



OPTN/SRTR 2018 Annual Data Report: Lung

M. Valapour1,2, C. J. Lehr2, M. A. Skeans1, J. M. Smith1,3,   
K. Uccellini4, R. Goff4, J. Foutz4, A. K. Israni1,5,6,   
J. J. Snyder1,5, B. L. Kasiske1,6

1 Scientific Registry of Transplant Recipients, Hennepin Healthcare Research

Institute, Minneapolis, MN   
2 Department of Pulmonary Medicine, Respiratory Institute, Cleveland Clinic,

Cleveland, OH   
3 Department of Pediatrics, University of Washington, Seattle, WA

4 Organ Procurement and Transplantation Network, United Network for

Organ Sharing, Richmond, VA   
5 Department of Epidemiology and Community Health, University of Min-

nesota, Minneapolis, MN   
6 Department of Medicine, Hennepin Healthcare, University of Minnesota,

Minneapolis, MN

**Abstract**   
The primary goal of US lung allocation policy is to ensure that candi-

dates with the highest risk for mortality receive appropriate access to lung   
transplant. In 2018, 2562 lung transplants were performed in the US, re-   
flecting a 31% increase over the past 5 years. More candidates are being   
listed for lung transplant, and the number of donors has increased sub-   
stantially. Despite an increase of 84 lung transplants in 2018, 365 adult   
candidates died or became too sick to undergo transplant. In 2018, 24   
new child (ages 0-11 years) candidates were added to the lung transplant   
waiting list. Fifteen lung transplants were performed in recipients aged   
0-11 years, three in recipients aged younger than 1 year, two in recipients   
aged 1-5 years, and ten in recipients aged 6-11 years. Of 27 child can-   
didates removed from the waiting list in 2018, 16 (59.3%) were removed   
due to undergoing transplant, six (22.2%) due to death, one (3.7%) due to   
improved condition, and one (3.7%) due to becoming too sick to undergo   
transplant.

**Keywords:** End-stage lung disease, LAS, lung allocation score, lung trans-   
plant, organ allocation, revised lung allocation score, transplant outcomes.

1



1 Adult lung transplant

1.1 Introduction

In 2018, 2562 lung transplants were performed in the US, reflecting a 31% in- crease over the past 5 years (Figure LU 46). More lung transplants are being performed due to more candidates being listed for lung transplant (Figure LU 1) and a precipitous increase in numbers of donors (Figure LU 37). The num- ber of candidates added to the waiting list increased by 233 in 2018 (Figure LU 1), and the number of donors increased by 80 (Figure LU 37). Despite an increase of 84 lung transplants in 2018, 365 candidates died or became too sick to undergo transplant (Table LU 5).

The primary goal of US lung allocation policy is to ensure that candidates with the highest risk for mortality receive appropriate access to lung trans- plant. The Organ Procurement and Transplantation Network (OPTN) monitors the status of transplant candidates and recipients and adjusts the system to meet this key objective. Candidates aged 12 years or older access lung trans- plant based on calculated lung allocation score (LAS), age, geography, and blood type (ABO) compatibility, and, if necessary, waiting time. Candidates aged younger than 12 years access transplant based on illness-based priority status, age, geography, blood type (ABO) compatibility, and waiting time.

The LAS considers waitlist mortality and posttransplant survival in its calcu- lation, with more weight given to waitlist mortality to allow candidates at the highest risk of mortality increased access to transplant. Posttransplant sur- vival is included in the model to minimize allocation of lungs to candidates with poor likelihood of posttransplant survival. In calculating the LAS, pul- monary diseases are categorized into four main groups based on similar sur- vival probability and disease pathophysiology. These are group A, obstructive lung disease; group B, pulmonary vascular disease; group C, cystic fibrosis and immunodeficiency disorders; and group D, restrictive lung disease.

The LAS was implemented in 2005, resulting in candidates who were older and/or sicker being listed for transplant and ultimately undergoing transplant. The LAS was most recently updated in February 2015 with an updated co- hort and new variables to more accurately reflect disease severity for the en- tire transplant population, and in particular group B candidates. Due to the changes in LAS calculation, scores prior to 2015 may not be directly compa- rable to those after. In March 2017, OPTN implemented a policy to improve transplant access for the pediatric population, with broader geographic shar- ing of organs for child (age 0-11 years) and adolescent (age 12-17 years) candi- dates. Additionally, adolescents and adults receive equal preference for adult donor lungs in the LAS system. Finally, in November 2017, a policy was im- plemented to eliminate donation service area as the first unit of allocation for donor lungs in favor of a more uniform 250-nautical-mile circle from the donor hospital. This policy has now been in effect for 1 year, and some of its impact is reflected in this year’s data report.

2



In this report, all lung transplant candidates and recipients aged 12 years or older are included under Adult Lung Transplant, and those aged 0-11 years are included under Lung Transplant in Children. Heart-lung patients are included in all tabulations.

1.2 Waiting list   
1.3 Characteristics of US candidates waiting for a lung transplant

In 2018, 3134 candidates were added to the lung transplant waiting list, reflect- ing an 8.0% increase from 2017 (Figure LU 1), and a 42.2% increase over the past decade. Mostly keeping pace with the increasing demand, the number of lung transplants being performed continued to increase annually (Figure LU 46), although the number of candidates remaining on the waiting list at the end of 2018 increased for the first time since the end of 2014 (Figure LU 2).

The proportion of candidates aged 65 years or older continued to increase, comprising 32.0% of the waiting list in 2018 (Figure LU 3). Men outnumbered women and made up 52.7% of the waiting list (Figure LU 4). The percentage of white candidates decreased from 81.9% in 2013 to 75.9% in 2018 (Figure LU 5). The composition of the waiting list continued to change, with an increasing proportion of group D candidates and a decreasing proportion of group A can- didates (Figure LU 6). Smaller changes occurred for groups B and C, but the waiting list included a larger proportion of group B candidates and a smaller proportion of group C candidates over the past 5 years. Candidates with type O blood comprised 49.2% of the waiting list, followed by types A, 36.1%; B, 11.1%; and AB, 3.7% (Figure LU 10). The percentage of candidates with lower LAS values at listing continued to decrease; 35.1% of candidates had a LAS of less than 35 at the time of listing, and the proportion of sicker candidates with of LAS 50 or higher continued to increase (Figure LU 8). In 2018, proportions of candidates by LAS values were: <30, 0.4%; 30-<35, 34.7%; 35-<40, 28.7%; 40-<50, 19.0%; and 50-100, 17.1% (Figure LU 8).

1.3.1 Outcome of US candidates listed for lung transplant

Overall lung transplant rates increased from 87.1 per 100 waitlist years in 2009 to 172.3 in 2018 (Figure LU 13). Transplant rates decreased for adolescents aged 12-17 years, although rates fluctuated widely in this age group due to the small number of candidates. From 2017 to 2018, transplant rates decreased slightly for candidates aged older than 50 years, remained similar for those aged 18-34 years, and increased for those aged 35-49 years (Figure LU 11). Candidate time on the waiting list remained stable in 2018; 53.4% of candi- dates had been listed for less than 90 days (Figure LU 7). The overall median time to transplant was 2.5 months, a decrease of 1.5 months compared with 2013 (Figure LU 19). Waiting time differed by diagnosis group, and was short- est for group D, 1.8 months; followed by group C, 2.7 months; group B, 2.8 months; and group A, 4.6 months (Figure LU 19). The greatest change occurred

3



in group B, with a 41.3% improved waiting time over the past year, likely due to the 2015 LAS revision. As expected, time to transplant was related to LAS val- ues, and was shortest for those with the highest LAS (Figure LU 20). However, waiting times have converged with time, with a 4-month difference in median waiting time between candidates with LAS below 35 and 50-100, due to the in- creasing transplant rates, allowing lower-LAS candidates to access transplant more readily (Figure LU 20).

Transplant rates differed by age, diagnosis, height, and blood type. By age, rates were highest for candidates aged 65 years or older, 220.1 transplants per 100 waitlist-years (Figure LU 11). By diagnosis, rates were highest for group D, 238.4 transplants per 100 waitlist-years, followed by groups C (205.6), A (109.1), and B (103.5) (Figure LU 13). By height, rates were highest for the tallest candidates, 302.4 transplants per 100 waitlist-years, and lowest for the shortest candidates, 102.7 (Figure LU 15). By blood type, rates were highest for candidates with type AB, 259.3 transplants per 100 waitlist-years, and lowest for candidates with type O, 152.1 (Figure LU 14). Generally, transplant rates did not differ based on distance between candidate residence and transplant program (Figure LU 17). Over the past 5 years, transplant rates for residents of metropolitan regions slowly outpaced rates for residents of non-metropolitan regions (Figure LU 16). Percentages of candidates who underwent lung trans- plant within one year of listing differed widely by state, from 33.3% to 100% (Figure LU 23).

