OPTN/SRTR 2018 Annual Data Report: Heart

M. Colvin[1,2], J. M. Smith[1,3], N. Hadley[1], M. A. Skeans[1], K. Uccellini[4], R. Goff[4], J. Foutz[4], A. K. Israni[1,5,6], J. J. Snyder[1,5], B. L. Kasiske[1,6]

[1] Scientific Registry of Transplant Recipients, Hennepin Healthcare Research Institute, Minneapolis, MN

[2] Department of Cardiology, University of Michigan, Ann Arbor, MI

[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 Minnesota, Minneapolis, MN

[6] Department of Medicine, Hennepin Healthcare, University of Minnesota, Minneapolis, MN

Abstract

The new adult heart allocation policy was approved in 2016 and implemented in October 2018, so its effect was not yet evident in 2018 data. However, the more granular data being collected are anticipated to allow for improved analyses. In 2018, new listings continued to increase; 3883 new adult and 685 new pediatric candidates were added. In 2018, 3440 heart transplants were performed, an increase of 167 over 2017; 473 transplants occurred in pediatric recipients and 2967 in adult recipients. Short-term and long-term posttransplant mortality improved. Overall 1-year survival for adults who underwent heart transplant in 2011-2013 was 90.3%, 3-year survival was 84.7%, and 5-year survival was 79.6%. Mortality rates for pediatric recipients were 4.5% at 6 months and in 5.9% at 1 year posttransplant, 12.5% at 3 years for transplants in 2014-2015, 14.8% at 5 years for transplants in 2012-2013, and 29.8% at 10 years for transplants performed in 2008-2009.

Keywords: End-stage heart failure, heart transplant, transplant outcomes, ventricular assist device.

1 Introduction

The new adult heart allocation policy was approved in 2016 and implemented in October 2018. Its goal is to better stratify heart transplant candidates and to broaden sharing for higher urgency statuses to reduce waitlist mortality. While it is too early to discern the impact of the new policy, the more granular data being collected as part of the new system are anticipated to allow for improved analyses of outcomes and risk factors, which will contribute to a more dynamic policy. The current Annual Data Report provides an early glimpse into the distribution of patients under the new allocation system.

2 Adult Heart Transplant

2.1 Waitlist Trends

Between 2009 and 2018, the number of new active listings for heart transplant increased by 33.7%, from 2810 to 3756 (Figure HR 1). The number of candidates actively awaiting heart transplant increased by 39.7% since 2009, from 1858 to 2596 (Figure HR 2); however, since 2015, the number of active patients on the list at the end of the year declined, and the number of inactive patient declined then increased slightly. Some remarkable demographic trends in heart transplantation include the following: a continued increase in the proportion of heart transplant candidates aged 65 years or older to 18.7% in 2018 (Figure HR 3); stable proportions of racial/ethnic minorities, with black candidates comprising a slightly smaller proportion of waitlist candidates, 24.8%, and whites candidates a slightly higher proportion, 62.4% (Figure HR 5); and a slight increase in patients with congenital heart disease (Figure HR 6). In 2018, 63% of candidates had been on the waiting list for less than 1 year, a slight increase since 2008. In 2008, 12.9% of candidates had been on the waiting list 5 years or longer; this proportion gradually declined to 4.0% in 2018, the lowest in the past decade (Figure HR 7). The proportion of candidates awaiting transplant as status 1A continued to increase, 48.1% in 2018 (Figure HR 8). The proportion of status 1B candidates increased similarly but reached a plateau over the past 4 years, while the proportion waiting as status 2 declined from 25.7% in 2008 to 14.2% in 2018. Note that new status groups in use as of October, 2018 were converted to former status 1A, 1B and 2 equivalents for the 2018 data point (see Preface). The proportion of candidates with ventricular assist devices (VADs) at listing increased from 11.8% in 2008 to 32.6% in 2018 (Figure HR 9). Sex distribution has not changed appreciably: in 2018, women comprised 26% of heart transplant candidates (Figure HR 4). In 2018, 85.5% of candidates resided in a metropolitan area (Table HR 1).The proportion of candidates within 50 miles of the transplant program increased from 56.3% in 2008 to 62.1% in 2018, and proportions of those at greater distances decreased. Candidates with a prior heart transplant declined from 4.3% in 2008 to 2.9% in 2018 (Table HR 3). In 2018, 206 candidates were listed for

heart-kidney transplant, a substantial increase since 2008, while those listed for heart-lung transplants decreased to only 42 (1.23%) in 2018 (Table HR 3).

The distribution of candidates by status on December 31 in 2017 and 2018 is shown in Table HR 4. At the end of 2018, 47.8% of candidates were listed as new status 4, similar to the proportion listed as former status 1B at the end of 2017. Only 7 patients, or 0.2%, were listed as new status 1 (Table HR 4). The number of patients receiving any life support prior to transplant increased from 1791 in 2013 to 2402 in 2018 (Table HR 7). Of these, 43.6% had left VADs (LVADs), an increase of 342 over the 5-year period. While the proportion of LVADs and inotropes declined slightly since 2013, intra-aortic balloon pump (IABP) use increased from 5.7% to 9.1% and extracorporeal membrane oxygenation (ECMO) use increased from 0.7% to 2.0%. In 2018, 270 candidates used IABP, compared with 123 in 2013, and 58 used ECMO, compared with 15 in 2013. Candidates with total artificial hearts and right VADs declined to just 1% and 1.6%, respectively (Table HR 7).

Between 2008 and 2018, heart transplant rates fluctuated, reaching a nadir of 61.5 per 100 waitlist-years in 2015, followed by an increase to a decade high of 82.0 per 100 waitlist-years in 2018 (Figure HR 14). This trend was similar for all age groups, blood types, and status groups (Figure HR 11, Figure HR 13, Figure HR 14). For most groups, transplant rates since 2007 reached a nadir in 2014 and 2015 and have increased since. Trends were similar for black and Hispanic candidates, but transplant rates did not recover at the same magnitude as for other groups and overall declined since 2008. The transplant rate for blacks declined from 82.0 per 100 waitlist-years in 2008 to 69.2 in 2018, and for Hispanics from 90.2 per 100 waitlist-years to 80.Transplant rates increased in all age groups since 2015, but to a greater extent for candidates aged 65 or older. The transplant rate for these candidates exceeded that for all the other age groups, at 109.4 per 100 waitlist-years. Despite the overall increase, the transplant rate remained lowest for candidates aged 35-49 years, 69.6 per 100 waitlist-years.

Transplant rates have consistently been highest for candidates with blood type AB (199.4 per 100 waitlist-years) and for those listed as status 1A (302.2 per 100 waitlist-years). In 2018, blood type O candidates underwent transplant at a rate of 58.0 per 100 waitlist-years, nearly half the rate of blood type A and B candidates and 29% of the rate of blood type AB candidates. Candidates with blood type A underwent transplant at a rate of 106.1 per 100 waitlist-years, higher than in previous years, and higher than candidates with blood type B. Despite a decline in transplant rates between 2007 and 2015, since then, rates have increased for nearly all groups. In 2018, candidates residing in non-metropolitan areas underwent transplant at slightly higher rates than those in metropolitan areas, 84.6 per 100 waitlist-years vs. 81.7 (Figure HR 15). Although trends based on candidate distance from the donor hospital have been similar over the past decade, in 2018, candidates residing 100-<250 nautical miles (NM) from the donor hospital underwent transplant at the highest rate, 85.7 per 100 waitlist-years, and those residing 50-<100 NM away at

the lowest rate, 80.4 per 100 waitlist-years (Figure HR 16).

The median waiting time in 2017-2018 was 6.9 months (Figure HR 18). The lowest median time to transplant of the decade occurred in 2007-2008. A peak of 11.6 months occurred in 2013-2014, followed by a gradual decline. In 2017-2018, median waiting time was longest for blood type O candidates, 13.5 months (Figure HR 19); status 2 candidates, 16.72 months; and candidates with body mass index ? 31 kg/m^2, 11.2 months (Figure HR 20, Figure HR 21). Waiting time decreased for all status groups and was lowest for status 1A, 1.97 months. Women waited on average 4.9 months, and men 7.9 months (Figure HR 18). Median waiting time was lowest of all groups for candidates with blood type AB, 1.5 months. Since 2007, the proportion of candidates undergoing transplant within 1 year of listing declined overall, but increased from 48.6% in 2014 to 57.2% in 2017. Of candidates listed in 2017, 33.3% underwent transplant within 3 months and 45.5% within 6 months (Figure HR 22). When stratified by donation service area (DSA), the proportion of candidates undergoing transplant within 1 year of listing in 2017 varied from 23.1% to 94.1% (Figure HR 23). Similar variability occurred by state, ranging from 25.0% to 100% (n = 3) (Figure HR 24).

Among candidates listed in 2015, 51.5% underwent transplant during the first year on the waiting list, 31.9% were still waiting, 9.4% were removed from the list, and 7.2% had died (Figure HR 17). At 3 years, 66.0% had undergone transplant, 8.1% were still waiting, 17.4% had been removed from the list, and 8.5% had died.

Since 2007-2008, pretransplant mortality declined from 16.6 to 10.8 deaths per 100 waitlist-years in 2017-2018 (Figure HR 25). Pretransplant mortality declined for all groups except candidates with valvular heart disease, unknown etiology, and unknown ethnicity. Pretransplant mortality was lowest for candidates aged 18-34 years and those listed as status 2, 7.3 deaths per 100 waitlist-years. Pretransplant mortality declined by more than 50% for candidates aged 18-34 years, from 15.4 per 100 wait-list deaths in 2007-2008 to 7.3 in 2017-2018 (Figure HR 25, Figure HR 29). Pretransplant mortality declined substantially over the past decade for black, Hispanic, and Asian candidates. In 2017-2018, pretransplant mortality was lowest for blacks, 9.2 deaths per 100 waitlist-years (Figure HR 26). In 2007-2008, pretransplant mortality for LVAD candidates was more than twice that for non-LVAD candidates, 38.3 vs. 15.0 deaths per 100 waitlist-years. However, pretransplant mortality declined substantially for LVAD candidates, to 10.2 deaths per 100 waitlist-years in 2017-2018. Pretransplant mortality for non-VAD candidates was 11.1 deaths per 100 waitlist-years in 2017-2018. Since 2013-2014, pretransplant mortality has been lower in VAD than in non-VAD candidates (Figure HR 30). Pretransplant mortality rates remained highest among candidates listed as status 1A, as might be expected, but declined dramatically between 2007-2008 and 2009-2010, from 71.9 deaths per 100 waitlist-years to 49.3 (Figure HR 29), followed by a gradual decline to 30.1 in 2017-2018. Similarly, pretransplant mortality among candidates listed as status 1B declined from 32.5 to 8.7 deaths per 100 waitlist-

years. Pretransplant mortality was slightly higher for candidates residing in nonmetropolitan areas than for those in metropolitan areas (Figure HR 31), and varied by DSA from 3.3 to 25.1 deaths per 100 waitlist-years (Figure HR 34).

Among candidates removed from the waiting list for reasons other than transplant, 16.9% died within 6 months of removal in 2018, although data from only the first half of 2018 were available. The overall trend showed a decline in patients who died within 6 months of removal from the waiting list, despite fluctuation and an increase to 33.2% in 2013 (Figure HR 35). In 2017, 172 patients died within 6 months of removal from the waiting list. In 2017, 47.9% of candidates listed as status 1A died within 6 months of removal. The percentage of candidates aged 18-34 years who died within 6 months followed a similar trend and decreased to 7.7% in 2017, but increased to 19.5% in 2018 (Figure HR 36).

2.2 Donor Trends

The number of deceased heart donations continued to increase; 3443 deceased donors in 2018 was the highest number to date, and an increase of 52% since 2007. While the number of donors increased in all age groups over the past decade, the greatest increase was donors aged 18-34 years, from 1039 in 2008 to 1706 in 2018 (Figure HR 37); the highest proportion of donors, 50%, were in this age group (Figure HR 38). Among donors 2014-2018, the number of pediatric heart donors in a DSA ranged from 2 to 164. The proportion of pediatric donor hearts that were transplanted into adults varied by DSA from 0% to 64% (Figure HR 41). The rate of discards, that is, the proportion of recovered hearts that were not transplanted, has fluctuated over the past decade and in 2018 was 0.8% (Figure HR 42). Although discards were highest in age group 50 years or older, they declined in this age group from 3.3% in 2015-2016 to 1.8% in 2017-2018. The discard rate for Public Health Service (PHS) high risk donors was 1.0% compared with 0.7% for non-PHS high risk donors (Figure HR 43).

Head trauma as cause of donor death continued to decline in prevalence and in 2018 was 43.0%. Conversely, anoxia continued to increase in prevalence to 41.6% of donors in 2018, second to head trauma (Figure HR 44). In 2007, anoxia was the cause of death for only 15.0% of donors. The increase in anoxic deaths may be partially attributable to the rise in opioid deaths.

2.3 Overall Trends in Heart Transplant

The general trend has been an increase in heart transplants over the past decade (Figure HR 45). In 2018, 3440 heart transplants were performed, an increase of 167 over 2017; 473 transplants occurred in pediatric recipients and 2967 in adult recipients (Figure HR 45). Pediatric heart transplants declined between 2015 and 2017, but increased by 41 since then. In 2018, six fewer transplants were performed in recipients aged 18-34 years, but transplants

increased for all other age groups, with the largest number, 1407, in recipients aged 50-64 years (Figure HR 46). In 2018, 2028 heart transplants were performed for cardiomyopathy (Figure HR 49). The number of recipients who underwent transplant at status 1A more than doubled, from 1108 in 2007 to 2439 in 2018, representing 71% of all transplants. The number of status 1B recipients has fluctuated, but decreased from 954 in 2017 to 868 in 2018. Of note, 133 transplants were performed in status 2 patients, the highest since 2011 and an increase of 48 over 2017 (Figure HR 50). Note that new status groups in use as of October, 2018 were converted to former status 1A, 1B and 2 equivalents for the 2018 data point.

In 2018, 84.2% of recipients resided in metropolitan areas, and 61.2% lived within 50 miles of the transplant program (Table HR 8). In 2018, 46.2% of recipients had LVADs. The number of recipients with VADs at the time of transplant increased from 519 in 2013 to 1370 in 2018 (Table HR 9). Although 28.9% of patients underwent transplant within 31 days of listing in 2018, the proportion who waited 1 year or longer increased over the past decade: 18.3% in 2018 vs. 9.5% in 2008 (Table HR 10). Multi-organ transplant accounted for 9.1% of heart transplants; 202 heart-kidney transplants were performed in 2018 compared with 63 in 2008 (Table HR 10).

Use of induction therapy has changed little since 2007. In 2018, 51.7% of adult heart transplant recipients received either IL2-RA or T-cell depleting therapy (Figure HR 51), 96.6% received a tacrolimus-based immunosuppression regimen, and 3.4% received other regimens (Figure HR 52).

In 2018, the median transplant program volume was 19 transplants per year, increased since 2008, but at a plateau since 2015 (Figure HR 54). The percentage transplants performed at low-volume programs (0 to 9 transplants per year) declined to 4.0% in 2018, compared with 10.7% in 2008. The proportion transplants performed at programs with volumes of 60 or more transplants fluctuated, peaking at 21.1% in 2017 and declining to 15.5% in 2018 (Figure HR 55). Overall, however, high-volume programs have increased over the past decade. Between 2007 and 2015, most heart transplants occurred at programs performing 10-29 per year; more recently, this shifted to programs performing 30-59 transplants per year, where 44.6% were performed in 2018 (Table HR 55).

2.4 Posttransplant Survival and Morbidity

Overall 1-year survival for patients who underwent heart transplant in 2011-2013 was 90.3%, 3-year survival was 84.7%, and 5-year survival was 79.6% (Figure HR 56). One-year survival in most subgroups was similar, but tended to be lower among recipients aged 65 years or older (Figure HR 56) and Hispanic recipients (Figure HR 57). Survival tended to be better for Asian recipients at all time-points. Survival at 1 year was similar for recipients with VADs, IABPs, and without circulatory support; however, survival was lower at 3 and 5 years for recipients with IABPs, 79.9% and 74.6%, respectively (Figure HR 59). Early

survival was lower for re-transplant recipients, but by 5 years was similar to those undergoing a first transplant (Figure HR 60). Survival tended to be worse for recipients residing 250 miles or farther from the transplant program than for those residing closer at 1, 3, and 5 years, and was the lowest 1-, 3-, and 5-year survival of all groups (Figure HR 63). Since 2001, short- and long-term death rates have declined. Among recipients who underwent transplant In 2017, 7.0% died at 6 months and 9.0% died at 1 year (Figure HR 64). Ten-year mortality remained high at 38.2% among those who underwent transplant in 2008, although this has declined from 43.0% among those who underwent transplant in 2001. The number of heart transplant survivors has increased by over 11,000 since 2007. On June 30, 2018, 33,885 heart transplant recipients were alive with a functioning graft, compared with 32,151 in 2017. Most survivors were aged 50 years or older at the time of transplant (Figure HR 65).

The incidence of acute rejection in the first year posttransplant was 27.0% for recipients undergoing transplant in 2016-2017 (Figure HR 66). Rejection occurred more frequently in younger patients, 32.0% of recipients aged 18-34 years compared with 23.1% of those aged 65 years or older. Posttransplant lymphoproliferative disorder (PTLD) occurred in 1.0% of recipients by year 5, but more frequently, 3.5%, in those who were seronegative for Epstein Barr virus (EBV) (Figure HR 68). The most common documented cause of death in the first posttransplant year was cardiovascular/cerebrovascular disease (Figure HR 69), and in years 2 through 5 (Figure HR 70). Malignancy was a relatively infrequent cause of death, 1.4% at 5 years (Figure HR 70).

3 Pediatric Heart Transplant

3.1 Pediatric Waitlist Trends

In 2018, 685 new pediatric candidates were added to the heart transplant waiting list, with few at inactive status (Figure HR 71). At year-end 2018, 395 candidates listed before their eighteenth birthdays were awaiting heart transplant, 73.2% active (Figure HR 72). Over the past decade, the proportion of inactive candidates at year-end decreased from 56.9% in 2007 to 26.8% in 2018. The largest pediatric age group on the waiting list in 2018 was 11-17 years (33.4%), followed by 1-5 years (26.9%), younger than 1 year (26.1%), and 6-10 years (13.6%) (Figure HR 73). Just over half of pediatric heart transplant candidates were white, 20.6% were black, 19.6% were Hispanic, and 4.2% were Asian (Figure HR 74). Over the past decade, the proportion of pediatric heart candidates with congenital defects increased from 41.6% in 2007 to 55.8% in 2018 (Figure HR 75). Considering trends over time, the age and race of waitlisted candidates has remained relatively unchanged (Table HR 13). For candidates waiting on December 31, 2018, congenital defect was the leading cause of heart disease at 62.2%, increased from 48.0% in 2008 (Table HR 14). The proportions of heart transplant candidates listed as status 1B and status 2 increased over the past decade, likely reflecting changes to pediatric heart allocation policy

implemented in 2016. The percentage of candidates using VADs at the time of listing remained stable, from 4.0% in 2008 to 6.6% in 2018 (Table HR 14). A smaller proportion of candidates were listed for heart-lung transplant in 2018, 0.6% compared with 5.6 % in 2008 (Table HR 15). Among the 674 candidates removed from the waiting list in 2018, 486 (72.1%) were removed due to undergoing transplant, 77 (11.4%) died, 62 (9.2%) were removed due to improved condition, and 31 (4.6%) were considered too sick to undergo transplant (Table HR 16, Table HR 17).

Just over 70% of pediatric candidates newly listed in 2015 underwent transplant within 3 years, 13.0% died, 11.8% were removed from the list, and 4.2% were still waiting (Figure HR 79). The rate of heart transplants among pediatric waitlist candidates has remained relatively stable over the past decade, and was 117.7 per 100 waitlist-years in 2018 (Figure HR 80). Transplant rates varied by age; rates were highest for candidates aged younger than 1 year, at 183.0 transplants per 100 waitlist-years in 2018, followed by candidates aged 11-17 years, at 117.7 transplants per 100 waitlist-years (Figure HR 80). Pretransplant mortality decreased over the past decade, from 27.6 deaths per 100 waitlist-years in 2007-2008 to 17.6 in 2017-2018 (Figure HR 83). By age, pretransplant mortality rates were highest for candidates aged younger than 1 year, at 41.1 deaths per 100 waitlist-years in 2017-2018, followed by 14.4 deaths per 100 waitlist-years for ages 1-5 years, 11.1 for ages 6-10 years, and 7.1 for ages 11-17 years (Figure HR 83). By medical urgency status, pretransplant mortality was highest for status 1A (46.6 deaths per 100 waitlist-years) and 1B (11.4) candidates, compared with 3.7 for status 2 candidates (Figure HR 85).

3.2 Pediatric Trends in Heart Transplant

Pediatric transplant recipients are defined as those aged 18 years or younger at the time of transplant. The number of pediatric heart transplants performed each year continued to increase, to 473 in 2018 from 330 in 2007 (Figure HR 89). In 2018, 27 of 138 total heart transplant programs performed pediatric heart transplants exclusively, 77 performed only adult heart transplants, and 26 performed both adult and pediatric heart transplants (Figure HR 90). In 2018, 7.8% of transplants in recipients aged younger than 10 years were performed at programs with volume of five or fewer pediatric transplants in that year (Figure HR 91). Over the past decade, the age, sex, and race/ethnicity of pediatric heart transplant recipients changed little (Table HR 18).The proportion of recipients with private insurance decreased over the decade and the proportion with Medicaid increased (Table HR 18). Congenital defects remained the most common primary cause of disease, affecting 50.1% of recipients who underwent transplant in 2016-2018 (Table HR 19). The proportion of patients who underwent transplant at status 1A and 1B increased over the decade, and the proportion at status 2 decreased. VAD use at the time of transplant increased from 13.1% of transplant recipients in 2006-2008 to 28.4% in

2016-2018 (Table HR 19). The proportion of ABO-incompatible transplants in 2016-2018 increased 3-fold to 9.9% from 3.3% a decade earlier (Table HR 20).

In 2018, use of T-cell depleting agents for induction continued to increase, to 74.6% of pediatric heart transplant recipients; use of interleukin-2 receptor antagonists decreased to 8.2% (Figure HR 92). The initial immunosuppression regimen used most commonly shifted in 2018 to more recipients using tacrolimus and MMF (47.5%) with a reciprocal decrease in those using tacrolimus, MMF, and steroid (39.0%) (Figure HR 93).

3.3 Pediatric Posttransplant Survival and Morbidity

Among pediatric heart transplant recipients 2016-2017, the rate of acute rejection in the first year was 18.8% overall; the highest rate was 23.4% in recipients aged 11-17 years, and the lowest was 15.8% in recipients aged younger than 6 years (Figure HR 96). Among pediatric heart transplant recipients 2016-2018, the combination of a CMV-positive donor and CMV-negative recipient occurred in 28.1% of transplants; for EBV, this combination occurred in 28.7% of transplants (Table HR 22).

