>	<u>2008</u>
<u>487</u>	<u>1598</u>	<u>529</u>	<u>1736</u>	<u>571</u>	<u>1873</u>	<u>613</u>	<u>2011</u>
<u>488</u>	<u>1601</u>	<u>530</u>	<u>1739</u>	<u>572</u>	<u>1877</u>	<u>614</u>	<u>2014</u>
<u>489</u>	<u>1604</u>	<u>531</u>	<u>1742</u>	<u>573</u>	<u>1880</u>	<u>615</u>	<u>2018</u>
<u>490</u>	<u>1608</u>	<u>532</u>	<u>1745</u>	<u>574</u>	<u>1883</u>	<u>616</u>	<u>2021</u>
<u>491</u>	<u>1611</u>	<u>533</u>	<u>1749</u>	<u>575</u>	<u>1886</u>	<u>617</u>	<u>2024</u>
<u>492</u>	<u>1614</u>	<u>534</u>	<u>1752</u>	<u>576</u>	<u>1890</u>	<u>618</u>	<u>2028</u>
<u>493</u>	<u>1617</u>	<u>535</u>	<u>1755</u>	<u>577</u>	<u>1893</u>	<u>619</u>	<u>2031</u>
<u>494</u>	<u>1621</u>	<u>536</u>	<u>1759</u>	<u>578</u>	<u>1896</u>	<u>620</u>	<u>2034</u>
<u>495</u>	<u>1624</u>	<u>537</u>	<u>1762</u>	<u>579</u>	<u>1900</u>	<u>621</u>	<u>2037</u>
<u>496</u>	<u>1627</u>	<u>538</u>	<u>1765</u>	<u>580</u>	<u>1903</u>	<u>622</u>	<u>2041</u>
<u>497</u>	<u>1631</u>	<u>539</u>	<u>1768</u>	<u>581</u>	<u>1906</u>	<u>623</u>	<u>2044</u>
<u>498</u>	<u>1634</u>	<u>540</u>	<u>1772</u>	<u>582</u>	<u>1909</u>	<u>624</u>	<u>2047</u>
<u>499</u>	<u>1637</u>	<u>541</u>	<u>1775</u>	<u>583</u>	<u>1913</u>	<u>625</u>	<u>2051</u>
<u>500</u>	<u>1640</u>	<u>542</u>	<u>1778</u>	<u>584</u>	<u>1916</u>	<u>626</u>	<u>2054</u>
<u>501</u>	<u>1644</u>	<u>543</u>	<u>1781</u>	<u>585</u>	<u>1919</u>	<u>627</u>	<u>2057</u>
<u>502</u>	<u>1647</u>	<u>544</u>	<u>1785</u>	<u>586</u>	<u>1923</u>	<u>628</u>	<u>2060</u>
<u>503</u>	<u>1650</u>	<u>545</u>	<u>1788</u>	<u>587</u>	<u>1926</u>	<u>629</u>	<u>2064</u>
<u>504</u>	<u>1654</u>	<u>546</u>	<u>1791</u>	<u>588</u>	<u>1929</u>	<u>630</u>	<u>2067</u>
<u>505</u>	<u>1657</u>	<u>547</u>	<u>1795</u>	<u>589</u>	<u>1932</u>	<u>631</u>	<u>2070</u>
<u>506</u>	<u>1660</u>	<u>548</u>	<u>1798</u>	<u>590</u>	<u>1936</u>	<u>632</u>	<u>2073</u>
<u>507</u>	<u>1663</u>	<u>549</u>	<u>1801</u>	<u>591</u>	<u>1939</u>	<u>633</u>	<u>2077</u>
<u>508</u>	<u>1667</u>	<u>550</u>	<u>1804</u>	<u>592</u>	<u>1942</u>	<u>634</u>	<u>2080</u>
<u>509</u>	<u>1670</u>	<u>551</u>	<u>1808</u>	<u>593</u>	<u>1946</u>	<u>635</u>	<u>2083</u>
<u>510</u>	<u>1673</u>	<u>552</u>	<u>1811</u>	<u>594</u>	<u>1949</u>	<u>636</u>	<u>2087</u>
<u>511</u>	<u>1677</u>	<u>553</u>	<u>1814</u>	<u>595</u>	<u>1952</u>	<u>637</u>	<u>2090</u>
<u>512</u>	<u>1680</u>	<u>554</u>	<u>1818</u>	<u>596</u>	<u>1955</u>	<u>638</u>	<u>2093</u>
<u>513</u>	<u>1683</u>	<u>555</u>	<u>1821</u>	<u>597</u>	<u>1959</u>	<u>639</u>	<u>2096</u>
<u>514</u>	<u>1686</u>	<u>556</u>	<u>1824</u>	<u>598</u>	<u>1962</u>	<u>640</u>	<u>2100</u>
<u>515</u>	<u>1690</u>	<u>557</u>	<u>1827</u>	<u>599</u>	<u>1965</u>	<u>641</u>	<u>2103</u>
<u>516</u>	<u>1693</u>	<u>558</u>	<u>1831</u>	<u>600</u>	<u>1969</u>	<u>642</u>	<u>2106</u>
<u>517</u>	<u>1696</u>	<u>559</u>	<u>1834</u>	<u>601</u>	<u>1972</u>	<u>643</u>	<u>2110</u>

