OPTN

Notice of OPTN Policy Changes

Standardize Six-Minute Walk for Lung Allocation

Sponsoring Committee:	**Lung Transplantation Committee**
Policies Affected:	***10.1.A.1 Waitlist Survival Points for Candidates at least 12 Years Old***
	10.1.B.1 Post-Transplant Outcomes Points for Candidates at least 12 Years Old
	10.3 Clinical Values and Update Schedule
	10.3.B Lung Clinical Values That Must Be Updated Every Six Months
	21.2.A Values Used in the Calculation of Lung Waiting List Survival
	21.2.B.1 Coefficients Used in Calculating Lung Post-Transplant Outcomes
New Guidance:	**Guidance for Conducting the Six-Minute Walk For Lung Allocation**
Public Comment:	**January 23, 2024 – March 19, 2024**
Board Approved:	**June 17-18, 2024**
Effective Date:	**September 3, 2024**

Purpose of Policy Changes and New Guidance

The purpose of these changes is to standardize how transplant programs perform the six-minute walk test when reporting the walk distance for use in the lung composite allocation score (CAS). Provision of supplemental oxygen during the test is one of the main sources of variability in performing the six-minute walk test. These changes will standardize how transplant programs determine oxygen needs ahead of the six-minute walk test and provide guidance specifically for lung transplant candidates to supplement current clinical standards. Standardizing the six-minute walk test for lung allocation will improve equity in lung allocation priority.

Proposal History

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. Six-minute walk distance has been incorporated into lung allocation since the implementation of the lung allocation score (LAS) in 2005.[1] In 2015, the LAS was updated to incorporate six-minute walk distance as

[1] 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.

a continuous variable in the waiting list survival model, as recommended concurrently in clinical literature,[2] and to add six-minute walk distance to the post-transplant survival model.[3] In 2021, the LAS was updated based on analysis of a more current cohort of lung candidates.[4] Finally, with the implementation of continuous distribution of lungs on March 9, 2023, the lung CAS replaced the LAS.[5] There were no changes to the coefficients for the variables in the waiting list survival model, 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[6].

To address gaps in current clinical standards and OPTN policy[7], the proposal introduced a new policy requirement for determining candidate oxygen needs ahead of the six-minute walk test and supplemental guidance on completing the six-minute walk test, including special considerations for lung candidates. Additionally, language for six-minute walk distance was updated and moved from policy to help documentation. The proposal was available for public comment during the Winter 2024 cycle. Overall, there was support for the proposal.

Based on community feedback received during public comment, the following updates were made:

- 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 moved related transition plan dates from policy to resolution language

Summary of Changes

There is a new policy requirement for an oxygen titration test to be completed 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 lung candidates turn 12 years old. Additionally, some of the existing policy

[2] 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.

[3] "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/.

[4] "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.

[5] "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.

[6] "Standardize Six-Minute Walk for Lung Allocation", OPTN, Briefing Paper, June 2024, page 5, Table 1, https://optn.transplant.hrsa.gov/media/5inj2xic/lung_six_minute_walk_board-briefing-paper_draft.pdf, accessed June 10, 2024.

[7] "Standardize Six-Minute Walk for Lung Allocation", OPTN, Briefing Paper, June 2024, page 5, Table 1, https://optn.transplant.hrsa.gov/media/5inj2xic/lung_six_minute_walk_board-briefing-paper_draft.pdf, accessed June 10, 2024.

language regarding the six-minute walk distance is removed, as it described how the six-minute walk test should be performed.

Guidance expands on current clinical standards for the six-minute walk test, providing recommendations specific to lung transplant candidates and a protocol for the oxygen titration test. Recommendations for the provision of supplemental oxygen during the six-minute walk test, safety and altitude considerations are included.

Implementation

Transplant hospitals with lung transplant programs must ensure that oxygen titration tests are completed 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. 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. Transplant hospitals must document in the candidate's medical record the final amount of supplemental oxygen from the oxygen titration test and provide that amount at the start of the six-minute walk test.

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. There is no anticipated impact to organ procurement organizations or histocompatibility laboratories.

Updated policies and new guidance will be published to the OPTN website. Help documentation for six-minute walk distance will be published in the OPTN Waiting List.