Recipient death occurred in 4.5% of patients at 6 months posttransplant and in 5.9% at 1 year posttransplant among pediatric heart transplants performed in 2016-2017, in 12.5% of patients at 3 years posttransplant for transplants performed in 2014-2015, in 14.8% of patients at 5 years posttransplant for transplants performed in 2012-2013, and in 29.8% of patients at 10 years posttransplant for transplants performed in 2008-2009 (Figure HR 99). Overall, 1-year and 5-year patient survival were 90.9% and 81.5%, respectively, among recipients who underwent transplant in 2006-2013 (Figure HR 100). By age, 5-year patient survival was 76.9% for recipients aged younger than 1 year, 82.9% for ages 1-5 years, 87.1% for ages 6-10 years, and 82.4% for ages 11-17 years (Figure HR 100). The leading identified causes of death in the first 12 months posttransplant among recipients from 2016-2017 were infection (1.4%) and cardio/cerebrovascular disease (1.4%) (Figure HR 101). At 5 years posttransplant, the leading causes were graft failure (3.9%) and cardio/cerebrovascular disease (3.7%) (Figure HR 102).

The overall incidence of PTLD was 4.1% at 5 years posttransplant; incidence was 5.3% among EBV-negative recipients and 3.1% among EBV-positive recipients (Figure HR 98).

The publication was produced for the U.S. Department of Health and Human Services, Health Resources and Services Administration, by the Hennepin Healthcare Research Institute (HHRI) and by the United Network for Organ Sharing (UNOS) under contracts HHSH250201500009C and 234-2005-37011C, respectively.

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.

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 include a citation and the following statement: The data and analyses reported in the 2018 Annual Data Report of the U.S. Organ Procurement and Transplantation Network and the Scientific Registry of Transplant Recipients have been supplied by the United Network for Organ Sharing and the Hennepin Healthcare 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. Government.

This report is available at srtr.transplant.hrsa.gov. Individual chapters, as well as the report as a whole, may be downloaded.

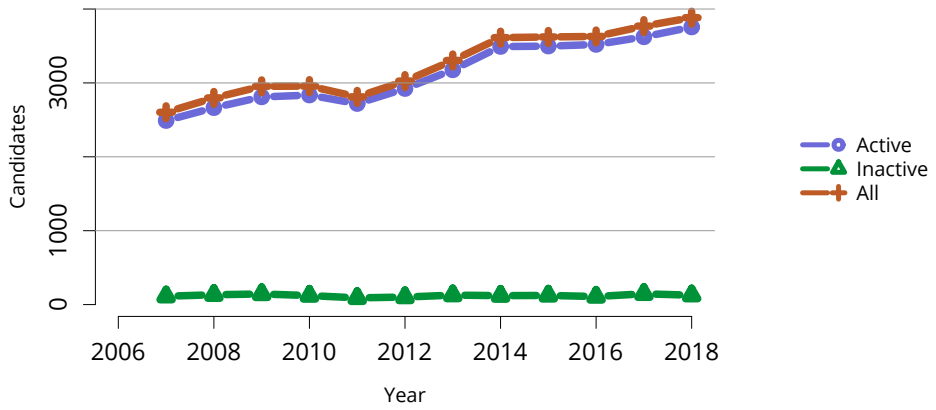

Figure HR 1. New adult candidates added to the heart transplant waiting list. A new candidate is one who first joined the list during the given year, without having been listed in a previous year. Previously listed candidates who underwent transplant and subsequently relisted are considered new. Candidates concurrently listed at multiple centers are counted once. Active and inactive patients are included.

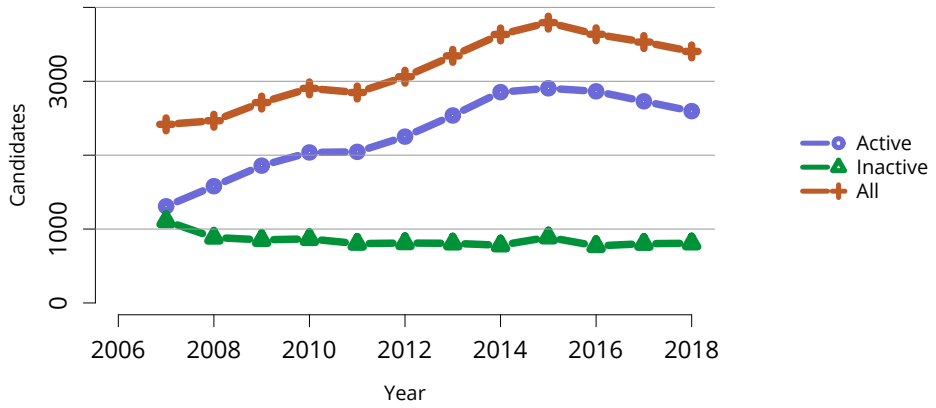

Figure HR 2. Adults listed for heart transplant on December 31 each year. Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active.

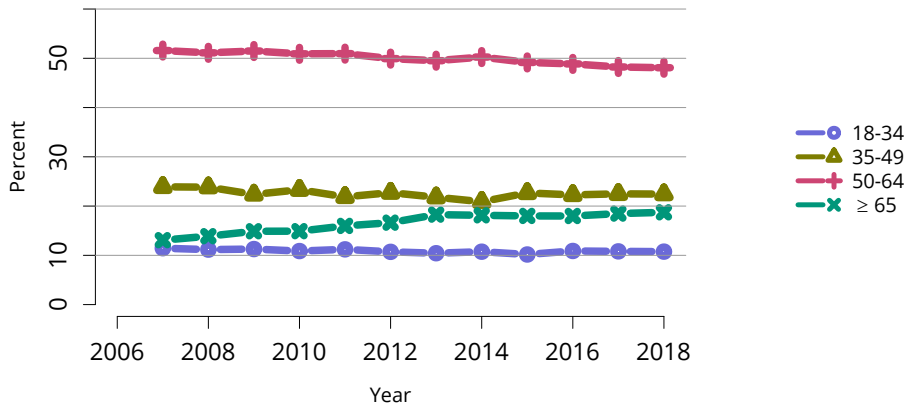

Figure HR 3. Distribution of adults waiting for heart transplant by age. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Active and inactive candidates are included.

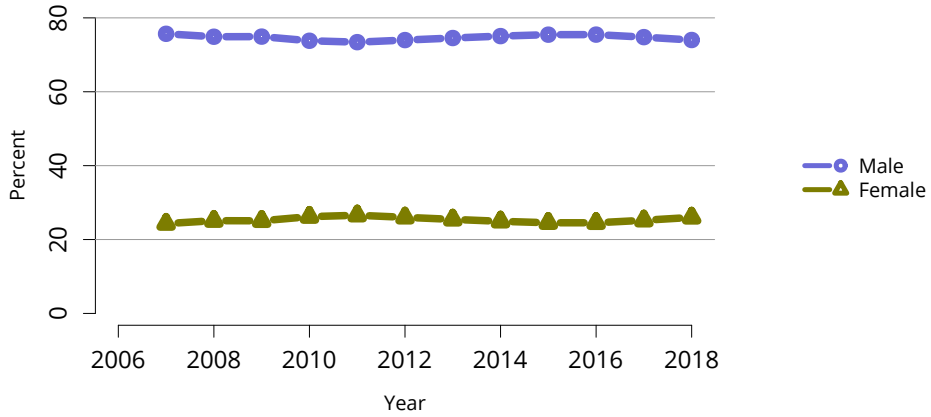

Figure HR 4. Distribution of adults waiting for heart transplant by sex. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included.

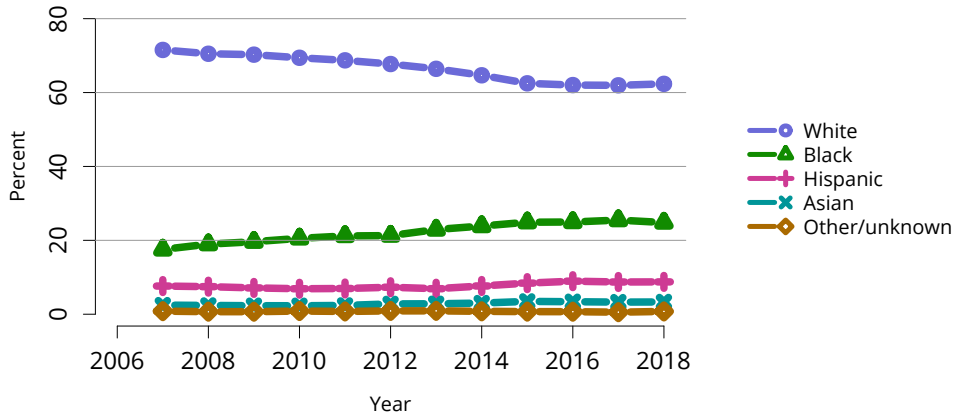

Figure HR 5. Distribution of adults waiting for heart transplant by race. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included.

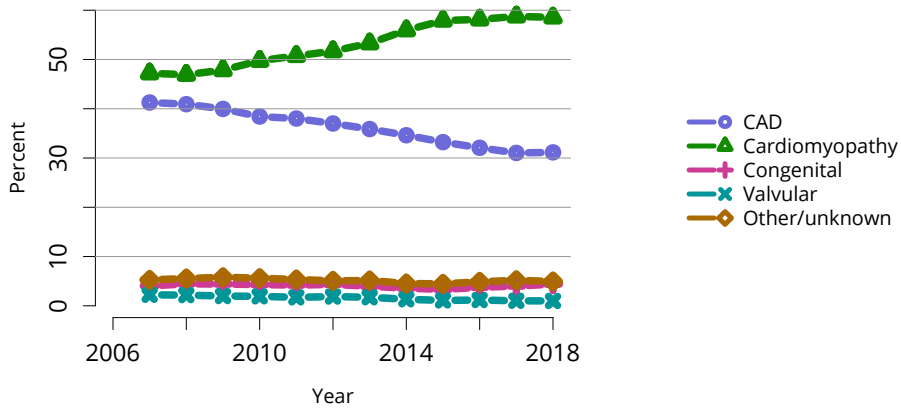

Figure HR 6. Distribution of adults waiting for heart transplant by diagnosis. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included. CAD, coronary artery disease.

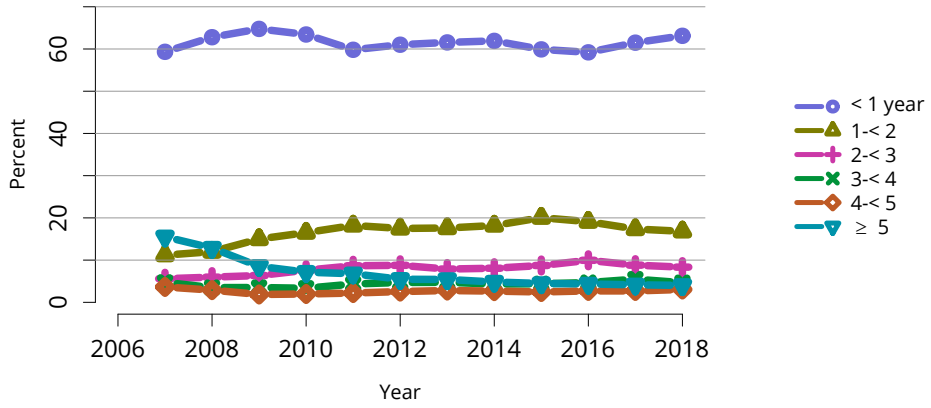

Figure HR 7. Distribution of adults waiting for heart transplant by waiting time. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of December 31 or removal from the waiting list. Active and inactive candidates are included.

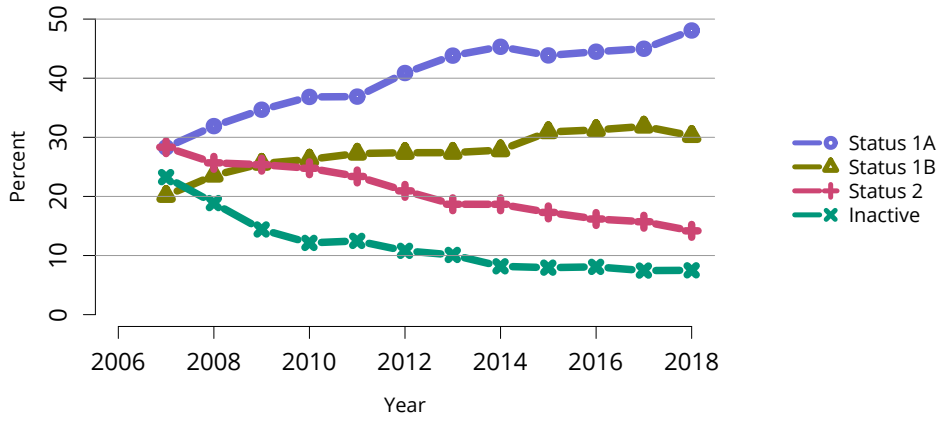

Figure HR 8. Distribution of adults waiting for heart transplant by medical urgency. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Medical urgency status is the most severe during the year. New status codes in use as of October 18, 2018 were converted to their old status equivalents for the 2018 data point. Active and inactive patients are included.

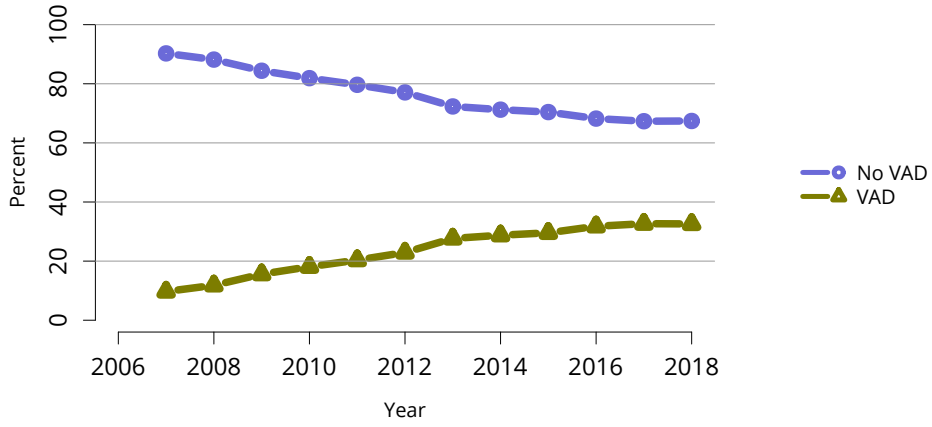

Figure HR 9. Distribution of adults waiting for heart transplant by VAD status at listing. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included. VAD, ventricular assist device.

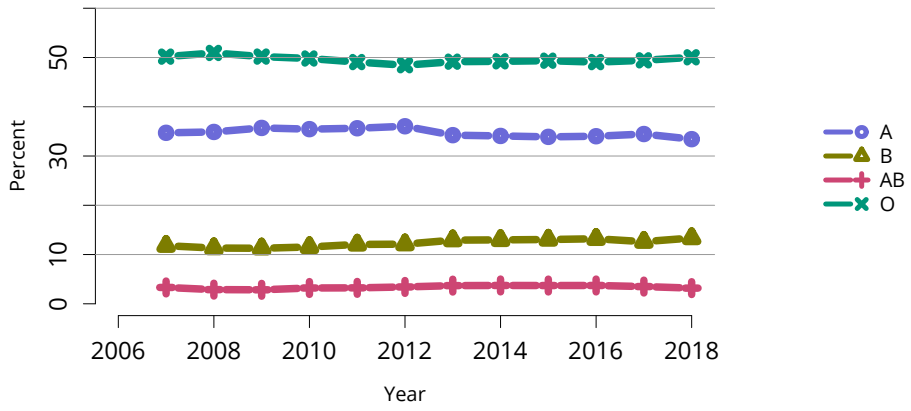

Figure HR 10. Distribution of adults waiting for heart transplant by blood type. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included.

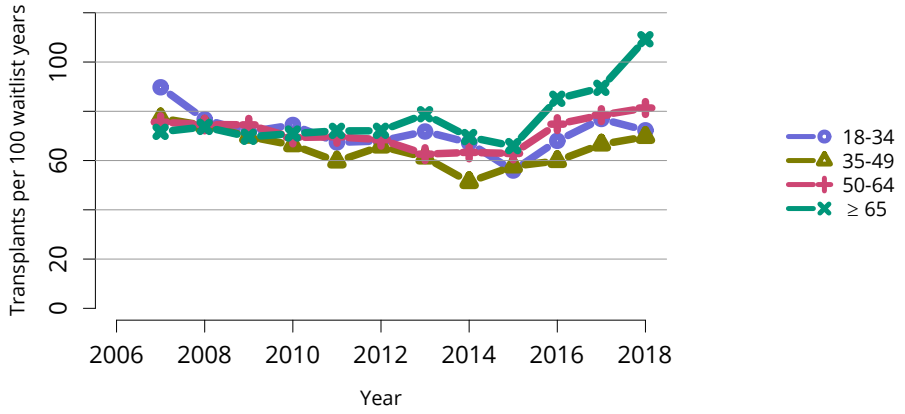

Figure HR 11. Deceased donor heart transplant rates among adult waitlist candidates by age. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Age is determined at the later of listing 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.

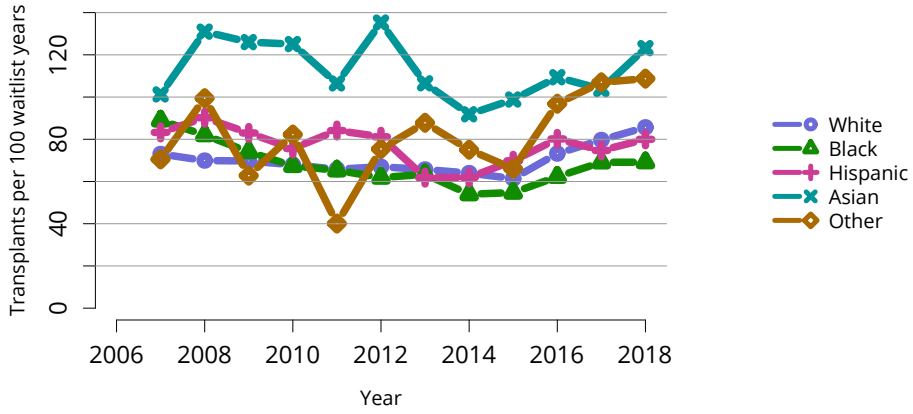

Figure HR 12. Deceased donor heart transplant rates among adult waitlist candidates by race. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years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

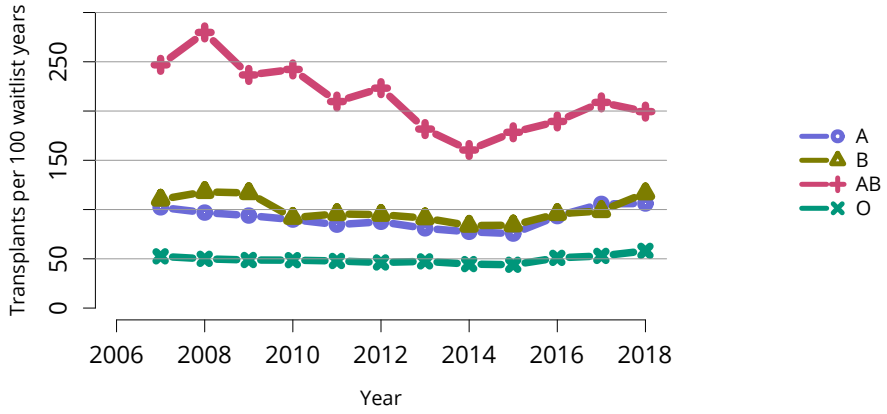

Figure HR 13. Deceased donor heart transplant rates among adult waitlist candidates by blood type. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

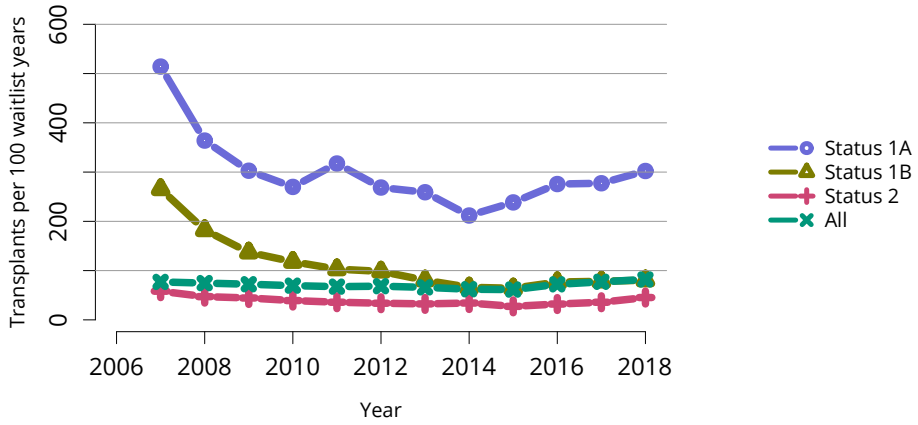

Figure HR 14. Deceased donor heart transplant rates among adult waitlist candidates by medical urgency. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Medical urgency is assessed at the time of listing. New status codes in use as of October 18, 2018 were converted to their old status equivalents for the 2018 data point. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

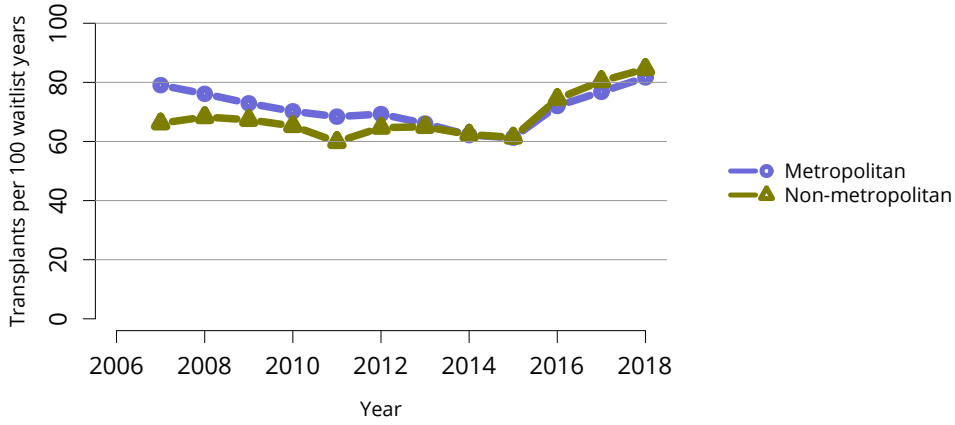

Figure HR 15. Deceased donor heart transplant rates among adult waitlist candidates by metropolitan vs. non-metropolitan residence. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Urban/rural determination is made using the RUCA (Rural-Urban Commuting Area) designation of the candidate's permanent zip code. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

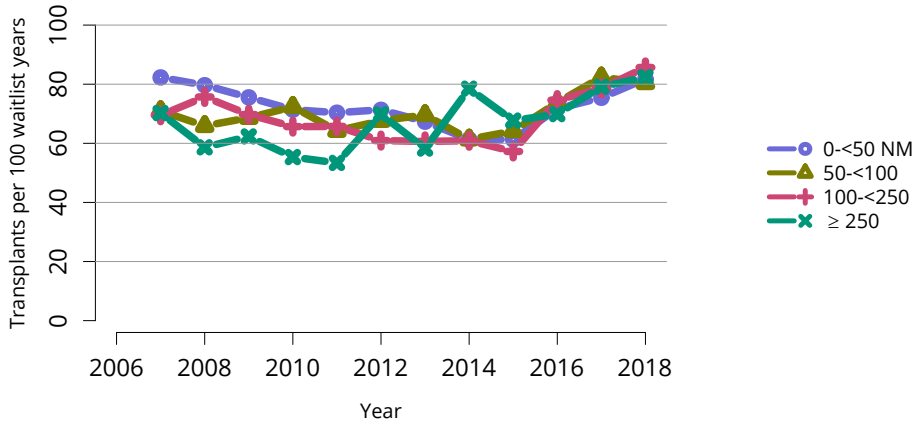

Figure HR 16. Deceased donor heart transplant rates among adult waitlist candidates by distance from listing center. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of wait time in a given year. Individual listings are counted separately. Distance is nautical 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.