Meters	Feet	Meters	Feet	Meters	Feet	Meters	Feet
<u>644</u>	<u>2113</u>	<u>686</u>	<u>2251</u>	<u>728</u>	<u>2388</u>	<u>770</u>	<u>2526</u>
<u>645</u>	<u>2116</u>	<u>687</u>	<u>2254</u>	<u>729</u>	<u>2392</u>	<u>771</u>	<u>2530</u>
<u>646</u>	<u>2119</u>	<u>688</u>	<u>2257</u>	<u>730</u>	<u>2395</u>	<u>772</u>	<u>2533</u>
<u>647</u>	<u>2123</u>	<u>689</u>	<u>2260</u>	<u>731</u>	<u>2398</u>	<u>773</u>	<u>2536</u>
<u>648</u>	<u>2126</u>	<u>690</u>	<u>2264</u>	<u>732</u>	<u>2402</u>	<u>774</u>	<u>2539</u>
<u>649</u>	<u>2129</u>	<u>691</u>	<u>2267</u>	<u>733</u>	<u>2405</u>	<u>775</u>	<u>2543</u>
<u>650</u>	<u>2133</u>	<u>692</u>	<u>2270</u>	<u>734</u>	<u>2408</u>	<u>776</u>	<u>2546</u>
<u>651</u>	<u>2136</u>	<u>693</u>	<u>2274</u>	<u>735</u>	<u>2411</u>	<u>777</u>	<u>2549</u>
<u>652</u>	<u>2139</u>	<u>694</u>	<u>2277</u>	<u>736</u>	<u>2415</u>	<u>778</u>	<u>2552</u>
<u>653</u>	<u>2142</u>	<u>695</u>	<u>2280</u>	<u>737</u>	<u>2418</u>	<u>779</u>	<u>2556</u>
<u>654</u>	<u>2146</u>	<u>696</u>	<u>2283</u>	<u>738</u>	<u>2421</u>	<u>780</u>	<u>2559</u>
<u>655</u>	<u>2149</u>	<u>697</u>	<u>2287</u>	<u>739</u>	<u>2425</u>	<u>781</u>	<u>2562</u>
<u>656</u>	<u>2152</u>	<u>698</u>	<u>2290</u>	<u>740</u>	<u>2428</u>	<u>782</u>	<u>2566</u>
<u>657</u>	<u>2156</u>	<u>699</u>	<u>2293</u>	<u>741</u>	<u>2431</u>	<u>783</u>	<u>2569</u>
<u>658</u>	<u>2159</u>	<u>700</u>	<u>2297</u>	<u>742</u>	<u>2434</u>	<u>784</u>	<u>2572</u>
<u>659</u>	<u>2162</u>	<u>701</u>	<u>2300</u>	<u>743</u>	<u>2438</u>	<u>785</u>	<u>2575</u>
<u>660</u>	<u>2165</u>	<u>702</u>	<u>2303</u>	<u>744</u>	<u>2441</u>	<u>786</u>	<u>2579</u>
<u>661</u>	<u>2169</u>	<u>703</u>	<u>2306</u>	<u>745</u>	<u>2444</u>	<u>787</u>	<u>2582</u>
<u>662</u>	<u>2172</u>	<u>704</u>	<u>2310</u>	<u>746</u>	<u>2448</u>	<u>788</u>	<u>2585</u>
<u>663</u>	<u>2175</u>	<u>705</u>	<u>2313</u>	<u>747</u>	<u>2451</u>	<u>789</u>	<u>2589</u>
<u>664</u>	<u>2178</u>	<u>706</u>	<u>2316</u>	<u>748</u>	<u>2454</u>	<u>790</u>	<u>2592</u>
<u>665</u>	<u>2182</u>	<u>707</u>	<u>2320</u>	<u>749</u>	<u>2457</u>	<u>791</u>	<u>2595</u>
<u>666</u>	<u>2185</u>	<u>708</u>	<u>2323</u>	<u>750</u>	<u>2461</u>	<u>792</u>	<u>2598</u>
<u>667</u>	<u>2188</u>	<u>709</u>	<u>2326</u>	<u>751</u>	<u>2464</u>	<u>793</u>	<u>2602</u>
<u>668</u>	<u>2192</u>	<u>710</u>	<u>2329</u>	<u>752</u>	<u>2467</u>	<u>794</u>	<u>2605</u>
<u>669</u>	<u>2195</u>	<u>711</u>	<u>2333</u>	<u>753</u>	<u>2470</u>	<u>795</u>	<u>2608</u>
<u>670</u>	<u>2198</u>	<u>712</u>	<u>2336</u>	<u>754</u>	<u>2474</u>	<u>796</u>	<u>2612</u>
<u>671</u>	<u>2201</u>	<u>713</u>	<u>2339</u>	<u>755</u>	<u>2477</u>	<u>797</u>	<u>2615</u>
<u>672</u>	<u>2205</u>	<u>714</u>	<u>2343</u>	<u>756</u>	<u>2480</u>	<u>798</u>	<u>2618</u>
<u>673</u>	<u>2208</u>	<u>715</u>	<u>2346</u>	<u>757</u>	<u>2484</u>	<u>799</u>	<u>2621</u>
<u>674</u>	<u>2211</u>	<u>716</u>	<u>2349</u>	<u>758</u>	<u>2487</u>	<u>800</u>	<u>2625</u>
<u>675</u>	<u>2215</u>	<u>717</u>	<u>2352</u>	<u>759</u>	<u>2490</u>	<u>801</u>	<u>2628</u>