Affected Policy Language

New language is underlined (<u>example</u>) and language that is deleted is struck through (~~example~~).

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

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

- Age at the time of the match run (fractional calendar years)
- Bilirubin (mg/dL) value with the most recent test date and time
- Body mass index (BMI) (kg/m2)
- Assisted ventilation
- Creatinine (serum) (mg/dL) with the most recent test date and time
- Diagnosis Group (A, B, C, or D), as defined in Policy 10.1.F Lung Disease Diagnosis Groups
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
    - Bronchiectasis
    - Sarcoidosis with pulmonary artery (PA) mean pressure of 30 mm Hg or less
    - Sarcoidosis with PA mean pressure missing

- Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
    - COVID-19: pulmonary fibrosis
    - Pulmonary fibrosis, other specify cause
    - Sarcoidosis with PA mean pressure greater than 30 mm Hg
- Functional Status
- Oxygen needed to maintain adequate oxygen saturation (88% or greater) at rest (L/min)
- PCO2 (mm Hg): current
- PCO2 increase of at least 15%
- PA systolic pressure (mm Hg) at rest, prior to any exercise
- Six-minute walk distance (feet) ~~obtained while the candidate is receiving supplemental oxygen required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental oxygen during this test is at the discretion of the center performing the test.~~

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

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

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

- Age at the time of the match run (fractional calendar years)
- Creatinine (serum) (mg/dL) with the most recent data and time
- Cardiac index (L/min/m2) at rest, prior to any exercise
- Assisted ventilation
- Diagnosis Group (A, B, C, or D), as defined in 10.1.F: Lung Disease Diagnosis Groups
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group A:
    - Bronchiectasis
    - Lymphangioleiomyomatosis
    - Sarcoidosis with PA mean pressure of 30 mm Hg or less
    - Sarcoidosis with PA mean pressure missing
- Whether the candidate has one of the following specific diagnoses within Diagnosis Group D:
    - COVID-19: pulmonary fibrosis
    - Obliterative bronchiolitis (non-retransplant)
    - Constrictive bronchiolitis
    - Sarcoidosis with PA mean pressure greater than 30 mm Hg
    - Pulmonary fibrosis, other specify cause
- Functional Status
- Six-minute walk distance (feet) ~~obtained while the candidate is receiving supplemental oxygen required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental oxygen during this test is at the discretion of the center performing the test.~~

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

[…]

10.3 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 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.

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

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

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

[…]

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

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

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

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

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

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

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

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

For this covariate:	When	The following coefficient is used in the lung waiting list survival calculation:
Age at the time of the match run (fractional calendar year)	~~All candidates~~ Candidates are at least 12 years old	0.0281444188123287*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.~~ Candidates are at least 12 years old	-0.09937981549564*Six-minute walk distance/100

[…]

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

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

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

For this covariate	When	The following coefficient is used in the lung post-transplant outcomes score calculation
[…]		
Six-minute walk distance (feet) ~~obtained while candidate is receiving supplemental oxygen required to maintain an oxygen saturation of 88% or greater at rest. Increase in supplemental oxygen during this test is at the discretion of the center performing the test.~~	Less than 200 feet	-0.0002535116049789 x (200 - Six-minute walk distance) + 0.11168755
	At least 200 feet and less than 600 feet	-0.0002841805913329 x (Six-minute walk distance - 200) + 0.11168755
	At least 600 feet and less than 800 feet	-0.0000049617083362 x (Six-minute walk distance - 600) - 0.00198468
	At least 800 feet and less than 1,200 feet	-0.0001950464256370 x (Six-minute walk distance - 800) - 0.00297703
	At least 1,200 feet and less than 1,600 feet	-0.0007428583659073 x (Six-minute walk distance - 1200) - 0.08099560
	At least 1,600 feet	0.0035374143842919 x (Six-minute walk distance - 1600) - 0.37813894

[…]

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.

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

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

Per OPTN *Policy 10.3.B Lung Clinical Values That Must Be Updated Every Six Months*, transplant hospitals must update the six-minute walk distance in feet for each lung candidate at least once in every six-month period following registration on the waiting list. This guidance offers recommendations for performing the six-minute walk test to promote standardization across transplant programs in how the six-minute walk distance is reported for the purposes of lung allocation. Transplant programs are advised to follow the 2002 American Thoracic Society Guidelines for the Six-Minute Walk Test[1] and the 2014 European Respiratory Society/American Thoracic Society technical standard on field walking tests in chronic respiratory disease[2] to the extent possible. If the walk distance is measured in meters, use **Appendix A** to convert the walk distance from meters to feet.