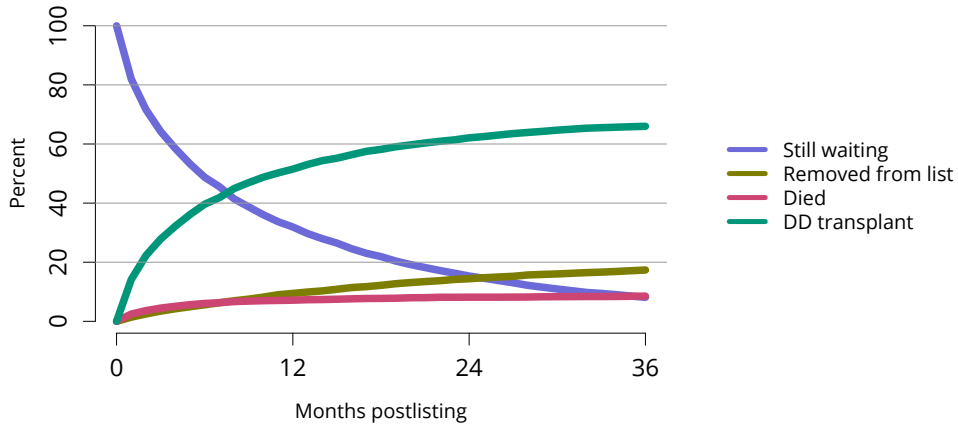

Figure HR 17. Three-year outcomes for adults waiting for heart transplant, new listings in 2015. Adults waiting for heart transplant and first listed in 2015. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. DD, deceased donor.

Figure HR 18. Median months to heart transplant for waitlisted adults by sex. Observations censored on December 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.

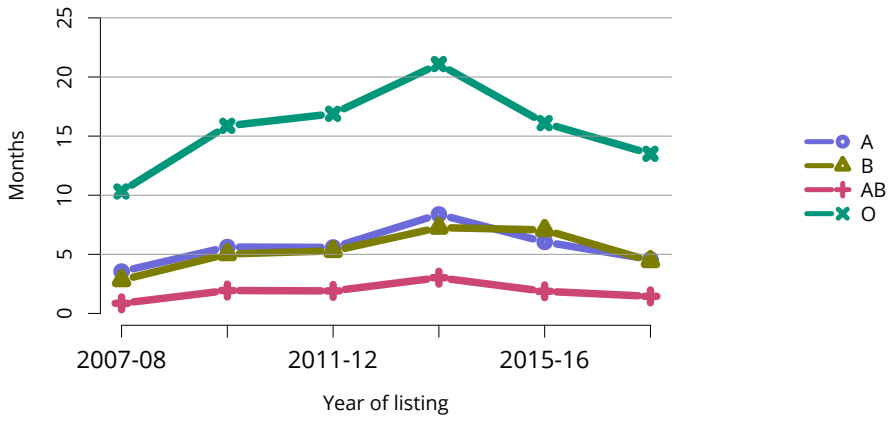

Figure HR 19. Median months to heart transplant for waitlisted adults by blood type. Observations censored on December 31, 2018; Kaplan-Meier competing risk methods used to estimate time to transplant. Analysis performed per candidate, not per listing. If an estimate is not plotted, 50% of the cohort listed in that year had not undergone transplant by the censoring date. Only the first transplant is counted.

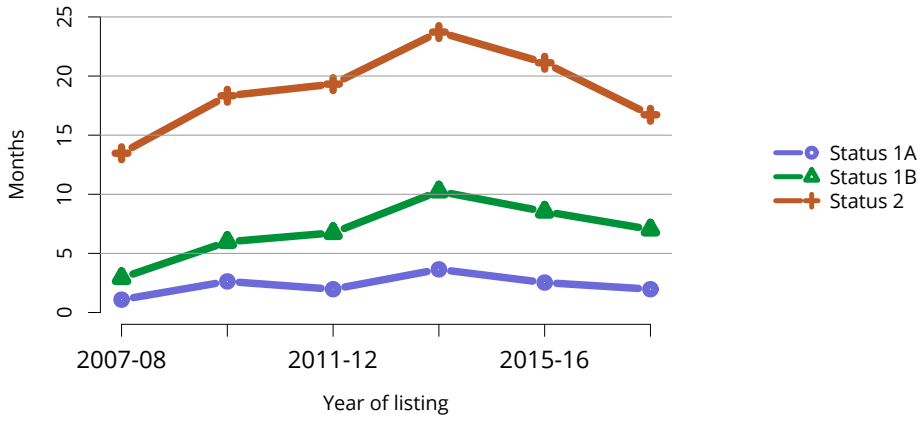

Figure HR 20. Median months to heart transplant for waitlisted adults by medical urgency at listing. Observations censored on December 31, 2018; Kaplan-Meier competing risk methods used to estimate time to transplant. Analysis performed per candidate, not per listing. If an estimate is not plotted, 50% of the cohort listed in that year had not undergone transplant by the censoring date. Only the first transplant is counted. New status codes in use as of October 18, 2018 were converted to their old status equivalents for the 2018 data point.

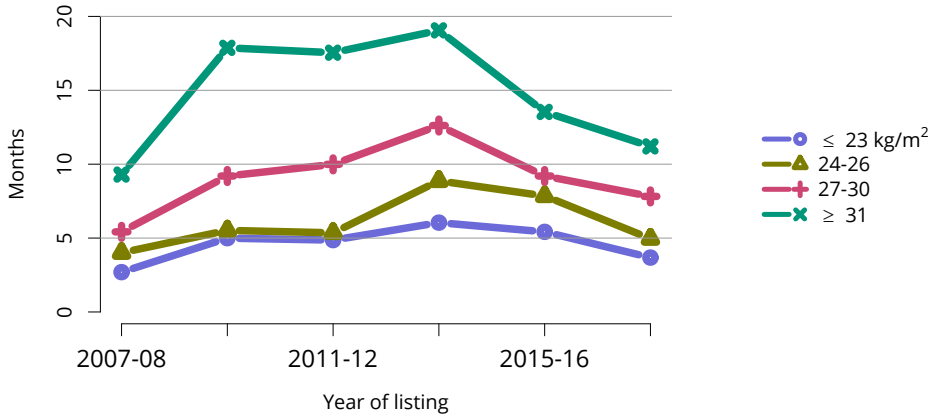

Figure HR 21. Median months to heart transplant for waitlisted adults by BMI at listing. Observations censored on December 31, 2018; Kaplan-Meier competing risk methods used to estimate time to transplant. Analysis performed per candidate, not per listing. If an estimate is not plotted, 50% of the cohort listed in that year had not undergone transplant by the censoring date. Only the first transplant is counted.

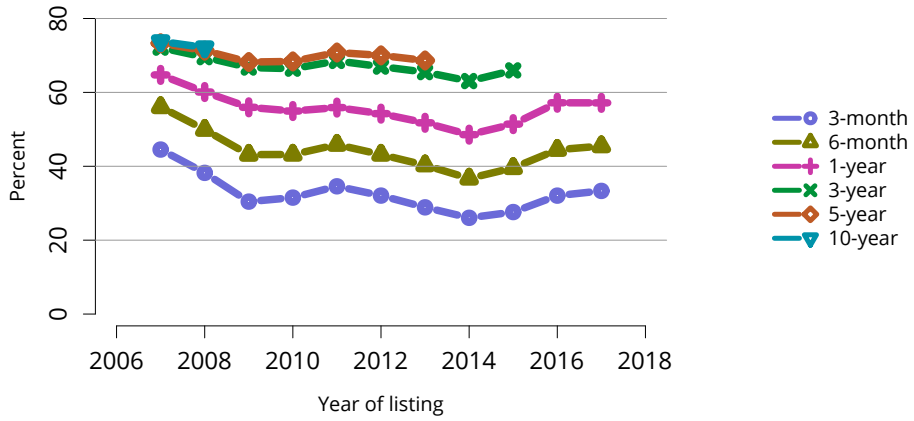

Figure HR 22. Percentage of adults who underwent deceased donor heart transplant within a given time period of listing. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal.

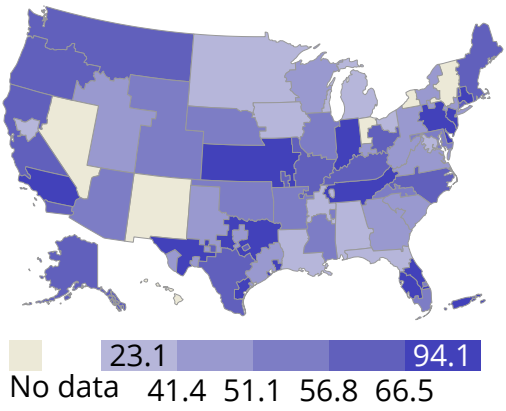

Figure HR 23. Percentage of adults who underwent deceased donor heart transplant within 1 year of listing in 2017 by DSA. Candidates listed concurrently in a single DSA are counted once in that DSA, from the time of earliest listing to the time of latest removal; candidates listed in multiple DSAs are counted separately per DSA.

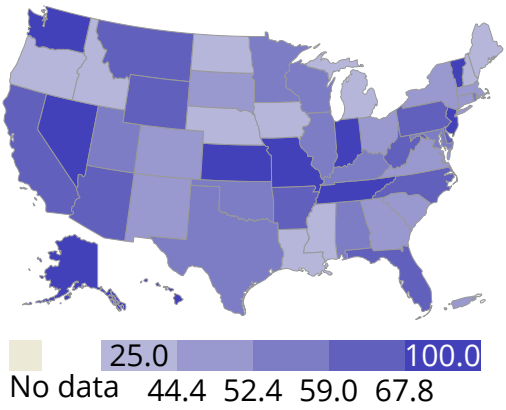

Figure HR 24. Percentage of adults who underwent deceased donor heart transplant within 1 year of listing in 2017 by state. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal.

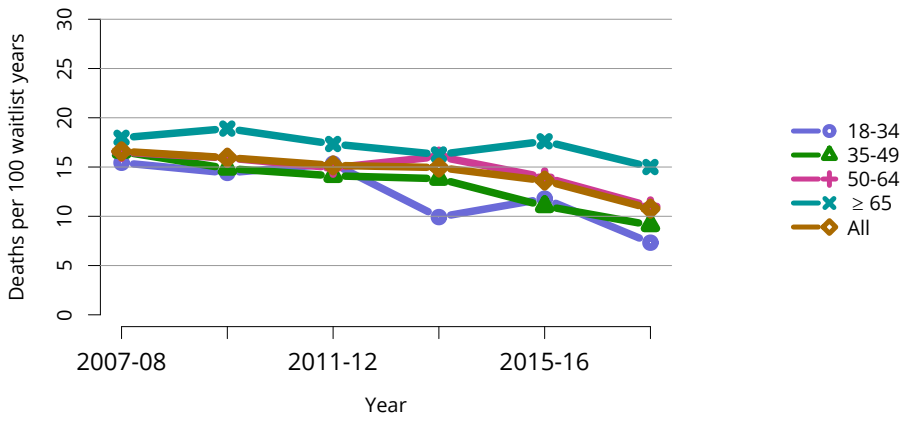

Figure HR 25. Pretransplant mortality rates among adults waitlisted for heart transplant by age. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure 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.

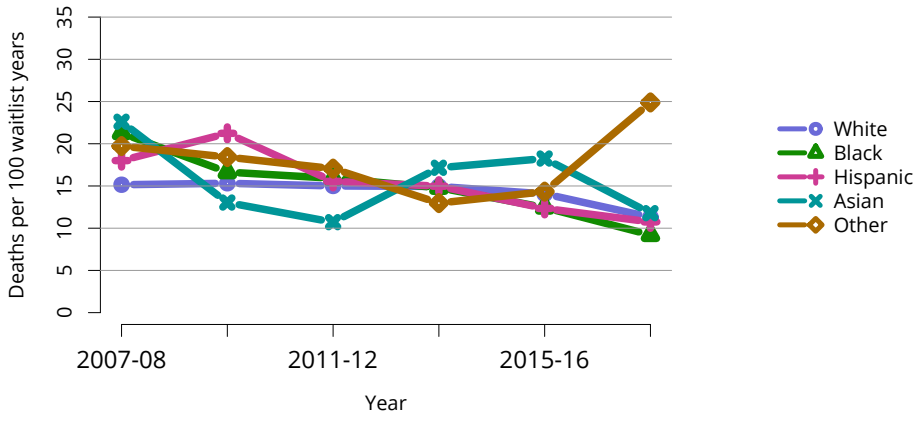

Figure HR 26. Pretransplant mortality rates among adults waitlisted for heart transplant by race. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved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

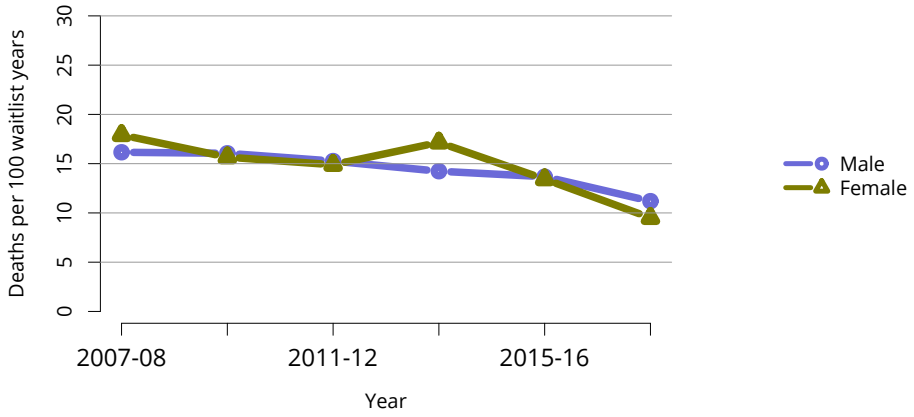

Figure HR 27. Pretransplant mortality rates among adults waitlisted for heart transplant by sex. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

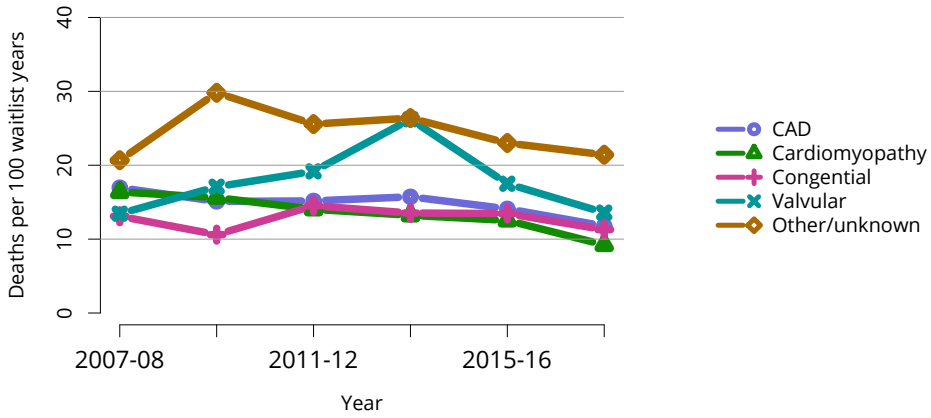

Figure HR 28. Pretransplant mortality rates among adults waitlisted for heart transplant by diagnosis. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of 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. CAD, coronary artery disease.

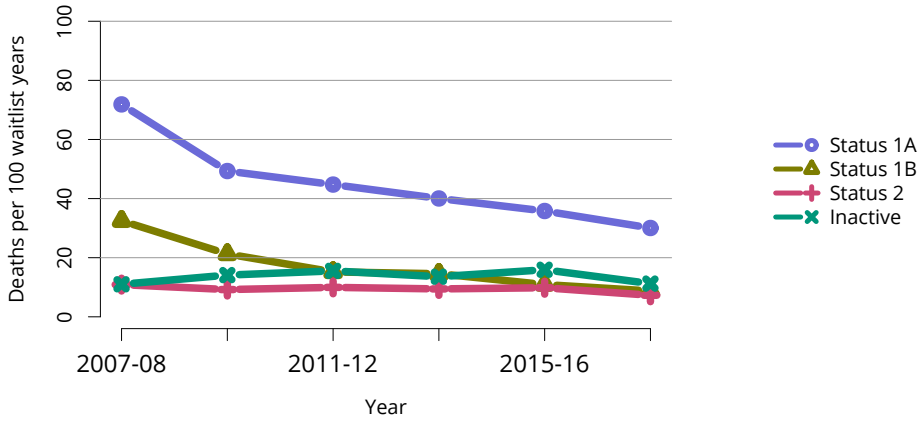

Figure HR 29. Pretransplant mortality rates among adults waitlisted for heart transplant by medical urgency. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because 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. Medical urgency is determined at the later of listing date and January 1 of the year.

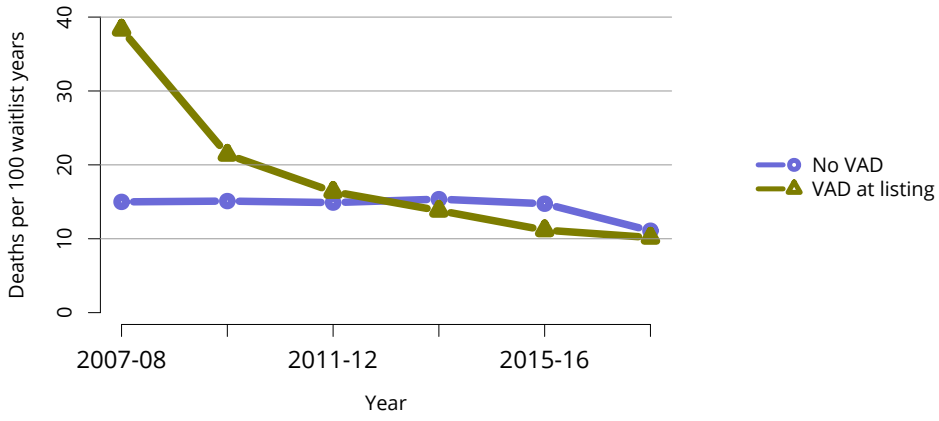

Figure HR 30. Pretransplant mortality rates among adults waitlisted for heart transplant by VAD at listing. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because 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. VAD, ventricular assist device.

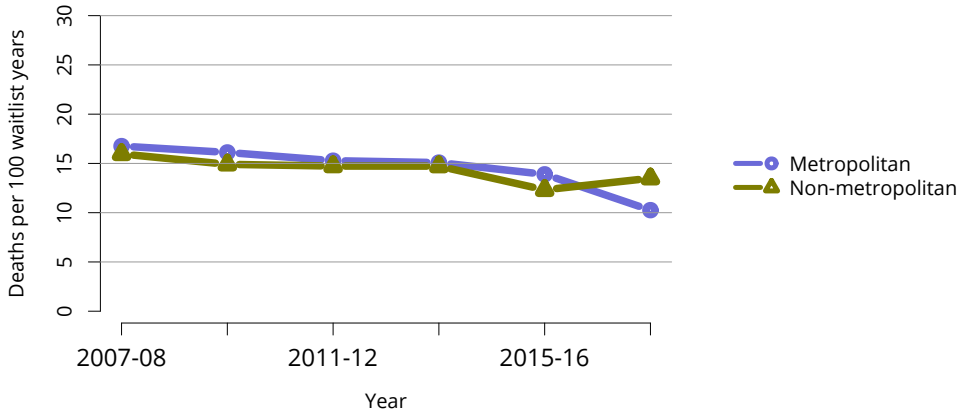

Figure HR 31. Pretransplant mortality rates among adults waitlisted for heart by metropolitan vs. non-metropolitan residence. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, 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. Urban/rural determination is made using the RUCA (Rural-Urban Commuting Area) designation of the candidate's permanent zip code.

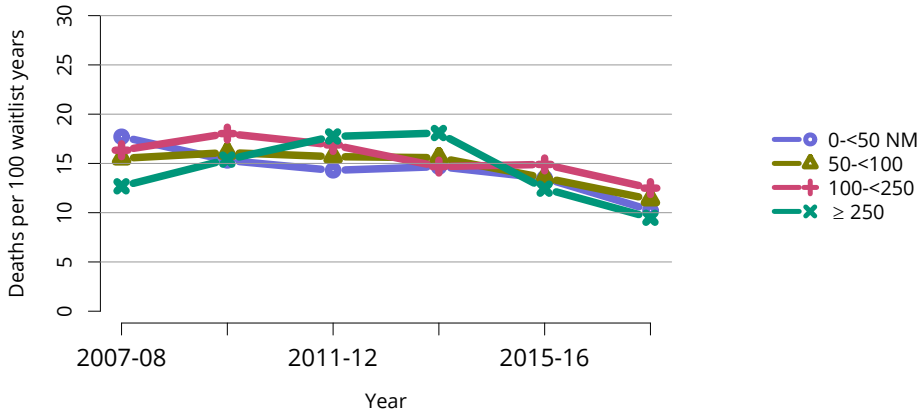

Figure HR 32. Pretransplant mortality rates among adults waitlisted for heart, by distance from listing center. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal 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 nautical miles (NM) between the zip code centroids of the candidate's listing center and candidate's permanent zip code.

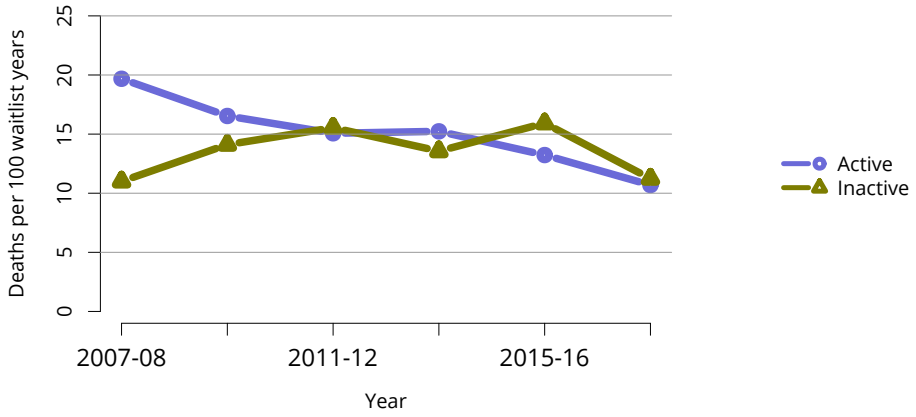

Figure HR 33. Pretransplant mortality rates among adults waitlisted for heart, by active/inactive status. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure 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.

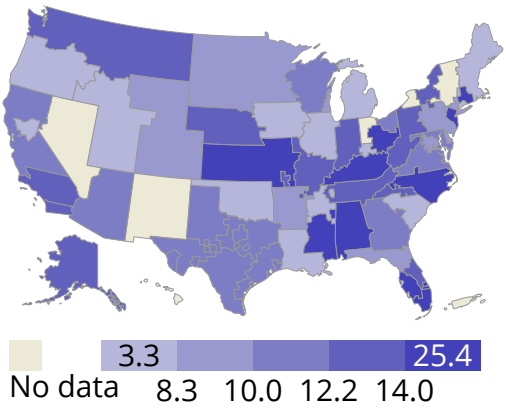

Figure HR 34. Pretransplant mortality rates among adults waitlisted for heart transplant in 2017-2018, by DSA. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the DSA. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown.