<u>676</u>	<u>2218</u>	<u>718</u>	<u>2356</u>	<u>760</u>	<u>2493</u>	<u>802</u>	<u>2631</u>
<u>677</u>	<u>2221</u>	<u>719</u>	<u>2359</u>	<u>761</u>	<u>2497</u>	<u>803</u>	<u>2635</u>
<u>678</u>	<u>2224</u>	<u>720</u>	<u>2362</u>	<u>762</u>	<u>2500</u>	<u>804</u>	<u>2638</u>
<u>679</u>	<u>2228</u>	<u>721</u>	<u>2365</u>	<u>763</u>	<u>2503</u>	<u>805</u>	<u>2641</u>
<u>680</u>	<u>2231</u>	<u>722</u>	<u>2369</u>	<u>764</u>	<u>2507</u>	<u>806</u>	<u>2644</u>
<u>681</u>	<u>2234</u>	<u>723</u>	<u>2372</u>	<u>765</u>	<u>2510</u>	<u>807</u>	<u>2648</u>
<u>682</u>	<u>2238</u>	<u>724</u>	<u>2375</u>	<u>766</u>	<u>2513</u>	<u>808</u>	<u>2651</u>
<u>683</u>	<u>2241</u>	<u>725</u>	<u>2379</u>	<u>767</u>	<u>2516</u>	<u>809</u>	<u>2654</u>
<u>684</u>	<u>2244</u>	<u>726</u>	<u>2382</u>	<u>768</u>	<u>2520</u>	<u>810</u>	<u>2657</u>
<u>685</u>	<u>2247</u>	<u>727</u>	<u>2385</u>	<u>769</u>	<u>2523</u>	<u>811</u>	<u>2661</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>812</u>	<u>2664</u>	<u>854</u>	<u>2802</u>	<u>896</u>	<u>2940</u>	<u>938</u>	<u>3077</u>
<u>813</u>	<u>2667</u>	<u>855</u>	<u>2805</u>	<u>897</u>	<u>2943</u>	<u>939</u>	<u>3081</u>
<u>814</u>	<u>2671</u>	<u>856</u>	<u>2808</u>	<u>898</u>	<u>2946</u>	<u>940</u>	<u>3084</u>
<u>815</u>	<u>2674</u>	<u>857</u>	<u>2812</u>	<u>899</u>	<u>2949</u>	<u>941</u>	<u>3087</u>
<u>816</u>	<u>2677</u>	<u>858</u>	<u>2815</u>	<u>900</u>	<u>2953</u>	<u>942</u>	<u>3091</u>
<u>817</u>	<u>2680</u>	<u>859</u>	<u>2818</u>	<u>901</u>	<u>2956</u>	<u>943</u>	<u>3094</u>
<u>818</u>	<u>2684</u>	<u>860</u>	<u>2822</u>	<u>902</u>	<u>2959</u>	<u>944</u>	<u>3097</u>
<u>819</u>	<u>2687</u>	<u>861</u>	<u>2825</u>	<u>903</u>	<u>2963</u>	<u>945</u>	<u>3100</u>
<u>820</u>	<u>2690</u>	<u>862</u>	<u>2828</u>	<u>904</u>	<u>2966</u>	<u>946</u>	<u>3104</u>
<u>821</u>	<u>2694</u>	<u>863</u>	<u>2831</u>	<u>905</u>	<u>2969</u>	<u>947</u>	<u>3107</u>
<u>822</u>	<u>2697</u>	<u>864</u>	<u>2835</u>	<u>906</u>	<u>2972</u>	<u>948</u>	<u>3110</u>
<u>823</u>	<u>2700</u>	<u>865</u>	<u>2838</u>	<u>907</u>	<u>2976</u>	<u>949</u>	<u>3114</u>
<u>824</u>	<u>2703</u>	<u>866</u>	<u>2841</u>	<u>908</u>	<u>2979</u>	<u>950</u>	<u>3117</u>
<u>825</u>	<u>2707</u>	<u>867</u>	<u>2844</u>	<u>909</u>	<u>2982</u>	<u>951</u>	<u>3120</u>
<u>826</u>	<u>2710</u>	<u>868</u>	<u>2848</u>	<u>910</u>	<u>2986</u>	<u>952</u>	<u>3123</u>
<u>827</u>	<u>2713</u>	<u>869</u>	<u>2851</u>	<u>911</u>	<u>2989</u>	<u>953</u>	<u>3127</u>
<u>828</u>	<u>2717</u>	<u>870</u>	<u>2854</u>	<u>912</u>	<u>2992</u>	<u>954</u>	<u>3130</u>
<u>829</u>	<u>2720</u>	<u>871</u>	<u>2858</u>	<u>913</u>	<u>2995</u>	<u>955</u>	<u>3133</u>
<u>830</u>	<u>2723</u>	<u>872</u>	<u>2861</u>	<u>914</u>	<u>2999</u>	<u>956</u>	<u>3136</u>
<u>831</u>	<u>2726</u>	<u>873</u>	<u>2864</u>	<u>915</u>	<u>3002</u>	<u>957</u>	<u>3140</u>
<u>832</u>	<u>2730</u>	<u>874</u>	<u>2867</u>	<u>916</u>	<u>3005</u>	<u>958</u>	<u>3143</u>
<u>833</u>	<u>2733</u>	<u>875</u>	<u>2871</u>	<u>917</u>	<u>3009</u>	<u>959</u>	<u>3146</u>