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."[3] 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 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. 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. 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.

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

[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/ajrccm.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.

candidate on the lung waiting list. To align with this timing, transplant programs are advised to perform the oxygen titration test at least once in every six-month period. 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. However, transplant programs may determine that a candidate's supplemental oxygen needs are well established and that a separate oxygen titration test is not necessary prior to performing a six-minute walk test other than the candidate's initial six-minute walk test. For example, particularly for pediatric candidates, adherence to multiple test protocols in the same day may present a challenge and the candidates' oxygen needs with exertion may be well established.

Safety Considerations

For most candidates, it is recommended that transplant programs provide supplemental oxygen to maintain a candidate's oxygen saturation of greater than 88% during the performance of the test. 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%.[4] Depending on the candidate's diagnosis and disease severity, lung transplant programs should not feel obligated to allow their candidates to desaturate below 80% before halting the test. For candidates who are unable to maintain an oxygen saturation of 88% of greater at rest but can safely complete the six-minute walk test, the transplant program may use a lower oxygen saturation threshold to guide supplemental oxygen needs.

If a candidate is unable to safely perform the six-minute walk test, 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.

When a lung candidate is unable to complete the six-minute walk due to reasons unrelated to their lung disease severity (e.g., lower limb amputation, joint necrosis, etc.), the lung transplant program should report a walk distance of 0 feet for the candidate. The transplant program may submit an exception request for the post-transplant outcomes component of the candidate's lung composite allocation score. In this case, transplant programs should estimate the candidate's six-minute walk distance based on the documented walk distance of candidates with similar levels of fitness and enter that value into the CAS calculator[5] along with the candidate's other characteristics to determine the estimated post-transplant outcomes subscore for that candidate were they able to complete the six-minute walk test. The transplant program should then divide this value by the total possible number of points for post-transplant outcomes and multiply by 100 to determine the percentage that should be entered into the exception request form. The exception request will be reviewed and adjudicated as outlined in OPTN *Policy 10.2 Lung Composite Score Exceptions* and the Lung Review Board Operational Guidelines.[6]

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

[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/.

what they use at home.[7] Transplant programs located in areas where residential altitude varies widely are advised to perform the oxygen titration test and the six-minute walk text 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.

[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

Six-minute walk distance is entered in OPTN Waiting List as a whole number measured in feet. The following table is provided for converting six-minute walk distances measured in meters to a whole number in feet, where one meter is equal to 3.28084 feet. The value was rounded up to the next whole 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
0	0	**36**	118	**72**	236	**108**	354
1	3	**37**	121	**73**	240	**109**	358
2	7	**38**	125	**74**	243	**110**	361
3	10	**39**	128	**75**	246	**111**	364
4	13	**40**	131	**76**	249	**112**	367
5	16	**41**	135	**77**	253	**113**	371
6	20	**42**	138	**78**	256	**114**	374
7	23	**43**	141	**79**	259	**115**	377
8	26	**44**	144	**80**	262	**116**	381
9	30	**45**	148	**81**	266	**117**	384
10	33	**46**	151	**82**	269	**118**	387
11	36	**47**	154	**83**	272	**119**	390
12	39	**48**	157	**84**	276	**120**	394
13	43	**49**	161	**85**	279	**121**	397
14	46	**50**	164	**86**	282	**122**	400
15	49	**51**	167	**87**	285	**123**	404
16	52	**52**	171	**88**	289	**124**	407
17	56	**53**	174	**89**	292	**125**	410
18	59	**54**	177	**90**	295	**126**	413
19	62	**55**	180	**91**	299	**127**	417
20	66	**56**	184	**92**	302	**128**	420
21	69	**57**	187	**93**	305	**129**	423
22	72	**58**	190	**94**	308	**130**	427
23	75	**59**	194	**95**	312	**131**	430
24	79	**60**	197	**96**	315	**132**	433
25	82	**61**	200	**97**	318	**133**	436
26	85	**62**	203	**98**	322	**134**	440
27	89	**63**	207	**99**	325	**135**	443
28	92	**64**	210	**100**	328	**136**	446
29	95	**65**	213	**101**	331	**137**	449
30	98	**66**	217	**102**	335	**138**	453
31	102	**67**	220	**103**	338	**139**	456
32	105	**68**	223	**104**	341	**140**	459
33	108	**69**	226	**105**	344	**141**	463
34	112	**70**	230	**106**	348	**142**	466
35	115	**71**	233	**107**	351	**143**	469