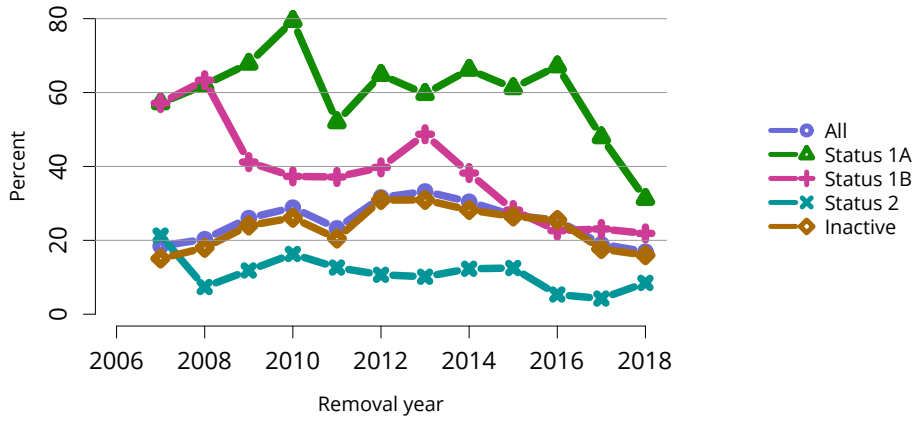

Figure HR 35. Deaths within six months after removal among adult heart waitlist candidates, by status at removal. Denominator includes only candidates removed from the waiting list for reasons other than transplant or death while on the list.

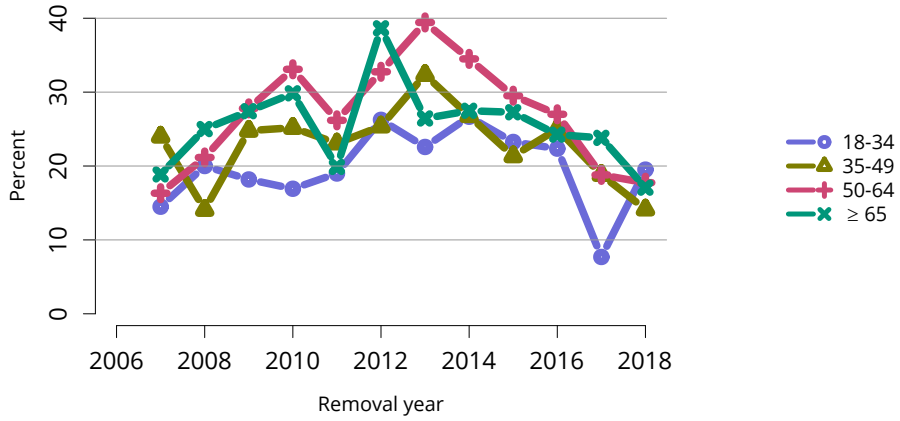

Figure HR 36. Deaths within six months after removal among adult heart waitlist candidates, by age at removal. Denominator includes only candidates removed from the waiting list for reasons other than transplant or death while on the list.

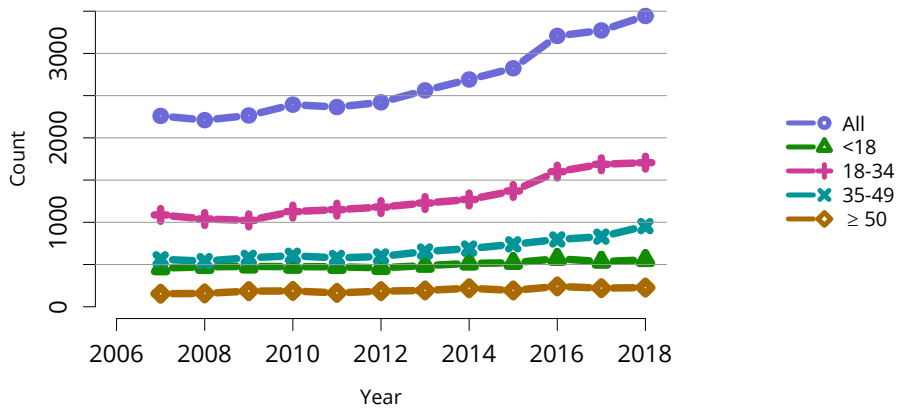

Figure HR 37. Deceased heart donor count by age. Count of deceased donors whose hearts were recovered for transplant, by age at donation.

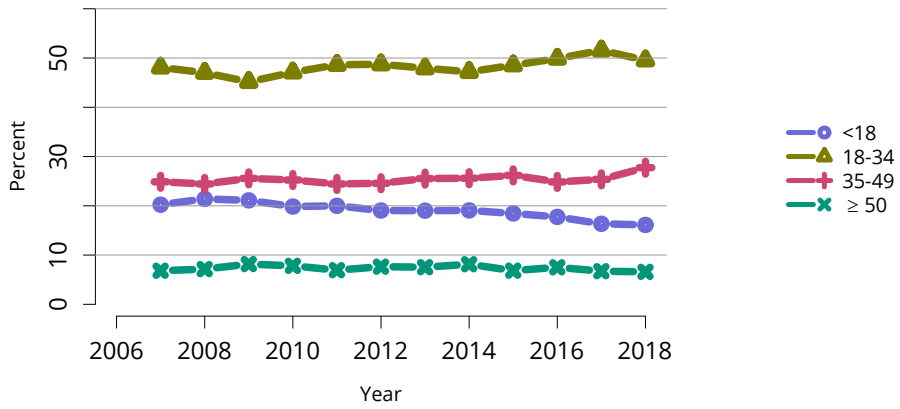

Figure HR 38. Distribution of deceased heart donors by age. Deceased donors whose hearts were recovered for transplant.

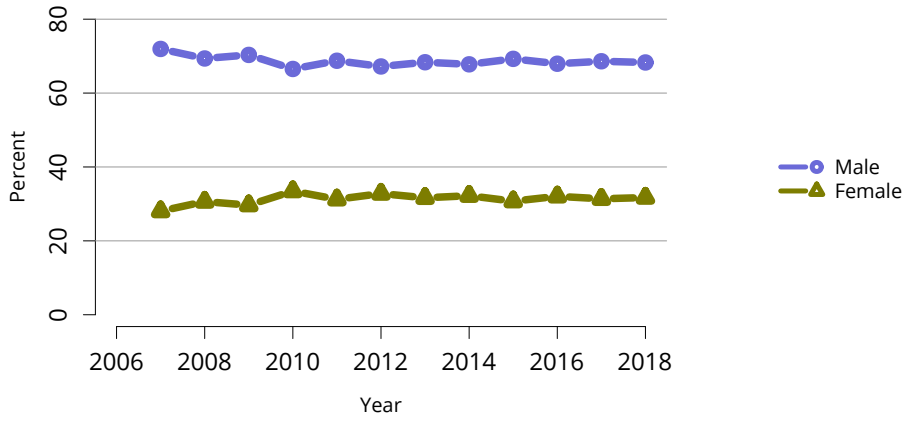

Figure HR 39. Distribution of deceased heart donors by sex. Deceased donors whose hearts were recovered for transplant.

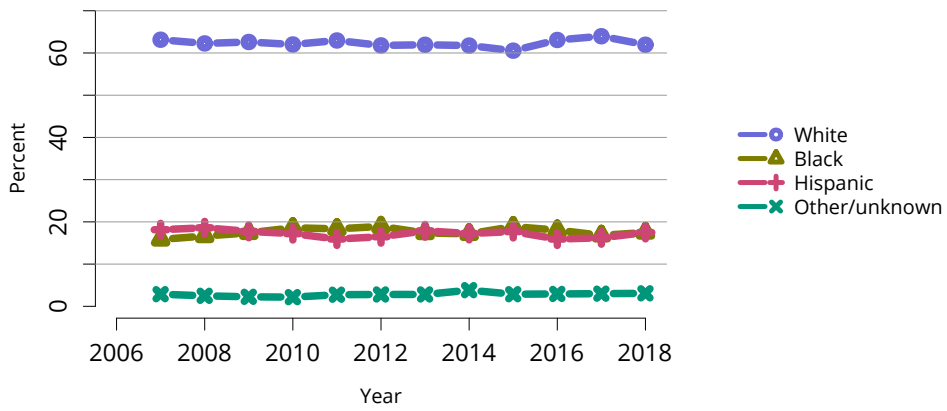

Figure HR 40. Distribution of deceased heart donors by race. Deceased donors whose hearts were recovered for transplant.

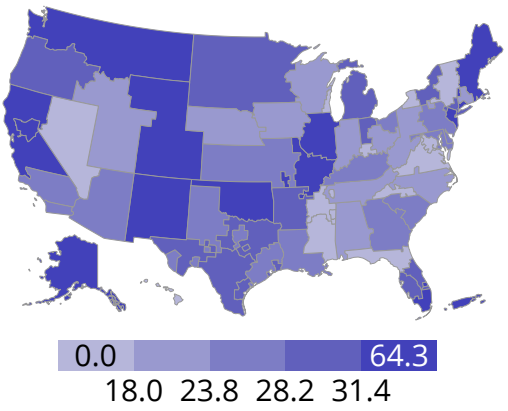

Figure HR 41. Percent of pediatric donor hearts allocated to adult recipients, by DSA of donor hospital, 2014-2018. Numerator: pediatric donor hearts donors allocated to adult recipients. Denominator: total pediatric donor hearts.

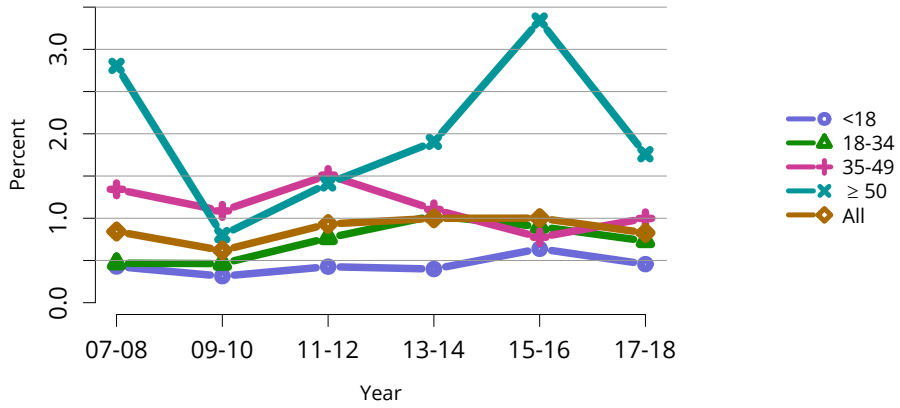

Figure HR 42. Rates of hearts recovered for transplant and not transplanted by donor age. Percentages of hearts not transplanted out of all hearts recovered for transplant.

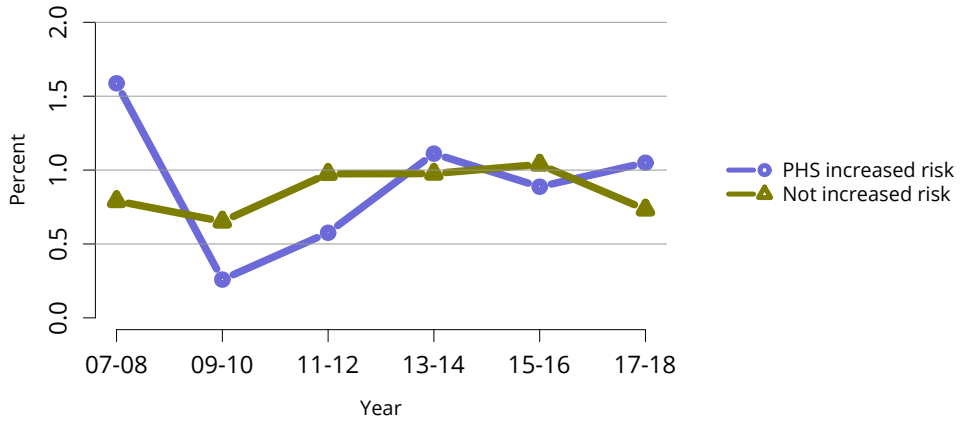

Figure HR 43. Rates of hearts recovered for transplant and not transplanted, by donor risk of disease transmission. "Increased risk" is defined by criteria from the US Public Health Service Guidelines for increased risk for HIV, hepatitis B and hepatitis C transmission.

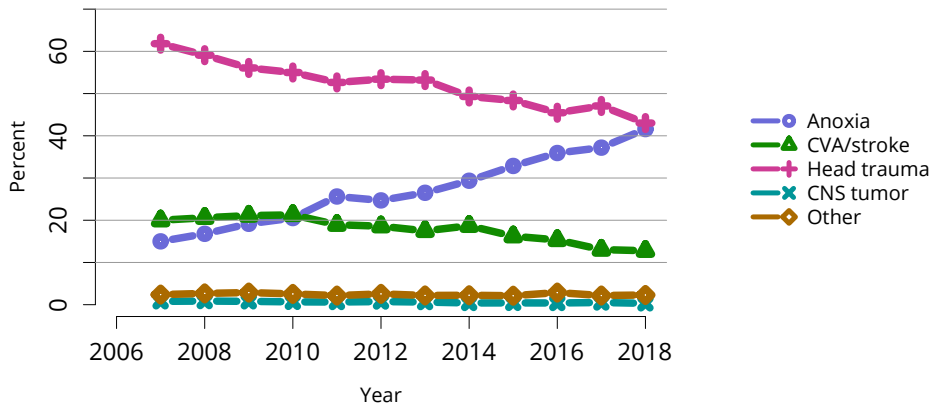

Figure HR 44. Cause of death among deceased heart donors. Deceased donors whose hearts were transplanted. CNS, central nervous system; CVA, cerebrovascular accident.

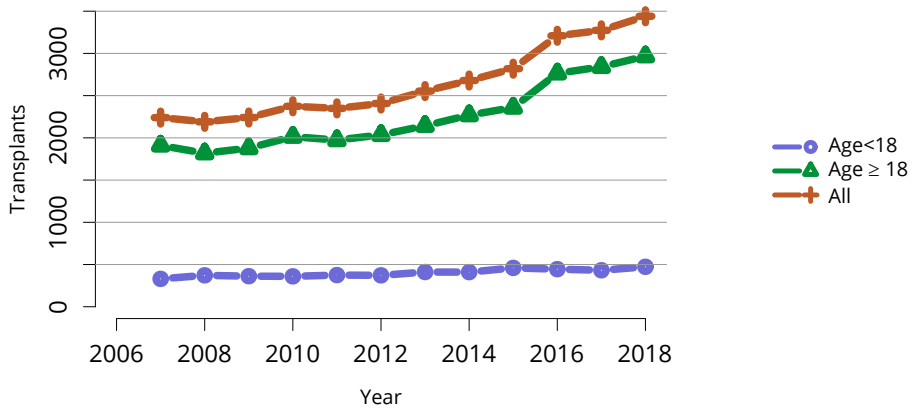

Figure HR 45. Total heart transplants. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

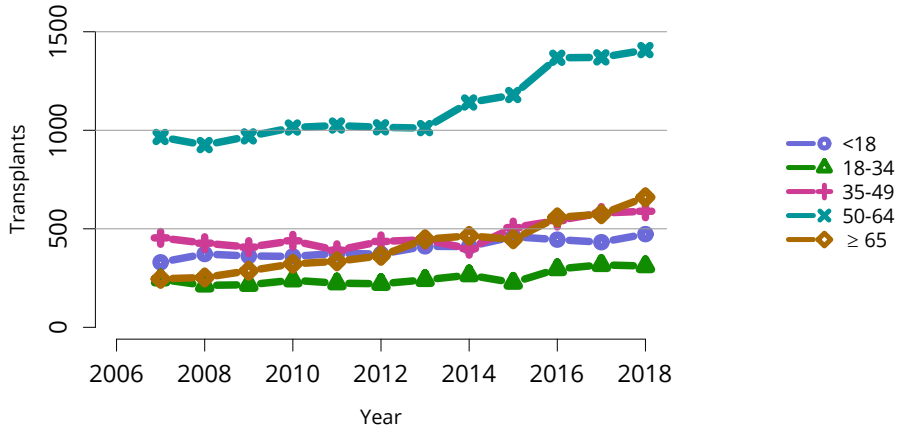

Figure HR 46. Total heart transplants by age. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

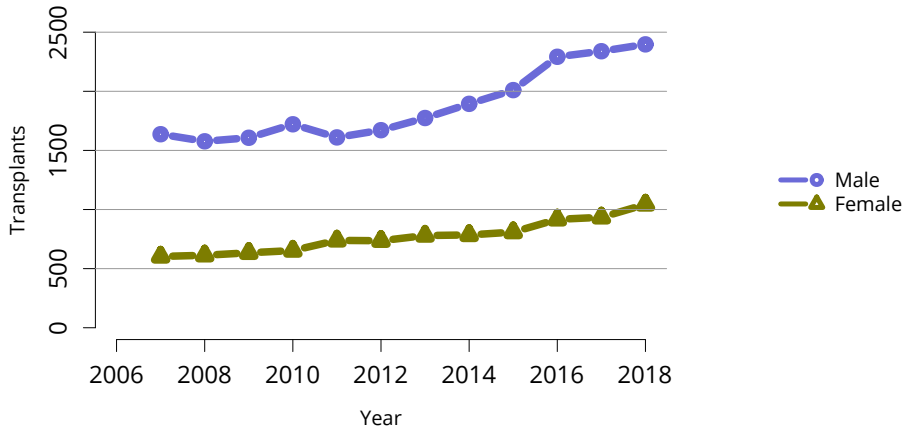

Figure HR 47. Total heart transplants by sex. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

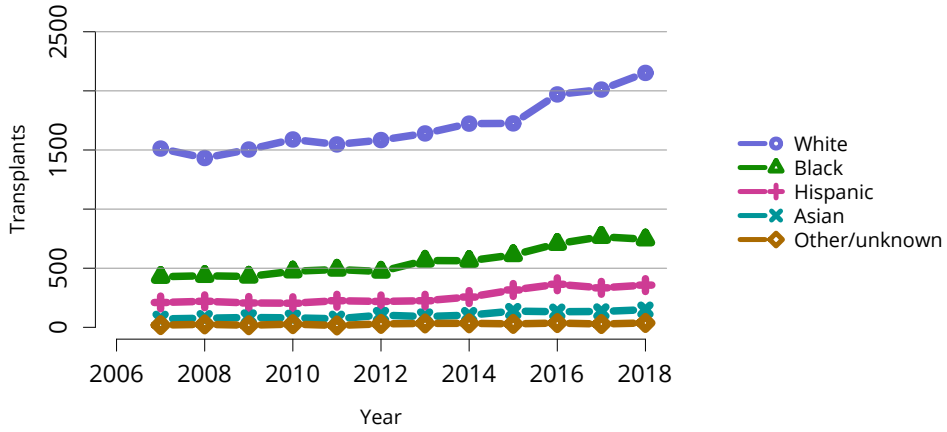

Figure HR 48. Total heart transplants by race. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients.

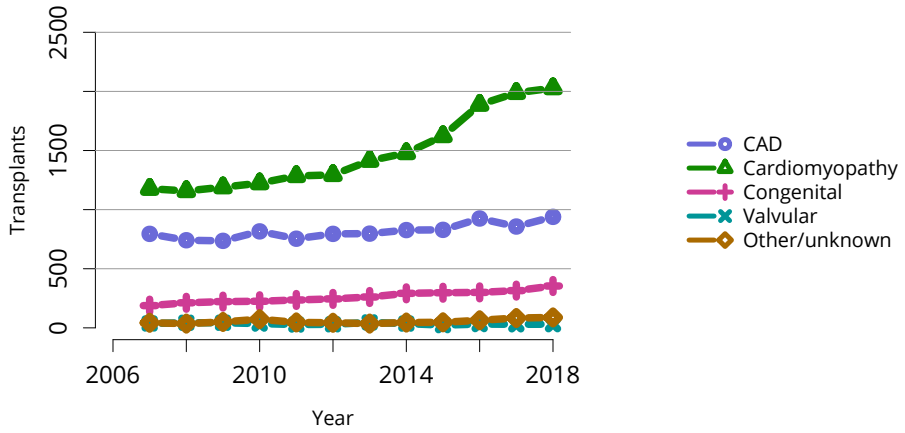

Figure HR 49. Total heart transplants by diagnosis. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients. CAD, coronary artery disease.

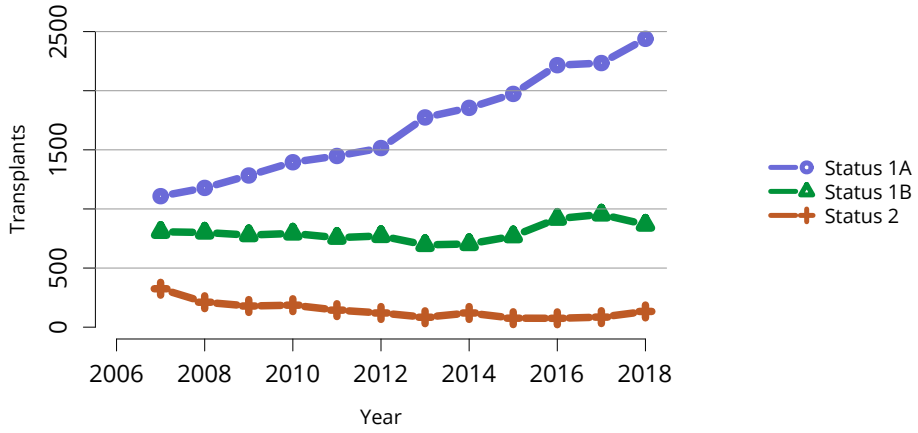

Figure HR 50. Total heart transplants by medical urgency. All heart transplant recipients, including adult and pediatric, retransplant, and multi-organ recipients. Urgency groups for recipients who underwent transplant October 18, 2018 or later were converted to former statuses.

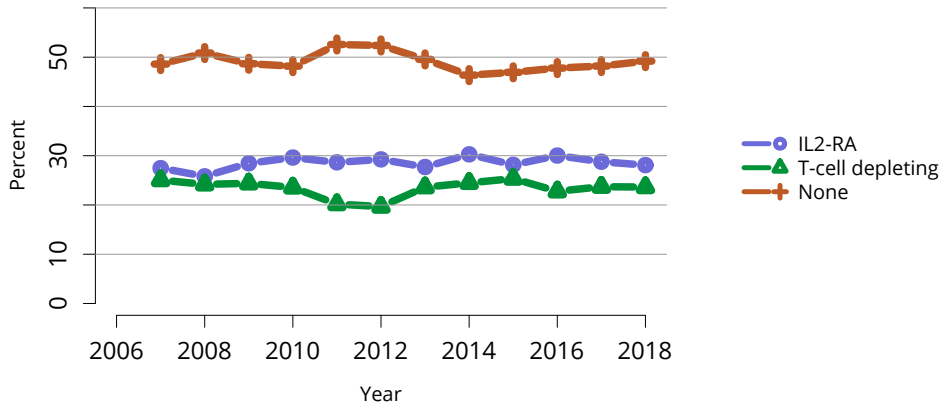

Figure HR 51. Induction agent use in adult heart transplant recipients. Immunosuppression at transplant reported to the OPTN. IL2-RA, interleukin-2 receptor antagonist.