<u>834</u>	<u>2736</u>	<u>876</u>	<u>2874</u>	<u>918</u>	<u>3012</u>	<u>960</u>	<u>3150</u>
<u>835</u>	<u>2740</u>	<u>877</u>	<u>2877</u>	<u>919</u>	<u>3015</u>	<u>961</u>	<u>3153</u>
<u>836</u>	<u>2743</u>	<u>878</u>	<u>2881</u>	<u>920</u>	<u>3018</u>	<u>962</u>	<u>3156</u>
<u>837</u>	<u>2746</u>	<u>879</u>	<u>2884</u>	<u>921</u>	<u>3022</u>	<u>963</u>	<u>3159</u>
<u>838</u>	<u>2749</u>	<u>880</u>	<u>2887</u>	<u>922</u>	<u>3025</u>	<u>964</u>	<u>3163</u>
<u>839</u>	<u>2753</u>	<u>881</u>	<u>2890</u>	<u>923</u>	<u>3028</u>	<u>965</u>	<u>3166</u>
<u>840</u>	<u>2756</u>	<u>882</u>	<u>2894</u>	<u>924</u>	<u>3031</u>	<u>966</u>	<u>3169</u>
<u>841</u>	<u>2759</u>	<u>883</u>	<u>2897</u>	<u>925</u>	<u>3035</u>	<u>967</u>	<u>3173</u>
<u>842</u>	<u>2762</u>	<u>884</u>	<u>2900</u>	<u>926</u>	<u>3038</u>	<u>968</u>	<u>3176</u>
<u>843</u>	<u>2766</u>	<u>885</u>	<u>2904</u>	<u>927</u>	<u>3041</u>	<u>969</u>	<u>3179</u>
<u>844</u>	<u>2769</u>	<u>886</u>	<u>2907</u>	<u>928</u>	<u>3045</u>	<u>970</u>	<u>3182</u>
<u>845</u>	<u>2772</u>	<u>887</u>	<u>2910</u>	<u>929</u>	<u>3048</u>	<u>971</u>	<u>3186</u>
<u>846</u>	<u>2776</u>	<u>888</u>	<u>2913</u>	<u>930</u>	<u>3051</u>	<u>972</u>	<u>3189</u>
<u>847</u>	<u>2779</u>	<u>889</u>	<u>2917</u>	<u>931</u>	<u>3054</u>	<u>973</u>	<u>3192</u>
<u>848</u>	<u>2782</u>	<u>890</u>	<u>2920</u>	<u>932</u>	<u>3058</u>	<u>974</u>	<u>3196</u>
<u>849</u>	<u>2785</u>	<u>891</u>	<u>2923</u>	<u>933</u>	<u>3061</u>	<u>975</u>	<u>3199</u>
<u>850</u>	<u>2789</u>	<u>892</u>	<u>2927</u>	<u>934</u>	<u>3064</u>	<u>976</u>	<u>3202</u>
<u>851</u>	<u>2792</u>	<u>893</u>	<u>2930</u>	<u>935</u>	<u>3068</u>	<u>977</u>	<u>3205</u>
<u>852</u>	<u>2795</u>	<u>894</u>	<u>2933</u>	<u>936</u>	<u>3071</u>	<u>978</u>	<u>3209</u>
<u>853</u>	<u>2799</u>	<u>895</u>	<u>2936</u>	<u>937</u>	<u>3074</u>	<u>979</u>	<u>3212</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>980</u>	<u>3215</u>	<u>1022</u>	<u>3353</u>	<u>1064</u>	<u>3491</u>	<u>1106</u>	<u>3629</u>
<u>981</u>	<u>3219</u>	<u>1023</u>	<u>3356</u>	<u>1065</u>	<u>3494</u>	<u>1107</u>	<u>3632</u>
<u>982</u>	<u>3222</u>	<u>1024</u>	<u>3360</u>	<u>1066</u>	<u>3497</u>	<u>1108</u>	<u>3635</u>
<u>983</u>	<u>3225</u>	<u>1025</u>	<u>3363</u>	<u>1067</u>	<u>3501</u>	<u>1109</u>	<u>3638</u>
<u>984</u>	<u>3228</u>	<u>1026</u>	<u>3366</u>	<u>1068</u>	<u>3504</u>	<u>1110</u>	<u>3642</u>
<u>985</u>	<u>3232</u>	<u>1027</u>	<u>3369</u>	<u>1069</u>	<u>3507</u>	<u>1111</u>	<u>3645</u>
<u>986</u>	<u>3235</u>	<u>1028</u>	<u>3373</u>	<u>1070</u>	<u>3510</u>	<u>1112</u>	<u>3648</u>
<u>987</u>	<u>3238</u>	<u>1029</u>	<u>3376</u>	<u>1071</u>	<u>3514</u>	<u>1113</u>	<u>3652</u>
<u>988</u>	<u>3241</u>	<u>1030</u>	<u>3379</u>	<u>1072</u>	<u>3517</u>	<u>1114</u>	<u>3655</u>
<u>989</u>	<u>3245</u>	<u>1031</u>	<u>3383</u>	<u>1073</u>	<u>3520</u>	<u>1115</u>	<u>3658</u>
<u>990</u>	<u>3248</u>	<u>1032</u>	<u>3386</u>	<u>1074</u>	<u>3524</u>	<u>1116</u>	<u>3661</u>