Meters	Feet
144	472
145	476
146	479
147	482
148	486
149	489
150	492
151	495
152	499
153	502
154	505
155	509
156	512
157	515
158	518
159	522
160	525
161	528
162	531
163	535
164	538
165	541
166	545
167	548
168	551
169	554
170	558
171	561
172	564
173	568
174	571
175	574
176	577
177	581
178	584
179	587
180	591
181	594
182	597
183	600
184	604
185	607

Meters	Feet
186	610
187	614
188	617
189	620
190	623
191	627
192	630
193	633
194	636
195	640
196	643
197	646
198	650
199	653
200	656
201	659
202	663
203	666
204	669
205	673
206	676
207	679
208	682
209	686
210	689
211	692
212	696
213	699
214	702
215	705
216	709
217	712
218	715
219	719
220	722
221	725
222	728
223	732
224	735
225	738
226	741
227	745

Meters	Feet
228	748
229	751
230	755
231	758
232	761
233	764
234	768
235	771
236	774
237	778
238	781
239	784
240	787
241	791
242	794
243	797
244	801
245	804
246	807
247	810
248	814
249	817
250	820
251	823
252	827
253	830
254	833
255	837
256	840
257	843
258	846
259	850
260	853
261	856
262	860
263	863
264	866
265	869
266	873
267	876
268	879
269	883

Meters	Feet
270	886
271	889
272	892
273	896
274	899
275	902
276	906
277	909
278	912
279	915
280	919
281	922
282	925
283	928
284	932
285	935
286	938
287	942
288	945
289	948
290	951
291	955
292	958
293	961
294	965
295	968
296	971
297	974
298	978
299	981
300	984
301	988
302	991
303	994
304	997
305	1001
306	1004
307	1007
308	1010
309	1014
310	1017
311	1020

Meters	Feet
312	1024
313	1027
314	1030
315	1033
316	1037
317	1040
318	1043
319	1047
320	1050
321	1053
322	1056
323	1060
324	1063
325	1066
326	1070
327	1073
328	1076
329	1079
330	1083
331	1086
332	1089
333	1093
334	1096
335	1099
336	1102
337	1106
338	1109
339	1112
340	1115
341	1119
342	1122
343	1125
344	1129
345	1132
346	1135
347	1138
348	1142
349	1145
350	1148
351	1152
352	1155
353	1158

Meters	Feet
354	1161
355	1165
356	1168
357	1171
358	1175
359	1178
360	1181
361	1184
362	1188
363	1191
364	1194
365	1198
366	1201
367	1204
368	1207
369	1211
370	1214
371	1217
372	1220
373	1224
374	1227
375	1230
376	1234
377	1237
378	1240
379	1243
380	1247
381	1250
382	1253
383	1257
384	1260
385	1263
386	1266
387	1270
388	1273
389	1276
390	1280
391	1283
392	1286
393	1289
394	1293
395	1296

Meters	Feet
396	1299
397	1302
398	1306
399	1309
400	1312
401	1316
402	1319
403	1322
404	1325
405	1329
406	1332
407	1335
408	1339
409	1342
410	1345
411	1348
412	1352
413	1355
414	1358
415	1362
416	1365
417	1368
418	1371
419	1375
420	1378
421	1381
422	1385
423	1388
424	1391
425	1394
426	1398
427	1401
428	1404
429	1407
430	1411
431	1414
432	1417
433	1421
434	1424
435	1427
436	1430
437	1434

Meters	Feet
438	1437
439	1440
440	1444
441	1447
442	1450
443	1453
444	1457
445	1460
446	1463
447	1467
448	1470
449	1473
450	1476
451	1480
452	1483
453	1486
454	1490
455	1493
456	1496
457	1499
458	1503
459	1506
460	1509
461	1512
462	1516
463	1519
464	1522
465	1526
466	1529
467	1532
468	1535
469	1539
470	1542
471	1545
472	1549
473	1552
474	1555
475	1558
476	1562
477	1565
478	1568
479	1572