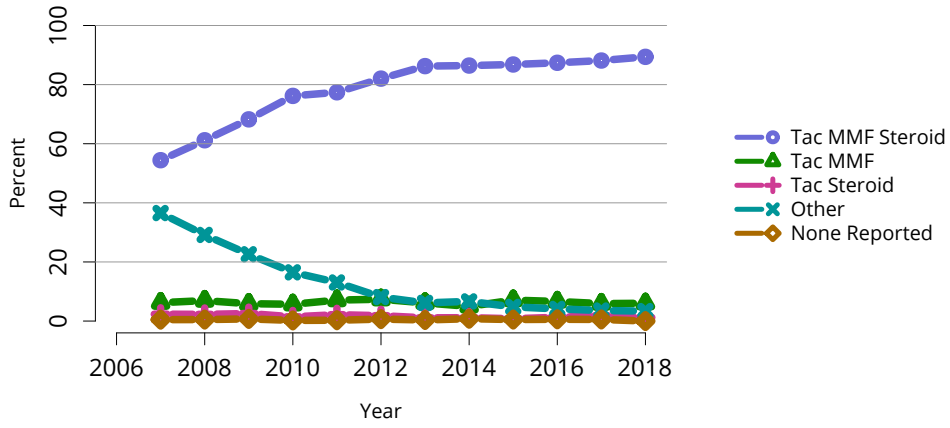

Figure HR 52. Immunosuppression regimen use in adult heart transplant recipients. Immunosuppression regimen at transplant reported to the OPTN. Tac, tacrolimus. MMF, mycophenolate mofetil.

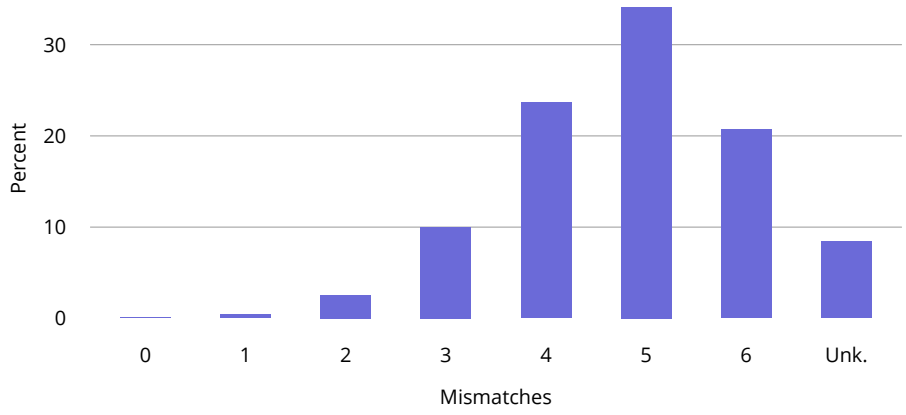

Figure HR 53. Total HLA A, B, and DR mismatches among adult deceased donor heart transplant recipients, 2014-2018. Donor and recipient antigen matching is based on OPTN antigen values and split equivalences policy as of 2018.

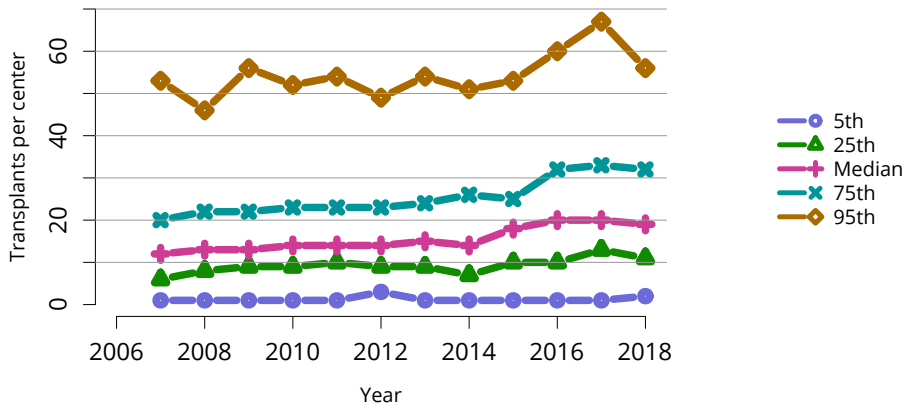

Figure HR 54. Annual adult heart transplant center volumes, by percentile. Annual volume data are limited to recipients aged 18 or older.

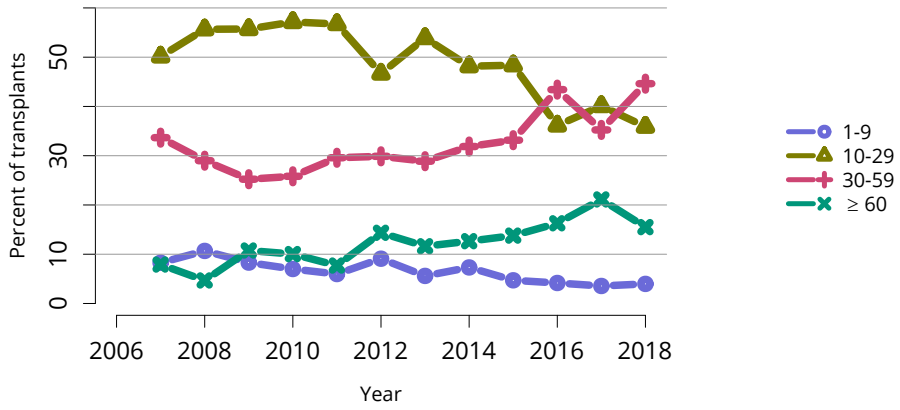

Figure HR 55. Distribution of adult heart transplants by annual center volume. Based on annual volume data among recipients aged 18 or older.

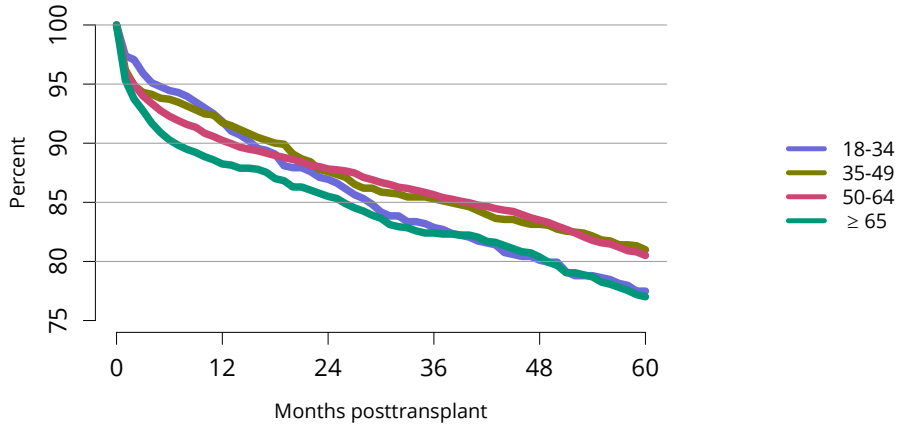

Figure HR 56. Patient survival among adult heart transplant recipients, 2011-2013, by age. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

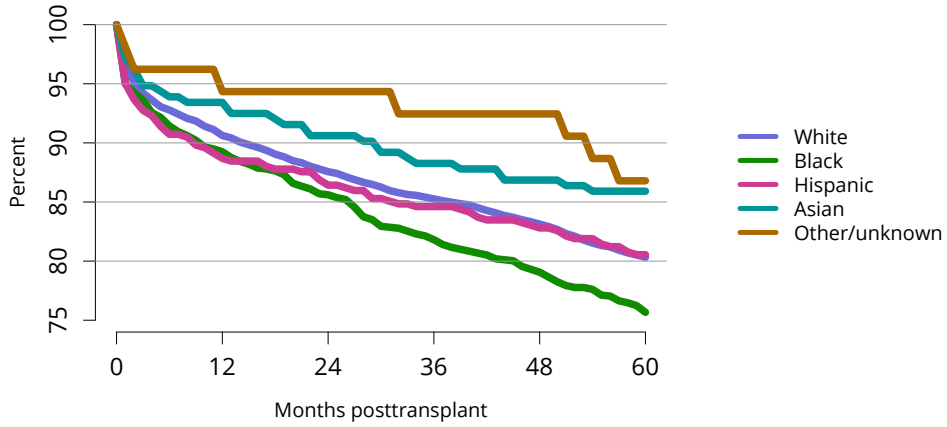

Figure HR 57. Patient survival among adult heart transplant recipients, 2011-2013, by race. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

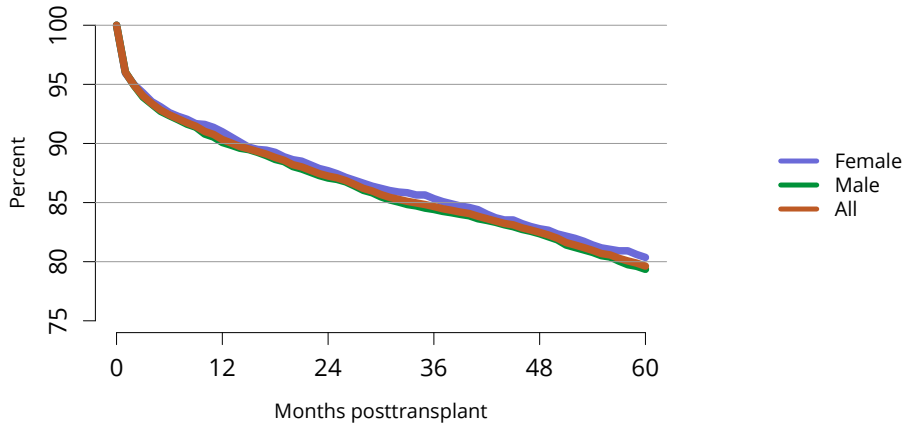

Figure HR 58. Patient survival among adult heart transplant recipients, 2011-2013, by sex. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

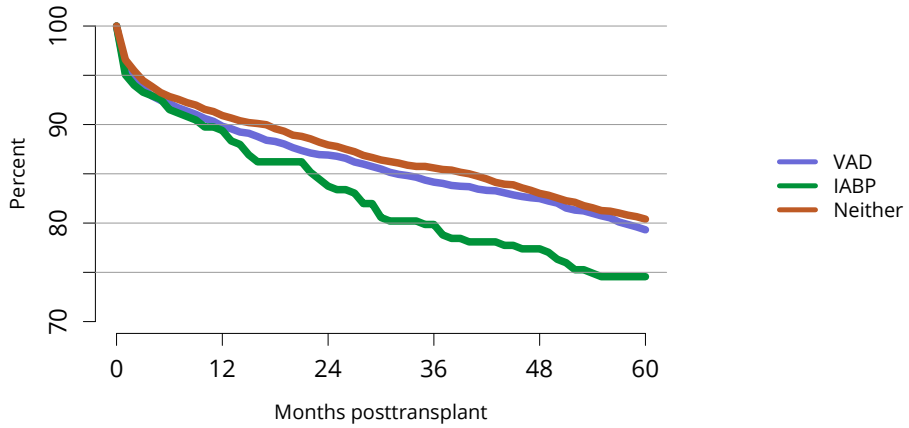

Figure HR 59. Patient survival among adult heart transplant recipients, 2011-2013, by circulatory support. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. Ventricular assist device (VAD) status at time of transplant. IABP, intra-aortic balloon pump.

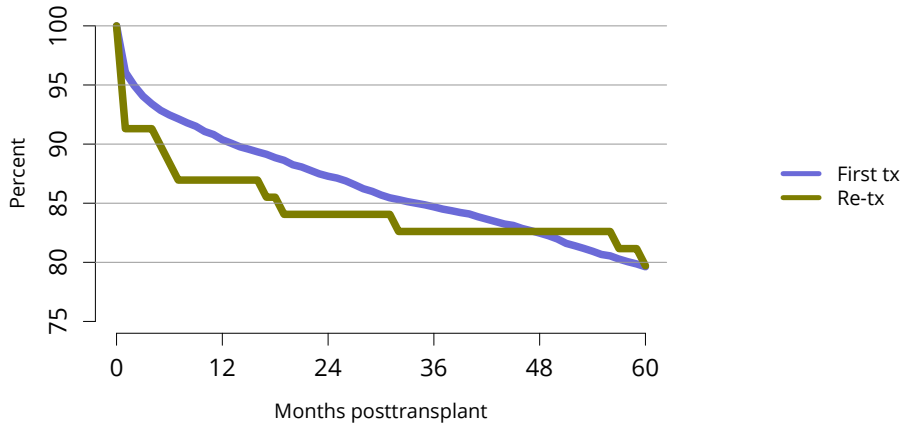

Figure HR 60. Patient survival among adult heart transplant recipients, 2011-2013, by first vs. retransplant. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

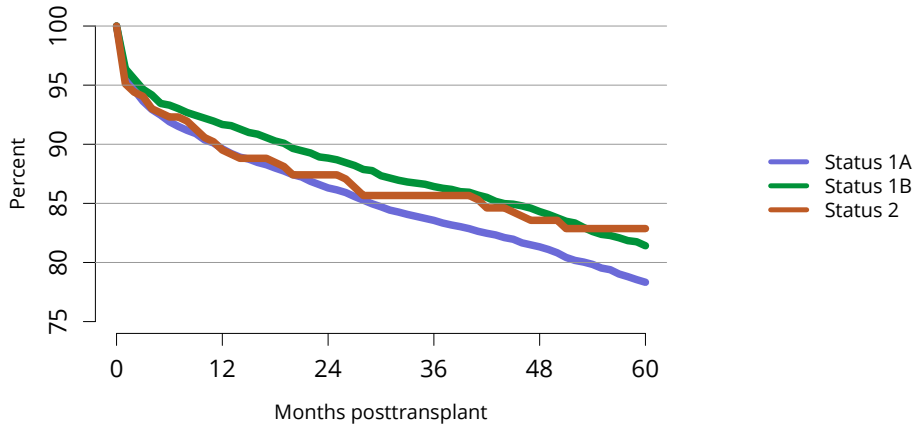

Figure HR 61. Patient survival among adult heart transplant recipients, 2011-2013, by medical urgency. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

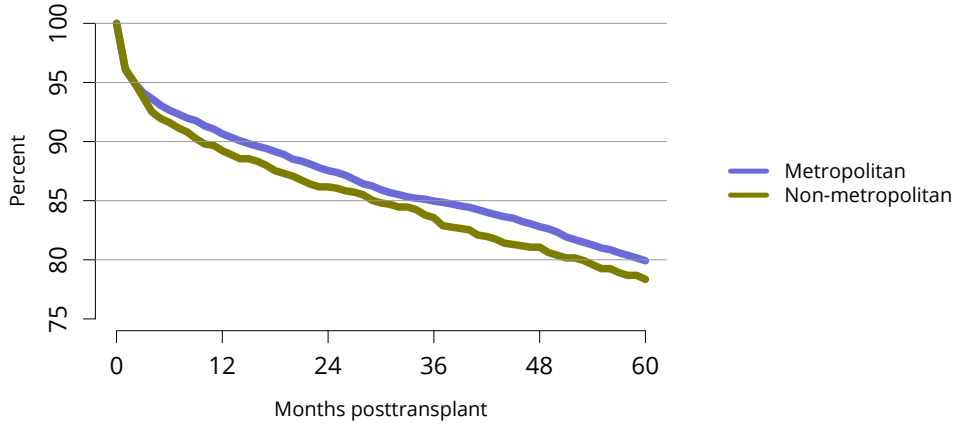

Figure HR 62. Patient survival among adult heart transplant recipients, 2011-2013, by metropolitan vs. non-metropolitan recipient residence. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered.

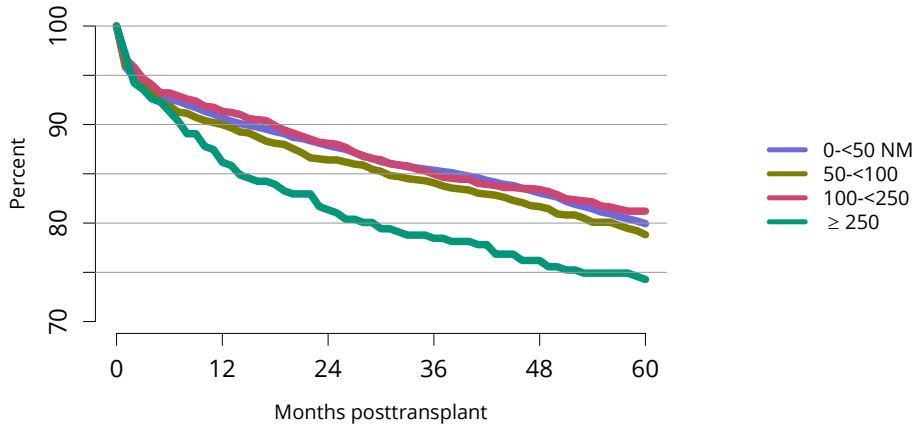

Figure HR 63. Patient survival among adult heart transplant recipients, 2011-2013, by recipients' distance from transplant center. Patient survival estimated using unadjusted Kaplan-Meier methods. For recipients of more than one transplant during the period, only the first is considered. Distance is between the zipcode centroids of the TX center and the recipient's permanent residence, measured in nautical miles (NM).

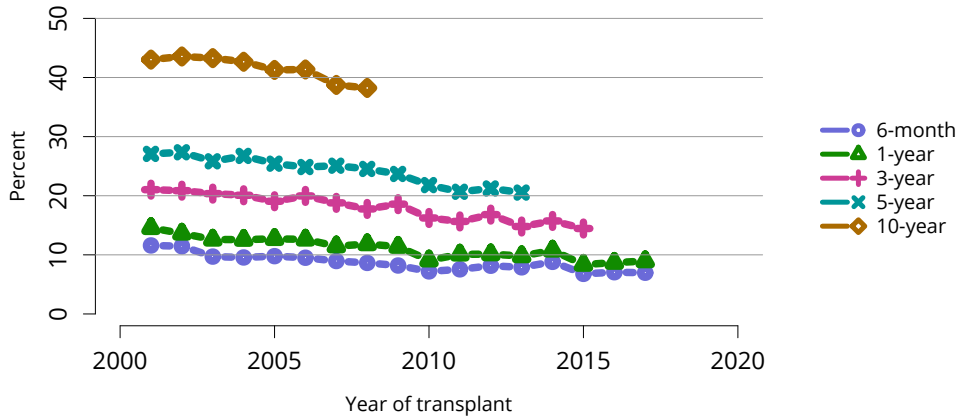

Figure HR 64. Patient death among adult heart transplant recipients. All adult recipients of deceased donor hearts, including multi-organ transplants. Patients are followed until the earlier of death or December 31, 2018.

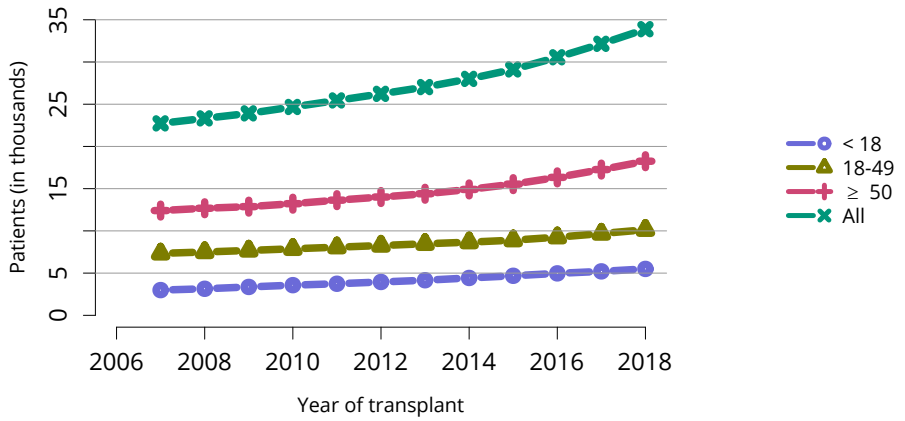

Figure HR 65. Recipients alive with a functioning heart graft on June 30 of the year, by age at transplant. Recipients are assumed to be alive with function unless a death or graft failure is recorded. A recipient may experience a graft failure and be removed from the cohort, undergo retransplant, and re-enter the cohort.

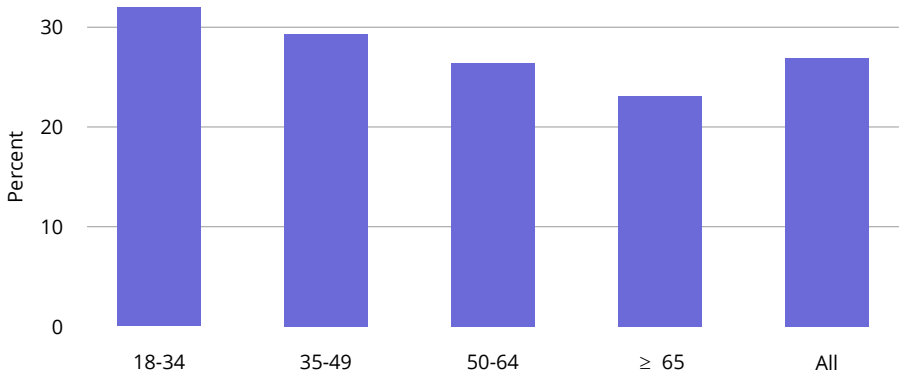

Figure HR 66. Incidence of acute rejection by 1 year posttransplant among adult heart transplant recipients by age, 2016-2017. Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

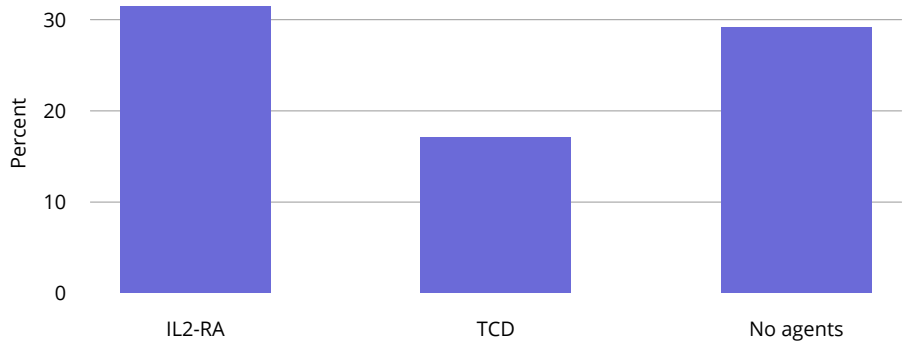

Figure HR 67. Incidence of acute rejection by 1 year posttransplant among adult heart transplant recipients by induction agent 2016-2017. Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method. If a recipient used both IL-2-RA and TCD agents, s/he will contribute to both of those cumulative incidence estimates.