<u>991</u>	<u>3251</u>	<u>1033</u>	<u>3389</u>	<u>1075</u>	<u>3527</u>	<u>1117</u>	<u>3665</u>
<u>992</u>	<u>3255</u>	<u>1034</u>	<u>3392</u>	<u>1076</u>	<u>3530</u>	<u>1118</u>	<u>3668</u>
<u>993</u>	<u>3258</u>	<u>1035</u>	<u>3396</u>	<u>1077</u>	<u>3533</u>	<u>1119</u>	<u>3671</u>
<u>994</u>	<u>3261</u>	<u>1036</u>	<u>3399</u>	<u>1078</u>	<u>3537</u>	<u>1120</u>	<u>3675</u>
<u>995</u>	<u>3264</u>	<u>1037</u>	<u>3402</u>	<u>1079</u>	<u>3540</u>	<u>1121</u>	<u>3678</u>
<u>996</u>	<u>3268</u>	<u>1038</u>	<u>3406</u>	<u>1080</u>	<u>3543</u>	<u>1122</u>	<u>3681</u>
<u>997</u>	<u>3271</u>	<u>1039</u>	<u>3409</u>	<u>1081</u>	<u>3547</u>	<u>1123</u>	<u>3684</u>
<u>998</u>	<u>3274</u>	<u>1040</u>	<u>3412</u>	<u>1082</u>	<u>3550</u>	<u>1124</u>	<u>3688</u>
<u>999</u>	<u>3278</u>	<u>1041</u>	<u>3415</u>	<u>1083</u>	<u>3553</u>	<u>1125</u>	<u>3691</u>
<u>1000</u>	<u>3281</u>	<u>1042</u>	<u>3419</u>	<u>1084</u>	<u>3556</u>	<u>1126</u>	<u>3694</u>
<u>1001</u>	<u>3284</u>	<u>1043</u>	<u>3422</u>	<u>1085</u>	<u>3560</u>	<u>1127</u>	<u>3698</u>
<u>1002</u>	<u>3287</u>	<u>1044</u>	<u>3425</u>	<u>1086</u>	<u>3563</u>	<u>1128</u>	<u>3701</u>
<u>1003</u>	<u>3291</u>	<u>1045</u>	<u>3428</u>	<u>1087</u>	<u>3566</u>	<u>1129</u>	<u>3704</u>
<u>1004</u>	<u>3294</u>	<u>1046</u>	<u>3432</u>	<u>1088</u>	<u>3570</u>	<u>1130</u>	<u>3707</u>
<u>1005</u>	<u>3297</u>	<u>1047</u>	<u>3435</u>	<u>1089</u>	<u>3573</u>	<u>1131</u>	<u>3711</u>
<u>1006</u>	<u>3301</u>	<u>1048</u>	<u>3438</u>	<u>1090</u>	<u>3576</u>	<u>1132</u>	<u>3714</u>
<u>1007</u>	<u>3304</u>	<u>1049</u>	<u>3442</u>	<u>1091</u>	<u>3579</u>	<u>1133</u>	<u>3717</u>
<u>1008</u>	<u>3307</u>	<u>1050</u>	<u>3445</u>	<u>1092</u>	<u>3583</u>	<u>1134</u>	<u>3720</u>
<u>1009</u>	<u>3310</u>	<u>1051</u>	<u>3448</u>	<u>1093</u>	<u>3586</u>	<u>1135</u>	<u>3724</u>
<u>1010</u>	<u>3314</u>	<u>1052</u>	<u>3451</u>	<u>1094</u>	<u>3589</u>	<u>1136</u>	<u>3727</u>
<u>1011</u>	<u>3317</u>	<u>1053</u>	<u>3455</u>	<u>1095</u>	<u>3593</u>	<u>1137</u>	<u>3730</u>
<u>1012</u>	<u>3320</u>	<u>1054</u>	<u>3458</u>	<u>1096</u>	<u>3596</u>	<u>1138</u>	<u>3734</u>
<u>1013</u>	<u>3323</u>	<u>1055</u>	<u>3461</u>	<u>1097</u>	<u>3599</u>	<u>1139</u>	<u>3737</u>
<u>1014</u>	<u>3327</u>	<u>1056</u>	<u>3465</u>	<u>1098</u>	<u>3602</u>	<u>1140</u>	<u>3740</u>
<u>1015</u>	<u>3330</u>	<u>1057</u>	<u>3468</u>	<u>1099</u>	<u>3606</u>	<u>1141</u>	<u>3743</u>
<u>1016</u>	<u>3333</u>	<u>1058</u>	<u>3471</u>	<u>1100</u>	<u>3609</u>	<u>1142</u>	<u>3747</u>
<u>1017</u>	<u>3337</u>	<u>1059</u>	<u>3474</u>	<u>1101</u>	<u>3612</u>	<u>1143</u>	<u>3750</u>
<u>1018</u>	<u>3340</u>	<u>1060</u>	<u>3478</u>	<u>1102</u>	<u>3615</u>	<u>1144</u>	<u>3753</u>
<u>1019</u>	<u>3343</u>	<u>1061</u>	<u>3481</u>	<u>1103</u>	<u>3619</u>	<u>1145</u>	<u>3757</u>
<u>1020</u>	<u>3346</u>	<u>1062</u>	<u>3484</u>	<u>1104</u>	<u>3622</u>	<u>1146</u>	<u>3760</u>
<u>1021</u>	<u>3350</u>	<u>1063</u>	<u>3488</u>	<u>1105</u>	<u>3625</u>	<u>1147</u>	<u>3763</u>