Waitlist mortality rates generally continued to decrease but varied by age, diagnosis group, LAS, blood type, and sex. By age, waitlist mortality was high- est for adolescents, 28.4 deaths per 100 waitlist-years, followed by ages 65 years or older (26.0), 35-49 years (18.2) 50-64 years (17.5), and 18-34 years (14.4) (Figure LU 24). By diagnosis, waitlist mortality was highest for group-D candidates, 29.7 deaths per 100 waitlist-years, and lowest for group-A can- didates, 9.4 (Figure LU 27). By blood type, waitlist mortality was higher for candidates with type AB (Figure LU 29). By LAS, waitlist mortality was substan- tially higher for candidates with an LAS of 50 or higher (121.8 deaths per 100 waitlist-years), and ranged from 6.6 for candidates with LAS 30-<35 to 28.7 for candidates with LAS 40-<50 (Figure LU 28). Waitlist mortality was higher for men in this unadjusted analysis (Figure LU 26). Of candidates removed from the waiting list, 22.6% died within 6 months, but this varied by age and LAS (Figure LU 35, Figure LU 36).

Pretransplant use of extra-corporeal membrane oxygenation (ECMO) and mechanical ventilation continued, with 8% of candidates bridged using one or both of these modalities, although this population has decreased from 9.6% in 2013 (Table LU 7). A quarter of candidates were hospitalized prior to trans- plant, and 13.6% required an intensive care unit stay (Table LU 7).

4



1.4 Donors

Of 2407 deceased lung donors in 2018, 1.3% were aged younger than 12 years, 6.9% 12-17 years, 46.2% 18-34 years, 26.7% 35-49 years, and 18.9% 50 years or older (Figure LU 38); 39.2% of donors were female (Figure LU 39), 18.2% black, and 15.5% Hispanic (Figure LU 40). Discard rates differed by donor age; discard rates were highest for donors aged 35 years or older, but did not meaningfully differ between increased risk and standard infectious risk donors (Figure LU 42, Figure LU 43). The proportion of donors with a smoking history of 20 pack- years or longer decreased slightly over time and was 7.9% in 2018 (Figure LU 44). Use of organs from donation after circulatory death donors increased over the past 5 years, 4.8% in 2018 compared with 1.8% in 2013 (Table LU 8). The percentage of donors with anoxia as a cause of death increased over time from 10.8% in 2007 to 32.8% in 2018 (Figure LU 45). Head trauma and stroke continued to decline as causes of death among deceased lung donors.

1.5 Transplant   
1.5.1 Characteristics of US lung transplant recipients

In 2018, 2562 lung transplants were performed, 75% bilateral (Figure LU 46); 97.4% were first lung transplants and only 2.6% were re-transplants (Table LU 8). Recipients aged 65 years or older underwent 886 transplants; 18-64 years, 1636 transplants; and younger than 18 years, 40 transplants (Figure LU 47). Men continued to undergo more transplants than women, and most recipients were of white race (Figure LU 48, Figure LU 49). Group D recipients underwent 60.0% of transplants, group A 23.8%, group C 10.3%, and group B 5.9% (Table LU 7). The median LAS at transplant was 42.3, an increase of two points from the previous year (Figure LU 53); LAS distribution was: 21.9%, <35; 21.3%, 35-<40; 23.0%, 40-<50; 10.3%, 50-<60; and 23.4%, 60-100 (Table LU 7). Notably, median LAS at transplant differed by primary diagnosis, and was highest for recipients in group B (49.0) and lowest for those in group A (33.6) (Figure LU 54).

In 2018, 67 programs in the US performed lung transplants in adults; a me- dian of 27 transplants were performed at a program (Figure LU 59). Programs in the 25th percentile performed 2-17 transplants per year, and those in the 75th percentile 28-50 (Figure LU 59). The annual transplant volume for pro- grams in the 95th percentile was 104, a value that ranged from 87 to 104 over the past 5 years (Figure LU 59); three programs accounted for nearly 20% of total volume of lung transplants performed in the US (Figure LU 60). Most lung transplants in the US were performed at programs performing 41-100 trans- plants per year (49.0%), followed by those performing 11-40 (30.5%), more than 100 (18.9%), and 1-10 (1.6%) (Figure LU 60).

In 2018, most transplant recipients lived in metropolitan regions, and only 15.2% in non-metropolitan regions (Table LU 6). Most recipients lived near their transplant programs, 51.3% within less than 50 miles and 16.7% within

5



50 to less than 100 miles (Table LU 6). The proportion of recipients with private insurance declined to 41.0%, compared with 50.6% in 2013, with a correspond- ing increase in the proportion with public insurance, likely due to increasing age of the lung transplant population (Table LU 6).

1.5.2 Outcomes of US lung transplant recipients

In 2018, over 15,000 individuals were living with a lung transplant, 426 who underwent transplant at age 17 or younger, 14,585 who underwent transplant as adults (Figure LU 70). Survival improved slightly at all time-points; 89.4% of recipients survived to 1 year, 73.5% to 3 years, and 59.4% to 5 years (Figure LU 69). Induction agents were used commonly; 68.9% of recipients received an IL-2 receptor antagonist and 9.1% T-cell depleting agents (Figure LU 56). Rates of acute rejection were only slightly lower (15.7%-15.9%) in recipients who received induction than in those who did not (18.0%) (Figure LU 72), and choice of induction did not seem to make a difference in incidence of rejection. Tacrolimus, mycophenolate, and steroids remained the most common im- munosuppression regimen, used in 85.5% of transplant recipients (Figure LU 57). Half of recipients received a matched serology donor for cytomegalovirus (CMV) and 82.2% for Epstein Barr virus (EBV) (Table LU 9).

Infection and cardiovascular and cerebrovascular causes remained com- mon causes of death in the first year posttransplant (Figure LU 75), with infec- tion the most prevalent, and graft failure predominating by 3 years posttrans- plant (Figure LU 76). Programs reported development of bronchiolitis obliter- ans syndrome in 6.4% of recipients by 1 year and in 41.8% by 5 years (Table LU 10). Malignancy remained a common complication; 23.7% of recipients were diagnosed with malignancy by 5 years posttransplant (Table LU 10). Chronic kidney disease affected 12.9% of recipients by 5 years, with 2.7% requiring dialysis, but only 20 individuals underwent renal transplant within 5 years of lung transplant (Table LU 10). Despite these complications, nearly 81.4% of recipients were at normal functional status and did not require assistance to complete activities of daily living.

2 Lung transplant in children   
2.1 Waiting list

In 2018, 24 new child (ages 0-11 years) candidates were added to the lung transplant waiting list; one was inactive at the time of listing (Figure LU 77). The number of prevalent child candidates (i.e., on the waiting list on Decem- ber 31 of a given year) steadily decreased from a peak of 107 in 2007 to 22 in 2018 (Figure LU 78). The largest age group of child candidates on the wait- ing list in 2018 was 6-11 years; these candidates made up 65.0%, followed by candidates aged 1-5 years, 22.5%, and younger than 1 year, 12.5% (Figure LU 79). Most child lung transplant candidates were white (57.5%), followed by

6



Hispanic (20.0%), other or unknown race (12.5%), and black (10.0%) (Figure LU 80).

Of 27 candidates removed from the waiting list in 2018, 16 (59.3%) were re- moved due to undergoing transplant, six (22.2%) due to death, one (3.7%) due to improved condition, and one (3.7%) due to becoming too sick to undergo transplant (Table LU 14, Table LU 15). Regarding 3-year outcomes for child lung transplant candidates listed in 2015, 73.9% underwent deceased donor transplant, 8.7% died waiting, 13.0% were removed from the list for reasons other than transplant or death, and 4.4% were still waiting (Figure LU 83). The overall child lung transplant rate rose dramatically in 2013 and has remained steady since, with a rate of 68.3 per 100 waitlist-years in 2018 (Figure LU 84). In general, pretransplant mortality has increased over the decade; the rate was 31.1 deaths per 100 waitlist-years among candidates aged 0-11 years in 2017-2018, compared with 11.7 in 2007-2008 (Figure LU 86).