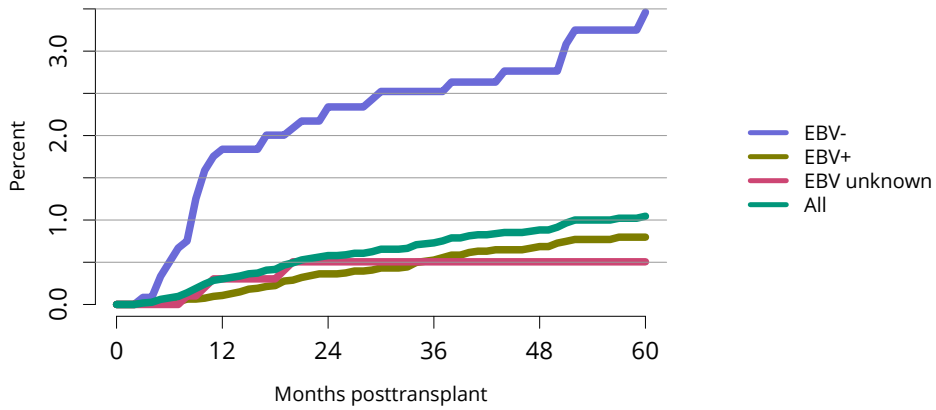

Figure HR 68. Incidence of PTLD among adult heart transplant recipients by recipient EBV status at transplant, 2012-2016. Cumulative incidence is estimated using the Kaplan-Meier competing risk method. PTLD is identified as a reported complication or cause of death on the OPTN Transplant Recipient Follow-up Form or the Posttransplant Malignancy Form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's disease. Only the earliest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus; PTLD, posttransplant lymphoproliferative disorder.

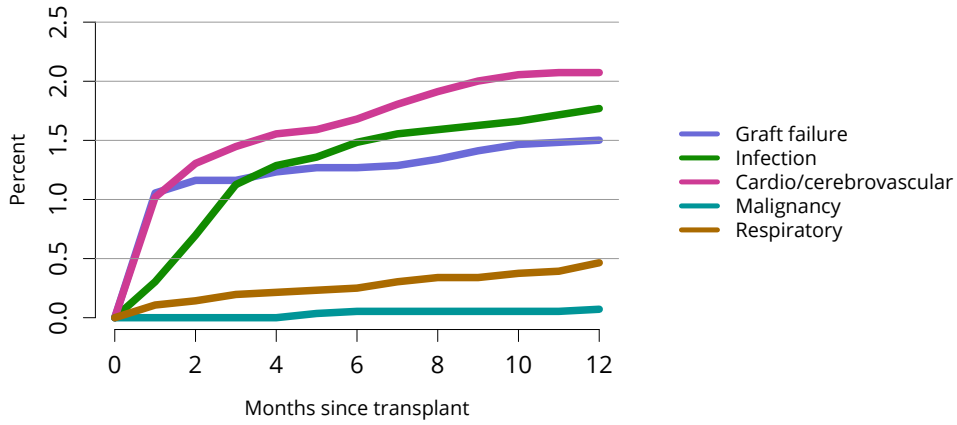

Figure HR 69. One-year cumulative incidence of death by cause among adult heart recipients, 2016-2017. Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

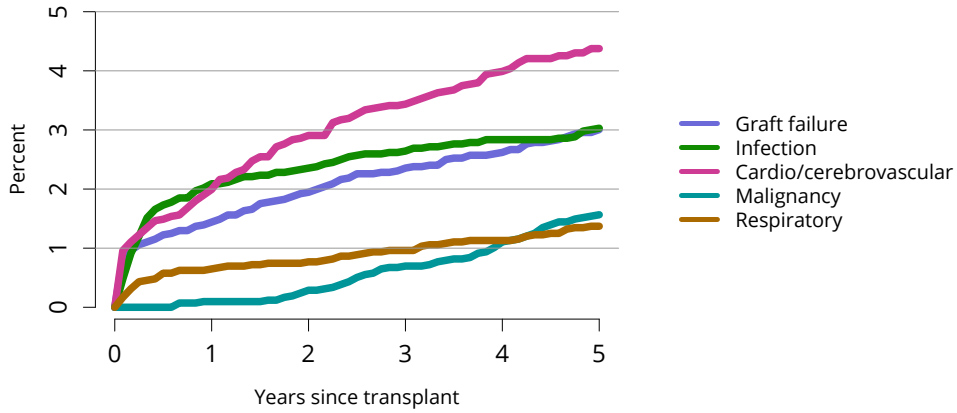

Figure HR 70. Five-year cumulative incidence of death by cause among adult heart recipients, 2012-2013. Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

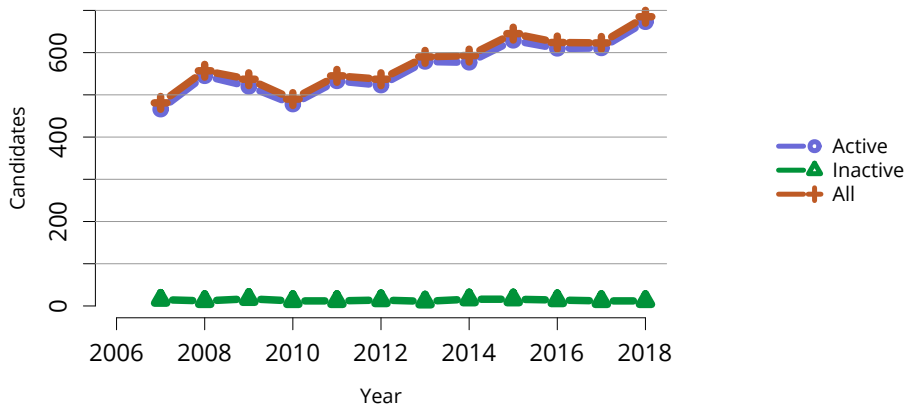

Figure HR 71. New pediatric candidates added to the heart transplant waiting list. A new candidate is one who first joined the list during the given year, without having been listed in a previous year. Previously listed candidates who underwent transplant and subsequently relisted are considered new. Candidates concurrently listed at multiple centers are counted once. Active and inactive patients are included. Age determined at listing.

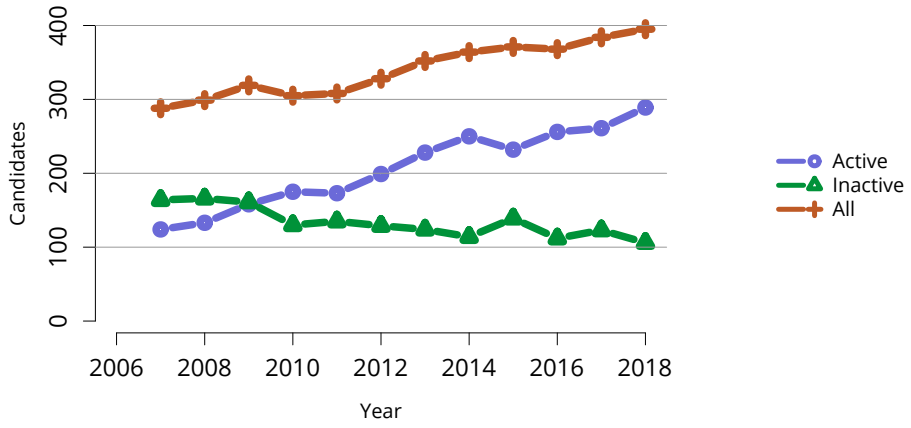

Figure HR 72. Pediatric candidates listed for heart transplant on December 31 each year. Candidates concurrently listed at multiple centers are counted once. Those with concurrent listings and active at any program are considered active.

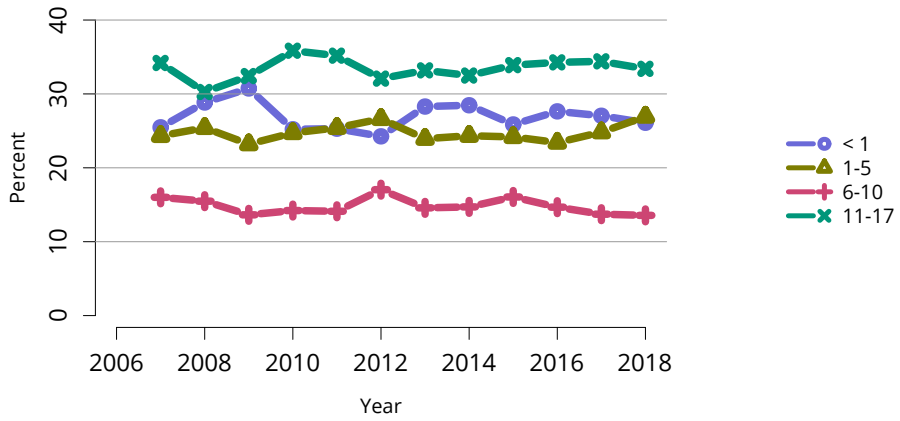

Figure HR 73. Distribution of pediatric candidates waiting for heart transplant by age. Candidates waiting for transplant at any time in the given year. Candidates listed concurrently at multiple centers are counted once. Age is determined at the later of listing date or January 1 of the given year. Active and inactive candidates are included.

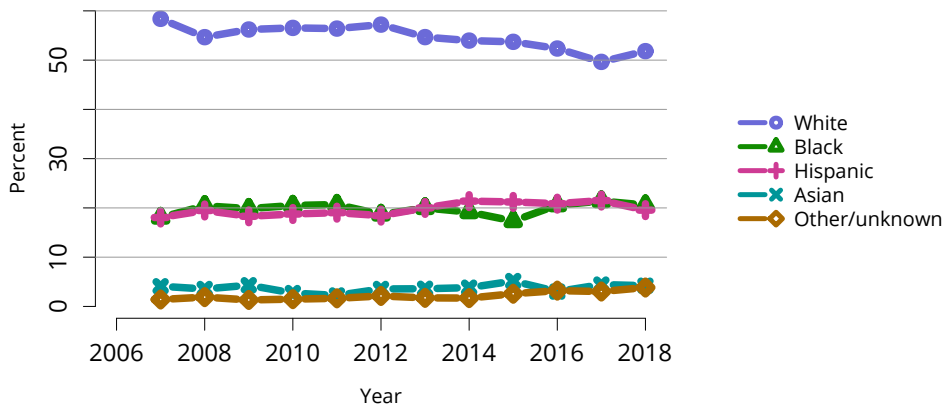

Figure HR 74. Distribution of pediatric candidates waiting for heart transplant by race. Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included.

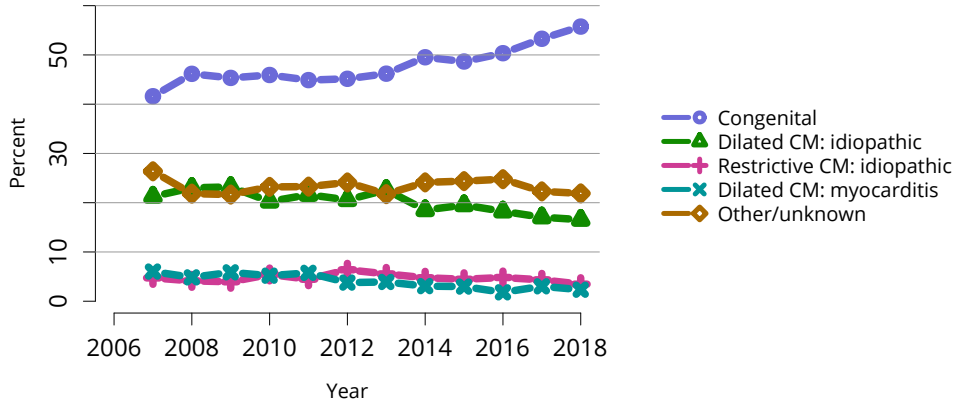

Figure HR 75. Distribution of pediatric candidates waiting for heart transplant by diagnosis. Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive candidates are included. CM, cardiomyopathy.

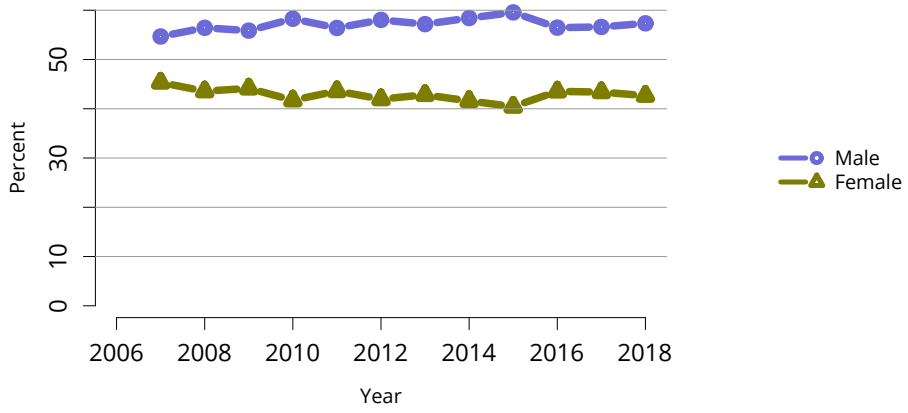

Figure HR 76. Distribution of pediatric candidates waiting for heart transplant by sex. Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Active and inactive patients are included.

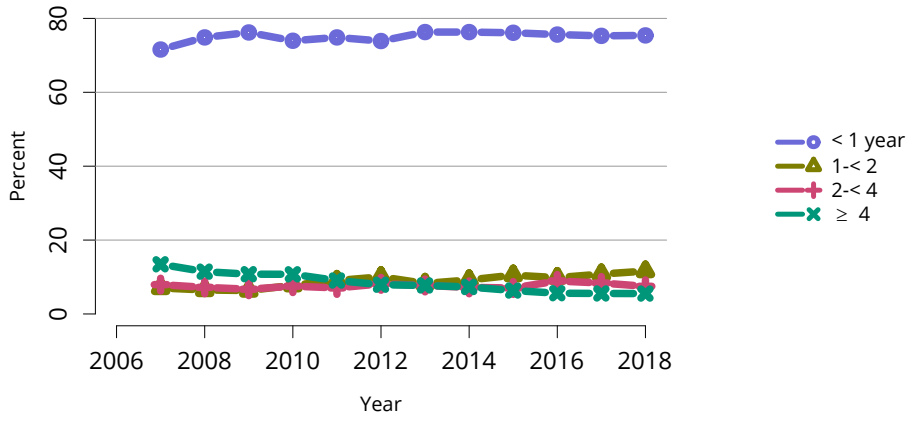

Figure HR 77. Distribution of pediatric candidates waiting for heart transplant by waiting time. Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Time on the waiting list is determined at the earlier of December 31 or removal from the waiting list. Active and inactive candidates are included.

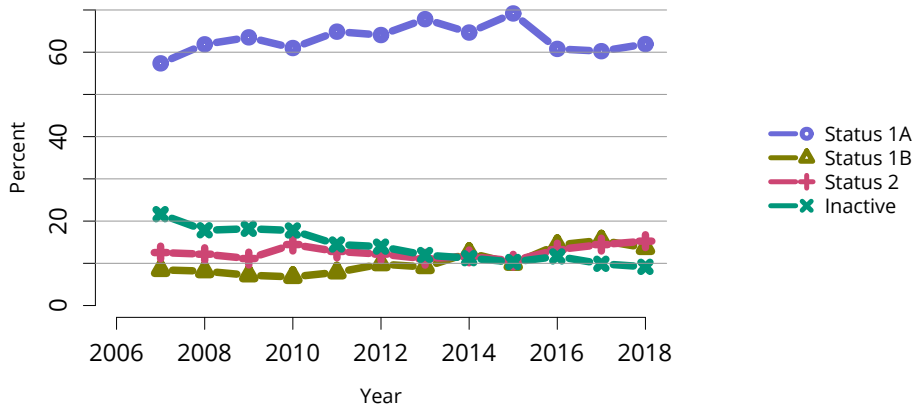

Figure HR 78. Distribution of pediatric candidates waiting for heart transplant by medical urgency. Candidates waiting for transplant any time in the given year. Candidates listed concurrently at multiple centers are counted once. Medical urgency status is the most severe during the year. Active and inactive patients are included.

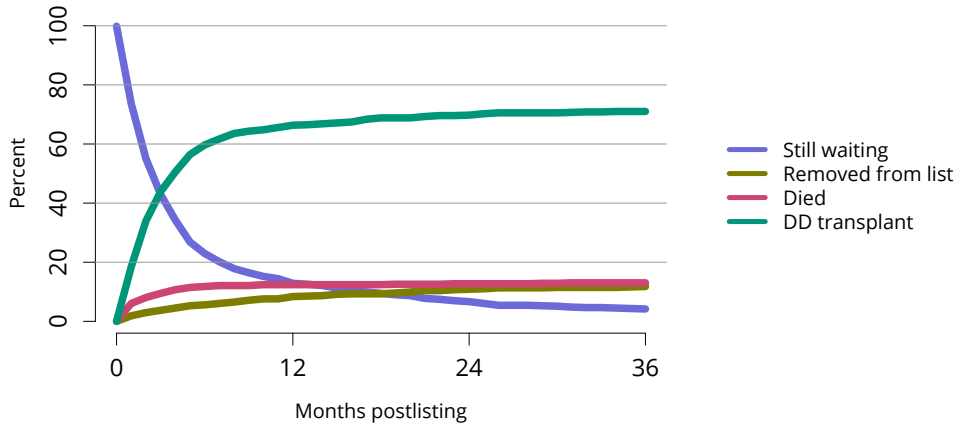

Figure HR 79. Three-year outcomes for newly listed pediatric candidates waiting for heart transplant, 2015. Pediatric candidates who joined the waitlist in 2015. Candidates concurrently listed at more than one center are counted once, from the time of earliest listing to the time of latest removal. DD, deceased donor.

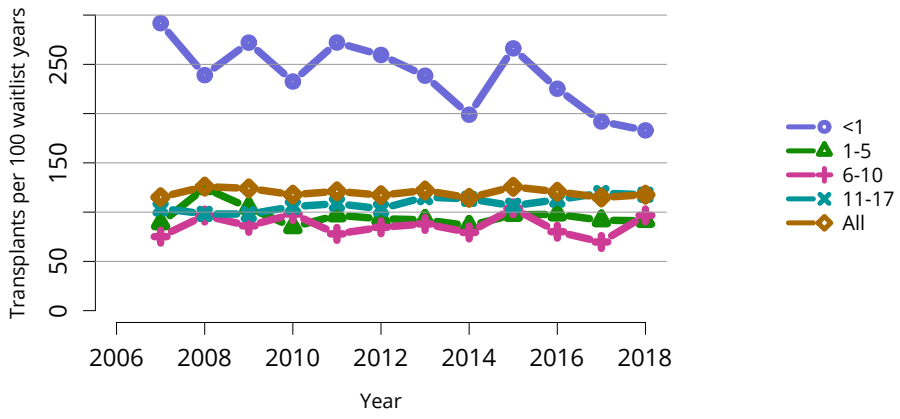

Figure HR 80. Deceased donor heart transplant rates among pediatric waitlist candidates by age. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of waiting in a given year. Individual listings are counted separately. Age is determined at the later of listing 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.

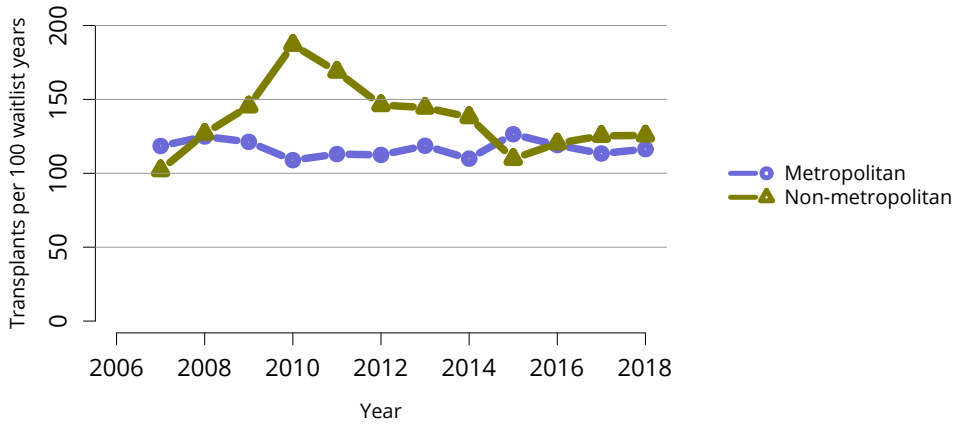

Figure HR 81. Deceased donor heart transplant rates among pediatric waitlist candidates by metropolitan vs. non-metropolitan residence. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of waiting in a given year. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

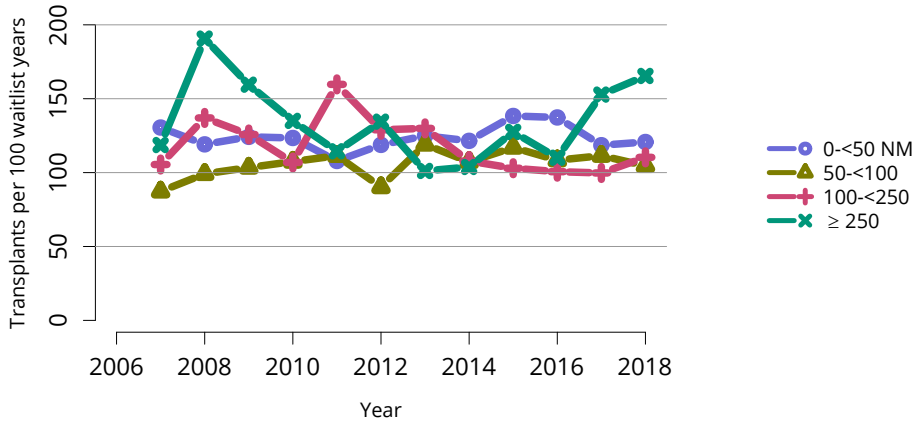

Figure HR 82. Deceased donor heart transplant rates among pediatric waitlist candidates by distance from listing center. Transplant rates are computed as the number of deceased donor transplants per 100 patient-years of waiting in a given year. Individual listings are counted separately. Rates with less 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).

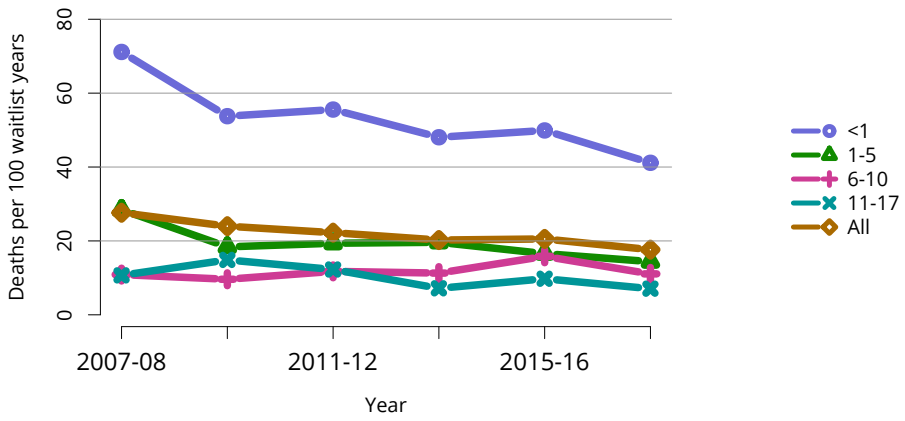

Figure HR 83. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by age. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of 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.