Meters	Feet
480	1575
481	1578
482	1581
483	1585
484	1588
485	1591
486	1594
487	1598
488	1601
489	1604
490	1608
491	1611
492	1614
493	1617
494	1621
495	1624
496	1627
497	1631
498	1634
499	1637
500	1640
501	1644
502	1647
503	1650
504	1654
505	1657
506	1660
507	1663
508	1667
509	1670
510	1673
511	1677
512	1680
513	1683
514	1686
515	1690
516	1693
517	1696
518	1699
519	1703
520	1706
521	1709

Meters	Feet
522	1713
523	1716
524	1719
525	1722
526	1726
527	1729
528	1732
529	1736
530	1739
531	1742
532	1745
533	1749
534	1752
535	1755
536	1759
537	1762
538	1765
539	1768
540	1772
541	1775
542	1778
543	1781
544	1785
545	1788
546	1791
547	1795
548	1798
549	1801
550	1804
551	1808
552	1811
553	1814
554	1818
555	1821
556	1824
557	1827
558	1831
559	1834
560	1837
561	1841
562	1844
563	1847

Meters	Feet
564	1850
565	1854
566	1857
567	1860
568	1864
569	1867
570	1870
571	1873
572	1877
573	1880
574	1883
575	1886
576	1890
577	1893
578	1896
579	1900
580	1903
581	1906
582	1909
583	1913
584	1916
585	1919
586	1923
587	1926
588	1929
589	1932
590	1936
591	1939
592	1942
593	1946
594	1949
595	1952
596	1955
597	1959
598	1962
599	1965
600	1969
601	1972
602	1975
603	1978
604	1982
605	1985

Meters	Feet
606	1988
607	1991
608	1995
609	1998
610	2001
611	2005
612	2008
613	2011
614	2014
615	2018
616	2021
617	2024
618	2028
619	2031
620	2034
621	2037
622	2041
623	2044
624	2047
625	2051
626	2054
627	2057
628	2060
629	2064
630	2067
631	2070
632	2073
633	2077
634	2080
635	2083
636	2087
637	2090
638	2093
639	2096
640	2100
641	2103
642	2106
643	2110
644	2113
645	2116
646	2119
647	2123

Meters	Feet
648	2126
649	2129
650	2133
651	2136
652	2139
653	2142
654	2146
655	2149
656	2152
657	2156
658	2159
659	2162
660	2165
661	2169
662	2172
663	2175
664	2178
665	2182
666	2185
667	2188
668	2192
669	2195
670	2198
671	2201
672	2205
673	2208
674	2211
675	2215
676	2218
677	2221
678	2224
679	2228
680	2231
681	2234
682	2238
683	2241
684	2244
685	2247
686	2251
687	2254
688	2257
689	2260

Meters	Feet
690	2264
691	2267
692	2270
693	2274
694	2277
695	2280
696	2283
697	2287
698	2290
699	2293
700	2297
701	2300
702	2303
703	2306
704	2310
705	2313
706	2316
707	2320
708	2323
709	2326
710	2329
711	2333
712	2336
713	2339
714	2343
715	2346
716	2349
717	2352
718	2356
719	2359
720	2362
721	2365
722	2369
723	2372
724	2375
725	2379
726	2382
727	2385
728	2388
729	2392
730	2395
731	2398

Meters	Feet
732	2402
733	2405
734	2408
735	2411
736	2415
737	2418
738	2421
739	2425
740	2428
741	2431
742	2434
743	2438
744	2441
745	2444
746	2448
747	2451
748	2454
749	2457
750	2461
751	2464
752	2467
753	2470
754	2474
755	2477
756	2480
757	2484
758	2487
759	2490
760	2493
761	2497
762	2500
763	2503
764	2507
765	2510
766	2513
767	2516
768	2520
769	2523
770	2526
771	2530
772	2533
773	2536