2.2 Transplant

In 2018, a total of 15 lung transplants were performed in recipients aged 0-11 years, three in recipients aged younger than 1 year, two in recipients aged 1-5 years, and ten in recipients aged 6-11 years (Figure LU 88). In 2018, seven pro- grams were characterized as pediatric, compared with 55 adult-only programs (Figure LU 89). Cystic fibrosis and pulmonary hypertension were the leading known causes of disease, but almost 50% of causes were identified as other or unknown (Table LU 17). Half of child lung transplant recipients in 2016- 2018 were not hospitalized at the time of transplant, with 77.3% as priority 1. Ventilator support and ECMO use remained stable over the past decade. In 2016-2018, lung-only transplants increased to 93.2% from 82.3% in 2006-2008 (Table LU 18).

2.2.1 Pediatric Immunosuppression and Outcomes

Induction therapy has changed over time, with increased use of T-cell-depleting agents to 60.0% of patients in 2017-2018 and continued decreased use of interleukin-2 receptor antagonists to 30.0% (Figure LU 90). The most com- mon initial immunosuppression agent regimen was tacrolimus, mycopheno- late, and steroids, used in 92.9% of child recipients (Figure LU 91). The in- cidence of posttransplant lymphoproliferative disorder among EBV-negative recipients who underwent transplant in 2006-2016 was 5.7% at 5 years post- transplant, compared with 1.1% among EBV-positive recipients (Figure LU 93). Incidence of death was 17.2% at 6 months and 24.1% at 1 year for transplants in 2016-2017, 41.7% at 3 years for transplants in 2014-2015, 33.3% at 5 years for transplants in 2012-2013, and 45.7% at 10 years for transplants in 2008- 2009 (Figure LU 94). For children who underwent transplant in 2006-2013, overall 1-, 3-, and 5-year patient survival was 85.0%, 68.8%, and 60.6%, respec- tively (Figure LU 95). By age, patient survival rates were highest for recipients

7



aged 6-11 years at all time-points. Among children, cystic fibrosis was asso- ciated with higher survival rates than pulmonary hypertension or other diag- noses (Figure LU 96). Leading causes of death at 1 year posttransplant were respiratory- and infection-related, and at 5 years graft failure and respiratory- related (Figure LU 97, Figure LU 98). The incidence of acute rejection among child lung transplant recipients in 2012-2017 was 7.1%.

Among child lung transplant recipients in 2016-2018, the combination of a CMV-positive donor and CMV-negative recipient occurred in 27.3% of trans- plants; this combination for EBV occurred in 43.2% of transplants (Table LU 19).

Complication rates in child lung transplant recipients increased with time posttransplant, including bronchiolitis obliterans syndrome (4.1% at 1 year and 26.0% at 5 years) (Table LU 20). For most surviving child lung transplant recipients (94.0%), functional status was reported as fully active at 5 years post- transplant.

8



The publication was produced for the U.S. Department of Health and Human   
Services, Health Resources and Services Administration, by the Hennepin Health-

care Research Institute (HHRI) and by the United Network for Organ Sharing   
(UNOS) under contracts HHSH250201500009C and 234-2005-37011C, respec-   
tively.

This publication lists non-federal resources in order to provide additional   
information to consumers. The views and content in these resources have not   
been formally approved by the U.S. Department of Health and Human Services   
(HHS) or the Health Resources and Services Administration (HRSA). Neither   
HHS nor HRSA endorses the products or services of the listed resources.

OPTN/SRTR 2018 Annual Data Report is not copyrighted. Readers are free   
to duplicate and use all or part of the information contained in this publication.   
Data are not copyrighted and may be used without permission if appropriate   
citation information is provided.

Pursuant to 42 U.S.C. §1320b-10, this publication may not be reproduced,   
reprinted, or redistributed for a fee without specific written authorization from   
HHS.

Suggested Citations Full citation: Organ Procurement and Transplantation   
Network (OPTN) and Scientific Registry of Transplant Recipients (SRTR). OPTN/SRTR

2018 Annual Data Report. Rockville, MD: Department of Health and Human   
Services, Health Resources and Services Administration; 2019. Abbreviated   
citation: OPTN/SRTR 2018 Annual Data Report. HHS/HRSA.

Publications based on data in this report or supplied on request must in-   
clude a citation and the following statement: The data and analyses reported   
in the 2018 Annual Data Report of the U.S. Organ Procurement and Transplan-   
tation Network and the Scientific Registry of Transplant Recipients have been   
supplied by the United Network for Organ Sharing and the Hennepin Health-   
care Research Institute under contract with HHS/HRSA. The authors alone are   
responsible for reporting and interpreting these data; the views expressed   
herein are those of the authors and not necessarily those of the U.S. Govern-   
ment.

This report is available at [srtr.transplant.hrsa.gov](http://srtr.transplant.hrsa.gov). Individual chapters, as   
well as the report as a whole, may be downloaded.

9



2006 2008 2010 2012 2014 2016 2018

Year

Active Inactive

All

**Figure LU 1. New candidates aged 12 years or older added to the lung** **transplant waiting list.** A new candidate is one who first joined the list during the given year, without having been listed in a previous year. Previ- ously listed candidates who underwent transplant and subsequently relisted are considered new. Candidates concurrently listed at multiple centers are counted once. Active and inactive patients are included.





Active Inactive

All

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 2. Candidates aged 12 years or older listed for lung transplant** **on December 31 of each year.** Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active.

10













2006 2008 2010 2012 2014 2016 2018

Year

12-17 18-34 35-49 50-64 ³ 65

**Figure LU 3. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by age.** Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Only candidates who were active for at least 1 day are included.







Male   
Female



2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 4. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by sex.** Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included.

11









2006 2008 2010 2012 2014 2016 2018

Year

White   
Black   
Hispanic

Asian   
Other/unknown

**Figure LU 5. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by race.** Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are included.





A

B

C

D

2006 2010 2014 2018

Year

**Figure LU 6. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by diagnosis group.** Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at mul- tiple centers are counted once. Only candidates who were active for at least 1 day are included.

12



2006 2008 2010 2012 2014 2016 2018

Year

< 31 days

31-< 90 days 3-< 6 months 6-< 12 months 1-< 2 years

³ 2 years

**Figure LU 7. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by waiting time.** Candidates waiting for trans- plant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of December 31 or removal from the waiting list. Only candidates who were active for at least 1 day are included.





< 30   
30-< 35 35-< 40 40-< 50 ³ 50   
No LAS

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 8. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by LAS at listing.** Candidates waiting for trans- plant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are included. LAS, lung allocation score.

13



2006 2008 2010 2012 2014 2016 2018

Year

< 160 cm 160-< 168 168-< 175 175-< 183 ³ 183

**Figure LU 9. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by height.** Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are in- cluded.





A

B

AB

O

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 10. Distribution of candidates aged 12 years or older actively** **waiting for lung transplant by blood type.** Candidates waiting for trans- plant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are included.

14









2006 2008 2010 2012 2014 2016 2018

Year

12-17 18-34 35-49 50-64 ³ 65

**Figure LU 11. Deceased donor lung transplant rates among waitlist can-** **didates aged 12 years or older by age.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

White   
Black   
Hispanic

Other

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 12. Deceased donor lung transplant rates among waitlist candi-** **dates aged 12 years or older by race.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

15









2006 2010 2014 2018

Year

A

B

C

D

All

**Figure LU 13. Deceased donor lung transplant rates among waitlist can-** **didates aged 12 years or older by diagnosis group.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.





A

B

AB

O

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 14. Deceased donor lung transplant rates among waitlist candi-** **dates aged 12 years or older by blood type.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

16



2006 2008 2010 2012 2014 2016 2018

Year

<160 cm 160-<168 168-<175 175-<183 ³ 183

**Figure LU 15. Deceased donor lung transplant rates among waitlist can-** **didates aged 12 years or older by height.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

Metropolitan   
Non-metropolitan

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 16. Deceased donor lung transplant rates among waitlist candi-** **dates aged 12 years or older by metropolitan vs. non-metropolitan res-** **idence.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual list- ings are counted separately. Urban/rural determination is made using the RUCA (Rural-Urban Commuting Area) designation of the candidate’s perma- nent zip code. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

17



2006 2008 2010 2012 2014 2016 2018

Year

0-<50 NM 50-<100 100-<250 ³ 250

**Figure LU 17. Deceased donor lung transplant rates among waitlist can-** **didates aged 12 years or older by distance from listing center.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted sep- arately. Distance is nautical miles (NM) between the zip code centroids of the candidate’s listing center and candidate’s permanent zip code. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.





Still waiting   
Removed from list Died

DD transplant

0 12 24 36

Months postlisting

**Figure LU 18. Three-year outcomes for candidates aged 12 years or older** **waiting for lung transplant, new listings in 2015.** Candidates aged 12 years or older waiting for lung transplant and first listed in 2015. Candidates con- currently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. DD, deceased donor.