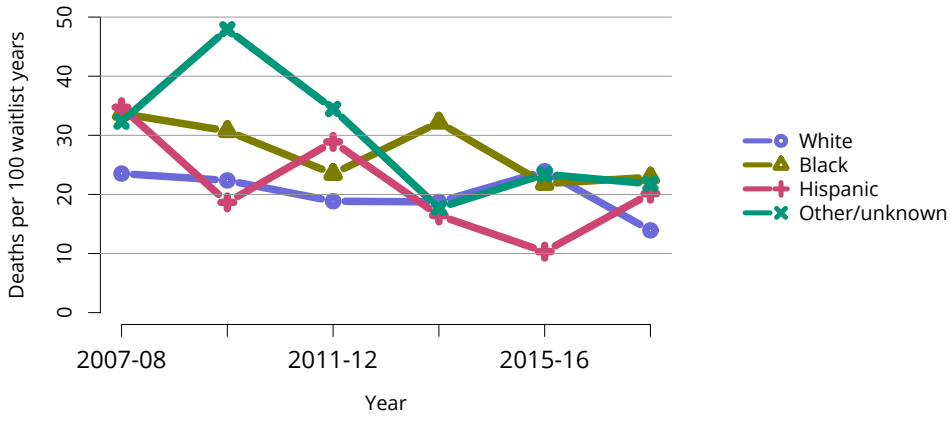

Figure HR 84. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by race. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure or fewer than 20 candidates at risk are not shown.

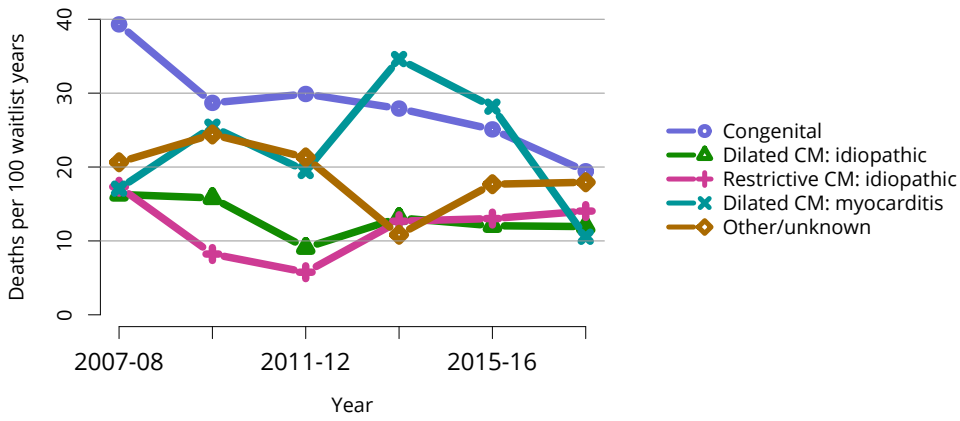

Figure HR 85. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by diagnosis. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal because of improved condition, or end of cohort. Individual listings are counted separately. Rates with less than 10 patient-years of exposure are not shown. CM, cardiomyopathy.

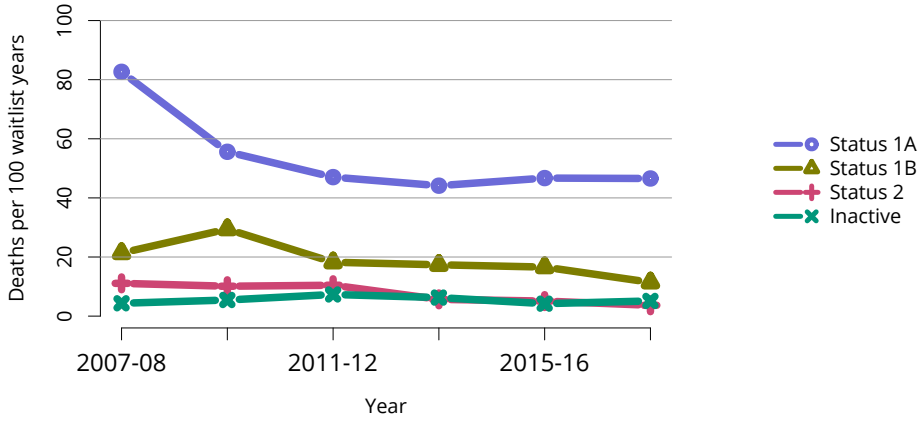

Figure HR 86. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by medical urgency. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, removal 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. Medical urgency status is determined at the later of listing date and January 1 of the given year.

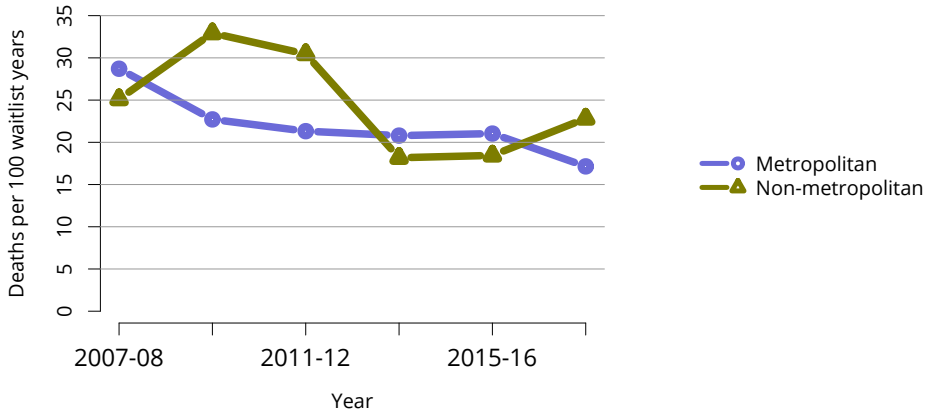

Figure HR 87. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by metropolitan vs. non-metropolitan residence. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer 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 are not shown. Urban/rural determination is made using the RUCA (Rural-Urban Commuting Area) designation of the candidate's permanent zip code.

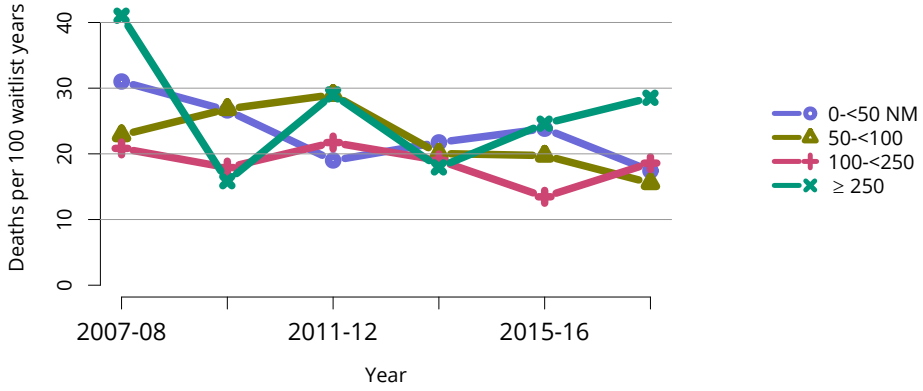

Figure HR 88. Pretransplant mortality rates among pediatrics waitlisted for heart transplant by distance from listing center. Mortality rates are computed as the number of deaths per 100 patient-years of waiting in the given year. Waiting time is censored at transplant, death, transfer to another program, 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).

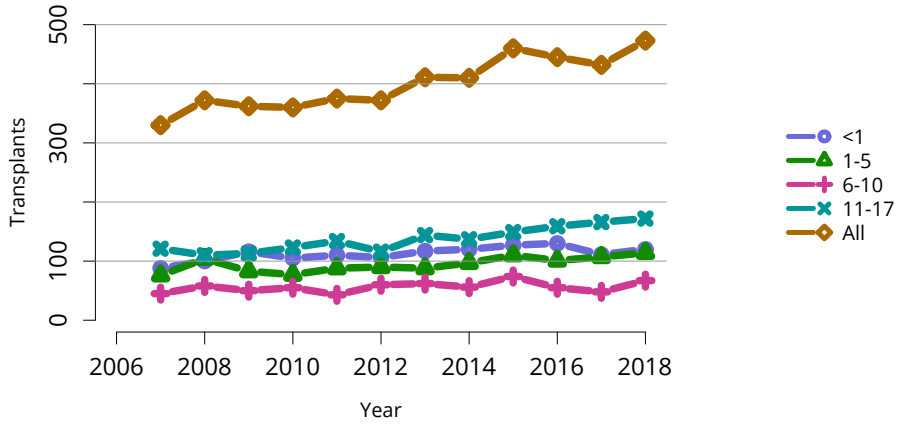

Figure HR 89. Pediatric heart transplants by recipient age. All pediatric heart transplant recipients, including retransplant and multi-organ recipients.

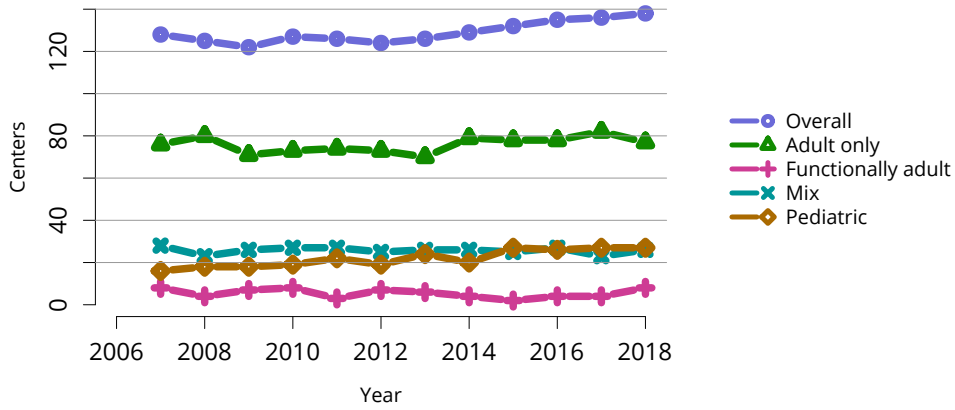

Figure HR 90. Number of centers performing pediatric and adult heart transplants by center's age mix. Adult centers transplanted only recipients aged 18 years or older. Functionally adult centers transplant 80% adults or more, and the remainder were children aged 15-17 years. Mixed included adults and children of any age groups. Child only centers transplanted recipients aged 0-17 years, and small number of adults up to age 21 years.

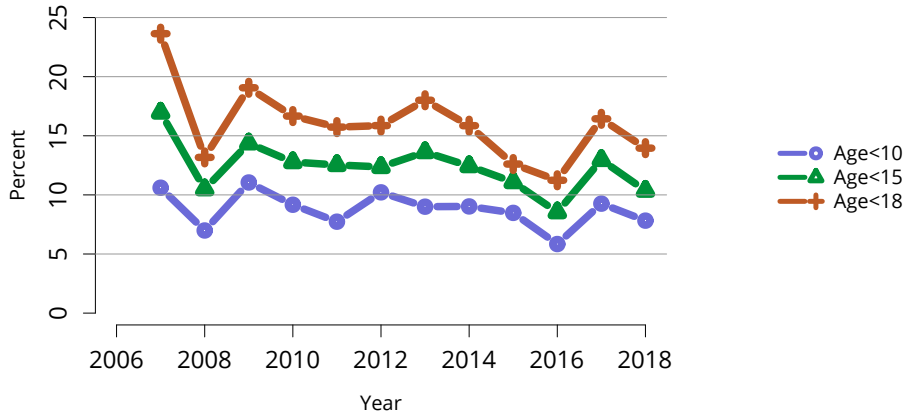

Figure HR 91. Pediatric heart recipients at programs that perform 5 or fewer pediatric transplants annually. Age groups are cumulative.

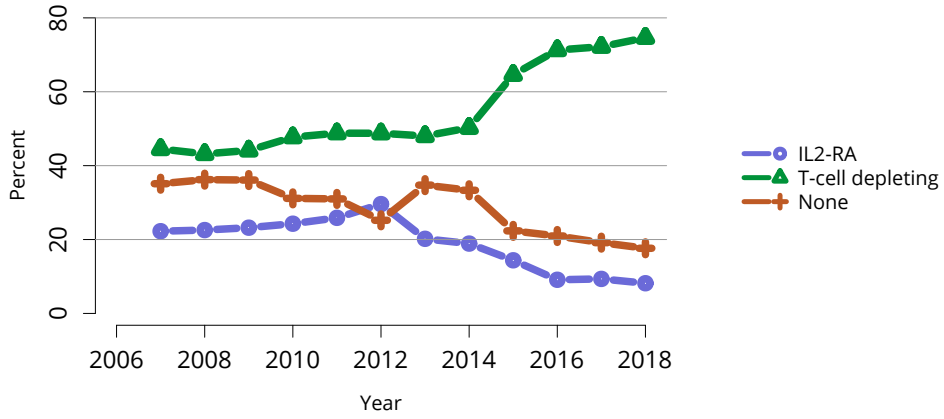

Figure HR 92. Induction agent use in pediatric heart transplant recipients. Immunosuppression at transplant reported to the OPTN. IL2-RA, interleukin-2 receptor antagonist.

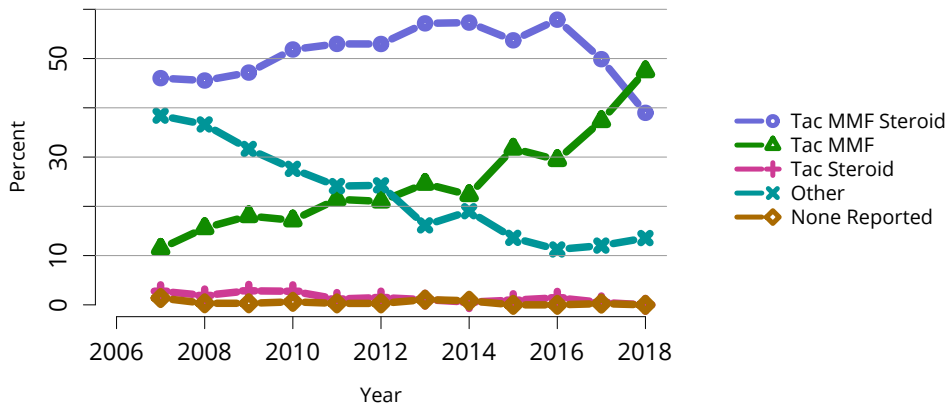

Figure HR 93. Immunosuppression regimen use in pediatric heart transplant recipients. Immunosuppression regimen at transplant reported to the OPTN. Tac, tacrolimus. MMF, mycophenolate mofetil.

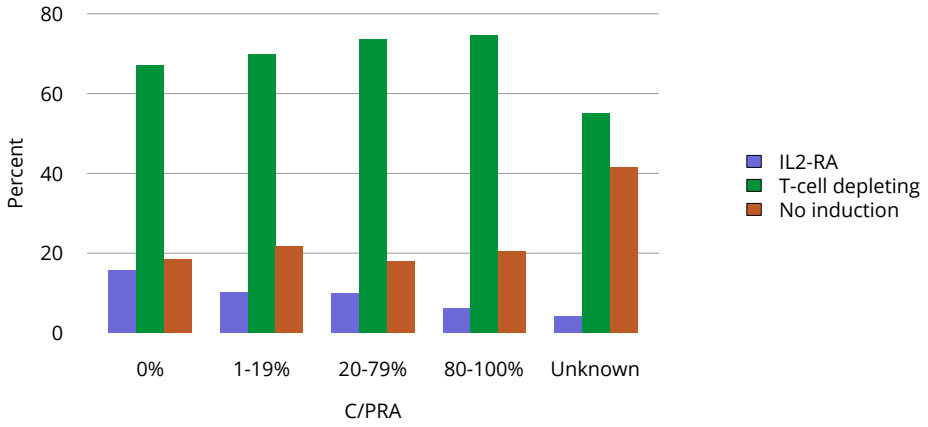

Figure HR 94. Induction use by C/PRA among pediatric heart transplant recipients, 2014-2018. Collection of calculated PRA (CPRA) began March 31, 2015. Prior to that, PRA class I and II values were used. IL2-RA, interleukin-2 receptor antagonist.

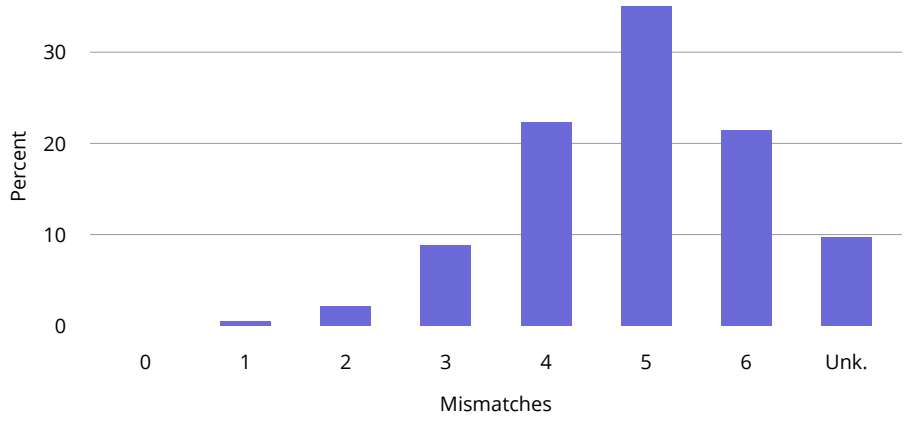

Figure HR 95. Total HLA A, B, and DR mismatches among pediatric deceased donor heart transplant recipients, 2014-2018. Donor and recipient antigen matching is based on OPTN antigen values and split equivalences policy as of 2018.

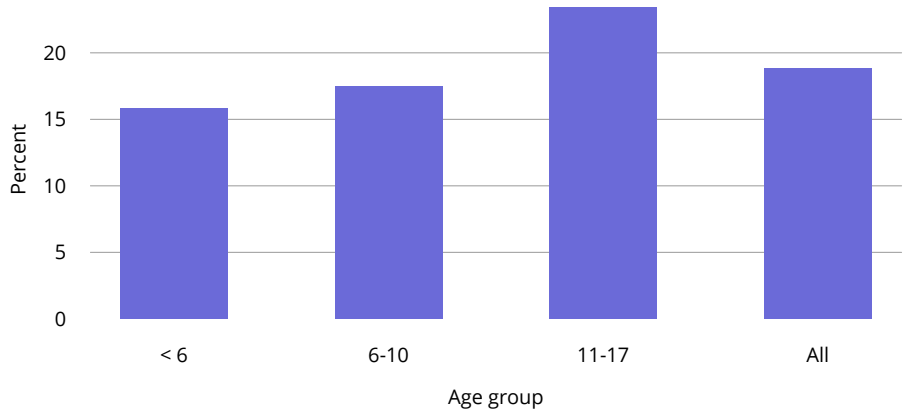

Figure HR 96. Incidence of acute rejection by 1 year posttransplant among pediatric heart transplant recipients by age, 2016-2017. Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration Form or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method.

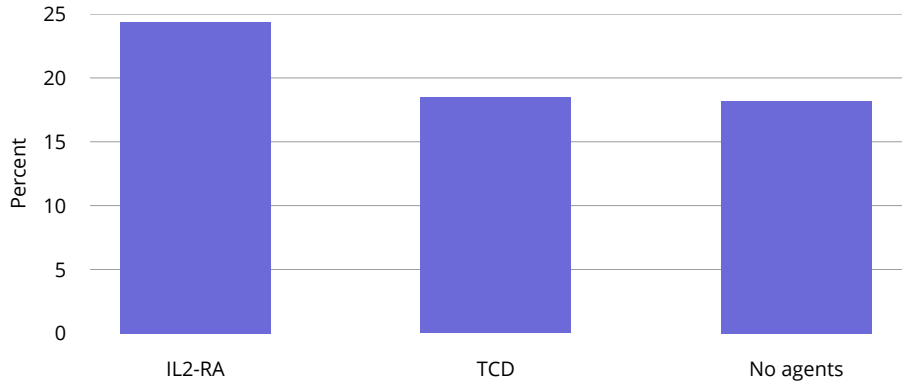

Figure HR 97. Incidence of acute rejection by 1 year posttransplant among pediatric heart transplant recipients by induction agent 2016-2017. Acute rejection is defined as a record of acute or hyperacute rejection, as reported on the OPTN Transplant Recipient Registration or Transplant Recipient Follow-up Form. Only the first rejection event is counted. Cumulative incidence is estimated using the Kaplan-Meier competing risk method. If a recipient used both IL-2-RA and TCD agents, s/he will contribute to both of those cumulative incidence estimates.

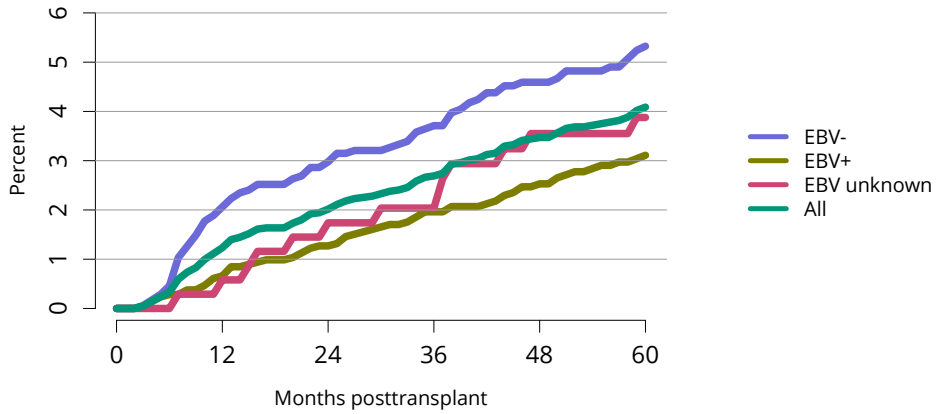

Figure HR 98. Incidence of PTLD among pediatric heart transplant recipients by recipient EBV status at transplant, 2006-2016. Cumulative incidence is estimated using the Kaplan-Meier competing risk method. Posttransplant lymphoproliferative disorder (PTLD) is identified as a reported complication or cause of death on the OPTN Transplant Recipient Follow-up Form or on the Posttransplant Malignancy Form as polymorphic PTLD, monomorphic PTLD, or Hodgkin's disease. Only the earliest date of PTLD diagnosis is considered. EBV, Epstein-Barr virus.

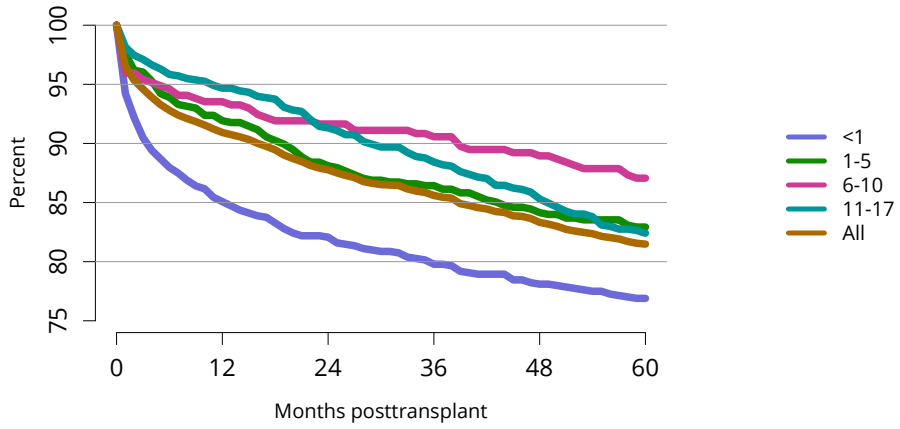

Figure HR 100. Patient survival among pediatric deceased donor heart transplant recipients, 2006-2013, by age. Recipient survival estimated using unadjusted Kaplan-Meier methods.