Meters	Feet
774	2539
775	2543
776	2546
777	2549
778	2552
779	2556
780	2559
781	2562
782	2566
783	2569
784	2572
785	2575
786	2579
787	2582
788	2585
789	2589
790	2592
791	2595
792	2598
793	2602
794	2605
795	2608
796	2612
797	2615
798	2618
799	2621
800	2625
801	2628
802	2631
803	2635
804	2638
805	2641
806	2644
807	2648
808	2651
809	2654
810	2657
811	2661
812	2664
813	2667
814	2671
815	2674

Meters	Feet
816	2677
817	2680
818	2684
819	2687
820	2690
821	2694
822	2697
823	2700
824	2703
825	2707
826	2710
827	2713
828	2717
829	2720
830	2723
831	2726
832	2730
833	2733
834	2736
835	2740
836	2743
837	2746
838	2749
839	2753
840	2756
841	2759
842	2762
843	2766
844	2769
845	2772
846	2776
847	2779
848	2782
849	2785
850	2789
851	2792
852	2795
853	2799
854	2802
855	2805
856	2808
857	2812

Meters	Feet
858	2815
859	2818
860	2822
861	2825
862	2828
863	2831
864	2835
865	2838
866	2841
867	2844
868	2848
869	2851
870	2854
871	2858
872	2861
873	2864
874	2867
875	2871
876	2874
877	2877
878	2881
879	2884
880	2887
881	2890
882	2894
883	2897
884	2900
885	2904
886	2907
887	2910
888	2913
889	2917
890	2920
891	2923
892	2927
893	2930
894	2933
895	2936
896	2940
897	2943
898	2946
899	2949

Meters	Feet
900	2953
901	2956
902	2959
903	2963
904	2966
905	2969
906	2972
907	2976
908	2979
909	2982
910	2986
911	2989
912	2992
913	2995
914	2999
915	3002
916	3005
917	3009
918	3012
919	3015
920	3018
921	3022
922	3025
923	3028
924	3031
925	3035
926	3038
927	3041
928	3045
929	3048
930	3051
931	3054
932	3058
933	3061
934	3064
935	3068
936	3071
937	3074
938	3077
939	3081
940	3084
941	3087

Meters	Feet
942	3091
943	3094
944	3097
945	3100
946	3104
947	3107
948	3110
949	3114
950	3117
951	3120
952	3123
953	3127
954	3130
955	3133
956	3136
957	3140
958	3143
959	3146
960	3150
961	3153
962	3156
963	3159
964	3163
965	3166
966	3169
967	3173
968	3176
969	3179
970	3182
971	3186
972	3189
973	3192
974	3196
975	3199
976	3202
977	3205
978	3209
979	3212
980	3215
981	3219
982	3222
983	3225

Meters	Feet
984	3228
985	3232
986	3235
987	3238
988	3241
989	3245
990	3248
991	3251
992	3255
993	3258
994	3261
995	3264
996	3268
997	3271
998	3274
999	3278
1000	3281
1001	3284
1002	3287
1003	3291
1004	3294
1005	3297
1006	3301
1007	3304
1008	3307
1009	3310
1010	3314
1011	3317
1012	3320
1013	3323
1014	3327
1015	3330
1016	3333
1017	3337
1018	3340
1019	3343
1020	3346
1021	3350
1022	3353
1023	3356
1024	3360
1025	3363

Meters	Feet
1026	3366
1027	3369
1028	3373
1029	3376
1030	3379
1031	3383
1032	3386
1033	3389
1034	3392
1035	3396
1036	3399
1037	3402
1038	3406
1039	3409
1040	3412
1041	3415
1042	3419
1043	3422
1044	3425
1045	3428
1046	3432
1047	3435
1048	3438
1049	3442
1050	3445
1051	3448
1052	3451
1053	3455
1054	3458
1055	3461
1056	3465
1057	3468
1058	3471
1059	3474
1060	3478
1061	3481
1062	3484
1063	3488
1064	3491
1065	3494
1066	3497
1067	3501

Meters	Feet
1068	3504
1069	3507
1070	3510
1071	3514
1072	3517
1073	3520
1074	3524
1075	3527
1076	3530
1077	3533
1078	3537
1079	3540
1080	3543
1081	3547
1082	3550
1083	3553
1084	3556
1085	3560
1086	3563
1087	3566
1088	3570
1089	3573
1090	3576
1091	3579
1092	3583
1093	3586
1094	3589
1095	3593
1096	3596
1097	3599
1098	3602
1099	3606
1100	3609
1101	3612
1102	3615
1103	3619
1104	3622
1105	3625
1106	3629
1107	3632
1108	3635
1109	3638