18



2006 2008 2010 2012 2014 2016 2018

Year of listing

A

B

C

D

All

**Figure LU 19. Median months to lung transplant for waitlisted candidates** **aged 12 years or older, by diagnosis group.** Observations censored on De- cember 31, 2018; Kaplan-Meier competing risk methods used to estimate time to transplant. Analysis performed per candidate, not per listing. If an estimate is not plotted, 50% of the cohort listed in that year had not undergone trans- plant by the censoring date. Only the first transplant is counted.





<35   
35-<40 40-<50 50-100

2006 2008 2010 2012 2014 2016 2018

Year of listing

**Figure LU 20. Median months to lung transplant for waitlisted candidates** **aged 12 years or older, by LAS at listing.** Observations censored on Decem- ber 31, 2018; Kaplan-Meier competing risk methods used to estimate time to transplant. Analysis performed per candidate, not per listing. If an estimate is not plotted, 50% of the cohort listed in that year had not undergone transplant by the censoring date. Only the first transplant is counted.

19









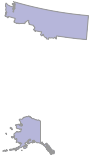
2006 2008 2010 2012 2014 2016 2018

Year of listing

3-month 6-month 1-year

3-year   
5-year   
10-year

**Figure LU 21. Percentage of candidates aged 12 years or older who un-** **derwent deceased donor lung transplant within a given time period of** **listing.** Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal.

















18.8 96.5   
65.9 72.0 79.1 88.6

**Figure LU 22. Percentage of candidates aged 12 years or older who under-** **went deceased donor lung transplant within 1 year of listing in 2017 by** **DSA.** Candidates listed concurrently in a single DSA are counted once in that DSA, from the time of earliest listing to the time of latest removal; candidates listed in multiple DSAs are counted separately per DSA.

20





















33.3 100.0   
60.0 71.2 81.1 91.7

**Figure LU 23. Percentage of candidates aged 12 years or older who un-** **derwent deceased donor lung transplant within 1 year of listing in 2017** **by state.** Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal.

12-17 18-34 35-49 50-64 ³ 65

2007-08 2011-12 2015-16

Year

**Figure LU 24. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by age.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of expo- sure or fewer than 20 candidates at risk are not shown. Age is determined at the later of listing date or January 1 of the given year.

21



2007-08 2011-12 2015-16

Year

White   
Black   
Hispanic

Other

All

**Figure LU 25. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by race.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individ- ual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.





Male   
Female



2007-08 2011-12 2015-16

Year

**Figure LU 26. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by sex.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individ- ual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

22



2007-08 2011-12 2015-16

Year

A

B

C

D

**Figure LU 27. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by diagnosis group.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to an- other program, removal because of improved condition, or end of cohort. In- dividual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.



<30   
30-<35 35-<40 40-<50 ³ 50



2007-08 2011-12 2015-16

Year

**Figure LU 28. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by LAS.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individ- ual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

23













2007-08 2011-12 2015-16

Year

A

B

AB

O

**Figure LU 29. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by blood type.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individ- ual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.





<160 cm 160-<168 168-<175 175-<183 ³ 183

2007-08 2011-12 2015-16

Year

**Figure LU 30. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by height.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individ- ual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

24













2007-08 2011-12 2015-16

Year

Metropolitan   
Non-metropolitan

**Figure LU 31. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by metropolitan vs. non-** **metropolitan residence.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is cen- sored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted sepa- rately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown. Urban/rural determination is made using the RUCA (Rural-Urban Commuting Area) designation of the candidate’s per- manent zip code.

25













2007-08 2011-12 2015-16

Year

0-<50 NM 50-<100 100-<250 ³ 250

**Figure LU 32. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant by distance from listing cen-** **ter.** Mortality rates are computed as the number of deaths per 100 patient- years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown. Distance is nautical miles (NM) between the zip code centroids of the candidate’s listing center and candidate’s permanent zip code.

26







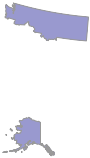


2007-08 2011-12 2015-16

Year

Active Inactive

**Figure LU 33. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung, by active/inactive status.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of expo- sure or fewer than 20 candidates at risk are not shown. Status (active/inactive) is assessed on the later of January 1 of the given year and listing date.



















2.3 58.1   
14.3 17.9 21.4 24.8

**Figure LU 34. Pretransplant mortality rates among candidates aged 12** **years or older waitlisted for lung transplant in 2016-2018, by DSA.** Mortal- ity rates are computed as the number of deaths per 100 patient-years of wait- ing in the DSA. Waiting time is censored at transplant, death, transfer to an- other program, removal because of improved condition, or end of cohort. In- dividual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

27



2006 2008 2010 2012 2014 2016 2018

Removal year

A

B

C

D

All

**Figure LU 35. Deaths within six months after removal among lung waitlist** **candidates aged 12 years or older, by diagnosis.** Denominator includes only candidates removed from the waiting list for reasons other than transplant or death while on the list.





18-34 35-49 50-64 ³ 65

2006 2008 2010 2012 2014 2016 2018

Removal year

**Figure LU 36. Deaths within six months after removal among lung wait-** **list candidates aged 12 years or older, by age at removal.** Denominator includes only candidates removed from the waiting list for reasons other than transplant or death while on the list. Data for candidates aged 12-17 years are not shown due to insufficient patient counts.

28









2006 2008 2010 2012 2014 2016 2018

Year

All

<12 12-17 18-34 35-49 ³ 50

**Figure LU 37. Deceased lung donor count by age.** Count of deceased donors with at least one lung recovered for transplant, by age at donation. Donors are counted once, regardless of number of lungs recovered.





<12 12-17 18-34 35-49 ³ 50

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 38. Distribution of deceased lung donors by age.** Deceased donors with at least one lung recovered for transplant. Donors who donated more than one lung are counted once.

29



2006 2008 2010 2012 2014 2016 2018

Year

Male   
Female

**Figure LU 39. Distribution of deceased lung donors by sex.** Deceased donors with at least one lung recovered for transplant. Donors who donated more than one lung are counted once.

White   
Black   
Hispanic

Other/unknown

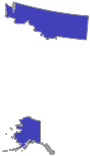
2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 40. Distribution of deceased lung donors by race.** Deceased donors with at least one lung recovered for transplant. Donors who donated more than one lung are counted once.

30



















0.0 100.0   
72.7 78.3 87.5 92.6

**Figure LU 41. Percent of pediatric donor lungs allocated to adult recip-** **ients, by DSA of donor hospital, 2014-2018.** Numerator: pediatric donor lungs donors allocated to adult recipients. Denominator: total pediatric donor lungs. When lungs are transplanted individually, we count them separately. When they are transplanted as a block, the are considered one lung.





PHS increased risk Not increased risk

2007-08 2011-12 2015-16

Year

**Figure LU 43. Rates of lungs recovered for transplant and not trans-** **planted, by donor risk of disease transmission.** ”Increased risk” is defined by criteria from the US Public Health Service Guidelines for increased risk for HIV, hepatitis B and hepatitis C transmission.

31



2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 44. Lung donors with a smoking history of 20 pack-years or** **more.** All deceased donors whose lungs were transplanted in the given year.

32













2006 2008 2010 2012 2014 2016 2018

Year

Anoxia   
CVA/stroke Head trauma CNS tumor Other

**Figure LU 45. Cause of death among deceased lung donors.** Deceased donors whose lungs were transplanted. Each donor is counted once. CNS, central nervous system; CVA, cerebrovascular accident.







Single Bilateral

All

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 46. Total lung transplants.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

33













2006 2008 2010 2012 2014 2016 2018

Year

<12 12-17 18-34 35-49 50-64 ³ 65

**Figure LU 47. Total lung transplants by age.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

Male   
Female

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 48. Total lung transplants by sex.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

34









2006 2008 2010 2012 2014 2016 2018

Year

White   
Black   
Hispanic

Asian   
Other/unknown

**Figure LU 49. Total lung transplants by race.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

A

B

C

D

Other/unknown

2006 2010 2014 2018

Year

**Figure LU 50. Total lung transplants by diagnosis group.** All lung trans- plant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

35



2006 2008 2010 2012 2014 2016 2018

Year

< 35   
35-<40 40-<50 50-<60 60-100

**Figure LU 51. Total lung transplants by LAS.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

< 1%   
1-<20% 20-<80% 80-100% Unknown

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 52. Total lung transplants by CPRA.** All lung transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

36



2006 2008 2010 2012 2014 2016 2018

Year

75th percentile Median LAS   
25th percentile

**Figure LU 53. Median LAS at transplant.** Recipients aged 12 years or older; last LAS before transplant.

A

B

C

D

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 54. Median LAS at transplant by diagnosis group.** Recipients aged 12 years or older; last LAS before transplant.