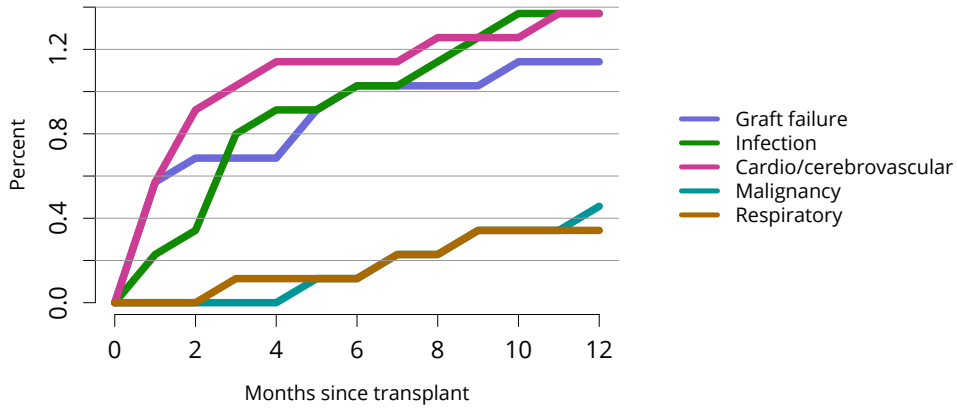

Figure HR 101. One-year cumulative incidence of death by cause among pediatric heart recipients, 2016-2017. Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

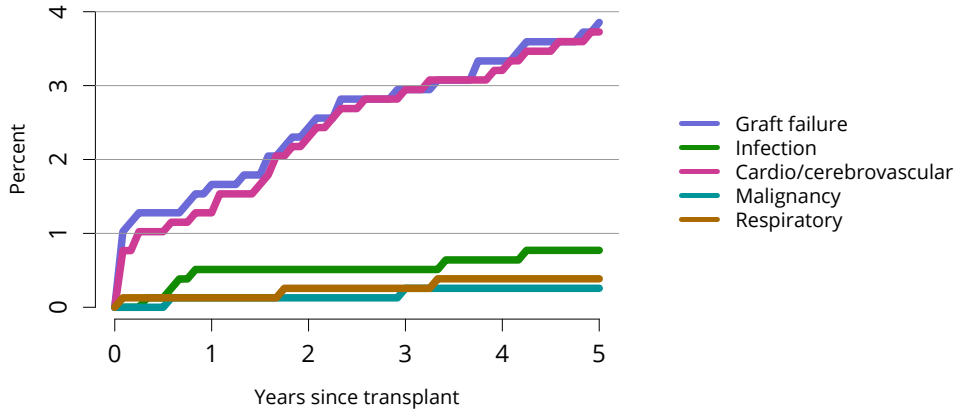

Figure HR 102. Five-year cumulative incidence of death by cause among pediatric heart recipients, 2012-2013. Primary cause of death is as reported on the OPTN Transplant Recipient Registration and Follow-up Forms. Other causes of death include hemorrhage, trauma, nonadherence, unspecified other, unknown, etc. Cumulative incidence is estimated using Kaplan-Meier competing risk methods.

Characteristic	2008		2018	
	N	Percent	N	Percent
Age				
18-34 years	267	10.8%	376	11.0%
35-49 years	564	22.9%	784	23.0%
50-64 years	1241	50.3%	1671	49.1%
≥ 65 years	394	16.0%	573	16.8%
Sex				
Female	599	24.3%	825	24.2%
Male	1867	75.7%	2579	75.8%
Race/ethnicity				
White	1807	73.3%	2080	61.1%
Black	447	18.1%	903	26.5%
Hispanic	163	6.6%	304	8.9%
Asian	37	1.5%	93	2.7%
Other/unknown	12	0.5%	24	0.7%
Geography				
Metropolitan	1998	81.0%	2910	85.5%
Non-metro	468	19.0%	494	14.5%
Distance				
< 50 miles	1388	56.3%	2114	62.1%
50-<100 miles	437	17.7%	543	16.0%
100-<150 miles	248	10.1%	325	9.5%
150-<250 miles	185	7.5%	219	6.4%
≥ 250 miles	181	7.3%	184	5.4%
Unknown	27	1.1%	19	0.6%
All candidates	2466	100.0%	3404	100.0%

Table HR 1 Demographic characteristics of adults on the heart transplant waiting list on December 31, 2008 and December 31, 2018. 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.

Characteristic	2008		2018	
	N	Percent	N	Percent
Diagnosis				
Coronary artery disease	1033	41.9%	1034	30.4%
Cardiomyopathy	1083	43.9%	1999	58.7%
Congenital disease	146	5.9%	174	5.1%
Valvular disease	50	2.0%	34	1.0%
Other/unknown	154	6.2%	163	4.8%
Blood type				
A	779	31.6%	1015	29.8%
B	230	9.3%	369	10.8%
AB	31	1.3%	66	1.9%
O	1426	57.8%	1954	57.4%
VAD at listing	243	9.9%	1166	34.3%
All candidates	2466	100.0%	3404	100.0%

Table HR 2 Clinical characteristics of adults on the heart transplant waiting list on December 31, 2008 and December 31, 2018. Candidates waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed. VAD, ventricular assist device.

Characteristic	2008		2018	
	N	Percent	N	Percent
Transplant history				
First	2359	95.7%	3305	97.1%
Retransplant	107	4.3%	99	2.9%
Wait time				
< 1 year	1240	50.3%	1772	52.1%
1-< 2 years	417	16.9%	725	21.3%
2-< 3 years	216	8.8%	365	10.7%
3-< 4 years	110	4.5%	210	6.2%
4-< 5 years	89	3.6%	145	4.3%
≥ 5 years	394	16.0%	187	5.5%
Tx type				
Heart only	2286	92.7%	3118	91.6%
Heart-kidney	84	3.4%	206	6.1%
Heart-lung	78	3.2%	42	1.2%
Other	18	0.7%	38	1.1%
All candidates	2466	100.0%	3404	100.0%

Table HR 3 Listing characteristics of adults on the heart transplant waiting list on December 31, 2008 and December 31, 2018. Candidates waiting for transplant on December 31 of the given year, regardless of first listing date; multiple listings are collapsed.

Status	2017		2018	
	N	Percent	N	Percent
Former status 1A	379	10.7%	0	0.0%
Former status 1B	1555	44.0%	0	0.0%
Former status 2	795	22.5%	0	0.0%
New status 1	0	0.0%	7	0.2%
New status 2	0	0.0%	64	1.9%
New status 3	0	0.0%	207	6.1%
New status 4	0	0.0%	1627	47.8%
New status 5	0	0.0%	86	2.5%
New status 6	0	0.0%	605	17.8%
Inactive	802	22.7%	808	23.7%
All	3531	100.0%	3404	100.0%

Table HR 4 Status of adults on the heart waiting list on December 31, 2017 and December 31, 2018. Candidates waiting for transplant on December 31, 2017, and December 31, 2018, regardless of first listing date. Allocation by status 1-6 was implemented October 18, 2018.

Waiting list state	2016	2017	2018
Patients at start of year	3790	3629	3522
Patients added during year	3629	3769	3883
Patients removed during year	3783	3867	4001
Patients at end of year	3636	3531	3404

Table HR 5 Heart transplant waitlist activity among adults. 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.

Removal reason	2016	2017	2018
Deceased donor transplant	2734	2811	2940
Patient died	324	290	268
Patient refused transplant	25	27	26
Improved, transplant not needed	187	176	180
Too sick for transplant	261	290	272
Other	251	271	315

Table HR 6 Removal reason among adult heart transplant candidates. Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

Support	2013		2018	
	N	Percent	N	Percent
Any life support	1791	83.6%	2402	81.0%
Left ventricular assist device	953	44.5%	1295	43.6%
Intravenous inotropes	797	37.2%	979	33.0%
Intra-aortic balloon pump	123	5.7%	270	9.1%
Right ventricular assist device	73	3.4%	46	1.6%
Total artificial heart	55	2.6%	31	1.0%
Prostaglandins	27	1.3%	4	0.1%
Ventilator	17	0.8%	30	1.0%
Extra corporeal membrane oxygenation	15	0.7%	58	2.0%
Inhaled NO	3	0.1%	5	0.2%

Table HR 7 Adult heart recipients on circulatory support before transplant. Patients may have more than one type of circulatory support.

Characteristic	2008 N	2008 Percent	2018 N	2018 Percent
Age				
18-34 years	213	11.7%	311	10.5%
35-49 years	427	23.5%	589	19.9%
50-64 years	925	50.9%	1407	47.4%
≥ 65 years	253	13.9%	660	22.2%
Sex				
Female	454	25.0%	839	28.3%
Male	1364	75.0%	2128	71.7%
Race/ethnicity				
White	1248	68.6%	1906	64.2%
Black	352	19.4%	654	22.0%
Hispanic	149	8.2%	261	8.8%
Asian	55	3.0%	122	4.1%
Other/unknown	14	0.8%	24	0.8%
Insurance				
Private	978	53.8%	1348	45.4%
Medicare	548	30.1%	1120	37.7%
Medicaid	229	12.6%	365	12.3%
Other government	45	2.5%	97	3.3%
Unknown	18	1.0%	37	1.2%
Geography				
Metropolitan	1496	82.3%	2498	84.2%
Non-metro	322	17.7%	469	15.8%
Distance				
< 50 miles	1105	60.8%	1816	61.2%
50-<100 miles	290	16.0%	470	15.8%
100-<150 miles	176	9.7%	273	9.2%
150-<250 miles	131	7.2%	199	6.7%
≥ 250 miles	105	5.8%	151	5.1%
Unknown	11	0.6%	58	2.0%
All recipients	1818	100.0%	2967	100.0%

Table HR 8 Demographic characteristics of adult heart transplant recipients, 2008 and 2018. Heart transplant recipients, including retransplants. Distance is computed from recipient's home zip code to the transplant center.

Characteristic	2008		2018	
	N	Percent	N	Percent
Diagnosis				
Coronary artery disease	735	40.4%	932	31.4%
Cardiomyopathy	962	52.9%	1823	61.4%
Congenital disease	51	2.8%	117	3.9%
Valvular disease	41	2.3%	29	1.0%
Other/unknown	29	1.6%	66	2.2%
Blood type				
A	754	41.5%	1144	38.6%
B	267	14.7%	485	16.3%
AB	100	5.5%	144	4.9%
O	697	38.3%	1194	40.2%
On VAD	519	28.5%	1370	46.2%
CPRA				
< 1%	1146	63.0%	1339	45.1%
1-< 20%	314	17.3%	334	11.3%
20-< 80%	223	12.3%	480	16.2%
80-< 98%	48	2.6%	107	3.6%
98-100%	17	0.9%	47	1.6%
Unknown	70	3.9%	660	22.2%
All recipients	1818	100.0%	2967	100.0%

Table HR 9 Clinical characteristics of adult heart transplant recipients, 2008 and 2018. Heart transplant recipients, including retransplants. Ventricular assist device (VAD) information is from the OPTN Transplant Recipient Registration Form and includes left VAD, right VAD, total artificial heart, and left + right VAD. Collection of calculated PRA (CPRA) began March 31, 2015. Prior to that, PRA class I and II values were used.

Characteristic	2008		2018	
	N	Percent	N	Percent
Wait time				
< 31 days	615	33.8%	858	28.9%
31-60 days	297	16.3%	431	14.5%
61-90 days	171	9.4%	278	9.4%
3-< 6 months	331	18.2%	443	14.9%
6-< 12 months	231	12.7%	413	13.9%
1-< 2 years	115	6.3%	312	10.5%
≥ 2 years	58	3.2%	232	7.8%
Transplant history				
First	1755	96.5%	2873	96.8%
Retransplant	63	3.5%	94	3.2%
Tx type				
Heart only	1723	94.8%	2697	90.9%
Heart-lung	20	1.1%	25	0.8%
Heart-kidney	63	3.5%	202	6.8%
Heart-liver	9	0.5%	38	1.3%
Other	3	0.2%	5	0.2%
All recipients	1818	100.0%	2967	100.0%

Table HR 10 Transplant characteristics of adult heart transplant recipients, 2008 and 2018. Heart transplant recipients, including retransplants.

Status	2017		2018	
	N	Percent	N	Percent
Former status 1A	313	66.3%	1	0.2%
Former status 1B	146	30.9%	0	0.0%
Former status 2	13	2.8%	0	0.0%
New status 1	0	0.0%	36	7.9%
New status 2	0	0.0%	176	38.6%
New status 3	0	0.0%	130	28.5%
New status 4	0	0.0%	91	20.0%
New status 5	0	0.0%	1	0.2%
New status 6	0	0.0%	21	4.6%
All	472	100.0%	456	100.0%

Table HR 11 Status of adult heart transplant recipients, November-December 2017 and 2018. Allocation by status 1-6 was implemented October 18, 2018.

Donor	Recipient	CMV	EBV	HIV
D-	R-	17.5%	0.9%	97.1%
D-	R+	20.2%	6.8%	0.4%
D-	R unk	0.9%	0.5%	2.2%
D+	R-	24.9%	8.8%	0.0%
D+	R+	35.0%	77.2%	0.0%
D+	R unk	0.9%	5.5%	0.0%
D unk	R-	0.3%	0.0%	0.3%
D unk	R+	0.3%	0.2%	0.0%
D unk	R unk	0.0%	0.0%	0.0%

Table HR 12 Adult heart donor-recipient serology matching, 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; HIV, human immunodeficiency virus.

Characteristic	2008 N	2008 Percent	2018 N	2018 Percent
Age				
< 1 year	47	18.7%	49	14.0%
1-5 years	79	31.3%	131	37.5%
6-10 years	56	22.2%	73	20.9%
11-17 years	70	27.8%	96	27.5%
Sex				
Female	115	45.6%	145	41.5%
Male	137	54.4%	204	58.5%
Race/ethnicity				
White	142	56.3%	191	54.7%
Black	53	21.0%	63	18.1%
Hispanic	51	20.2%	69	19.8%
Asian	4	1.6%	8	2.3%
Other/unknown	2	0.8%	18	5.2%
Geography				
Metropolitan	217	86.1%	285	81.7%
Non-metro	35	13.9%	64	18.3%
Distance				
< 50 miles	126	50.0%	190	54.4%
50-<100 miles	50	19.8%	54	15.5%
100-<150 miles	26	10.3%	43	12.3%
150-<250 miles	23	9.1%	38	10.9%
≥ 250 miles	23	9.1%	19	5.4%
Unknown	4	1.6%	5	1.4%
All candidates	252	100.0%	349	100.0%

Table HR 13 Demographic characteristics of pediatric candidates on the heart transplant waiting list on December 31, 2008 and December 31, 2018. Candidates aged younger than 18 years waiting for transplant on December 31 of given year, regardless of first listing date; multiple listings are collapsed. Age calculated at snapshot. Candidates listed as children who turned 18 before the cohort date are excluded. Distance is computed from candidate's home zip code to the transplant center.

Characteristic	2008 N	2008 Percent	2018 N	2018 Percent
Diagnosis				
Congenital defect	121	48.0%	217	62.2%
Idiopathic dilated CM	60	23.8%	44	12.6%
Familial dilated CM	2	0.8%	9	2.6%
Idiopathic restrictive CM	10	4.0%	9	2.6%
Myocarditis	14	5.6%	8	2.3%
Other/unknown	45	17.9%	62	17.8%
Blood type				
A	74	29.4%	108	30.9%
B	35	13.9%	45	12.9%
AB	4	1.6%	9	2.6%
O	139	55.2%	187	53.6%
Medical urgency				
Status 1A	57	22.6%	96	27.5%
Status 1B	20	7.9%	70	20.1%
Status 2	49	19.4%	100	28.7%
Inactive status	126	50.0%	83	23.8%
VAD at listing	10	4.0%	23	6.6%
All candidates	252	100.0%	349	100.0%

Table HR 14 Clinical characteristics of pediatric candidates on the heart transplant waiting list on December 31, 2008 and December 31, 2018. Candidates aged younger than 18 years waiting for transplant on December 31, 2008, and December 31, 2018, regardless of first listing date; multiple listings are collapsed. Candidates listed as children who turned 18 before the cohort date are excluded. CM, cardiomyopathy; VAD, ventricular assist device.

Characteristic	2008 N	2008 Percent	2018 N	2018 Percent
Transplant history				
First	234	92.9%	327	93.7%
Retransplant	18	7.1%	22	6.3%
Wait time				
< 1 year	140	55.6%	237	67.9%
1-< 2 years	33	13.1%	51	14.6%
2-< 3 years	19	7.5%	29	8.3%
3-< 4 years	15	6.0%	12	3.4%
4-< 5 years	11	4.4%	9	2.6%
≥ 5 years	34	13.5%	11	3.2%
Tx type				
Heart only	236	93.7%	341	97.7%
Heart-kidney	1	0.4%	5	1.4%
Heart-lung	14	5.6%	2	0.6%
Other	1	0.4%	1	0.3%
All candidates	252	100.0%	349	100.0%

Table HR 15 Listing characteristics of pediatric candidates on the heart transplant waiting list on December 31, 2008 and December 31, 2018. Candidates aged younger than 18 years waiting for transplant on December 31, 2008, and December 31, 2018, regardless of first listing date; multiple listings are collapsed. Candidates listed as children who turned 18 before the cohort date are excluded.

Waiting list state	2016	2017	2018
Patients at start of year	369	367	384
Patients added during year	626	623	685
Patients removed during year	627	606	674
Patients at end of year	368	384	395

Table HR 16 Heart transplant waitlist activity among pediatric candidates. 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.

Removal reason	2016	2017	2018
Deceased donor transplant	460	444	486
Patient died	61	67	77
Patient refused transplant	2	0	2
Improved, transplant not needed	60	54	62
Too sick for transplant	28	28	31
Other	16	13	16

Table HR 17 Removal reason among pediatric heart transplant candidates. Removal reason as reported to the OPTN. Candidates with death dates that precede removal dates are assumed to have died waiting.

Characteristic	2006-08		2016-18	
	N	Percent	N	Percent
Age				
< 1 year	280	27.4%	361	26.7%
1-5 years	254	24.8%	322	23.9%
6-10 years	141	13.8%	170	12.6%
11-17 years	348	34.0%	497	36.8%
Sex				
Female	457	44.7%	591	43.8%
Male	566	55.3%	759	56.2%
Race/ethnicity				
White	556	54.3%	694	51.4%
Black	219	21.4%	269	19.9%
Hispanic	176	17.2%	285	21.1%
Asian	51	5.0%	61	4.5%
Other/unknown	21	2.1%	41	3.0%
Insurance				
Private	529	51.7%	533	39.5%
Medicaid	391	38.2%	688	51.0%
Other government	70	6.8%	95	7.0%
Unknown	33	3.2%	34	2.5%
Geography				
Metropolitan	849	83.0%	1108	82.1%
Non-metro	174	17.0%	242	17.9%
Distance				
< 50 miles	525	51.3%	725	53.7%
50-<100 miles	148	14.5%	246	18.2%
100-<150 miles	110	10.8%	129	9.6%
150-<250 miles	98	9.6%	114	8.4%
≥ 250 miles	119	11.6%	104	7.7%
Unknown	23	2.2%	32	2.4%
All recipients	1023	100.0%	1350	100.0%

Table HR 18 Demographic characteristics of pediatric heart transplant recipients, 2006-2008 and 2016-2018. Pediatric heart transplant recipients, including retransplants. Distance is computed from recipient's home zip code to the transplant center.

Characteristic	2006-08		2016-18	
	N	Percent	N	Percent
Diagnosis				
Congenital defect	430	42.0%	677	50.1%
Idiopathic dilated CM	300	29.3%	291	21.6%
Familial dilated CM	37	3.6%	77	5.7%
Idiopathic restrictive CM	65	6.4%	63	4.7%
Myocarditis	44	4.3%	31	2.3%
Other/unknown	147	14.4%	211	15.6%
Blood type				
A	372	36.4%	472	35.0%
B	131	12.8%	193	14.3%
AB	37	3.6%	46	3.4%
O	483	47.2%	639	47.3%
Medical urgency				
Status 1A	788	77.0%	1082	80.1%
Status 1B	130	12.7%	227	16.8%
Status 2	105	10.3%	41	3.0%
On VAD	134	13.1%	384	28.4%
CPRA				
< 1%	597	58.4%	519	38.4%
1-< 20%	159	15.5%	190	14.1%
20-< 80%	118	11.5%	266	19.7%
80-< 98%	36	3.5%	71	5.3%
98-100%	28	2.7%	51	3.8%
Unknown	85	8.3%	253	18.7%
All recipients	1023	100.0%	1350	100.0%

Table HR 19 Clinical characteristics of pediatric heart transplant recipients, 2006-2008 and 2016-2018. Heart transplant recipients, including re-transplants. Collection of calculated PRA (CPRA) began March 31, 2015. Prior to that, measured PRA values were used. CM, cardiomyopathy; VAD, ventricular assist device.

Characteristic	2006-08		2016-18	
	N	Percent	N	Percent
Wait time				
< 31 days	468	45.7%	374	27.7%
31-60 days	190	18.6%	234	17.3%
61-90 days	116	11.3%	207	15.3%
3-< 6 months	129	12.6%	274	20.3%
6-< 12 months	76	7.4%	147	10.9%
1-< 2 years	26	2.5%	78	5.8%
≥ 2 years	18	1.8%	36	2.7%
ABO				
Compatible/identical	989	96.7%	1216	90.1%
Incompatible	34	3.3%	134	9.9%
Transplant history				
First	958	93.6%	1300	96.3%
Retransplant	65	6.4%	50	3.7%
Tx type				
Heart only	997	97.5%	1334	98.8%
Heart-lung	16	1.6%	7	0.5%
Heart-kidney	7	0.7%	7	0.5%
Heart-liver	3	0.3%	2	0.1%
All recipients	1023	100.0%	1350	100.0%

Table HR 20 Transplant characteristics of pediatric heart transplant recipients, 2006-2008 and 2016-2018. Heart transplant recipients, including re-transplants.

Support	2013		2018	
	N	Percent	N	Percent
Any life support	318	77.4%	349	73.8%
Intravenous inotropes	221	53.8%	226	47.8%
Left ventricular assist device	107	26.0%	141	29.8%
Ventilator	62	15.1%	59	12.5%
Right ventricular assist device	23	5.6%	27	5.7%
Extra corporeal membrane oxygenation	20	4.9%	16	3.4%
Prostaglandins	7	1.7%	10	2.1%
Inhaled NO	4	1.0%	8	1.7%
Intra-aortic balloon pump	3	0.7%	0	0.0%
Total artificial heart	0	0.0%	3	0.6%

Table HR 21 Pediatric heart recipients on circulatory support before transplant. Patients may have more than one type of circulatory support.

Donor	Recipient	CMV	EBV
D-	R-	33.8%	17.1%
D-	R+	14.9%	14.7%
D-	R unk	1.1%	1.4%
D+	R-	28.1%	28.7%
D+	R+	20.4%	36.2%
D+	R unk	0.7%	1.6%
D unk	R-	0.7%	0.0%
D unk	R+	0.3%	0.3%
D unk	R unk	0.0%	0.0%

Table HR 22 Pediatric heart donor-recipient serology matching, 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.