<u>Meters</u>	<u>Feet</u>	<u>Meters</u>	<u>Feet</u>
<u>1148</u>	<u>3766</u>	<u>1190</u>	<u>3904</u>
<u>1149</u>	<u>3770</u>	<u>1191</u>	<u>3907</u>
<u>1150</u>	<u>3773</u>	<u>1192</u>	<u>3911</u>
<u>1151</u>	<u>3776</u>	<u>1193</u>	<u>3914</u>
<u>1152</u>	<u>3780</u>	<u>1194</u>	<u>3917</u>
<u>1153</u>	<u>3783</u>	<u>1195</u>	<u>3921</u>
<u>1154</u>	<u>3786</u>	<u>1196</u>	<u>3924</u>
<u>1155</u>	<u>3789</u>	<u>1197</u>	<u>3927</u>
<u>1156</u>	<u>3793</u>	<u>1198</u>	<u>3930</u>
<u>1157</u>	<u>3796</u>	<u>1199</u>	<u>3934</u>
<u>1158</u>	<u>3799</u>	<u>1200</u>	<u>3937</u>
<u>1159</u>	<u>3802</u>	<u>1201</u>	<u>3940</u>
<u>1160</u>	<u>3806</u>	<u>1202</u>	<u>3944</u>
<u>1161</u>	<u>3809</u>	<u>1203</u>	<u>3947</u>
<u>1162</u>	<u>3812</u>	<u>1204</u>	<u>3950</u>
<u>1163</u>	<u>3816</u>	<u>1205</u>	<u>3953</u>
<u>1164</u>	<u>3819</u>	<u>1206</u>	<u>3957</u>
<u>1165</u>	<u>3822</u>	<u>1207</u>	<u>3960</u>
<u>1166</u>	<u>3825</u>	<u>1208</u>	<u>3963</u>
<u>1167</u>	<u>3829</u>	<u>1209</u>	<u>3967</u>
<u>1168</u>	<u>3832</u>	<u>1210</u>	<u>3970</u>
<u>1169</u>	<u>3835</u>	<u>1211</u>	<u>3973</u>
<u>1170</u>	<u>3839</u>	<u>1212</u>	<u>3976</u>
<u>1171</u>	<u>3842</u>	<u>1213</u>	<u>3980</u>
<u>1172</u>	<u>3845</u>	<u>1214</u>	<u>3983</u>
<u>1173</u>	<u>3848</u>	<u>1215</u>	<u>3986</u>
<u>1174</u>	<u>3852</u>	<u>1216</u>	<u>3990</u>
<u>1175</u>	<u>3855</u>	<u>1217</u>	<u>3993</u>
<u>1176</u>	<u>3858</u>	<u>1218</u>	<u>3996</u>
<u>1177</u>	<u>3862</u>	<u>1219</u>	<u>3999</u>
<u>1178</u>	<u>3865</u>	<u>1220</u>	<u>4003</u>
<u>1179</u>	<u>3868</u>		
<u>1180</u>	<u>387</u>		
<u>1181</u>	<u>3875</u>		
<u>1182</u>	<u>3878</u>		
<u>1183</u>	<u>3881</u>		
<u>1184</u>	<u>3885</u>		
<u>1185</u>	<u>3888</u>		
<u>1186</u>	<u>3891</u>		
<u>1187</u>	<u>3894</u>		
<u>1188</u>	<u>3898</u>		
<u>1189</u>	<u>3901</u>		