37









2006 2008 2010 2012 2014 2016 2018

Year

Alpha-1 COPD IPF   
Other

**Figure LU 55. Percentage of transplants that were bilateral among lung** **recipients aged 12 years or older by diagnosis.** Heart-lung transplants are excluded. COPD, chronic obstructive pulmonary disease; IPF, idiopathic pul- monary fibrosis.

IL2-RA

T-cell depleting None

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 56. Induction agent use in lung transplant recipients aged 12** **years or older.** Immunosuppression at transplant reported to the OPTN. IL2- RA, interleukin-2 receptor antagonist.

38









2006 2008 2010 2012 2014 2016 2018

Year

Tac MMF Steroid Tac MMF

Tac Steroid   
Other

None Reported

**Figure LU 57. Immunosuppression regimen use in transplant recipients** **aged 12 years or older.** Immunosuppression regimen at transplant reported to the OPTN. Tac, tacrolimus. MMF, mycophenolate mofetil.

30

20

10

0

0 1 2 3 4 5 6 Unk.

Mismatches

**Figure LU 58. Total HLA A, B, and DR mismatches among deceased donor** **lung transplant recipients aged 12 years or older, 2014-2018.** Donor and recipient antigen matching is based on OPTN antigen values and split equiva- lences policy as of 2018.

39













2006 2008 2010 2012 2014 2016 2018

Year

5th   
25th   
Median 75th   
95th

**Figure LU 59. Annual adult lung transplant center volumes, by percentile.** Annual volume data are limited to recipients aged 18 or older.





1-10   
11-40 41-100 ³ 101

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 60. Distribution of adult lung transplants by annual center vol-** **ume.** Based on annual volume data among recipients aged 18 or older.

40













0 12 24 36 48 60

Months posttransplant

12-17 18-34 35-49 50-64 ³ 65

All

**Figure LU 61. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by age.** Patient survival estimated using unad- justed Kaplan-Meier methods. For recipients of more than one transplant dur- ing the period, only the first is considered.





White   
Black   
Hispanic

Asian   
Other/unknown

0 12 24 36 48 60

Months posttransplant

**Figure LU 62. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by race.** Patient survival estimated using unad- justed Kaplan-Meier methods. For recipients of more than one transplant dur- ing the period, only the first is considered.

41









0 12 24 36 48 60

Months posttransplant

<35   
35-<40 40-<50 50-<60 ³ 60

**Figure LU 63. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by LAS.** Patient survival estimated using unad- justed Kaplan-Meier methods. For recipients of more than one transplant dur- ing the period, only the first is considered.





Single left Single right Bilateral

0 12 24 36 48 60

Months posttransplant

**Figure LU 64. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by transplant type.** Patient survival estimated us- ing unadjusted Kaplan-Meier methods. For recipients of more than one trans- plant during the period, only the first is considered.

42









0 12 24 36 48 60

Months posttransplant

A

B

C

D

**Figure LU 65. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by diagnosis group.** Patient survival estimated us- ing unadjusted Kaplan-Meier methods. For recipients of more than one trans- plant during the period, only the first is considered.





Alpha-1 single   
Alpha-1 bilateral IPF single

IPF bilateral   
COPD single   
COPD bilateral

0 12 24 36 48 60

Months posttransplant

**Figure LU 66. Patient survival among lung transplant recipients aged** **12 years or older, 2011-2013, by diagnosis and transplant type.** Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. COPD, chronic obstructive pulmonary disease; IPF, idiopathic pulmonary fibrosis.

43









0 12 24 36 48 60

Months posttransplant

Metropolitan   
Non-metropolitan

**Figure LU 67. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by metropolitan vs. non-metropolitan recip-** **ient residence.** Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.





0-<50 NM 50-<100 100-<250 ³ 250

0 12 24 36 48 60

Months posttransplant

**Figure LU 68. Patient survival among lung transplant recipients aged 12** **years or older, 2011-2013, by recipients’ distance from transplant cen-** **ter.** Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is con- sidered. Distance is between the zipcode centroids of the TX center and the recipient’s permanent residence, measured in nautical miles (NM).

44















2000 2005 2010 2015 2020

Year of transplant

6-month 1-year   
3-year   
5-year   
10-year

**Figure LU 69. Patient death among lung transplant recipients aged 12** **years or older.** All recipients aged 12 years or older of deceased donor lungs, including multi-organ transplants. Patients are followed until the earlier of death or December 31, 2018.

< 18 18-49 ³ 50

All

2006 2008 2010 2012 2014 2016 2018

Year of transplant

**Figure LU 70. Recipients alive with a functioning lung graft on June 30** **of the year, by age at transplant.** Recipients are assumed to be alive with function unless a death or graft failure is recorded. A recipient may experience a graft failure and be removed from the cohort, undergo retransplant, and re- enter the cohort.

45



20

15

10

5

0









12-17 18-34 35-49 50-64 ³ 65 All

**Figure LU 71. Incidence of acute rejection by 1 year posttransplant** **among lung transplant recipients aged 12 years or older by age, 2016-** **2017.** Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration or Transplant Re- cipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

15

10

5

0

IL2-RA TCD No agents

**Figure LU 72. Incidence of acute rejection by 1 year posttransplant** **among lung transplant recipients aged 12 years or older by induction** **agent 2016-2017.** Acute rejection is defined as a record of acute or hy- peracute rejection, as reported on the OPTN Transplant Recipient Registra- tion or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier compet- ing risk method. If a recipient used both IL-2-RA and TCD agents, s/he will contribute to both of those cumulative incidence estimates.

46



20

15

10

5

0





A B C D

**Figure LU 73. Incidence of acute rejection by 1 year posttransplant** **among lung transplant recipients aged 12 years or older by diagnosis** **group, 2016-2017.** Acute rejection is defined as a record of acute or hy- peracute rejection, as reported on the OPTN Transplant Recipient Registra- tion or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier compet- ing risk method.





EBV-   
EBV+   
EBV unknown

All

0 12 24 36 48 60

Months posttransplant

**Figure LU 74. Incidence of PTLD among lung transplant recipients aged** **12 years or older by recipient EBV status at transplant, 2012-2016.** Cumu- lative incidence is estimated using the Kaplan-Meier competing risk method. PTLD is identified as a reported complication or cause of death on the OPTN Transplant Recipient Follow-up Form or the Posttransplant Malignancy Form as polymorphic PTLD, monomorphic PTLD, or Hodgkin’s disease. Only the ear- liest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus; PTLD, post- transplant lymphoproliferative disorder.

47









0 2 4 6 8 10 12

Months since transplant

Graft failure

Infection   
Cardio/cerebrovascular Malignancy

Respiratory

**Figure LU 75. One-year cumulative incidence of death by cause among** **lung recipients aged 12 years or older, 2016-2017.** Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.





Graft failure

Infection   
Cardio/cerebrovascular Malignancy

Respiratory

0 1 2 3 4 5

Years since transplant

**Figure LU 76. Five-year cumulative incidence of death by cause among** **lung recipients aged 12 years or older, 2012-2013.** Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

48









2006 2008 2010 2012 2014 2016 2018

Year

Active Inactive

All

**Figure LU 77. New candidates aged 0-11 years added to the lung trans-** **plant waiting list.** Candidates concurrently listed at multiple centers are counted once. Candidates who are active at at least one program are consid- ered active; otherwise they are inactive. A new patient is one who first joined the list during the given year without ever listing in a prior year, or one who listed and underwent transplant in a prior year and relisted in the given year. Patients on the list on December 31 were aged 0-11 years at listing.





Active Inactive

All

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 78. Candidates aged 0-11 years waiting for lung transplant.** Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active.

49



2006 2008 2010 2012 2014 2016 2018

Year

< 1 1-5 6-11

**Figure LU 79. Distribution of candidates aged 0-11 years actively waiting** **for lung transplant, by age.** Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Only candidates who were active for at least 1 day are included.

White   
Black   
Hispanic

Other/unknown

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 80. Distribution of candidates aged 0-11 years actively waiting** **for lung transplant by race.** Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are included.

50



2006 2008 2010 2012 2014 2016 2018

Year

Male   
Female

**Figure LU 81. Distribution of candidates aged 0-11 years actively waiting** **for lung transplant by sex.** Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Only candidates who were active for at least 1 day are included.

< 6 months

6 months-< 2 years ³ 2 years

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 82. Distribution of candidates aged 0-11 years actively waiting** **for lung transplant by waiting time.** Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of Decem- ber 31 or removal from the waiting list. Only candidates who were active for at least 1 day are included.