Meters	Feet
1110	3642
1111	3645
1112	3648
1113	3652
1114	3655
1115	3658
1116	3661
1117	3665
1118	3668
1119	3671
1120	3675
1121	3678
1122	3681
1123	3684
1124	3688
1125	3691
1126	3694
1127	3698
1128	3701
1129	3704
1130	3707
1131	3711
1132	3714
1133	3717
1134	3720
1135	3724
1136	3727
1137	3730
1138	3734
1139	3737
1140	3740
1141	3743
1142	3747
1143	3750
1144	3753
1145	3757
1146	3760
1147	3763
1148	3766
1149	3770
1150	3773
1151	3776

Meters	Feet
1152	3780
1153	3783
1154	3786
1155	3789
1156	3793
1157	3796
1158	3799
1159	3802
1160	3806
1161	3809
1162	3812
1163	3816
1164	3819
1165	3822
1166	3825
1167	3829
1168	3832
1169	3835

Meters	Feet
1170	3839
1171	3842
1172	3845
1173	3848
1174	3852
1175	3855
1176	3858
1177	3862
1178	3865
1179	3868
1180	387
1181	3875
1182	3878
1183	3881
1184	3885
1185	3888
1186	3891
1187	3894

Meters	Feet
1188	3898
1189	3901
1190	3904
1191	3907
1192	3911
1193	3914
1194	3917
1195	3921
1196	3924
1197	3927
1198	3930
1199	3934
1200	3937
1201	3940
1202	3944
1203	3947
1204	3950
1205	3953

Meters	Feet
1206	3957
1207	3960
1208	3963
1209	3967
1210	3970
1211	3973
1212	3976
1213	3980
1214	3983
1215	3986
1216	3990
1217	3993
1218	3996
1219	3999
1220	4003

Appendix B: Oxygen Titration Protocol

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

1. Prior to the start of the test, record resting heart rate and room air SpO_2.
2. Supply continuous supplemental oxygen as needed to ensure a resting $SpO_2 > 88\%$. If candidate's baseline SpO_2 is less than 88%, supply continuous supplemental oxygen as needed to ensure a resting SpO_2 equal to or greater than the candidate's baseline.
3. Stabilize the candidate on any supplemental oxygen for 5 minutes prior to the start of the test to establish resting supplemental oxygen demands. Enter this value on the Lung Candidate record in OPTN Waiting List as the amount of supplemental oxygen required at rest.
4. Instruct the candidate to walk at "a vigorous pace or one that they can maintain for at least 6 minutes."
5. Station the respiratory technician performing the test near the halfway point on the course to continuously monitor the candidate without interfering with the walking pace. The technician walks directly with the candidate only if it is necessary as a safety precaution against falls.
6. Measure time via a stopwatch. The testing time starts when the candidate begins to walk.
7. Record heart rate, SpO_2, and any supplemental oxygen flow (L/min) every minute, or sooner with any significant clinical change.
8. The minimum duration of testing is 6 minutes.
    a. If no desaturation occurs (SpO_2 remains > 88%) for the duration of testing, the test concludes at 6 minutes.
    b. If desaturation occurs during testing ($SpO_2 \leq 88\%$), stop the candidate and timer and deliver supplemental oxygen through a nasal cannula at an increase of 2 L/min greater than the current oxygen amount until SpO_2 is $\geq 90\%$.
        i. Allow the candidate to stabilize at this level for 2 minutes.
        ii. Restart the timer and instruct the candidate to resume walking.
        iii. Repeat this process as necessary until at least 6 minutes of walking has occurred and the oxygen amount has remained unchanged for 3 minutes, at which point the test is terminated.
        iv. The test is also terminated if:
            1. The candidate is unable to maintain $SpO_2 > 88\%$ at 25 L/min for 3 minutes.
            2. The candidate experiences chest pain or lightheadedness or requests to stop the test for any reason.
9. The final amount of supplemental oxygen from the oxygen titration test must be documented in the candidate's medical record. Provide that amount of supplemental oxygen to the candidate when completing the six-minute walk test for lung allocation.

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[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.