195 Appendix B: Oxygen Titration Protocol

196 This protocol¹ may be used in advance of the six-minute walk test to determine the amount of
 197 supplemental oxygen needed so that the candidate can complete the six-minute walk test without
 198 titrating up supplemental oxygen during the test. The oxygen titration test should be conducted on a flat
 199 standard 30-meter course with cones at each end and wall markings at 1-meter intervals as advised by
 200 the European Respiratory Society/American Thoracic Society for the six-minute walk test.²

- 201 1. Prior to the start of the test, record resting heart rate and room air SpO₂.
- 202 2. Supply continuous supplemental oxygen as needed to ensure a resting SpO₂ > 88%. If
 203 candidate's baseline SpO₂ is less than 88%, supply continuous supplemental oxygen as needed
 204 to ensure a resting SpO₂ equal to or greater than the candidate's baseline.
- 205 3. Stabilize the candidate on any supplemental oxygen for 5 minutes prior to the start of the test to
 206 establish resting supplemental oxygen demands. Enter this value on the Lung Candidate record
 207 in OPTN Waiting List as the amount of supplemental oxygen required at rest.
- 208 4. Instruct the candidate to walk at "a vigorous pace or one that they can maintain for at least 6
 209 minutes."
- 210 5. Station the respiratory technician performing the test near the halfway point on the course to
 211 continuously monitor the candidate without interfering with the walking pace. The technician
 212 walks directly with the candidate only if it is necessary as a safety precaution against falls.
- 213 6. Measure time via a stopwatch. The testing time starts when the candidate begins to walk.
- 214 7. Record heart rate, SpO₂, and any supplemental oxygen flow (L/min) every minute, or sooner
 215 with any significant clinical change.
- 216 8. The minimum duration of testing is 6 minutes.
 - 217 a. If no desaturation occurs (SpO₂ remains > 88%) for the duration of testing, the test
 218 concludes at 6 minutes.
 - 219 b. If desaturation occurs during testing (SpO₂ ≤ 88%), stop the candidate and timer and
 220 deliver supplemental oxygen through a nasal cannula at an increase of 2 L/min greater
 221 than the current oxygen amount until SpO₂ is ≥ 90%.
 - 222 i. Allow the candidate to stabilize at this level for 2 minutes.
 - 223 ii. Restart the timer and instruct the candidate to resume walking.
 - 224 iii. Repeat this process as necessary until at least 6 minutes of walking has occurred
 225 and the oxygen amount has remained unchanged for 3 minutes, at which point
 226 the test is terminated.
 - 227 iv. The test is also terminated if:
 - 228 1. The candidate is unable to maintain SpO₂ > 88% at 25 L/min for 3
 229 minutes.
 - 230 2. The candidate experiences chest pain or lightheadedness or requests to
 231 stop the test for any reason.

¹ Adopted with modifications from: Coral X. Giovacchini, Anne M. Mathews, Brian R. Lawlor, and Neil R. MacIntyre, "Titrating Oxygen Requirements During Exercise: Evaluation of a Standardized Single Walk Test Protocol," *CHEST* 153 no. 4 (2018): 922-928, <https://doi.org/10.1016/j.chest.2017.11.009>.

² Anne E. Holland, Martijn A. Spruit, Thierry Troosters, et al., "An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease," *European Respiratory Journal* 44 (2014): 1428-1446, DOI: [10.1183/09031936.00150314](https://doi.org/10.1183/09031936.00150314).

- 232 9. The final amount of supplemental oxygen from the oxygen titration test must be documented in
233 the candidate's medical record. Provide that amount of supplemental oxygen to the candidate
234 when completing the six-minute walk test for lung allocation.

#

Appendix A: Proposed Changes to Data Definitions

Proposed new language is underlined (example) and language that is proposed for removal is struck through (~~example~~).