51









0 12 24 36

Months postlisting

Still waiting   
Removed from list Died

DD transplant

**Figure LU 83. Three-year outcomes for newly listed candidates aged 0-11** **years waiting for lung transplant, 2015.** Candidates aged 0-11 who joined the waitlist in 2015. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. DD, deceased donor.

<6

6-11   
Overall

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 84. Deceased donor lung transplant rates among waitlist candi-** **dates aged 0-11 years, by age.** Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of waiting in a given year. Individual listings are counted separately. Age is determined at the later of list- ing date or January 1 of the given year. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

52



2006 2008 2010 2012 2014 2016 2018

Year

White   
Non-white

**Figure LU 85. Deceased donor lung transplant rates among waitlist can-** **didates aged 0-11 years, by race.** Transplant rates are computed as the num- ber of deceased donor transplants per 100 patient-years of waiting in a given year. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Rates with less than 10 patient- years of exposure or fewer than 20 candidates at risk are not shown.

Overall

<6

6-11

2007-08 2011-12 2015-16

Year

**Figure LU 86. Pretransplant mortality rates among candidates aged 0-11** **years waitlisted for lung transplant by age.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Age is determined at the later of listing date or January 1 of the given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

53



2007-08 2011-12 2015-16

Year

0-<100 NM ³ 100

**Figure LU 87. Pretransplant mortality rates among candidates aged 0-** **11 years waitlisted for lung transplant by distance from listing center.** Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown. Distance is between the zipcode centroids of the TX center and the recipient’s permanent residence, measured in nautical miles (NM).





<1

1-5 6-11

All

2006 2008 2010 2012 2014 2016 2018

Year

**Figure LU 88. Lung transplants, recipients aged 0-11 years by age.** All lung transplant recipients aged 0-11 years, including retransplant and multi-organ recipients.

54



2006 2008 2010 2012 2014 2016 2018

Year

Overall

Adult only   
Functionally adult Mix

Pediatric

**Figure LU 89. Number of centers performing pediatric and adult lung** **transplants by center’s age mix.** Adult centers transplanted only recipients aged 18 years or older. Functionally adult centers transplant 80% adults or more, and the remainder were children aged 15-17 years. Mixed included adults and children of any age groups. Child only centers transplanted recipi- ents aged 0-17 years, and small number of adults up to age 21 years.

IL2-RA

T-cell depleting None

2007-08 2011-12 2015-16

Year

**Figure LU 90. Induction agent use in lung transplant recipients aged 0-** **11 years.** Immunosuppression at transplant reported to the OPTN. IL2-RA, interleukin-2 receptor antagonist.

55









2007-08 2011-12 2015-16

Year

Tac MMF Steroid Tac MMF

Tac Steroid   
Other

None Reported

**Figure LU 91. Immunosuppression regimen use in transplant recipients** **aged 0-11 years.** Immunosuppression regimen at transplant reported to the OPTN. Tac, tacrolimus. MMF, mycophenolate mofetil.

40

30

20

10

0

0 1 2 3 4 5 6 Unk.

Mismatches

**Figure LU 92. Total HLA A, B, and DR mismatches among deceased donor** **lung transplant recipients aged 0-11 years, 2014-2018.** Donor and recipi- ent antigen matching is based on OPTN antigen values and split equivalences policy as of 2018.

56













0 12 24 36 48 60

Months posttransplant

EBV- EBV+

All

**Figure LU 93. Incidence of PTLD among lung transplant recipients aged** **0-11 years by recipient EBV status at transplant, 2006-2016.** Cumulative incidence is estimated using the Kaplan-Meier competing risk method. Post- transplant lymphoproliferative disorder (PTLD) is identified as a reported com- plication or cause of death on the OPTN Transplant Recipient Follow-up Form or on the Posttransplant Malignancy Form as polymorphic PTLD, monomor- phic PTLD, or Hodgkin’s disease. Only the earliest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus.





<1

1-5 6-11

All

0 12 24 36 48 60

Months posttransplant

**Figure LU 95. Patient survival among lung transplant recipients aged 0-** **11 years, 2006-2013, by age.** Recipient survival estimated using unadjusted Kaplan-Meier methods.

57













0 12 24 36 48 60

Months posttransplant

Cystic fibrosis PH

Other

**Figure LU 96. Patient survival among lung transplant recipients aged 0-** **11 years, 2006-2013, by diagnosis.** Recipient survival estimated using unad- justed Kaplan-Meier methods. PH, pulmonary hypertension.

58



0 2 4 6 8 10 12

Months since transplant

Graft failure

Infection   
Cardio/cerebrovascular Malignancy

Respiratory

**Figure LU 97. One-year cumulative incidence of death by cause among** **lung transplant recipients aged 0-11 years, 2008-2017.** Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonad- herence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.





Graft failure

Infection   
Cardio/cerebrovascular Malignancy

Respiratory

0 1 2 3 4 5

Years since transplant

**Figure LU 98. Five-year cumulative incidence of death by cause among** **lung transplant recipients aged 0-11 years, 2008-2013.** Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonad- herence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

59



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Age  12-17 years  18-34 years 35-49 years 50-64 years ≥ 65 years  Sex  Female  Male Race/ethnicity  White Black Hispanic Asian Other/unknown  Geography  Metropolitan  Non-metro Distance  < 50 miles 50-<100 miles 100-<150 miles 150-<250 miles ≥ 250 miles Unknown  Height  < 150 cm  150-< 160 cm 160-< 170 cm 170-< 180 cm ≥ 180 cm Unknown | 20 1.3%130.9%  175 11.0%1127.9% 240 15.2%19914.0% 813 51.3%67347.4% 336 21.2%42229.7%  944 59.6%82558.1%  640 40.4%59441.9%  1280 80.8%104173.4% 158 10.0%16211.4% 99 6.2%15911.2% 40 2.5%493.5% 7 0.4%80.6%  1286 81.2%119384.1%  298 18.8%22615.9%  728 46.0%76053.6% 294 18.6%24917.5% 153 9.7%1349.4% 205 12.9%14610.3% 191 12.1%1258.8% 13 0.8%50.4%  69 4.4%634.4%  325 20.5%33623.7% 589 37.2%48334.0% 428 27.0%36625.8% 171 10.8%17012.0% 2 0.1%10.1% |

**Table LU 1 Demographic characteristics of candidates aged 12 years or** **older on the lung transplant waiting list on December 31, 2013, and De-** **cember 31, 2018 (continued on next page).** Candidates waiting for trans- plant on December 31 of the given year, regardless of first listing date; mul- tiple listings are collapsed. Distance is computed from candidate’s home zip code to the transplant center.

60



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| All candidates | 1584 100.0%1419100.0% |

**Table LU 1 Demographic characteristics of candidates aged 12 years or** **older on the lung transplant waiting list on December 31, 2013, and De-** **cember 31, 2018 (continued from previous page).** Candidates waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed. Distance is computed from candidate’s home zip code to the transplant center.

61



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Diagnosis group A  B C D  LAS  < 30  30-< 35 35-< 40 40-< 50 50-< 60 ≥ 60 Unknown  Blood type  A  B AB O All candidates | 724 45.7%57240.3%  113 7.1%1349.4% 189 11.9%1198.4% 558 35.2%59441.9%  33 2.1%745.2%  741 46.8%55839.3% 370 23.4%42830.2% 266 16.8%24617.3% 78 4.9%523.7% 74 4.7%614.3% 22 1.4%00.0%  621 39.2%49835.1%  155 9.8%15510.9% 47 3.0%282.0% 761 48.0%73852.0% 1584 100.0%1419100.0% |

**Table LU 2 Clinical characteristics of candidates aged 12 years or older on** **the lung transplant waiting list on December 31, 2013, and December 31,** **2018.** Candidates waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed. All candidates with unknown LAS in are inactive.

62



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Wait time  < 31 days  31-60 days 61-90 days 3-< 6 months 6-< 12 months 1-< 2 years  2-< 3 years ≥ 3 years  Waitlist status  Active  Inactive Unknown  Transplant history First  Retransplant Tx type  Lung only Heart-lung Other  All candidates | 143 9.0%18813.2%  104 6.6%1198.4% 99 6.2%1188.3% 234 14.8%24317.1% 311 19.6%29220.6% 272 17.2%25117.7%  145 9.2%866.1% 276 17.4%1228.6%  1281 80.9%119484.1%  303 19.1%21315.0% 0 0.0%120.8%  1534 96.8%138797.7%  50 3.2%322.3%  1522 96.1%135695.6% 45 2.8%423.0% 17 1.1%211.5%  1584 100.0%1419100.0% |

**Table LU 3 Listing characteristics of candidates aged 12 years or older on** **the lung transplant waiting list on December 31, 2013, and December 31,** **2018.** Candidates waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed.

63



|  |  |
| --- | --- |
| **Waiting list state** | **201620172018** |
| Patients at start of year Patients added during year Patients removed during year Patients at end of year | 151813871354 269229013134 281629283069 139413601419 |

**Table LU 4 Lung transplant waitlist activity among candidates aged 12** **years or older.** Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Candidates who are listed, undergo transplant, and are relisted are counted more than once. Candidates are not considered to be on the list on the day they are removed; counts on January 1 may differ from counts on Decem- ber 31 of the prior year. Candidates listed for multi-organ transplants are in- cluded.

64



|  |  |
| --- | --- |
| **Removal reason** | **201620172018** |
| Deceased donor transplant Living donor transplant  Patient died Patient refused transplant Improved, transplant not needed Too sick for transplant Other | 232224492541 000  202214238 161221 293847 136112127 11110395 |

**Table LU 5 Removal reason among lung transplant candidats aged 12** **years or older.** Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

65



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Age  12-17 years  18-34 years 35-49 years 50-64 years ≥ 65 years  Sex  Female  Male Race/ethnicity  White Black Hispanic Asian Other/unknown  Height  < 150 cm  150-< 160 cm 160-< 170 cm 170-< 180 cm ≥ 180 cm Unknown  Insurance  Private  Medicare Other government Unknown  Geography  Metropolitan  Non-metro | 39 2.0%251.0%  193 10.1%2339.1% 224 11.7%31012.2% 910 47.5%109342.9% 550 28.7%88634.8%  755 39.4%102240.1%  1161 60.6%152559.9%  1591 83.0%200778.8% 167 8.7%2409.4% 125 6.5%2248.8% 19 1.0%562.2% 14 0.7%200.8%  44 2.3%572.2%  233 12.2%36014.1% 596 31.1%76330.0% 666 34.8%87334.3% 374 19.5%49219.3% 3 0.2%20.1%  969 50.6%104441.0%  753 39.3%114645.0% 173 9.0%29611.6% 21 1.1%612.4%  1586 82.8%215984.8%  330 17.2%38815.2% |

**Table LU 6 Demographic characteristics of lung transplant recipients** **aged 12 years or older, 2013 and 2018 (continued on next page).** Lung transplant recipients, including retransplants. Distance is computed from re- cipient’s home zip code to the transplant center.

66



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Distance  < 50 miles  50-<100 miles 100-<150 miles 150-<250 miles ≥ 250 miles Unknown  All recipients | 889 46.4%130651.3%  325 17.0%42516.7% 229 12.0%26510.4% 232 12.1%2509.8% 225 11.7%2379.3% 16 0.8%642.5%  1916 100.0%2547100.0% |

**Table LU 6 Demographic characteristics of lung transplant recipients** **aged 12 years or older, 2013 and 2018 (continued from previous page).** Lung transplant recipients, including retransplants. Distance is computed from recipient’s home zip code to the transplant center.

67



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Diagnosis group  A  B C D  Blood type  A  B AB O  Medical condition  Hospitalized in ICU  Hospitalized, not ICU Not hospitalized Hospitalization unknown  LAS  < 30  30-< 35 35-< 40 40-< 50 50-< 60 ≥ 60  Vent/ECMO at transplant  Vent + ECMO  Vent only ECMO only Neither All recipients | 50426.3%60723.8%  703.7%1505.9% 24012.5%26210.3% 110257.5%152860.0%  74538.9%95637.5%  1849.6%28511.2% 733.8%1134.4% 91447.7%119346.8%  29015.1%34713.6%  1658.6%29311.5% 146176.3%187473.6% 00.0%331.3%  40.2%30.1%  40521.1%55421.8% 37319.5%54321.3% 46124.1%58723.0% 21611.3%26310.3% 45723.9%59723.4%  613.2%793.1%  914.7%411.6% 321.7%843.3% 173290.4%234392.0% 1916100.0%2547100.0% |

**Table LU 7 Clinical characteristics of lung transplant recipients aged 12** **years or older, 2013 and 2018.** Lung transplant recipients, including retrans- plants. ECMO, extracorporeal membrane oxygenation.

68



|  |  |
| --- | --- |
| **Characteristic** | **20132018**  **N Percent N Percent** |
| Wait time  < 31 days  31-60 days 61-90 days 3-< 6 months 6-< 12 months ≥ 1 year  Procedure  Lobar  Single Bilateral  Donor type  DBD  DCD Living  Transplant history First  Retransplant Tx type  Lung only Heart-lung Other  All recipients | 665 34.7%102040.0%  279 14.6%43417.0% 130 6.8%25610.1% 314 16.4%39915.7% 252 13.2%2469.7% 276 14.4%1927.5%  2 0.1%00.0%  619 32.3%64025.1% 1295 67.6%190774.9%  1880 98.1%242695.2%  35 1.8%1214.8% 1 0.1%00.0%  1838 95.9%248197.4%  78 4.1%662.6%  1884 98.3%249397.9% 19 1.0%281.1% 13 0.7%261.0%  1916 100.0%2547100.0% |

**Table LU 8 Transplant characteristics of lung transplant recipients aged** **12 years or older, 2013 and 2018.** Lung transplant recipients, including re- transplants. DBD, donation after brain death; DCD, donation after circulatory death.

69



|  |  |
| --- | --- |
| **Donor Recipient** | **CMVEBV** |
| D- R- D- R+ D- R unk D+ R- D+ R+  D+ R unk D unk R- D unk R+ D unk R unk | 18.1%0.7% 19.8%7.5% 0.3%0.2% 27.7%7.8% 33.0%81.6%  0.5%2.2% 0.2%0.0% 0.3%0.1% 0.0%0.0% |

**Table LU 9 Donor-recipient serology matching among lung transplant re-** **cipients aged 12 years or older, 2016-2018.** Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Trans- plant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. CMV, cytomegalovirus; EBV, Epstein-Barr virus.

70



|  |  |
| --- | --- |
| **Event** | **One-yearFive-year**  **N Pct N Pct** |
| BOS  None reported  Reported Unknown  Creatinine > 2.5 mg/dl Chronic dialysis Renal transplant Diabetes Malignancy Re-hospitalization Functional status  No assistance needed Some assistance needed Total assistance needed Unknown  All recipients | 544990.6%175758.1%  3826.4%126241.8% 1843.1%30.1%  2514.2%39012.9% 951.6%822.7% 50.1%200.7% 4838.0%56818.8% 2183.6%71723.7% 288948.0%236678.3%  482880.3%245981.4% 4287.1%2127.0% 1262.1%742.4% 63210.5%2779.2%  6015100.0%3022100.0% |

**Table LU 10 Posttransplant events among lung transplant recipients aged** **12 years or older.** Posttransplant morbidities are recorded on the OPTN Transplant Recipient Follow-up Form and are included in the table if they were reported anytime on or before 1-year and 5-year follow-up. One-year events are reported for recipients in 2015-2017 and 5-year events for recipients in 2011-2013. Recipients of more than one transplant are counted separately per transplant.

71



|  |  |
| --- | --- |
| **Characteristic** | **20082018**  **N Percent N Percent** |
| Age  < 1 year  1-5 years 6-11 years  Sex  Female  Male Race/ethnicity  White Black Hispanic  Geography  Metropolitan  Non-metro Distance  < 50 miles 50-<100 miles 100-<150 miles 150-<250 miles ≥ 250 miles  Unknown Height  < 70 cm 70-< 90 cm 90-< 110 cm 110-< 130 cm ≥ 130 cm  All candidates | 4 7.7%00.0%  12 23.1%741.2% 36 69.2%1058.8%  28 53.8%741.2%  24 46.2%1058.8%  38 73.1%1270.6% 5 9.6%15.9% 9 17.3%423.5%  41 78.8%1376.5%  11 21.2%423.5%  12 23.1%635.3% 7 13.5%15.9% 3 5.8%211.8% 6 11.5%211.8% 24 46.2%529.4%  0 0.0%15.9%  9 17.3%211.8% 15 28.8%211.8% 11 21.2%423.5% 15 28.8%847.1% 2 3.8%15.9%  52 100.0%17100.0% |

**Table LU 11 Demographic characteristics of candidates aged 0-11 years** **on the lung transplant waiting list on December 31, 2008 and December** **31, 2018.** Candidates aged 0-11 years waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed. Age calculated at snapshot. Candidates listed as before age 12 who turned 12 before the cohort date are excluded. Distance is computed from candidate’s home zip code to the transplant center.