Six-minute walk distance: Enter the total exertional distance on a flat surface the candidate is able to walk in six minutes in feet. Refer to *Guidance for Conducting the Six-Minute Walk Test for Lung Allocation* for additional information on conducting the test and converting walk distance from meters to feet. ~~The distance walked is a measure of functional status. The normal expected range of values is between 0 and 3000, although a value outside of greater than this range may be entered.~~ Enter the Test Date when this information was obtained. These fields must be updated every 6 months from the time the candidate was added to the waiting list. If they are incomplete or expired, the least beneficial value will be used to calculate the candidate's lung composite allocation score.

Appendix B: Post-Public Comment Changes

New language that was proposed following public comment is underlined and highlighted (example); language that is proposed for removal following public comment is struck through and highlighted (example).

Excerpt from OPTN Policy 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*.

For any six-minute walk distances reported during the six months preceding a candidate turning 12 years old, and for any initial six-minute walk distances reported for candidates at least 12 years old, transplant programs must perform an oxygen titration test prior to conducting the six-minute walk test for a candidate on the lung waiting list. The final amount of supplemental oxygen from the oxygen titration test must be the amount provided to the candidate at the start of the six-minute walk test and documented in the candidate’s medical record.

~~For lung candidates registered prior to September 5, 2024, who are at least 11 years 6 months old on September 5, 2024, transplant programs must perform an oxygen titration test prior to conducting the six-minute walk test for reporting a six-minute walk distance by March 5, 2025.~~

For six-minute walk distances reported prior to the six months preceding the candidate turning 12 years old, and for any subsequent updates to the six-minute walk distance according to *Policy 10.3.B Lung Clinical Values That Must Be Updated Every Six Months*, transplant programs may conduct an oxygen titration test prior to the six-minute walk test and may modify the amount of supplemental oxygen provided to the candidate at the start of the six-minute walk test.

...

ENACTMENT CLAUSE:

~~For lung candidates registered prior to September 3, 2024, who are at least 11 years 6 months old on September 3, 2024, transplant programs must perform an oxygen titration test prior to conducting the six-minute walk test for reporting a six-minute walk distance by March 3, 2025.~~

Excerpts from “Guidance for Conducting the Six-Minute Walk Test for Lung Allocation”:

Provision of Supplemental Oxygen

The 2014 technical standard states, “Oxygen is not to be titrated during any of the tests where distance is a measured outcome. If oxygen titration is desired, this should be done during a separate test.”³³ Per *OPTN Policy 10.3 Clinical Values and Update Schedule*, transplant hospitals must conduct an oxygen titration test to determine the amount of supplemental oxygen that should be provided to the

³³ Holland et al., “Field walking tests,” 1438.

candidate during the candidate's initial six-minute walk test. This requirement applies to candidates at least 12 years old and for six-minute walk distances reported during the six months preceding a candidate turning 12 years old. Accordingly, transplant programs are advised to perform the oxygen titration test as close in time ahead of the six-minute walk test as is feasible but no more than 12 weeks prior to the six-minute walk test. Pediatric lung transplant programs are advised to ensure that candidates approaching 12 years old complete an oxygen titration test ahead of the six-minute walk test for the six-minute walk distance reported within six months before the candidate turns 12 years of age. The intent of performing the oxygen titration test ahead of the six-minute walk test is to provide a standardized approach for determining supplemental oxygen needs for completing the test and to avoid titration during the test so as not to interfere with the candidate's performance. A sample oxygen titration protocol is enclosed in **Appendix B**. If a candidate desaturates during the six-minute walk test, the transplant program may provide additional supplemental oxygen to enable the candidate to complete the test.

...

If a candidate is unable to safely perform the six-minute walk test (e.g., while supported by continuous mechanical ventilation and/or extracorporeal membrane oxygenation), then the test should not be performed, and the lung transplant program should report a walk distance of 0 feet for the candidate. However, lung transplant programs are advised to avoid entering a walk distance of 0 feet and to administer the six-minute walk test if it is deemed safe for a candidate to attempt the test, even if the candidate is not expected to walk far or is not expected to walk the full six minutes.

...

Altitude Considerations

Some candidates may live at an altitude that is different enough from their transplant program that the candidates require different levels of supplemental oxygen when at the transplant center relative to what they use at home.³⁴ Transplant programs located in areas where residential altitude varies widely are advised to perform the oxygen titration test and the six-minute walk test at their transplant hospital when possible so that all candidates registered at the program are performing these tests at the same altitude. This approach will help to ensure that the six-minute walk distances reported for each candidate registered at the program are being measured consistently.

³⁴ Deirdre Caffrey, J. Jaime Miranda, Robert H. Gilman, et al., "A cross-sectional study of differences in 6-min walk distance in health adults residing at high altitude versus sea level," *Extreme Physiology & Medicine* 3, no. 3 (2014), <https://extremephysiolmed.biomedcentral.com/articles/10.1186/2046-7648-3-3>.