72



|  |  |
| --- | --- |
| **Characteristic** | **20082018**  **N Percent N Percent** |
| Diagnosis  Cystic fibrosis  Pulmonary hypertension Pulmonary fibrosis Other vascular Other/unknown  Blood type  A  B AB O  All candidates | 713.5%423.5%  2140.4%211.8% 815.4%00.0% 35.8%211.8% 1325.0%952.9%  2242.3%635.3%  815.4%00.0% 23.8%211.8% 2038.5%952.9%  52100.0%17100.0% |

**Table LU 12 Clinical characteristics of candidates aged 0-11 years on the** **lung transplant waiting list on December 31, 2008 and December 31, 2018.** Candidates aged 0-11 years waiting for transplant on December 31, 2008, and December 31, 2018, regardless of first listing date; multiple listings are col- lapsed. Candidates listed as before age 12 who turned 12 before the cohort date are excluded.

73



|  |  |
| --- | --- |
| **Characteristic** | **20082018**  **N Percent N Percent** |
| Wait time  < 31 days  31-60 days 61-90 days 3-< 6 months 6-< 12 months 1-< 2 years  2-< 3 years ≥ 3 years  Waitlist status  Active  Inactive Transplant history  Tx type  Lung only  Heart-lung Other  All candidates | 3 5.8%00.0%  0 0.0%211.8% 1 1.9%423.5% 7 13.5%15.9% 4 7.7%317.6% 11 21.2%423.5%  6 11.5%211.8% 20 38.5%15.9%  15 28.8%1270.6%  37 71.2%529.4% 52 100.0%17100.0%  44 84.6%1482.4%  7 13.5%211.8% 1 1.9%15.9%  52 100.0%17100.0% |

**Table LU 13 Listing characteristics of candidates aged 0-11 years on the** **lung transplant waiting list on December 31, 2008 and December 31, 2018.** Candidates aged 0-11 years waiting for transplant on December 31, 2008, and December 31, 2018, regardless of first listing date; multiple listings are col- lapsed. Candidates listed as before age 12 who turned 12 before the cohort date are excluded.

74



|  |  |
| --- | --- |
| **Waiting list state** | **201620172018** |
| Patients at start of year Patients added during year Patients removed during year Patients at end of year | 202225 233024 212727 222522 |

**Table LU 14 Lung transplant waitlist activity among candidates aged 0-** **11 years.** Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. Candidates who are listed, undergo transplant, and are relisted are counted more than once. Candidates are not considered to be on the list on the day they are removed; counts on January 1 may differ from counts on December 31 of the prior year. Candidates listed for multi-organ transplants are included.

75



|  |  |
| --- | --- |
| **Removal reason** | **201620172018** |
| Deceased donor transplant Living donor transplant Patient died Patient refused transplant Improved, transplant not needed Too sick for transplant Other | 151616 000  486  000  221  011  003 |

**Table LU 15 Removal reason among lung transplant candidates aged 0-11** **years.** Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

76



|  |  |
| --- | --- |
| **Characteristic** | **2006-082016-18**  **N Percent N Percent** |
| Age  < 1 year  1-5 years 6-11 years  Sex  Female  Male Race/ethnicity  White Black Hispanic Asian Other/unknown  Height  < 70 cm  70-< 90 cm 90-< 110 cm 110-< 130 cm ≥ 130 cm  Insurance  Private  Medicaid Unknown  Geography  Metropolitan  Non-metro | 15 24.2%920.5%  19 30.6%1125.0% 28 45.2%2454.5%  33 53.2%2556.8%  29 46.8%1943.2%  39 62.9%2556.8% 7 11.3%49.1% 11 17.7%1125.0% 5 8.1%24.5% 0 0.0%24.5%  17 27.4%1125.0%  10 16.1%715.9% 10 16.1%49.1% 15 24.2%1636.4% 10 16.1%613.6%  31 50.0%1431.8%  30 48.4%2454.5% 1 1.6%613.6%  50 80.6%3477.3%  12 19.4%1022.7% |

**Table LU 16 Demographic characteristics of lung transplant recipients** **aged 0-11 years, 2006-2008 and 2016-2018 (continued on next page).** Lung transplant recipients aged 0-11 years, including retransplants. Distance is computed from recipient’s home zip code to the transplant center.

77



|  |  |
| --- | --- |
| **Characteristic** | **2006-082016-18**  **N Percent N Percent** |
| Distance  < 50 miles  50-<100 miles 100-<150 miles 150-<250 miles ≥ 250 miles Unknown All recipients | 16 25.8%1125.0%  5 8.1%613.6% 5 8.1%00.0% 4 6.5%613.6% 32 51.6%1738.6% 0 0.0%49.1% 62 100.0%44100.0% |

**Table LU 16 Demographic characteristics of lung transplant recipients** **aged 0-11 years, 2006-2008 and 2016-2018 (continued from previous** **page).** Lung transplant recipients aged 0-11 years, including retransplants. Distance is computed from recipient’s home zip code to the transplant center.

78



|  |  |
| --- | --- |
| **Characteristic** | **2006-082016-18**  **N Percent N Percent** |
| Diagnosis  Cystic fibrosis  Pulmonary hypertension Pulmonary fibrosis Other vascular Other/unknown  Blood type  A  B AB O  Medical condition  Hospitalized in ICU  Hospitalized, not ICU Not hospitalized  Medical urgency  priority 1  priority 2 Vent/ECMO at transplant  Vent + ECMO Vent only ECMO only Neither All recipients | 1219.4%1022.7%  1219.4%1022.7% 69.7%24.5% 23.2%24.5% 3048.4%2045.5%  2540.3%1329.5%  58.1%818.2% 711.3%24.5% 2540.3%2147.7%  2133.9%1738.6%  1625.8%511.4% 2540.3%2250.0%  3477.3%  1022.7%  23.2%24.5% 2133.9%1227.3% 00.0%12.3%  3962.9%2965.9% 62100.0%44100.0% |

**Table LU 17 Clinical characteristics of lung transplant recipients aged 0-** **11 years, 2006-2008 and 2016-2018.** Lung transplant recipients, including re- transplants. Pediatric priority was reported in 2012 and later. ECMO, extra- corporeal membrane oxygenation.

79



|  |  |
| --- | --- |
| **Characteristic** | **2006-082016-18**  **N Percent N Percent** |
| Wait time  < 31 days  31-60 days 61-90 days 3-< 6 months 6-< 12 months ≥ 1 year  Bilateral procedure Transplant history  First Retransplant  Tx type  Lung only  Heart-lung Other All recipients | 18 29.0%511.4%  13 21.0%1125.0% 8 12.9%715.9% 10 16.1%715.9% 10 16.1%1022.7% 3 4.8%49.1%  62 100.0%44100.0%  59 95.2%44100.0% 3 4.8%00.0%  51 82.3%4193.2%  11 17.7%24.5% 0 0.0%12.3% 62 100.0%44100.0% |

**Table LU 18 Transplant characteristics of lung transplant recipients aged** **0-11 years, 2006-2008 and 2016-2018.** Lung transplant recipients, including retransplants.

80



|  |  |
| --- | --- |
| **Donor Recipient** | **CMVEBV** |
| D- R- D- R+ D- R unk D+ R- D+ R+ D+ R unk | 36.4%20.5% 15.9%15.9% 2.3%0.0% 27.3%43.2% 18.2%20.5% 0.0%0.0% |

**Table LU 19 Donor-recipient serology matching among lung transplant** **recipients aged 0-11 years, 2016-2018.** Donor serology is reported on the OPTN Donor Registration Form and recipient serology on the OPTN Transplant Recipient Registration Form. There may be multiple fields per serology. Any evidence for a positive serology is treated as positive for that serology. CMV, cytomegalovirus; EBV, Epstein-Barr virus.

81



|  |  |
| --- | --- |
| **Event** | **One-yearFive-year** **N Pct N Pct** |
| BOS  None reported  Reported Unknown  Diabetes Malignancy Re-hospitalization Functional status  Fully active Min. active Bedbound Unknown  All recipients | 44 89.8%3774.0%  2 4.1%1326.0% 3 6.1%00.0%  00.0%48.0% 12.0%12.0% 2244.9%4386.0%  45 91.8%4794.0% 1 2.0%12.0% 1 2.0%00.0% 2 4.1%24.0%  49 100.0%50100.0% |

**Table LU 20 Posttransplant events among lung transplant recipients aged** **0-11 years.** Posttransplant morbidities are recorded on the OPTN Pediatric Transplant Recipient Follow-up Form and are included in the table if they were reported anytime on or before 1-year and 5-year follow-up. One-year events are reported for recipients in 2014-2017 and 5-year events for recipients in 2010-2013. Recipients of more than one transplant are counted separately per transplant.

82